



EDUCATION, RESEARCH, AND SERVICE COMMITTEE  
APPENDIX

February 29, 2024

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# New Academic Program Proposal

## Bachelor of Science Data Science CIP 30.7001



Updated: January 18, 2024



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## Section I: Overview

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### *Program Information*

<b>Institution:</b>	University of Tennessee at Knoxville
<b>College:</b>	College of Emerging and Collaborative Studies
<b>Title of Degree:</b>	Data Science
<b>Degree Designation:</b>	Bachelor of Science
<b>Formal Degree Abbreviation:</b>	BSDS
<b>CIP Code:</b>	30.7001
<b>CIP Code Title:</b>	Data Science
<b>Proposed UT BOT Approval:</b>	February 2024
<b>Proposed THEC Approval:</b>	May 2024
<b>Proposed Implementation Date:</b>	August 2024
<b>Academic Program Liaisons:</b>	<p>Karen Galicia, Director of Academic Affairs            505 Summer Place / 1268-B UT Tower            Phone: 865-974-2140            Email: <a href="mailto:galicia@tennessee.edu">galicia@tennessee.edu</a></p> <p>Professor Xiaopeng Zhao, Interim Program Director            College of Emerging and Collaborative Studies            Claxton Education Building, Suite 106            1122 Volunteer Boulevard            Knoxville, TN 37996            Email: <a href="mailto:xzhao9@utk.edu">xzhao9@utk.edu</a>            Phone: 865-974-7682</p>

*System Letter of Support*

August 5, 2023

Dr. Bob Smith, Interim Executive Director  
Tennessee Higher Education Commission  
312 Rosa L Parks Ave. 9<sup>th</sup> Floor  
Nashville, TN 37243

Dr. Smith:

On behalf of the University of Tennessee, Knoxville (UTK), please accept this Letter of Notification (LON) for a proposed Bachelor of Science in Data Science, which will be housed in UTK's new College of Emerging and Collaborative Studies (CECS). The program. Students in this program will learn to transform raw data into meaningful information using data-oriented programming languages through core data mining, statistics, data modeling, and machine learning skills. Students will also learn to extract, prepare, and visualize data for modeling and analyses. Data Science students learn to apply these skills with sector-specific knowledge in the internship(s) and capstone courses, where they develop workforce-ready skills on real-world projects. It is expected that graduates with this degree will be well-prepared for employment or graduate school applications.

We look forward to receiving an evaluation this proposed program by THEC staff.

Sincerely,

Bernie Savarese, Ed.D.  
Acting Vice President of Academic Affairs and Student Success  
University of Tennessee System

CC: Donde Plowman  
John Zomchick  
Ozlem Kilic  
Alex Bentley  
Heather Hartman  
Karen Etzkorn

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[aass.tennessee.edu](http://aass.tennessee.edu)

## Campus Letter of Support



July 29, 2023

President Randy Boyd  
505 Summer Place / UT Tower  
Knoxville, TN 37902

President Boyd:

As Provost of the University of Tennessee-Knoxville (UTK), I am writing in support of the B.S. degree in Data Science to be offered by the College of Emerging and Collaborative Studies (CECS) at UTK. As approved by the U.T. Board of Trustees in February 2023, CECS is a new interdisciplinary college created specifically to facilitate emerging, interdisciplinary undergraduate programs at UTK.

Although being proposed as a new program, Data Science began as an undergraduate degree concentration in Interdisciplinary Programs (IDP) in the College of Arts and Sciences. By mutual agreement, oversight of the existing major and minor will be moved from the College of Arts and Sciences to CECS after August 1, 2023. We are seeking expedited approval to modify and re-launch Data Science as a standalone Bachelor of Science degree offered by CECS. This program modification will include essential core courses delivered by CECS as well as internship placements, an additional capstone course, and modified electives.

Judged from the perspective of student demand, Data Science at UTK is already a success. Enrollment in the existing core course, DATA 201, increased from 35 (100% of capacity) in Spring 2022 to its current cap of 50 (100% of expanded capacity) in Fall 2022 and Spring 2023. For Fall 2023, DATA 201 is enrolled to its capacity with 50 students, with about half of those students continuing on to DATA 202, and then 90% those students moving to DATA 301 and DATA 302, based on Fall 2023 enrollment. These DATA courses have a broad mix of students from several colleges such as Engineering, Arts and Sciences, Business, and Communications.

When re-launched as a stand-alone major, the Data Science degree will be an excellent fit for CECS. Other new programs being launched by CECS in Fall 2024 are Applied Artificial Intelligence, a customizable bachelor in science degree, and a minor in Cybersecurity. CECS is resourced sufficiently to deliver the core courses for the B.S. in Data Science through instructors employed by CECS, which introduces consistency and reliability into the core of the degree. Upper-level elective courses for the Data Science degree can be chosen from selected courses already offered across the UTK campus. The staffing of CECS means that the Data Science program will be sustainable, consistent, adaptable, and customizable for the wide range of students interested in this rapidly evolving field.

The proposed B.S. in Data Science addresses one of the fastest-growing employment sectors in Tennessee and neighboring regions. According to the U.S. Bureau of Labor and Statistics (USBLS), 113,300 data scientists were employed in 2021. USBLS predicts an annual growth of 5%, or about 36% in the decade from 2021-2031, which is much faster than average. About 13,500 openings for data scientists are

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2 BS\_Data\_Science\_proposal request

projected annually over the decade. Median pay in 2021 was \$100,910 per year (\$48.52 per hour) with a Bachelor's degree as the typical entry credential.

In delivering an employable skill, the Data Science major degree aligns with the “Drive to 55” objective of the THEC Master Plan for postsecondary education, according to which 55% of Tennessee’s working-age population (ages 25-64) are to attain a postsecondary credential by 2025. In Tennessee, data scientists on average currently earn about \$80,000 per year, and the top 10% of data scientists earned over \$130,000 in 2021 (USBLS). According to the Tennessee Department of Labor & Workforce Development, the sector of “Computing Infrastructure Providers, Data Processing, Web Hosting, and Related Services” is expected to grow 43% in Tennessee by 2030.

A B.S. degree in Data Science will contribute to UT’s mission and UTK’s goals by (i) enhancing educational excellence, (ii) creating value through economic, social, and technological development, and (iii) fostering outreach and engagement. In terms of *educational excellence*, Data Science is multidisciplinary and naturally articulates with other UTK strengths, including machine learning and Artificial Intelligence. With its eight core courses delivered by CECS, the electives for the B.S. degree in Data Science will draw upon multiple UTK colleges that are already teaching relevant upper-level elective courses. Facilitated by CECS, the degree can leverage these interdisciplinary resources in a new degree.

*In creating value*, the B.S. degree in Data Science will engage the workforce in this sector, through internships of upper-level students and jobs for graduates. To foster *engagement*, instructors in Data Science have experience as practitioners and network contacts in commercial, government, industry, and non-profit sectors. CECS also has administrators dedicated to industry engagement to secure workforce internships for upper-level students—a major upgrade in student experience compared to the existing program from which the degree is being elevated. The capstone project in Data Science will involve students in real-world research and outreach projects.

In summary, I fully support the CECS Bachelor of Science degree in Data Science.

No additional resources will be required in order to implement this change. At this time, we request transmission to Tennessee Higher Education Commission for approval. Please contact me if you have any questions or need additional documentation. Thank you in advance for your attention to this matter.

Sincerely,



John Zomchick  
Provost and Senior Vice Chancellor

CC: Bernie Savarese  
Karen Etkorn  
Donde Plowman  
Ozlem Kilic  
Heather Hartman

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## Section II: Background

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### *Background Concerning Academic Program Development*

Today, most organizations use large datasets to model consumer trends, analyze natural and biological systems, and strategically anticipate the future. Virtually every sector uses data science—from management to insurance, government, public health, energy, retail, transportation, logistics, media, entertainment, advertising, finance, military, business, health care, and education. Data scientists are needed, from certified entry-level technicians with a BS to highly specialized research scientists with a doctoral degree. Recognizing this demand for data science skills, The University of Tennessee, Knoxville (UTK) recently began offering a major and minor degree in Data Science for undergraduate students seeking careers in diverse application areas. With participation from multiple colleges of the UTK since 2021, the undergraduate concentration in Data Science has been a part of the Interdisciplinary Program (IDP) hosted by the UTK College of Arts and Sciences.<sup>1</sup>

Students in the proposed Data Science BS program will learn to transform raw data into meaningful information using data-oriented programming languages through core data mining, statistics, data modeling, and machine learning skills. Students learn to extract, prepare, and visualize data, which they will model and analyze. Students will apply these skills with sector-specific knowledge in the internship(s) and capstone courses, where they develop skills on real-world projects. Graduates with a BS in Data Science will be well-positioned for the workforce or graduate school.

For AY 2023-2024, both the Data Science concentration and the Data Science minor programs will move to the College of Emerging and Collaborative Studies (CECS), a new interdisciplinary college (approved by the UT Board of Trustees, 2/24/2023) to facilitate emerging, interdisciplinary undergraduate and graduate programs at UTK. This move was planned from the outset in the intercollegiate planning of the Data Science degree (please see the support letter from the College of Arts and Sciences in **Appendix A**).

When this new B.S. launches in Fall 2024, CECS will inactivate the IDP concentration and offer a teach-out plan to students who want to continue under IDP rather than switch to the new B.S. program. We will offer this teach-out plan through the 2028-29 academic year to ensure all students have time to complete the program. All courses in the IDP degree will continue to be offered as part of the new CECS degree. This includes the core sequence of DATA 202, 202, 203, 301, 302, and the capstone, DATA 499. Additionally, the electives in the IDP program are all regularly offered by their respective UTK colleges. As a result, the students enrolled in the IDP can see their degrees through the same list of courses.

<sup>1</sup> [https://catalog.utk.edu/preview\\_program.php?catoid=34&poid=17174](https://catalog.utk.edu/preview_program.php?catoid=34&poid=17174)



## Purpose and Nature of Academic Program

### Description of the Academic Program

With the IDP Data Science concentration approved to move to CECS for AY 2023-24, this proposal aims to outline a new BS in Data Science. This new degree is similar to the IDP version and expands it with additional core courses to be delivered by CECS (**Table 1**). As described below, Data Science has already become successful and sustainable at UTK. The current introductory class, DATA 201, has enrolled to capacity (currently 50) every fall and spring semester since it was first offered in Spring 2022. So far, this success with DATA courses has occurred with minimal formal support; moving the IDP concentration to CECS will provide resources, including significant staffing, for course delivery, promotion, student advising, and student internship placement.

### Total Credit Hours

The BS in Data Science will be a 120-credit, 4-year program built around nine DATA core courses to be delivered by CECS. The Data Science BS program follows the curriculum structure in **Table 1**. Each semester, students typically take one of the eight sequential DATA core courses (DATA 101, DATA 102, ... DATA 499). In parallel, students meet Vol Core requirements and take listed electives (see below) available from across UTK in other colleges on the campus via a list of approved elective options. Students will also complete at least six credits of service research and internship courses (**Table 1**).

**Table 1.** Generalized Structure for the BS Data Science Program

Semester 1	Semester 2	Semester 3	Semester 4	Semester 5	Semester 6	Semester 7	Semester 8
DATA 101	DATA 102	DATA 201	DATA 202	DATA 301	DATA 302	DATA 401	DATA 499
VolCore	VolCore	VolCore	VolCore	DATA 399	DATA elective	DATA elective	DATA elective
				DATA 375 (N) or		DATA 475 (N) or	
VolCore	VolCore	VolCore		DATA 385 (R)		DATA 485 (R)	
UTK prerequisites	UTK prerequisites	UTK prerequisites	UTK electives	UTK electives	UTK electives	UTK electives	UTK electives

*Abbreviations with courses: R, research-oriented; S, service-oriented; N, Internship.*

### Target Audience

The target audience is multidisciplinary and open to students from all backgrounds and a wide range of interests. Data science has become a necessary discipline with applications across all sectors of the economy due to the rapid growth in data, especially in the billions of connected devices and media that generate data globally. Today, most organizations use large datasets to model consumer trends, analyze natural and biological systems, and strategically anticipate the future. There is almost no sector that does not employ data scientists—from management to insurance,

government, public health, energy, retail, transportation, logistics, media, entertainment, advertising, finance, business, health care, and education—in businesses, armed forces government research labs and state and federal government agencies. Data scientists are needed, from certified entry-level technicians with a BS to highly specialized research scientists with a doctoral degree.

### **Purpose**

The comprehensive list of approved electives from campus will enable CECS students to design their focus areas in the vast field of data science. For instance, a student may emphasize programming perspectives of the field by choosing most electives in computer science. At the same time, another may concentrate on telling a compelling story with data by emphasizing electives from communications. As a stand-alone degree under CECS, the proposed BS degree will be flexible and comprehensive, with reliability and continuity in program delivery.

The core of the program includes multiple experiences for workforce readiness, which is one of the primary purposes of the degree. These experiences include internship placements with partner companies and organizations (see letters of support in Appendix A) and research and service courses. Two capstone courses will place CECS students in faculty labs, industry and community operations, exposing them to interdisciplinary team-based projects provided by industry partners to apply their new skills to impactful and relevant topics.

### **Program Outcomes**

Students with a BS in Data Science will:

- Develop relevant programming abilities
- Demonstrate proficiency with statistical analysis of data
- Develop the ability to build and assess data-based models
- Demonstrate skill in data wrangling and data management
- Apply data science concepts and methods to address problems in real-world contexts
- Develop the ability to visualize, conceptualize data, and extract meaning for relevant audiences
- Understand ethical and privacy aspects of data in different contexts

### **Delivery Method**

CECS intends to increase access to timely workforce skills by providing online versions of its programs. Therefore, all CECS courses will be offered in online modality, and CECS will work with other colleges for specific electives to be transitioned to online format so that the BS program can be offered in online format as well.

### *Alignment with State Master Plan and Institutional Mission*

By delivering an employable skill, the Data Science degree aligns with the State Master Plan for postsecondary education,<sup>2</sup> by which 55% of Tennessee’s working-age population (ages 25-64) would attain a postsecondary credential by 2025. As detailed in the section above, Data Science is a highly sought-after skill for employment in Tennessee and nationwide. The skills are highly versatile. Leveraging instantaneous digitization, large data sets, and accessible computer languages, data scientists visualize, interpret, and report data findings in various application areas. These areas range from business analytics to transportation logistics, network analysis, urban planning, public health, resource and environmental management, well-being, emergency response, sustainability, and data-driven social sciences. Data science is interdisciplinary, applying quantitative and coding skills to data from a myriad of contexts.

The Data Science program fits the land-grant objectives of UT, as articulated by UTK Chancellor Plowman (*The Tennessean* 2/2/23), by “making our curriculum more flexible and designing new degree programs that allow students to master competencies essential to success in the innovation economy.” As approved by the UT Board of Trustees in Spring 2023, CECS is the ideal home for the interdisciplinary Data Science BS. CECS delivers the core courses and facilitates the inclusion of subject-specific electives offered across UTK colleges into the Data Science major.

A BS degree in Data Science will contribute to the UT mission<sup>3</sup> and the goals of UTK<sup>4</sup> by:

- (i) Enhancing educational excellence
- (ii) Creating value through economic, social, and technological development, and
- (iii) Fostering outreach and engagement.

Regarding *education excellence*, Data Science is multidisciplinary and naturally articulates with other UTK strengths, including machine learning and artificial intelligence. With its nine core courses delivered by CECS, the BS degree in Data Science electives will draw upon multiple UTK colleges already teaching relevant upper-level elective courses. *In creating value*, the BS degree in Data Science will engage the workforce in this sector through internships for upper-level students and jobs for graduates. To foster *engagement*, instructors in Data Science have experience as practitioners and network contacts in commercial, government, industry, and non-profit sectors. CECS also has administrators dedicated to industry engagement to secure workforce internships for upper-level students—a significant upgrade in student experience compared to the existing program from which the degree is being elevated. The capstone project in Data Science will involve students in real-world research and outreach projects.

<sup>2</sup> <https://www.tn.gov/content/dam/tn/thec/bureau/research/other-research/master-plan/finalmp.pdf>

<sup>3</sup> <https://tennessee.edu/mission-statements/>

<sup>4</sup> <https://plan.tennessee.edu/wp-content/uploads/sites/38/2022/05/strategic-vision-2021-UTK.pdf>

Internships will be available via ongoing partnerships CECS has been actively developing such as the companies listed in the section “Community and Industry Partnerships,” with letters of their support in Appendix A. Since its inception the Data Science program has relied on an Advisory Board with industry partners. With the new college structure supporting the Data Science program, CECS will have a dedicated office to fostering deep relations with employees to help students forge their unique paths as they customize the degree to their future career aspirations. Internship courses will be developed in partnership with employees, and they will count as credit for up to 6 credit hours (in addition to internships students may pursue in summer). Depending on student experience, an internship could involve training in company procedures to data analysis of, say, health statistics or sales statistics, management of datasets that a company has collected, or text mining and topic analysis. We expect these internships will lead to post-degree employment for some students at their host company, as many companies use internships to recruit skilled students. As described in the section on employment demand, there is a significant demand for data science by employers in Tennessee and the nation in sectors such as health care, customer services, real estate, financial services, industrial engineering, and many more. Entering “data science” on job search sites such as indeed.com or Riipen.com reveals hundreds of unique job postings in Tennessee (more below).

### *Institutional Capacity to Deliver the Proposed Program*

The proposed B.S. in Data Science program will be housed in CECS, a new college created to host emerging, future-oriented interdisciplinary programs at UTK. CECS is resourced sufficiently to deliver the core courses for the BS in Data Science through instructors employed by CECS, which introduces consistency and reliability into the core of the degree (upper-level elective courses for the Data Science will be offered across UTK colleges and departments).

The Data Science program is supported at multiple levels. The Program Director, appointed by CECS, oversees the curriculum and enrollment, appoints GTAs, and handles course scheduling, assessment, accreditation, and capstone course content. The program director is supported by a program coordinator who manages the day-to-day activities, enters the curriculum, ensures timely, conflict-free course scheduling, etc. The CECS Director of Advising oversees the advising of Data Science majors in their degree program operations. The Director of Partnerships and Economic Development will also engage campus, community, and industry partners to support experiential learning in the program, fostering pathways to student employment.

The staffing of CECS means that the Data Science program will be sustainable, consistent, adaptable, and flexible for the wide range of students interested in this rapidly evolving field. The scale of CECS means that the establishment of this degree adds the benefits of its components to other programs offered by CECS, including a data science minor and two 12-credit certificates for a transdisciplinary BS degree under CECS as of Fall 2024. The certificate programs are related to the

proposed Bachelor of Science in Innovative Transdisciplinary Studies program that CECS will also offer.

Since its inception, the Data Science program has had a comprehensive governance structure stretching well beyond the college that has hosted it until now. The Data Science program has a campus Program Curriculum Committee that votes on curriculum matters and has met monthly since Fall 2021, comprising 12 UTK faculty from across all undergraduate degree-serving colleges. Additionally, there is a separate Data Science executive committee composed of associate deans of the UTK colleges and a Data Science advisory board comprising external industry leaders<sup>5</sup>. All these committees and the executive committee have provided valuable feedback on the curriculum of Data Science as well as its external partnerships and internship placement opportunities. The proposed Data Science BS program will expand the campus Program Curriculum Committee to include graduate-serving colleges such as the College of Law and Graduate School of Medicine to provide insights into the curriculum and enable pathways to careers such as law and medicine.

**Table 2** below lists undergraduate and graduate Data Science programs in Tennessee. The UTK program would be the first 4-year BS program in the eastern Tennessee region. As noted, the other 4-year BS in Data Science are at MTSU and Belmont University and located in middle Tennessee. These two programs are based in computer science and mathematics. Intercollegiate The interdisciplinarity curriculum and intercollegiate structure at UTK sets the CECS Data Science BS program apart from other undergraduate Data Science programs in the state. The core colleges (i.e., those that offer a required course) participating in the CECS Data Science BS include Arts and Sciences, Haslam Business, Tickle College of Engineering, and the College of Communications and Information. All other colleges on campus will participate in the program by offering approved electives. Evidence of intercollegiate support for the proposed Data Science BS program is represented in the letters of support in **Appendix A**.

CECS Data Science students will apply data science across assorted topics, with a broad range of elective courses to be detailed in our forthcoming NAPP. For example, the Data Science major can complement the Public Policy Analytics minor to help students see the relevance of data skills in solving public problems. As one of two new colleges, the Howard H. Baker Jr. School of Public Policy and Public Affairs has offered its support for the proposed program. Please see Appendix A for more information. Since launching the inaugural undergraduate Data Science program at MTSU in 2020, the number of master's programs has increased in Tennessee (e.g., MTSU, Tennessee State, U. Memphis, and Vanderbilt University), providing students with graduate degree options.

<sup>5</sup> <https://cecs.utk.edu/for-industry>

*Existing Programs Offered at TN Institutions***Table 2: Similar Programs in Tennessee**

Institution Name	Program Title & Degree Designation	CIP Code	Focus of Program	Miles from UTK	Degrees Awarded 3 Years
East Tennessee State University	MS, Applied Data Science	30.7001	Applied Data Science	107	Program started Fall 2022
Middle Tennessee State University	BS, Data Science	30.7001	Applied coding, statistics, databases, and machine learning.	183	22
Middle Tennessee State University	MS, Data Science	30.7001	Data Science	183	No graduates; program started in 2021
Middle Tennessee State University	Graduate Certificate, Data Science	30.7001	Data Science	183	56
Tennessee State University	MS, Data Science	30.7001	Data Science	181	Program started Fall 2022
University of Memphis	MS, Data Science	30.7001	Data Science	381	Program started Fall 2022
UT Knoxville	Ph.D., Data Science & Engineering	30.0601	Data science in engineering and healthcare	--	10
UT Knoxville	Graduate Certificate Data-Driven Decision-Making	30.7001	Data Science	--	
Vanderbilt University	MS, Data Science	30.7001	Applied statistics & computer science		
Belmont University	BS, Data Science	52.1301	Programming, statistics, databases, and Data Science capstone project.	180	

<sup>1</sup> No record of any degree awarded could be found in the most recent university factbook (NB: many of these are new degree programs).

## Accreditation

### Programmatic Accreditation

In AY 2024-25, the program will obtain accreditation from the Data Science Council of America (DASCA) for \$21,900 (**Appendix B**) by completing the following steps:

- Meet eligibility requirements, which include having a full-time faculty member dedicated to the program, a curriculum that meets DASCA's standards, and sufficient students.
- Submit a Request for Evaluation (RFE) to DASCA. The RFE must include a self-study report that describes the program's curriculum, faculty, resources, and student outcomes.
- On-site visit by a team of DASCA evaluators, who will review the program's self-study report and interview faculty, staff, and students.
- DASCA will make an accreditation decision based on the results of the on-site visit. The decision will be made public on the DASCA website.
- The DASCA accreditation process ensures accredited programs meet the highest standards for quality education. The process is rigorous, but it is also fair and transparent.

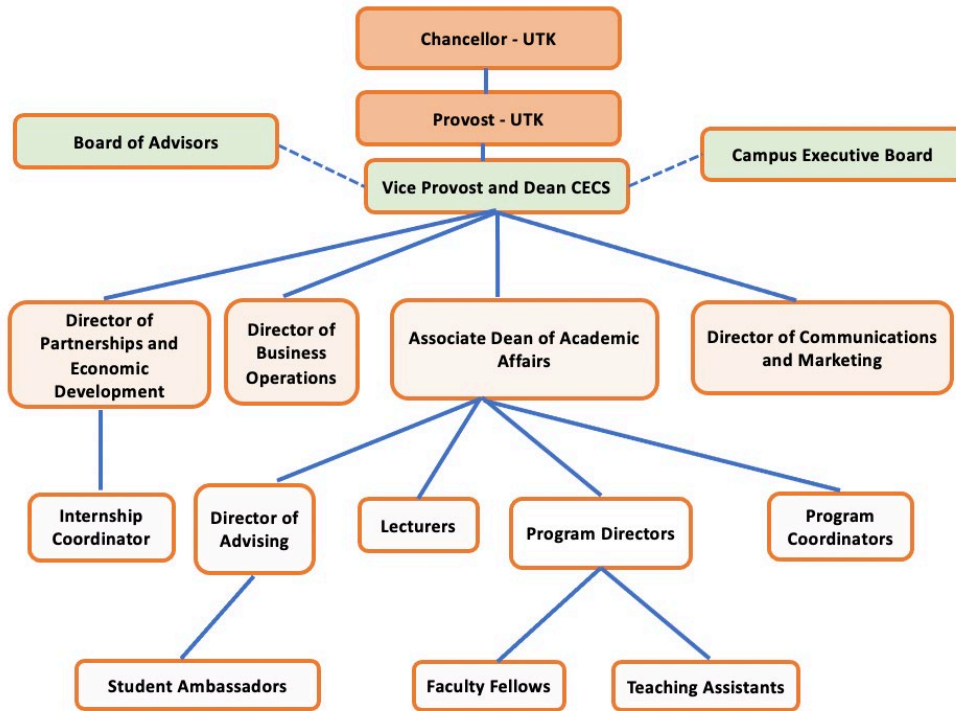
We have contacted DASCA for requirements and a timeline for the accreditation application.

### Institutional Accreditation

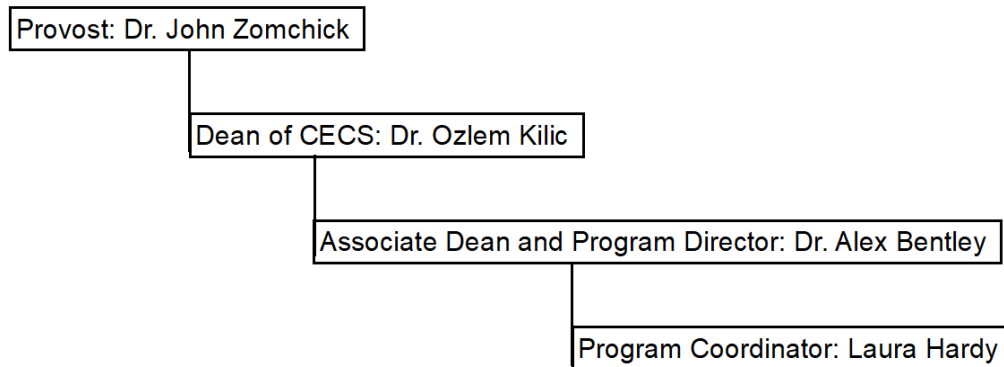
We have notified SACSCOC of a substantial change via Dr. Heather Hartman, UTK's SACSCOC liaison and Associate Vice Provost for Institutional Effectiveness, who confirmed that this program will require only notification (i.e., not a new prospectus) of the substantive change with SACSCOC.<sup>6</sup>

<sup>6</sup> <https://sacscoc.org/app/uploads/2019/08/SubstantiveChange.pdf>

*Administrative Structure*



**Figure 1.** Administrative Structure of the College of Emerging and Collaborative Studies



**Figure 2.** Administrative structure of the Data Science program.



## Section III: Feasibility Study

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### *Student Interest*

Regarding student interest, enrollment in Data Science is growing at UTK and peer institutions. Data Science is among the fastest-growing subjects in higher education today. At the University of Wisconsin-Madison, Data Science has been the #1 fastest-growing undergraduate major, with 914 majors enrolled since the program's inception in 2019.<sup>7</sup> When UC Berkeley began offering a BA in Data Science in 2018, 780 students submitted pre-declarations of this major as soon as it became available. Very soon after, Berkeley's entry-level class on the Foundations of Data Science had an enrollment of 1,300, half women, representing almost all majors.<sup>8</sup> Within the SEC, the University of Georgia will hire 70 new data science and artificial intelligence faculty by FY 2025.

At UTK, enrollment in the existing Data Science IDP program has proliferated from one major and 12 minors in AY 2021-22 to 16 majors and 76 minors in 2022-23. In Fall 2023, 50 new Data Science majors were admitted. Enrollment in individual DATA classes has also grown. The intro class (DATA 201) has enrolled to its capacity of 50 students for each of the last three semesters (FA 22, SP23, and FA 23). The more advanced courses—DATA 202, 301, 302—have also grown in enrollment as students progress. The expected retention rate is typical for a UTK major; about 75% of students from DATA 201 and 202 indicated they plan to take DATA 301/302 next year.

In terms of qualitative perspective, we polled students from the early cohort of students who took DATA 201 in the spring of 2022. Some were explicit in their support for launching a stand-alone Data Science major. As one UTK student wrote,

*"[I] would like to bring [data science] skills into my future job... I definitely think that the university should make Data Science a major. Every job fair I have attended, recruiters have mentioned that data science is a great addition and an upcoming pathway to study."* – Information Science major, Data Science minor.

Their reasons are often workforce-related, as our students anticipate the growth in data science careers. As one UTK student wrote,

*"I wholeheartedly believe that Data Science should become a major here! When I was originally applying to colleges, I was applying as a data analytics major."* – Neuroscience major with a pre-med track, minoring in Data Science.

Another student wrote,

*"I want to leverage [data science] as much as possible and even move into a more analytical role in the future."* –Supply Chain Management major, Data Science minor

<sup>7</sup> <https://news.wisc.edu/uws-5-hottest-majors-student-demand-workforce-trends-drive-enrollment-gains/>

<sup>8</sup> <https://data.berkeley.edu/distinctly-berkeley-data-science-major-has-wide-appeal>

Enrollment in the existing Data Science IDP program has been growing. Based in the UTK College of Arts and Sciences in AY 2021-22, the program began with one student in the major and 12 students in the minor. Table 3 shows that by AY 2022-23, 16 students were enrolled in the Data Science major, and 76 enrolled in the minor. By Fall 2023, with new Data Science majors admitted to the program, there were 41 total majors, more than double from the previous year.

**Table 3.** Total Majors and Minors during the First Three Years of the Data Science IDP Program.

Academic Year	Data Science majors	Data Science minors
2021–2022	1	12
2022–2023	16	76
2022–2023	41	79

All the Data Science majors are registered in the College of Arts and Sciences, which has hosted the IDP since the program's inception. Once this program moves to CECS, we expect majors to declare from many colleges across the UTK campus. In individual DATA courses, students already come from colleges across the UTK campus. **Table 4** provides enrollment of data science courses from spring 2022 through fall 2023.

**Table 4.** Data Science Course Enrollment: Spring 2022-Fall 2023.

DATA Course	Headcount Enrollment				2023 vs. 2022
	Spring 2022	Fall 2022	Spring 2023	Fall 2023	
DATA 201	35	48	50	50	+17
DATA 202	N/A	6	28	23	+45
DATA 301	N/A	24	12	31	+9
DATA 302	N/A	4	N/A	24	+20
Totals	35	82	90	129	+91

Finally, in a July 2023 survey of current undergraduate students in the Tickle College of Engineering (3716 students) and School of Information Sciences (199 students) at UTK, two-thirds of the 281 students who responded would be interested in the data science major. This includes 25% (70) who would be "extremely" interested and 41% (115) "moderately" interested.

### *Local and Regional Need/Demand*

According to the Tennessee Department of Labor & Workforce Development,<sup>9</sup> the “Computing Infrastructure Providers, Data Processing, Web Hosting, and Related Services” sector is expected to grow by 43% in Tennessee by 2030. Moreover, in Tennessee, data scientists earn about \$80,000 annually; the top 10% of data scientists earned over \$130,000 in 2021.

We obtained more details using the tools from the labor market analytics firm Lightcast.<sup>10</sup> According to the Lightcast analysis, there were over 324,600 data science jobs in the U.S. Southeast region (TN, MO, AK, MS, AL, NC, SC, VA, KY) in 2022, with almost 35,000 job openings in data science annually. In the Southeast, data science jobs are predicted to grow by more than 17% in the next five years. From August 2022 to July 2023, there were 232,101 job postings in data science in the Southeast region, including 15,707 in Tennessee, over 50,000 in North Carolina, and 59,000 in Virginia (many data scientists work in the suburbs of Washington DC). Those numbers are for jobs related to data science, and within the narrower label of data scientists strictly, there were about 38,000 unique job listings in the Southeast from August 2022 to July 2023.

Among the top employers in the Southeast region are staffing agencies, healthcare companies, insurance companies, banks, investment agencies, aerospace/defense companies, and I.T. business consulting companies. CGI Senior Vice President Debudatta Mohapatra has been a member of our Advisory Board since the program's inception. Among the top ten regional institutions supplying the labor market with workers in data science, almost all are in Georgia, North Carolina, and Virginia; none so far are in Tennessee—UTK CECS aims to change that.

Data Science, being amenable to remotely-conducted work, is also a substantial employment occupation in nonmetropolitan areas of the southeastern U.S., including (according to USBSL) Northeast Mississippi (0.50% of jobs, median wage of \$26.69 per hour), Southwest Missouri (0.72% of jobs, median wage \$34.27 per hour) and Mountain North Carolina (0.25% of jobs, median wage \$54.49 per hour). The hiring prospects out of college are good, as over a third of employed data scientists are under 34.

As for East Tennessee, a quick search on an employment site such as Indeed.com at the time of writing reveals over 200 jobs in Data Science in the state at various entry levels. Further evidence of local employer demand for data science skills in East Tennessee is exemplified in the section on industry partnerships below and the letters in **Appendix A**.

<sup>9</sup> [www.jobs4tn.gov](http://www.jobs4tn.gov)

<sup>10</sup> <https://lightcast.io>

## Employer Demand

Nationally, there are over 1.8 million jobs related to data science (software developers, data scientists, database administrators), with growth in jobs predicted to be almost 19% in the next five years (Lightcast analysis). The top five states in 2022 to employ Data Scientists are California (29,420), New York (14,760), Texas (13,780), Florida (8,190), and Pennsylvania (6,370), according to the U.S. Bureau of Labor and Statistics (USBLS).<sup>11</sup> As those are the most populous states in the U.S.— if we look instead at the fraction of employment below California and New York, the top five states also include Utah and Missouri. As one of the top five most business-friendly states in 2023,<sup>12</sup> Tennessee can become a significant employer of data scientists. Furthermore, as Atlanta and Charlotte (each with over 20,000 unique job postings in data science since Aug 2022) rank among the top ten metropolitan areas in 2022 for employment of data scientists, the market in Nashville (#10 in the Southeast, with over 5,000 unique postings) could become a major employer of Data Science graduates from UT-Knoxville. Other major metropolitan markets in our region include Huntsville, AL, Raleigh-Durham, and Washington, D.C.

Overall, the proposed BS in Data Science addresses one of the fastest-growing employment sectors in Tennessee and neighboring regions. According to the USBLS, 113,300 data scientists were employed in 2021, which by May 2022 had increased to 159,630. This is a remarkable 40% increase in one year. For the next decade, USBLS predicts an annual growth of 5%, or about 36%, in the decade from 2021-2031, with about 13,500 openings for data scientists every year.

Pay for data scientists is increasing. In 2021, the median salary nationally in 2021 was \$100,910 per year (\$48.52 per hour), with a bachelor's degree as the typical entry. By May 2022, median pay had increased to \$ 115,240 (\$55.40 per hour), according to USBLS, a one-year increase of 14% in median pay. **Table 5** shows Industries with the highest employment levels among Data Scientists.

**Table 5.** Industries with the highest employment among Data Scientists (May 2022).

Industry	Number Employed	% of Industry Employment	Hourly Mean Pay	Annual Mean Pay
Computer Systems Design	21,440	0.87	\$ 56.63	\$ 117,800
Management of Companies and Enterprises	15,440	0.58	\$ 54.77	\$ 113,920
Management, Scientific, & Technical Consulting	11,640	0.66	\$ 53.10	\$ 110,450
Scientific Research and Development Services	8,380	0.97	\$ 60.39	\$ 125,620
Insurance Carriers	8,320	0.69	\$ 53.43	\$ 111,130

Source: USBLS

<sup>11</sup> <https://www.bls.gov/oes/current/oes152051.htm>

<sup>12</sup> <https://www.cnbc.com/2023/07/11/americas-top-states-for-business-2023-the-full-rankings.html>

### *Community and Industry Partnerships*

As mentioned, the Data Science Advisory Board<sup>13</sup> facilitates support from community and industry partners in Knox County and beyond. Letters of support are provided in Appendix A. We expect more letters of support to follow in our ENAPP and for these partners to join in the site visit.

As data science is incorporated across industry, government, and community sectors, we have support from large companies, small start-ups, government research labs such as ORNL, and local government. Several companies (e.g., LabCorp and Liria) specialize in public health or health analytics. In contrast, others (e.g., Pilot, CGI, XS Power batteries) use data science to improve customer service and marketing. Government organizations such as Knoxville Chamber, committed to the region's economic development, use data science to understand public demographics, logistics, and energy usage. These organizations incorporate data science into teams of diverse skills, such as designers, engineers, coders, project managers, marketing, guest services, and digital products. The letters of support from partner companies show that our community and industry partners are enthusiastic about collaborating with CECS, providing internships, sponsoring capstone projects, and hiring graduates. The letters in **Appendix A** include:

- **CGI** is a global company of 90,000 employees with a new office in Knoxville, where they are keen to partner with CECS and this Data Science program. CGI has already established other internship agreements with other UTK colleges. CGI uses data science to help businesses meet their evolving demands quickly.
- **Knoxville Chamber**, which uses data science to analyze future economic prosperity in East Tennessee, is committed to providing Data Science students with real-life experiences in the workplace, including internships and capstone projects.
- **Labcorp**, a global life sciences company that uses data science in diagnostic labs and clinical trials for its drug development services, expressed interest in internships or placements for CECS data students with Labcorp in analyzing, visualizing, and managing data.
- **XS Power**, a Knoxville-based battery manufacturer, supports the Data Science program and is interested in partnering with CECS on student internship placements and collaborative capstone projects.
- **Lirio**, a company that combines behavioral and data science to deliver personalized health strategies, describes their work as “highly compatible” with the Data Science program. They are interested in providing internship placements and real-world capstone projects.
- **Nell One**, a pharmaceutical lab in Knox County, inspired by a partnership between the data science program at Carnegie Mellon and the Health Data Alliance of Pittsburg, is interested in the data analytics in our curriculum as entry into internships and collaborative projects.
- **Moment Energy**, a sustainable energy company, is “extremely eager” to partner with CECS on industry-relevant curricula, internships, and collaborative team projects.

<sup>13</sup><https://cecs.utk.edu/for-industry>

- **JTEKT**, an automotive manufacturer, is expressing interest in partnering with CECS to provide invaluable real-world experiences to the students.
- **Viridi Parente**, which advances lithium-ion battery products and their potential to contribute to economic development, is interested in partnering with CECS on student internships, interdisciplinary research, and collaborative capstone projects.
- **iO Urology**, which has developed a remote patient monitoring system, is interested in internships for CECS students as potential future employees of their fast-growing company.

## Section IV: Enrollment and Graduation Projections

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Projected enrollment and graduates appear in **Table 6**. In the first few years, graduates are projected based on current students enrolled in the Data Science IDP from 2021-2022. Enrollment projections are based on an increase of 10 students per year from the Fall 2023 enrollment of 50 students.

**Table 6:** Projected Enrollments and Graduates.

Year	Academic Year	Projected Total Fall Enrollment	Projected Attrition*	Projected Graduates
1	2024-2025	50	2	--
2	2025-2026	60	3	--
3	2026-2027	70	4	10
4	2027-2028	80	4	35 (70% graduation)
5	2028-2029	90	5	42 (70% graduation)

The projected total fall enrollment is the number of **new students admitted** to the program each year. The University of Tennessee, Knoxville, has a first-year retention rate of 90%<sup>14</sup>. The retention rate is the percentage of a school's first-time, first-year undergraduate students who continue at that school the following year.

<sup>14</sup> <https://ie.utk.edu/student-success-ut/>

## Section V: Projected Costs to Deliver the Proposed Program

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### *Faculty and Instructional Staff*

The sub-categories of Faculty and Instructional Staff are: Program Director, Lecturers, Faculty fellows, and summer course instructors.

- **Program director.** The Program Director, a tenured faculty member, is responsible for the program's initiation, delivery, and continuous progression. The Program Director's salary is \$160,000 per year plus benefits at a rate of 32% with an increment of three percent annually. Fifty percent of the of the Program Director's salary and benefits are allocated to the Data Science B.S. program, as the program director oversees another program at CECS.
- **Lecturers.** Each lecturer's salary is estimated at \$90,000 annually plus 32% benefits. To allow for course preparation, the teaching load is 3/3 in Year 1, and 4/4 teaching load in years 2 and after. Based on the Student Credit Hour (SCH) estimate, we estimate .5 FTE Lecturers needed in years 1-2, 1.0 FTE in year 3, and 1.5 FTE the years 4-5. Fractional FTEs can be accommodated as lecturers teach across multiple CECS programs. The planned hiring of lecturers is as follows: 1 in Years 1-3 and 1.5 in Years 4-5.
- **CECS Faculty Fellows:** In Year 1, and Year 2, two Faculty Fellows are recruited annually to contribute to curriculum development, teaching, and program service, each at a cost of \$10,000 per semester.
- A **Faculty Lead** in Year 0 is engaged in program planning and curriculum development as the head of the program curriculum committee, at a cost of \$10,000.

### *Non-Instructional Staff*

Non-instructional staff include: Program Coordinator, Internship Coordinator, student graders, and lab instructors.

- **Program Coordinator.** The Program Coordinator, at \$70,000/year plus 32% for benefits, will commit 1/3 of their time for the five years.
- **Internship Coordinator.** To enhance the practical experience of the students, an Internship Coordinator will be recruited in Year 3 (Academic Year 2026). This position supervises all internship courses across the six anticipated programs at CECS. The cost for the Internship Coordinator will be 1/3 of their annual salary (\$60,000) plus benefits (a fringe rate of 32%), as CECS expects to oversee 6 programs as of Academic Year 2026.
- **Student graders.** For introductory courses, there are weekly labs to be graded, with increasing class sizes over the five years. For the introductory courses, there are weekly assignments to be graded, and we expect class sizes to increase over the five years. We assume ten assignments per student to grade, with the graders needing two hours to grade every 40 assignments at \$20/hr. The required numbers of student graders are 2 in year 1, 5 in year 2, 9 in year 3, 12 in year 4, and 14 in year 5.
- A **Lab Instructor** is needed for the introductory course (DATA 101), which is offered in both Spring and Fall semesters in all years.



### *Graduate Assistants*

None – Lecturers, UTK faculty, CECS Fellows will deliver instruction.

### *Accreditation*

We estimate the costs of accreditation by DSCA based on our experience with accreditation for other programs at UT Knoxville. The detailed estimates are as follows.

- Accreditation Cost by DSCA: total = \$21,900
  - Readiness review: \$1100
  - Base fee: \$3700
  - Evaluators: \$3700 \*3
  - Additional expenses (lodging, etc.): \$2000\*3.

### *Consultants*

\$2,000 for the external evaluator for the program.

### *Equipment*

\$500 per year equipment budget will be utilized for acquiring and upgrading essential hardware and software, ensuring students have access to current technologies for hands-on learning and research in Data Science.

### *Information Technology*

The \$500 annual budget for Information Technology will cover maintaining online learning platforms and addressing unforeseen IT issues in the Data Science program.

### *Library Resources*

No additional costs associated with library resources are needed for this program.

### *Marketing*

\$500 per year miscellaneous marketing expenses.

### *Facilities*

No additional costs are anticipated for facilities.

### *Travel*

No travel expenses are specifically associated with this program.

### *Other Resources*

Ongoing renovations in the Claxton Education Building. The cost of renovation associated with the BS in Data Science is estimated to be \$62,006. The renovation cost includes the following items: 1.) a lab area will be shared between the programs at CECS (Applied AI, Data Science, Cybersecurity, Innovative Transdisciplinary Studies); 2.) space for lecturers of the program; 3.) office for the program director; and 4.) office for a program coordinator.

## Section VI: Projected Revenues for the Proposed Program

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The THEC Financial Projections Form in Appendix B reflects anticipated revenues associated with the proposed program.

### *Tuition*

Income is \$378 per SCH for Tennessee residents and \$759 for non-residents. We assume that 20% of undergraduate students pay non-resident tuition.

## Section VII: Implementation Timeline

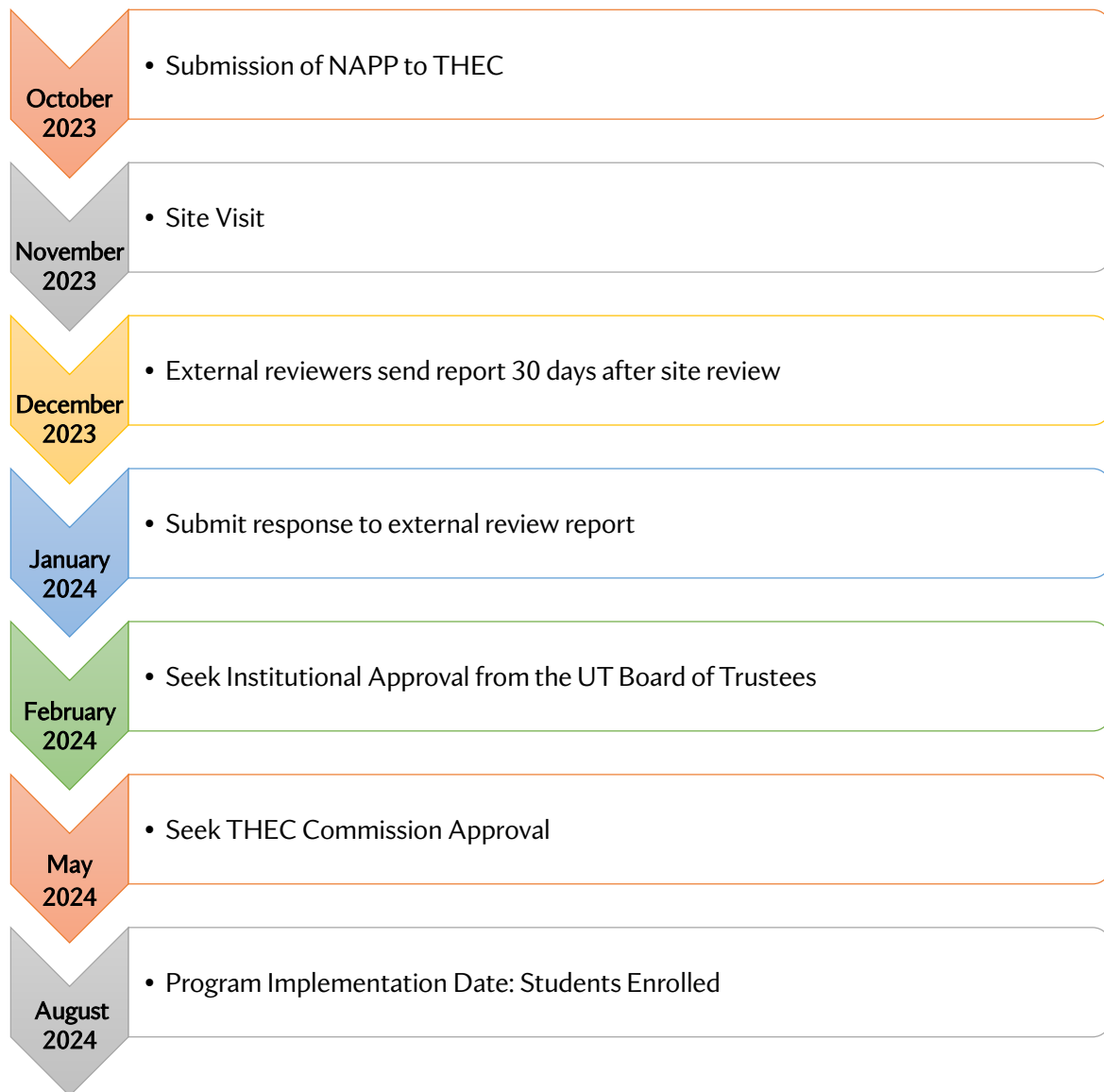


Figure 3: *Implementation Timeline*

### *Accreditation Considerations*

SACSCOC Accreditation:

We have notified SACSCOC of a substantial change via Dr. Heather Hartman, UTK's SACSCOC liaison and Associate Vice Provost for Institutional Effectiveness, who confirmed that this program will require only notification (i.e., not a new prospectus) of the substantive change with SACSCOC.<sup>15</sup>

Programmatic Accreditation:

In AY 2024-25, the program will obtain accreditation from the Data Science Council of America (DASCA) at a cost of \$21,900 (see **Appendix B**) by completing the following steps:

- Meeting eligibility requirements, which include having a full-time faculty member dedicated to the program, a curriculum that meets DASCA's standards, and sufficient students.
- Submitting a Request for Evaluation (RFE) to DASCA. The RFE must include a self-study report that describes the program's curriculum, faculty, resources, and student outcomes.
- Hosting an on-site visit by a team of DASCA evaluators, who will review the program's self-study report and interview faculty, staff, and students.
- DASCA will make an accreditation decision based on the results of the on-site visit. The decision will be made public on the DASCA website.
- The DASCA accreditation process ensures accredited programs meet the highest standards for quality education. The process is rigorous, but it is also fair and transparent.

We have contacted DASCA for requirements and a timeline for the accreditation application.

### *UT Board of Trustees*

- February 29 – March 1, 2024

### *Tennessee Higher Education Commission*

- Commission Meeting, May 16, 2024

<sup>15</sup> <https://sacscoc.org/app/uploads/2019/08/SubstantiveChange.pdf>

## Section VIII: Curriculum

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### *Program-specific Goals/Objectives*

The Bachelor of Science in Data Science will consist of 120 total student credit hours, as required for any bachelor's degree at the University of Tennessee. Students will complete 51-58 credit hours of VolCore courses that set the foundation for all the bachelor's students at the University of Tennessee.

In addition to Vol Core requirements, 27 hours of this B.S. program will be Data Science core courses, including two capstone courses. The Data Science B.S. is designed to prepare all the enrolled students to succeed in the workforce. Therefore, these 27 credit hours (9 courses) will orient students with concepts of data analysis, data wrangling, data visualization, and data ethics. **Additionally, each student is required to complete 6 credit hours of research or internship courses.** Each student also selects five upper-level elective courses (at least 15 credit hours) to apply data science in their field of interest. As these electives are upper-level, the program has approximately 20 credit hours to allow students to take the prerequisite courses for these upper-division courses (with guidance from the Director of Advising).

The Data Science major is mainly based on existing core courses, and all the upper-division elective courses already exist in other colleges at UTK. Several new core courses (DATA 301, 302, 375/475, DATA 385/485, and DATA 399) are being developed by CECS. All new and current courses with an established certificate are listed below. Please refer to Appendix C for the syllabi for each of these courses.

The Program-Specific Goals are

1. Career Readiness in Diverse Fields: Graduates will be equipped to enter and excel in various professional sectors, including technology, healthcare, finance, and public service, applying their data science expertise to real-world challenges.
2. Advanced Problem-Solving Skills: Students will be capable of tackling complex data-related problems, employing their skills in programming, data analysis, and model building.
3. Effective Communication of Data Insights: Graduates will be adept at visualizing data and communicating their findings clearly and effectively to both technical and non-technical audiences.
4. Ethical and Responsible Use of Data: Students will demonstrate an understanding of ethical considerations and privacy concerns in data science, ensuring responsible handling of sensitive information.

5. Innovation and Continuous Learning: Graduates will be prepared to contribute to innovation in the field of data science and possess a strong foundation for lifelong learning and adaptation in a rapidly evolving discipline.
6. Leadership in Interdisciplinary Teams: Equipped with a broad range of data science skills, graduates will be ready to lead and collaborate effectively in interdisciplinary teams, addressing complex issues that span multiple domains.
7. Research and Development Contribution: Students will be prepared to contribute to research and development in academic, industry, and government settings, using their skills in data analysis and model development.

*Student Learning Outcomes***Table 7: Student Learning Outcomes Mapped to Core Courses**

Learning Outcome <i>Students will develop/demonstrate</i>	DATA 101: Data Knowledge and Discovery	DATA 102: Data Stewardship and Ethics	DATA 201: Analytical Methods of Data Science	DATA 202: Data structures and algorithms	DATA 303: Advanced Data Analysis	DATA 304: Data Wrangling	DATA 375N/475N: Internship in Data Science	DATA 385R/485R: Research project in Data Science	DATA 401: Visual Analytics	DATA 399, 499: Capstone
Relevant programming abilities	X		X	X	X	X	X	X	X	X
Proficiency with statistical analysis of data	X		X		X					
Ability to build and assess data-based models				X		X	X			X
Skill in data wrangling and management										
Ability to apply data science concepts and methods to address problems in real-world contexts							X	X		X
Methods to visualize data patterns	X								X	
Understanding of data ethics		X					X			



## Academic Program Requirements

### Overview

**Table 8: Program Curriculum**

Course Prefix, #, and Title	Course Catalog Description	Credit Hours	New or Existing
<b>Prerequisite Course(s) (General Education): 51-58 Hours</b>			
Vol Core WC	Written Communication (WC): 3 courses, including ENGL 101 and ENGL 102, plus an approved WC course	9	Existing
Vol Core OC	1 Oral Communication (OC) course	1-3	Existing
Vol Core AOC	1 Applied Oral Communication course	1-3	Existing
Vol Core NS	2 Natural Sciences (NS), one 4-credit w/ lab	7-8	Existing
Vol Core QR	2 Quantitative Reasoning (QR) courses	6-8	Existing
Vol Core AH	1 Arts and Humanities	3	Existing
Vol Core EP	2 Expanded Perspectives (EP) courses	6	Existing
Vol Core GCI and GCIUS	1 GCI and 1 GCIUS course	6	Existing
Vol Core SS	1 Social Sciences (SS) course	3	Existing
Vol Core EI	3 Engaged Inquiries (EI) courses	9	Existing
<b>Core Classes: 27 Hours</b>			
DATA 101	Data Knowledge and Discovery	3	Existing
DATA 102	Data Stewardship and Ethics	3	Existing
DATA 203	Analytical Methods of Data Science	3	Existing
DATA 202	Data Management and Visualization	3	Existing

DATA 303	Advanced Data Analysis	3	New
DATA 304	Data Wrangling	3	New
DATA 399	Junior Capstone	3	New
DATA 499	Senior Capstone	3	Existing
DATA 401	Visual Analytics	3	New
<b>Additional Requirements: 6 Hours of Internship or Research</b>			
DATA 375N or 475N	Internship in Data Science	3	New
DATA 385R or 485R	Research project in Data Science	3	New
<b>Elective Courses: Select 15 Hours</b>			
<b>Mathematical &amp; Statistical Foundations</b>			
MATH 323	Probability and Statistics	3	Existing
MATH 371	Numerical Algorithms	3	Existing
MATH 423	Probability	3	Existing
MATH 424	Stochastic Processes	3	Existing
MATH 425	Statistics	3	Existing
<b>Methods of Data Science</b>			
BAS 320	Regression Modeling	3	Existing
BAS 471	Statistical Methods	3	Existing
BAS 474	Data Mining and Business Analytics	3	Existing
COSC 425	Introduction to Machine Learning	3	Existing
COSC 453	Data Visualization	3	Existing

IE 301	Operations Research I	3	Existing
IE 310	Operations Research II	3	Existing
IE 340	Design of Experiments	3	Existing
INSC 486	Data Analytics	3	Existing
COSC 422	Applied Machine Learning	3	Existing
COSC 426	Intro to Data Mining & Analytics	3	Existing
<b>Data Management and Visualization</b>			
ARCH 321	Representation IV: Information Modeling	2	Existing
BAS 476	Data Engineering and Visualization	3	Existing
COSC 465	Databases and Scripting Languages	3	Existing
GEOG 311	Geovisualization and GIS	3	Existing
IARC 321	Advanced Representation	3	Existing
INDS 321	Digital Representation and Fabrication for Industrial Design	2	Existing
INSC 260	Programming for Info. Applications	3	Existing
INSC 384	Database Design	3	Existing
INSC 484	Database Applications	3	Existing
INSC 489	Information Visualization	3	Existing
INSC 486	Data Analytics	3	Existing
<b>Ethics and Policy in Data Science</b>			
INSC 305	Internet and Society	3	Existing

GEOG 421	Maps, Society, Power	3	Existing
EEB 451	Research Ethics	3	Existing
PHIL 360	Philosophy of science	3	Existing
PHIL 371	Epistemology	3	Existing
GEOG 425	Human Dimensions in GIScience	3	Existing
<b>Data and Society</b>			
BCMB 422	Computational Biol. & Bioinfo.	3	Existing
CLAS/ANTH 446	Archaeological Statistics	3	Existing
COSC 445	Fundamentals Digital Archeology	3	Existing
EEB 411	Biostatistics	3	Existing
ESM 350	Applied Statistical Concepts	3	Existing
FWF 313	Measurements and Sampling	3	Existing
FWF 430	Introduction to GIS for Natural Resources	3	Existing
GEOG 414	Spatial Data Management	3	Existing
IE 465	Applied Data Science	3	Existing

## Program of Study

**Table 9: Sample Course Enrollment Schedule/ Plan of Study for Traditional, Full-time Student**

<b>Semester 1: Fall YEAR 1</b>		
<b>CRN/Course Abbreviation</b>	<b>Course Title</b>	<b>Credit Hours</b>
DATA 101	Data Knowledge and Discovery	3
ENGL 101	English Composition I	3
STAT 201	Introduction to Statistics	4
ANTH 120	Introduction to Archaeology	3
MATH 125	Basic Calculus	3
<i>Total Semester Credit Hours: 16</i>		
<b>Semester 2: Spring YEAR 1</b>		
DATA 102	Data Stewardship and Ethics	3
ENGL 102	English Composition II	3
ESS 110	Energy for the World	3
INSC 210	Foundations of Information Technology	3
PHIL 101	Introduction to Philosophy	3
<i>Total Semester Credit Hours: 15</i>		
<b>Semester 3: Fall YEAR 2</b>		
DATA 203	Analytical Methods of Data Science	3
PHIL 244	Professional Responsibility	3
JREM 330	Communication for Media	3
PSYC 110	General Psychology	3
INSC 260	Programming for Information Applications <sup>†</sup>	3
<i>Total Semester Credit Hours: 15</i>		
<b>Semester 4: Spring YEAR 2</b>		
DATA 202	Data Management and Visualization	3
ENGL 360	Technical and Professional Writing	3
ARCH 201	The American City: Citizens of the 21st Century	3
ALEC 102	Interpersonal Leadership Development	3
BAS 320	Regression Modelling <sup>†</sup>	3
<i>Total Semester Credit Hours: 15</i>		
<b>Semester 5: Fall YEAR 3</b>		
DATA 303	Advanced Data Science	3
DATA 375(N)	Internship in Data Science (N)	3
INSC 384	Database Design <sup>†</sup>	3
RMM 341	Consumers in the Global Marketplace	3
BAS 471	Statistical Methods <sup>†</sup>	3
<i>Total Semester Credit Hours: 15</i>		

<b><i>Semester 6: Spring YEAR 3</i></b>		
DATA 304	Data Wrangling	3
DATA 399	Junior Capstone in Data Science	3
INSC 484	Database Applications	3
INSC 486	Data Analytics	3
BAS 474	Data Mining and Business Analytics	3
<i>Total Semester Credit Hours: 15</i>		

<b><i>Semester 7: Fall YEAR 4</i></b>		
DATA 401	Visual Analytics	3
DATA 485(R)	Service-Research (S/R) in Data Science	3
AI 101	Introduction to the World of AI	3
GEOG 131	Weather, Climate, and Climate Change	4
INSC 489	Information Visualization	3
<i>Total Semester Credit Hours: 17</i>		

<b><i>Semester 8: Spring YEAR 4</i></b>		
DATA 499	Capstone in Data Science	3
ECON 201	Introductory Economics	4
INSC 305	Internet and Society <sup>†</sup>	3
BAS 476	Data Engineering and Visualization <sup>†</sup>	3
<i>Total Semester Credit Hours: 12</i>		

**TOTAL PROGRAM HOURS: 120**

Table 10 on the following page provides a sample program of study for a transfer student coming into the program. This hypothetical student will have taken a AS degree in Computer Science at Roane State Community College (RSCC), and then transfer to the Data Science B.S. at UTK. The AS means that all Vol Core requirements are fulfilled when entering the B.S. Data Science degree, such that the student takes core DATA classes at double the pace of a 4-year UTK student to complete all the Data Science core requirements in two years.

**Table 10: Sample Course Enrollment Schedule/ Plan of Study Transfer Student (AS Computer Science, Roane State Community College).**

Semester	School	Course code	Course title (and UTK equivalent for years 1-2)	credits
Year 1, S1	RSCC	ENG 1010	English Composition I (UTK: ENGL 101)	3
Year 1, S1	RSCC	MAT 1910	Calculus I (UTK: MATH 141)	4
Year 1, S1	RSCC	HIST 2010	Early United States History (UTK: HIUS 221)	3
Year 1, S1	RSCC	ARTP 1120	Three-Dimensional Design (UTK: ART 103)	3
Year 1, S2	RSCC	ENG 1020	English Composition II (UTK: ENGL 102)	3
Year 1, S2	RSCC	MAT 1920	Calculus II (UTK: MATH 142)	4
Year 1, S2	RSCC	COMM 2025	Fundamentals of Communication (UTK: CMST 201)	3
Year 1, S2	RSCC	ART 2000	Art History Survey I (UTK: ART 172)	3
Year 1, S2	RSCC	HIST 2310	Early World History (UTK: HIST 261)	3
Year 2, S1	RSCC	CISP 1010	Computer Science I (UTK: COSC 100)	4
Year 2, S1	RSCC	MATH 2050	Calculus-Based Prob/Stats (UTK: STAT 201)	3
Year 2, S1	RSCC	GEO 1040	Physical Geology (UTK: GEOL 101)	4
Year 2, S1	RSCC	SOCI 1020	Social Problems (UTK: SOSI 1101)	3
Year 2, S1	RSCC	ENG 2310	Early World Literature (UTK: ENGL 221)	3
Year 2, S2	RSCC	CISP 1020	Computer Science II (UTK: COSC 101)	4
Year 2, S2	RSCC	POL 1010	US Government and Politics (UTK: POLS 101)	3
Year 2, S2	RSCC	GEOG 1040	Geog of the Natural Environment I (UTK: GEOG 131)	4
Year 2, S2	RSCC	CISP 2410	Assembly & Computer Organization (no UTK equivalent)	3
			<b><i>Credits to Transfer to UTK:</i></b>	<b>60</b>
Year 3, S1	UTK	DATA 101	The Data Knowledge and Discovery	3
Year 3, S1	UTK	DATA 102	Data Stewardship and Ethics	3
Year 3, S1	UTK	INSC 210	Foundations of Information Technology	3
Year 3, S1	UTK	RMM 341	Consumers in the Global Marketplace	3
Year 3, S1	UTK	INSC 305	Internet and Society <sup>†</sup>	3
Year 3, S2	UTK	DATA 203	Analytical Methods of Data Science	3
Year 3, S2	UTK	DATA 202	Data Management and Visualization	3
Year 3, S2	UTK	INSC 260	Programming for Information Applications <sup>†</sup>	3
Year 3, S2	UTK	INSC 384	Database Design <sup>†</sup>	3
Year 3, S2	UTK	DATA 388	Service-Research (S/R) in Data Science	3
Year 4, S1	UTK	DATA 303	Advanced Data Science	3
Year 4, S1	UTK	DATA 304	Data Wrangling	3
Year 4, S1	UTK	DATA 399	Junior Capstone in Data Science	3
Year 4, S1	UTK	INSC 484	Database Applications	3
Year 4, S1	UTK	INSC 486	Data Analytics	3
Year 4, S2	UTK	DATA 499	Capstone in Data Science	3
Year 4, S2	UTK	DATA 375(N)	Internship in Data Science (N)	3
Year 4, S2	UTK	DATA 401	Visual Analytics	3
Year 4, S2	UTK	INSC 489	Information Visualization	3
Year 4, S2	UTK	AI 101	Introduction to the World of AI	3
			<i>UTK Credits:</i>	<b>60</b>
			<b>Total credits:</b>	<b>120</b>

## *Assessment and Evaluation*

Assessment activities encompass data collection for both the operations of the Data Science program and the evaluation of the major. The activities pertaining to program operations focus on the faculty delivering the major and the IT infrastructure, services, and resources facilitating the learning. Annual performance reviews gauge faculty teaching and service performance in relation to the major. The assessment activities connected to the evaluation of the major are about (a) recruitment, (b) retention, (c) graduation, (d) placement, (e) curriculum review, (f) student satisfaction, (g) student learning outcomes, and (h) student organization activities. The following are the primary assessment activities:

- **Annual Reports:** These will capture data on recruitment, retention, graduation statistics, student organization activities, and more. The Data Science Program Curriculum Committee is responsible for developing instruments for data collection and guidelines for generating the annual reports. The instruments will be developed by May 2024. The Data Science program director and program coordinator are responsible for collecting the data and producing the annual reports.
- **Triennial Curriculum Review:** Every three years, there will be a systematic curriculum review, assessing program learning outcomes via a 20% sample of student work. Curricular modifications will be made if learning outcomes are not achieved. This is the responsibility of the Data Science program director and program coordinator.
- **Biannual Employer Survey:** This will gauge the curriculum's relevance to current job markets. This is the responsibility of the Data Science Program Curriculum Committee. The survey is being designed and is expected to be distributed next year.
- **Data Science Board:** They will offer additional feedback on the major. The responsible party is the Data Science Program Curriculum Committee Chair.

For the program's first five years, THEC post-approval monitoring will be scheduled, including specific assessment of program outcomes, curriculum processes, enrollment, retention, and graduation rates. To assess the extent to which students achieve the Data Science major program learning outcomes, each course must have at least one assignment demonstrating at least one program learning outcome. In their capstone courses (DATA 399 and DATA 499), Data Science majors must submit a project assignment demonstrating achievement in at least half of the program learning outcomes.

The assessments will be shared with the Data Science Program Curriculum Committee for their evaluation of the B.S. in Data Science in terms of program effectiveness, student outcomes, and program impact. Primary student outcome indicators, such as GPA, course, and capstone performance, are used to assess overall student performance. Data regarding admission, progression, remediation, attrition, and completion are used to evaluate programmatic success. Data are disaggregated by student subgroup to allow equity evaluation of success for students from



populations that have been historically underrepresented in higher education. Alumni survey data and employer feedback data provide valuable insights regarding program impact and effectiveness.

**Table 11: Evaluation Process**

Evaluation Process	Timeframe	Responsible Party(ies)
THEC Post Approval Monitoring	Annually for five years	Program Director
Program Outcomes Review <ul style="list-style-type: none"> <li>• Curriculum</li> <li>• Student evaluations</li> <li>• THEC criteria</li> </ul>	Annually	Program Director and Program Curriculum Committee
Capstone Review	Annually	Program Director and Program Curriculum Committee
Review of Recruitment, Enrollment, and Graduation	Annually	Program Director

### Responsible Parties

The Dean of the College of Emerging and Collaborative Studies (CECS) manages all faculty and lecturer appointments, reviews, and retainment. The Program Director for Data Science oversees the implementation of all program assessments related to the program's operations and the evaluation of the major. Additionally, the following committees will have assessment and program evaluation responsibilities:

- ***The Data Science Program Curriculum Committee*** which has been convening since 2021, has members from each of the colleges on the Knoxville campus. The Data Science faculty committee oversees the curriculum of the B.S. program, both core courses delivered by CECS and elective courses offered by other UTK colleges. With representatives from all colleges, the Data Science Program Curriculum Committee also oversees changes to courses that could be added to the elective list or need to be removed (e.g., due to discontinuation). Initially, this intercollegiate committee worked to design the Intercollegiate Minor in Data Science and, subsequently, the IDP Major with a Data Science concentration in the College of Arts and Sciences. Recently, new members have been added to the committee, including the instructors on the core DATA courses and other faculty who have volunteered their interest in contributing to this proposal to elevate the bachelor's degree into the College of Emerging and Collaborative Studies (CECS).

- *The Data Science Advisory Board* meets bi-annually in April and October 2023. The Advisory Board oversees the development of the Data Science degree program in consideration of academic standards and requirements along with workforce needs and potential internship placements with companies participating in the committee. The Advisory board includes representatives from industry partners (e.g., CGI, Pilot Company, LabCorp, PetSafe) and government offices (e.g., Tennessee Department of Health, Oak Ridge National Laboratory) together with academic advising directors, Deans, Associate Deans, and faculty across multiple UTK colleges, including Arts and Sciences, Business, Engineering, Agriculture, Library Services, Music, and Education Health and Human Sciences.

### *Articulation and Transfer*

Transferring into this Data Science B.S. is straightforward for students who earn an Associate of Science (AS) degree via an approved Tennessee Transfer Pathway (TTP).<sup>16</sup> Transfer students admitted to UTK will be considered by CECS for the B.S. in Data Science, with a preference for students with an AS degree and a GPA of 2.3 or higher. UTK has a competitive admission process for transfer applicants and utilizes a holistic application review process considering all parts of the transfer student's academic record.<sup>17</sup>

Transfer applicants who have earned an AS degree from institutions in the Tennessee Board of Regents (TBR) system will have fulfilled the Volunteer Core (general education) requirement for UTK (the same is true for TBR Associate degrees in Arts, Fine Arts, and Science in Teaching). With Vol Core requirements satisfied, transfer students entering the Data Science B.S. program in CECS can focus on completing the nine DATA core courses and their five chosen elective courses in their years at UTK.

For transfer students entering the Data Science B.S. as full-time CECS students, our normal guidance would be that the student takes two DATA core courses per semester plus electives from the approved list for the program. Because the electives are upper level, most will have prerequisites. Fulfilling the prerequisites for the upper-division electives (15 credits) will often need guidance from advising and uTrack – the tool that identifies milestones designed to keep students on track for timely graduation. Transfer students and advisors will review the Data Science B.S. curriculum and list of electives (see Table 10) to ensure they complete milestones to facilitate transfer into specific majors.

The best strategy for the Data Science B.S. will use the prerequisites already satisfied via the student's AS degree. For this reason, the best-positioned transfer students would have an AS in Computer Science, Electrical Engineering, Mathematics, Physics, Mechanical Engineering, or

<sup>16</sup> <https://www.tntransferpathway.org/institutions>

<sup>17</sup> Full details at: [https://catalog.utk.edu/content.php?catoid=43&navoid=8258#Transfer\\_Admission](https://catalog.utk.edu/content.php?catoid=43&navoid=8258#Transfer_Admission)

Information Systems. The TTP versions of these AS programs typically contain two semesters of calculus and often classes in computer science that serve as prerequisites for many of the electives in the Data Science B.S.

Table 10, above, shows a sample degree plan for a Roane State Community College<sup>18</sup> student entering the Data Science B.S. program with a Computer Science Transfer Program (A.S) degree option, with which Vol Core will be considered by UTK to be fulfilled.

<sup>18</sup> <https://www.tntransferpathway.org/institutions/roane-state-community-college>

## Section IX: Students

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### *Academic Standards*

#### *Admissions*

At the University of Tennessee, Knoxville, the Undergraduate Admissions office is responsible for the administration of all admissions (e.g., high school seniors, international students, transfer students, and so forth) (<https://admissions.utk.edu/>). The processes and deadlines for undergraduate admissions are outlined on the university website. When applying to the University of Tennessee, Knoxville, students choose a major, and if they choose Data Science, they will be automatically admitted to the College of Emerging and Collaborative Studies; no additional admission requirements need to be fulfilled. Admissions to the Data Science BS program will be handled by the University of Tennessee, Knoxville, and will follow the same requirements:

- Completed and submitted an application for admission
- Core GPA evaluated
- Standardized test scores
- High school and/or college official transcripts
- One required essay
- Recommendations from teachers or counselors (optional)
- Personal statement (optional)
- TOEFL or IELTS for international students

The requirements described reflect the minimum requirements for admissions consideration at the University of Tennessee, Knoxville, and do not guarantee acceptance.

Students seeking admission to the B.S. in Data Science program may select it upon application to the University. Students seeking to change to the major must be in good academic standing—either both term GPA and cumulative GPA are 2.0 or higher or, if after two consecutive terms, the student's cumulative GPA is 2.0 or higher and at least one term GPA is also 2.0 or higher.

#### *Retention*

Retention standards for students match those of the University. Students in good academic standing will be retained. Students are placed on Academic Probation when (1) his/her cumulative GPA falls below the minimum acceptable level of 2.0 for one semester or (2) the semester GPA falls below the minimum acceptable level of 2.0 for two consecutive terms of enrollment. During the semester that a student is placed on Academic Probation, and any other semesters in Academic Probation, a student must participate in a special directive advising program to help the student address concerns impacting his/her academic performance and outline a plan for achieving academic success. Other details related to Academic Probation and Academic Dismissal for the

major will match those found in the University of Tennessee, Knoxville Academic Policies and Procedures (<https://onestop.utk.edu/academic-policies/>).

### ***Graduation***

Program graduation standards for the major follow the University of Tennessee, Knoxville Academic Policies and Procedures (<https://onestop.utk.edu/academic-policies/>). The University of Tennessee, Knoxville, requires a minimum of 120 credit hours to earn a bachelor's degree. At least 36 credit hours should be completed within the major. Students must achieve a grade point average of at least 2.0 on all work attempted at the University of Tennessee, Knoxville.

### *Marketing and Recruitment*

As described above, there is a growing market for Data Science, nationally and in Tennessee, among students and employers. Led by our We plan to employ social media for advertising, digital campaigns, and promotional videos for building our brand and engaging with potential students.

CECS will target schools and community colleges with programs for adult learners and minority populations to recruit a diverse student body, especially those that offer associate degrees in data science, computer science, and other related skills. CECS Program Director Dr. Vandana Singh will work with the National Center for Women & Information Technology to develop recruitment strategies focused on recruiting women into CECS degrees, including the B.S. in Data Science.

The CECS Director of Marketing and Communication (DMC) leads strategic marketing plans and recruitment, promoting all CECS undergraduate programs, including Data Science. The DMC organizes CECS involvement with in-person recruitment events and career fairs, such as College Connect during new-student orientation week, the Big Orange Preview and the Knox County College Fair (for recruiting high school students). The DMC uses search engine optimization and social media activity on the latest platforms for maintaining the online presence of CECS.

### *Student Support Services*

CECS has hired full-time staff positions in student advising, internship placement, and external partnerships. These positions are described in the section on Administrative Support. Among these, listed in Table 14, is the CECS Director of Partnerships and Economic Engagement, who will arrange partnerships with industry partners for internship placement for Data Science students, for which they will get course credit (DATA 375N or 485N). At the University of Tennessee, Knoxville, incoming Students participate in orientation, which includes new student advising. After UTK students settle into their semester, each is assigned an academic advisor to help them stay on track with coursework, career goals, and co-curricular experiences. Through their time at UTK, the Advising office helps students set and achieve their academic, professional, and personal goals. For deep student engagement, the Vol EDGE Program, guided by the Volunteer Experience committee, offers experiential learning and engagement activities that foster well-being and purposeful life-career readiness preparation.

The following student support services are available at CECS:

- **Program Director:** The Program Director plays a pivotal role in overseeing the curriculum and ensuring it remains relevant and cutting-edge. They will also be available for consultations with students, offering advice on career paths, connecting them with faculty research initiatives, and helping navigate any academic challenges specific to the data science field.

- **Tailored Academic Advising:** The Director of Academic Advising at CECS will guide students through course selections, research opportunities, and academic planning. For instance, an advisor might assist a student in selecting electives that align with their interest in applications of data science in real-world projects.
- **Technical Workshops and Seminars:** Regularly scheduled workshops on current emerging technologies and tools will be offered. The Director of Partnerships and the Program Director of Data Science will facilitate these activities.
- **Internship and Research Opportunities:** We provide assistance in securing internships and participating in research projects relevant to data science. An example is a partnership with a local tech company offering internships in data science development. The Director of Partnerships and the Internship Coordinator will support these activities.
- **Peer Support and Study Groups:** We will facilitate peer support groups and study sessions for challenging data science courses, providing a collaborative environment for students to enhance their learning and understanding of complex concepts.

At the University of Tennessee, Knoxville, incoming Students participate in orientation, which includes new student advising. After UTK students settle into their semester, each is assigned an academic advisor to help them stay on track with coursework, career goals, and co-curricular experiences. Through their time at UTK, the Advising office helps students set and achieve their academic, professional, and personal goals. For deep student engagement, the Vol EDGE Program, guided by the Volunteer Experience committee, offers experiential learning and engagement activities that foster well-being and purposeful life-career readiness preparation. The following student support services are available at UTK.

- [The Writing Center](#): The Writing Center is to help students with writing papers, citations, and all other paper-writing questions.
- [Stat Lab](#): For students needing help with statistics, a tutoring service is available on the second floor of Hodges Library.
- [The Math Place](#): Used as both a study space and a tutoring location, the website for this service details the support provided for specific math courses.
- [OneStop Student Services](#): One-stop help service for enrollment, academic records, financial aid, and payment; OneStop is located on the ground floor of Hodges Library.
- [Student Disability Services](#): Offers support in the coordination of accommodations in the classroom.

- [Division of Student Success](#): With a wealth of resources, from academic success to career development resources to national scholarships, their mission is to help students recognize and apply their strengths.
- [Student Health Center](#): Taking care of your physical health is important, and the Student Health Center is here to help. Visit their website to learn about eligibility and cost, services, and to book appointments.
- [Counseling Center](#): Just as important as your physical health, taking care of your mental health is essential. Visit their website to learn more about the counseling services available to students.
- [974-HELP](#): Are you or another Vol experiencing distress? Developed to help students reach their academic goals and to help maintain a safe community and learning environment for all students, 974-HELP creates a safe, nonjudgmental place for students to be understood and supported.
- [Pride Center](#): The lesbian, gay, bisexual, transgender, and queer (LGBTQ+) resource center at UTK, the Pride Center provides events, programming, community space, and initiatives to engage and explore issues relating to gender and sexuality.
- [Frieson Black Cultural Center](#): This gathering place offers a library/reading room, computer lab, student lounge, gallery, multipurpose rooms, a student organization suite, conference rooms, and more. It serves as a place for the campus community to learn, share ideas, and discuss experiences.
- [Veterans' Resource Center](#): Located on the ground floor of Hodges Library, this resource provides assistance for active-duty service members, veterans, reservists, guardsmen, and family members using their VA educational benefits.
- [Student Disability Services](#): This service works to establish an inclusive environment where every aspect of the university experience is readily accessible for all students without barriers or bias.
- [Big Orange Meal Share](#): A short-term assistance program that allocates meals to students in need; visit their website to either sign up or donate meals.
- [Big Orange Pantry](#): Open Wednesdays and Fridays from 2-5 p.m., this service provides emergency food assistance to UT students, faculty, and staff.
- [Smokey's Pantry](#): Smokey's Pantry serves the UT community to combat food insecurity. No qualifying information is required.
- [Smokey's Closet](#): Smokey's Closet provides free, gently used professional clothing and accessories to students at UT. Students check in and can receive one free outfit.



- **[The Free Store](#)**: The Free Store is a community share space that allows UT students to shop for free, high-quality, lightly used clothing, kitchenware, accessories, and small appliances at regularly scheduled Free Store Pop-Up events held throughout each academic year. Look out for events on their [Instagram](#) page.
- **[Student Organizations](#)**: Finding a group of people who share your interests is a great way to enhance your university experience. This list details 600+ student organizations at the University of Tennessee, Knoxville.

## Section X: Instructional and Administrative Resources

### *Faculty Resources: Current Faculty*

The table below provides an overview of all program faculty.

**Table 12:** *Summary of Faculty Who Contribute to the Proposed Program*

Faculty Name	Faculty Dept.	Rank or Title	Highest Degree	Role in Program
Xiaopeng Zhao	College of Emerging and Collaborative Studies	Full Professor	Ph.D.	B, A, C, D
Michael Berry	Tickle College of Engineering	Professor	Ph.D.	B
Nana Bryan	Haslam College of Business	Lecturer	Ph.D.	A
Brianne Dosch	John C. Hodges Library	Librarian	MSIS	B, D
Joshua Fagan	College of Emerging and Collaborative Studies	Lecturer	Ph.D.	A, B, C, D
Rebecca Frank	College of Communication & Information	Assistant Professor	Ph.D.	A, B, C, D
Jianguen He	College of Communication & Information	Assistant Professor	Ph.D.	B
Ben Horne	College of Communication & Information	Assistant Professor	Ph.D.	B
Mingzhou Jin	Tickle College of Engineering	Professor, ISSE Dir.	Ph.D.	B
Nicholas Nagle	College of Arts and Sciences	Professor	Ph.D.	B
William Nugent	College of Social Work	Professor	Ph.D.	B
Adam Petrie	Haslam College of Business	Senior Lecturer	Ph.D.	B
Marshall Prado	College of Architecture & Design	Assistant Professor	Ph.D.	B
Jonathan Ring	Baker School of Public Policy and Public Affairs	Lecturer	Ph.D.	B

Faculty Name	Faculty Dept.	Rank or Title	Highest Degree	Role in Program
Louis Rocconi	College of Education, Health, and Human Sciences	Associate Professor	Ph.D.	B
Vandana Singh	College of Emerging and Collaborative Studies	Professor, Program Director	Ph.D.	A, C
Jorge Variego	College of Music	Assistant Professor	Ph.D.	B

Note: As shown in the Table above, contributions to the program are keyed as:

- A - Will teach in the program
- B - Will design curriculum for the program
- C - Will conduct related research
- D - Will advise students in the program

### *How Faculty Will Support the Program*

The Data Science program's success hinges on our faculty members' dedication and expertise. Firstly, the program draws upon an existing Bachelors of Arts program, which launched in 2022, and includes courses that are already running at UTK: DATA 101, 102, 202, 203 and 499. Of these, the two first-year courses are already taught by CECS faculty (one by the Associate Dean and one by a CECS Lecturer, who also supervise the capstone 499 course). All the additional courses for this new B.S. in Data Science have been vetted and discussed by the Data Science Program Curriculum Committee, and these new courses will be taught by new CECS Lecturers to be hired to start in Fall 2024. In addition, Faculty Fellows will be recruited by CECS to collaboratively co-develop and co-teach core DATA courses.

### Anticipated Faculty

The Data Science **Program Director** oversees the degree program operations, including enrollment, appointing undergraduate student graders, advertising, course scheduling, assessment, accreditation, and capstone course content. In cooperation with the Director of Partnerships (below), the program Director will also engage campus, community, and industry partners to support experiential learning in the program as well as foster pathways to employment. For the Program Director 50% of their salary and benefits is budgeted to the Data Science program to reflect their time split between the Data Science program and other college activities.

**Full-time Lecturers** will be appointed with specialized knowledge in Data Science, will lead in crafting the core Data Science courses, ensuring that the program's foundational elements are robust and cutting-edge. With specific expertise, **Faculty Fellows** will be strategically recruited among tenure-track faculty, to deliver selected Data Science core courses. **Undergraduate Graders** are needed for regular homework assignments in the larger lower-division core courses. A **Lab Instructor** is needed for the introductory course (DATA 101).

Table 13: Anticipated Faculty and Instructional Staff.

Faculty Rank or Employment Classification	Part-Time or Full-Time	Anticipated Salary	Anticipated Start Date	Comments
Program Director	Full-time	\$211,200 / year	July 2023	Data Science Program Director
Full-time Lecturers	Full-time	\$90,000 / year	Aug 2024	To teach DATA 101, 102, 201, 202 as needed
CECS Faculty Lead	Part-time	\$10,000/year	August 2023	Program planning and curriculum development
CECS Faculty Fellows	Part-time	\$10,000 / semester	Academic Year 2024-2026	To co-develop and co-teach DATA core courses, as needed.

The undergraduate graders are expected to work no more than 10 hours each week.

### *Administrative Support*

The CECS **Program Coordinator** oversees the degree program operations, including enrollment, appointing GTAs, advertising, course scheduling, assessment, accreditation, and capstone course content. The program coordinator will also engage campus, community, and industry partners to support experiential learning in the program as well as foster pathways to employment.

CECS will hire a full-time **Director of Advising** (DoA) to provide advising to undergraduate CECS students. As this Data Science B.S. is intercollegiate, the DoA consults with other advising directors across UTK to ensure that CECS students can schedule courses that meet their interests while achieving the requirements of the degree, course prerequisites, and Vol Core. The DoA also manages academic planning, petitions, registration issues, retention initiatives, and graduation and degree completion matters for students enrolled in CECS. The DoA will also oversee internal transfers and change of major advising, academic advising development, assisting in problem resolution, and using positive open-ended questions and intentional strategies to help students explore their goals and interests. Additionally, the advisor educates students about curricular requirements, collaborates in developing academic plans, advises on majors, minors, honors, and college policies, assists transfer students, and conducts academic reviews each semester.

For internship placement, CECS has a **Director of Partnerships**, who has already developed numerous partnerships with industry partners (see support letters in **Appendix A**) and government agencies such as Knoxville Chamber (**Appendix A**). These organizations are prepared to offer research and internship opportunities for Data Science students, for which they will get course credit (DATA 375N or 475N). The DPEE manages relationships between CECS, the U.T. Research Office, and existing top-tier private sector partners (such as CGI – see **Appendix A**). The Director of Partnerships also consults with local, regional, and national economic development organizations and businesses to encourage industry collaborations and support CECS student success by expanding educationally relevant opportunities such as internships, co-op, and employment upon graduation. The Director of Partnerships works with the UTK Center for Career Development to ensure students' working conditions meet academic goals.

The Internship Coordinator will oversee student appointments as interns with industry partners, monitor and assess the learning outcomes and coordinate scheduling of these courses and placement of students.

Table 14: Anticipated Non-Instructional (Administrative Support) Staff.

Job Title	Part-Time or Full-Time	Anticipated Salary	Anticipated Start Date	Comments
Director of Marketing/Comms*	Full-time	\$90,000	Aug 2023	Supports all CECS programs
Program Coordinator	Full-time	\$70,000	Sept 2023	Supports all CECS programs
Director of Advising*	Full-time	\$80,000	Nov 2023	Supports all CECS programs
Director of Business Operations*	Full-time	\$80,000	Aug 2023	Supports all CECS programs
Director of Partnerships*	Full-time	\$90,000	Aug 2023	Supports all CECS programs
Laboratory Instructor	Part-time	\$4000/course	Aug 2024	To run coding labs for DATA 101
Undergraduate Graders	Part-time	\$20/hour*	Aug 2024	Mark homework (DATA 101, 102, 201, 202)
Internship Coordinator	Full-time	\$60,000	Aug 2026	Support all CECS programs

\* These positions support college-wide business and their costs are not included in the financial projection for the proposed Data Science BS program.

## Section XI: Resources

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### *Equipment*

CECS is located on the ground floor of the Claxton Education Building on Volunteer Boulevard, at the center of the Knoxville campus. The 3,200 square feet of Claxton devoted to CECS has a “unique boutique college” feel, which represents CECS well and needs minimal renovation. The available classrooms upstairs in Claxton, as well as the multi-purpose seminar room in the CECS space, will be ideal for upper-level CECS courses of small to medium sizes. The Claxton space is ideal for interdisciplinary instruction and collaboration with students: whiteboards on the hallway walls for interactive teaching, discussion space, and lounge space upstairs, all of which are oriented toward collaborative instruction and experiential and group learning by CECS. The space is particularly ideal for CECS capstone courses for advanced students in Data Science, where CECS instructors based in one of the office suites can lead small groups of students to focus on their complementary skills.

For student experiential learning, a large kitchen room is being converted into the CECS Living and Learning Lab, in which numerous equipment and technology will be available to students and instructors to test innovative ideas for teaching and learning in an immersive fashion. Few such technologies are XR (extended reality) equipment or high-end GPU-supported computers that enable game design, drones, and robots that students can interact with, etc.

A drop-by advising office will serve Data Science students planning their CECS courses, degree timetable, internships, and placements. The student-serving office provides face-to-face meetings with students that will be especially necessary due to the inter-disciplinarity nature of CECS degrees (CECS core courses, electives in other colleges, and Vol Core requirements). As the CECS Claxton space can accommodate this advising office as well as the Director of Advising and the Director of Partnerships, these student-serving faculty can collaborate regularly. Claxton Education Building will also welcome new Tennessee Transfer partnership students from our partner programs at Tennessee community colleges. CECS Faculty Fellows can reside part-time in CECS office spaces.

### *Information Technology*

Everywhere on campus, students access online Internet access on UT’s wireless network by registering their computer, tablet, and/or smartphone. OIT provides full technical and logistical management for UTK Computer Labs, which offers a stable, available, and reliable environment for students to complete their academic assignments. OIT Computer Labs offers students easy access to Windows and iMac desktop computers, Windows and MacBook loaner laptops, more than 60 printers, a wide range of software applications, and the ability to reserve specific classrooms for computer classes. Student Computer Support offers support for your personal computer as a drop-off service or quick-help service.

Educational IT resources for students are organized through Canvas, which is the online learning portal, and MyUTK, which is the students' portal for quick access to online resources such as Google Drive and essential Microsoft Office products: Outlook, Word, Excel, or PowerPoint and 365 OneDrive. Google Workspace and Microsoft 365 allow students to connect with classmates for team projects and online collaboration. Courses with synchronous meeting times have students join online via Zoom by signing in with their NetID and password. St

Workshops and training are available from the UTK Office of Information Technology (OIT), including live Zoom workshops and self-paced online training. Students also have access to LinkedIn online training for technology, creative, and business courses.

### *Library Resources*

Located in the Claxton Education Building on Volunteer Boulevard, CECS is across the street from John C. Hodges Library, the main library facility on campus. It is open 7:30 am - 10 pm on weekdays and 10 am - 8 pm on weekends. Hodges Library can seat 2,000 users in its 350,000-square-foot building. The University of Tennessee, Knoxville Libraries have a print collection of approximately 3 million volumes. Access is provided to approximately 80,000 electronic periodicals/serials and to over half a million e-books. As a selective depository, Hodges Library receives 42 percent of the available items currently offered through the Federal Depository Library Program. The libraries' facilities include several branch libraries: Music, Agriculture and Veterinary Medicine, Special Collections in the Hoskins Building, and the Social Work Library in Nashville. In particular, the George F. Devine Music Library has been recently updated and housed in the Natalie L. Haslam Music Center. In addition, facilities and collections of the independently administered Katz Law Library (also a Federal Depository Library) and Preston Medical Library are also available.

The Studio, located in the Commons South at Hodges Library, is a media production and design lab open to all UT students, staff, and faculty. The Studio provides multimedia workstations, production software, knowledgeable staff, and training materials to assist in the creation of multimedia education projects. The Studio continues the UT Libraries' rich tradition of innovation and operates in a creative environment of instructional and service excellence. Multimedia and GIS workstations are available on a first-come, first-served basis. Specialized production facilities, like audio recording booths, the virtual reality lab, and the video production suite, are available by reservation.

### *Facilities*

The Data Science B.S. program at UTK will be bolstered by state-of-the-art facilities designed to promote innovation, collaboration, and hands-on learning. Every classroom at UTK is outfitted with interactive technology, providing a dynamic setting for lectures and presentations. Because CECS is collaborative, classroom spaces for DATA core courses are booked by central timetabling in excellent classrooms across campus. In Fall 2023, for example, these classrooms were in Perkins Hall



on the engineering campus, Nielsen Physics Building, and Ayres Hall on the arts and sciences campus, and the Humanities and Social Sciences building. To enhance collaboration and facilitate group projects, the campus features several open-concept spaces dotted with whiteboards and furnished with modular seating. The program also includes dedicated office spaces for students, fostering an atmosphere conducive to research and peer learning. A central hub acts as a dual-purpose space, serving both as a communal area for students and faculty and as a breeding ground for innovative projects. This harmonious fusion of classic and contemporary learning spaces guarantees that students enrolled in the Data Science B.S. program have all the necessary resources.

CECS itself has about 2,000 square feet of dedicated space on the ground floor of the Claxton Education Building, on Volunteer Drive on the UTK campus. Centrally located on campus, Claxton provides students with access to their classes as well as the main library and the Student Union. Moreover, it can accommodate the offices of advisors, the Director of Advising, and the Director of Placements to serve CECS students. Claxton provides routine office functions—printing and scanning facilities, conference rooms, kitchens, and lounge areas— as well as kitchen and lounges for incidental team interaction. A large conference room (Claxton 105) can serve as a medium sized classroom (capacity ~ 35 students) for core courses in Data Science, which also provides students in the Data Science program with the feeling of a home base. Additionally, the Claxton space has shown itself to be an ideal space for interdisciplinary instruction and collaboration with students: whiteboards on the walls for collaborative brainstorming, discussion spaces, lounge space and classrooms, all of which being oriented toward collaborative instruction and experiential and group learning for students in advanced Data Science classes (such as the Junior Capstone or Senior Capstone).

### *Evidence of Willingness to Partner*

Numerous entities express willingness to partner with the program. Each of the entities listed below has a signed letter of support; see Appendix A.

1. **Knoxville Chamber**, which uses data science to analyze future economic prosperity in East Tennessee, is committed to providing Data Science students with real-life experiences in the workplace, including internships and capstone projects.
2. **Labcorp**, a global life sciences company that uses data science in diagnostic labs and clinical trials for its drug development services, expressed interest in internships or placements for CECS data students with Labcorp in analyzing, visualizing, and managing data.
3. **XS Power**, a Knoxville-based battery manufacturer, supports Data Science and is interested in student internship placements and collaborative capstone projects for CECS students.
4. **Lirio**, a company that combines behavioral and data science to deliver personalized health strategies, describes their work as “highly compatible” with the Data Science program. They are interested in providing internship placements and real-world capstone projects.
5. **CGI** is an ideal partner for Data Science, as data science is essential to all their services in telemedicine and diagnostics. Internships or placements with CGI for CECS students could focus on analyzing, visualizing, and managing data.
6. **Nell One**, a pharmaceutical lab in Knox County, inspired by the partnership between the data science program at Carnegie Mellon and the Health Data Alliance of Pittsburgh, is interested in data analytics as entry into internships and collaborative projects.
7. **Moment Energy**, a sustainable energy company, is “extremely eager” to partner with CECS on industry-relevant curricula, internships, and collaborative team projects.
8. **JTEKT**, an automotive manufacturer, is expressing interest in partnering with CECS to provide invaluable real-world experiences to the students.
9. **Viridi Parente**, which designs lithium-ion battery products and their potential to contribute to economic development, is interested in partnering with CECS on student internships, interdisciplinary research, and collaborative capstone projects.
10. **iO Urology**, which has developed a remote patient monitoring system, is interested in internships for CECS students as potential future employees of their fast-growing company.
11. **Baker School of Public Policy** is a collaborating academic unit on the UTK campus
12. **Tickle College of Engineering** is a collaborating academic unit on the UTK campus.
13. **College of Arts and Science** is a collaborating academic unit on the UTK campus.

## Appendix A: Letters of Support

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July 28, 2023

To Whom It May Concern:

I am writing to lend the Knoxville Chamber's support for a new bachelor's degree in data sciences from the University of Tennessee's College of Emerging and Collaborative Studies (CECS).

The mission of the Knoxville Chamber is to drive regional economic prosperity. Increasingly, employers in the Knoxville area are seeking to fill and create jobs that support innovation to be competitive in what many consider the fourth industrial revolution, the Imagination Age. Data science is one of those occupations.

The CECS data science degree will provide students with core skills in data science, such as data visualization and regression analysis, which are in-demand now and will continue to grow. The Knoxville Chamber is looking forward to partnering with CECS to ensure that the curriculum meets the needs of Tennessee employers and to assist in giving students real-life experiences in the workplace, including internships and capstone projects.

In summary, the Knoxville Chamber views the CECS data science degree as complementary to the region's efforts to attract and retain high-paying, high-skilled jobs and ensure our employers can thrive in the "Imagination Age."

Thank you for your consideration,

A handwritten signature in blue ink that reads "Amy Nolan".

Amy Nolan  
Vice President for Regional Enhancement



July 11, 2023

College of Emerging and Collaborative Studies  
The University of Tennessee, Knoxville  
527 Andy Holt Tower  
Knoxville, TN 37996-0152  
Attention: Ozlem Kilic, Dean

Re: Opportunities at Labcorp

Dear Dr. Kilic:

I am writing to register the interest of Labcorp in partnering with University of Tennessee students in the Bachelor of Science in Data Sciences into the College of Emerging and Collaborative Studies (CECS). As you know, Labcorp is a leading global life sciences company that is deeply integrated in guiding patient care through its comprehensive clinical laboratory and drug development services. Our mission is to improve health and improve lives by delivering world-class diagnostics, accelerating the availability of innovative medicines to patients, and using technology to alter the way care is delivered.

At Labcorp, data science is essential to our services in diagnostic labs and clinical trials. The Data science degree in CECS would provide students with the core skills such as database management, sampling, data visualization, and regression analysis, all of which are relevant to geographic and temporal mapping of pandemics and socioeconomic covariates. Internships or placements for CECS students with Labcorp could focus on analyzing, visualizing, and managing data.

We are excited to see that UTK has funded data-driven research to analyze the opioid crisis, obesity, online misinformation, and future pandemics. The tipping point between Data Science and health informatics became clear during the pandemic. Almost immediately, covid data were rich, granular and freely available: daily infection and fatality rates in every country, U.S. county or city, yielding epidemiological measures comparable to pre-existing societal data on economics, health facilities, cultures, and governmental actions in those places. Thousands of peer-reviewed papers and billions of dollars in research funding were devoted to studying not just a vaccine but also the effects of government, community, and individual responses to the virus. The first were studies on the spread of the virus itself, followed by research on the effect of government actions (policies and lockdowns), individual actions (masks, social distancing, vaccination) and finally the population-level effects of cultures and socio-economic disparities.

Labcorp was a leader in the pandemic, and we are very supportive of UTK growing the next generation of leaders that will be needed to continue to use data to improve lives.

Kind regards,

Adam Sullivan, Ph.D.  
Executive Director of AI

Laboratory Corporation of America Holdings  
531 South Spring Street  
Burlington, North Carolina 27215

[labcorp.com](https://www.labcorp.com)



XS POWER  
 2847 John Deere Drive, Suite 102  
 Knoxville, TN 37917  
 Ph : (865) 688-5953 Fax : (865) 281-9844  
[www.4xspower.com](http://www.4xspower.com)

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Date : July 27, 2023

To whom it may concern,

We are writing to express our full endorsement of the initiatives to develop a Bachelor of Science degree in Data Science by the University of Tennessee, Knoxville's College of Emerging and Collaborative Studies (CECS). As a local employer we have a vested interest in the advancement and prosperity of our area. In our view, CECS is spearheading the drive to revolutionize the education of their students by instilling the values, skills, and knowledge to not only succeed, but thrive in their fields by successfully partnering with their employers.

Now, more than ever, it is vital that students have access to education and training that prepares them to be an integral part of rapidly changing technology of various industries. CECS achieves this admirably through its customized degree programs that enables its students to choose a career path with confidence that they will have the educational background and practical experience to be able to excel in their chosen field.

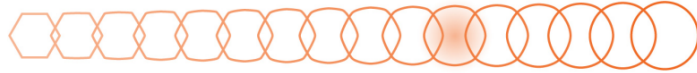
The philosophy of CECS of enriching students' educational journeys while also granting local employers like us the opportunity to tap into an array of skilled graduates with varied expertise and industry-specific insights shows immense insight and forethought.

As it relates to technology advancements in our company, we are excited to support curriculum that addresses topics in AI and Data Science for the Fall of 2024. This curriculum is aligned with our goals, and we would be interested in working with the team to create internship and co-op opportunities to the students going through those programs. We are looking forward to the future opportunities that an alliance with CECS will provide to our industry, to the students looking forward to joining the workforce, and to the future of East Tennessee.



**KNOXVILLE** | 320 Corporate Drive, NW | Knoxville, TN 37923  
**FRANKLIN** | 5000 Meridian BLVD, STE 200 | Franklin, TN 37067

[www.lirio.com](http://www.lirio.com)



July 31, 2023

Ozlem Kilib, Dean  
 College of Emerging and Collaborative Studies  
 University of Tennessee, Knoxville  
 527 Andy Hott Tower  
 Knoxville, TN 37996-0152

Dean Kilib,

I am writing today to express Lirio, LLC's support of the B.S. degree in Data Science to be offered by the new College of Emerging and Collaborative Studies (CECS) at UTK.

Based in Knoxville and Nashville, Lirio combines behavioral science with data science and artificial intelligence to deliver highly personalized behavioral nudging solutions to the healthcare consumers of our nation's healthcare sector. Given the reliance upon data science and AI, Lirio is an excellent fit for partnership with CECS, which I understand to be launching new degrees in applied AI and Data Science in the fall of 2024.

In terms of the fit with CECS Data Science specifically, our purpose is to combine data-driven behavioral science with artificial intelligence to facilitate improved health behaviors in our clients' populations. This is an excellent fit with the CECS Data Science degree, as the gateway course (DATA 201, to be re-numbered as DATA 101) we understand to contain a considerable behavioral science component, in terms of analyzing patterns in public health statistics as well as predicting behavior changes in response to certain stimuli.

In addition, we understand the Data Science degree also offers core courses on the ethics of data curation, data wrangling, and data visualization, as well as electives courses on data in psychology, biostatistics, teamwork and leadership skills, behavioral geography and more.

The Data Science bachelor's degree is therefore highly compatible with the work we do at Lirio. As CECS is also committed to providing internship placements, as well as real-world capstone project opportunities to all students in CCS majors, we are confident that there will be multiple ways to engage on these fronts with Lirio.

In summary, we support the CECS Bachelor of Science degree in Data Science and look forward to collaborating on giving students a chance to engage with our work at Lirio.

Local: 865.243.8000 | Toll Free: 877.819.2188 | [www.lirio.com](http://www.lirio.com)





CGI  
 900 South Gay Street  
 Suite 1000  
 Knoxville, TN 37902  
 Tel. 337-281-2066

cgi.com

September 11, 2023

University of Tennessee, Knoxville  
 College of Emerging & Collaborative Studies  
 527 Andy Holt Tower  
 Knoxville, TN 37996

ATTN: Dr. Ozlem Kilic

RE: Letter of Support for CECS, B.S. in Data Science

I am writing to register the support of CGI in partnering with UTK students in the Bachelor of Science in Data Science into the College of Emerging and Collaborative Studies (CECS).

CGI is the world's fifth largest independent information technology and business process services company with more than 91,000 members working in 40 countries around the world. Our commitment to Knoxville and our partnership with the University of Tennessee, is a key component of a public-private partnership that is bringing 300 jobs to the Eastern Tennessee region. These high paying jobs are rooted in the technology consulting sector, including data science as an area of focus, but also span a breadth of domains that include health, the environment, financial services, aerospace, telecommunication, cybersecurity, and governmental sectors.

At CGI, data science is essential to our services across all of these industry domains. We work closely with clients to drive as much value as possible from data, incorporating multidisciplinary insights and capabilities. Most organizations collect vast amounts of data and struggle to make the most of it. CGI works with organizations that, for example, try to find patterns in vast amounts of customer data, in order to predict the choices of hundreds of thousands of customers, identify new target groups for customized marketing, and personalized preferences.

Analysis of these datasets require advanced data analytics, data visualization, and data wrangling, all of which are core features of the CECS B.S. degree in Data Science. CGI also employs techniques of machine learning and artificial intelligence, which are complimentary offerings in the CECS suite of bachelor's programs to be offered in the Fall of 2024.

The Data Science degree in CECS would provide students with the core skills such as databases, sampling, data visualization, and regression analysis, all of which are relevant to geographic and temporal mapping of pandemics and socioeconomic covariates. Internships or placements with CGI for CECS students could focus on analyzing, visualizing, and managing data.

Overall, the proposed Data Science program aligns very well with CGI's commitment to advancing the data-intensive knowledge economy. The healthcare sector in Tennessee, for example, increasingly needs to analyze complex datasets. A bachelor's program in data science positions students into this workforce very well, along with countless other sectors that continually analyze vast amounts of data to better serve their markets and clients. We are excited about the opportunities this collaboration will create for students, faculty, and the state of Tennessee. If any additional information or details about CGI are required, please do not hesitate to reach out to me.

Sincerely,



William R. LaBar  
Vice President  
CGI Federal





University of Tennessee Knoxville  
College of Emerging and Collaborative Studies 513  
Andy Holt Tower  
Knoxville, TN 37996

Dear University of Tennessee Knoxville,

I am writing to express our wholehearted support for the Data Science B.S. degree program being developed at the College of Emerging and Collaborative Studies (CECS). As the CEO of NellOne Therapeutics Inc., I am committed to fostering regional growth and innovation. CECS will be at the forefront of educational advancement, equipping students with innovative skills that drive economic development and raise the standard of living for all of East Tennessee.

I envision CECS having a similar impact to the partnership between Carnegie Mellon University and the University of Pittsburgh in the Health Data Alliance. By incorporating AI and data analytics, their program achieved groundbreaking advancements in precision medicine, disease prediction, and personalized healthcare. This transformative initiative attracted established and entrepreneurial companies to the region. Knoxville has the potential to experience a similar positive transformation through CECS in multiple fields of innovation.

In our rapidly evolving world, where new technologies and industries emerge unprecedentedly, academic institutions must adapt to prepare graduates for the future. NellOne Therapeutics Inc. would benefit from CECS's training programs in computational biology, statistics, and AI, as these disciplines are integral to growing the Life Science Community in East Tennessee. By offering stackable degree programs that combine expertise in microbiology, chemistry, or genetics with entrepreneurial skills, we can attract and retain top talent from both within and outside the region, fueling our economy and ensuring long-term prosperity.

The Data Science B.S. program being designed has a strong potential to instill in students the skills to help organizations like NellOne extract meaningful patterns and insights to make data-driven decisions. This program will contain a curriculum that will help develop data analytic skills and statistical inference and move into a practical application of supervised and unsupervised learning, time series analysis, neural networks, regression, and visualization techniques, which we need in future employees. Students also learn how machine learning and artificial intelligence can accomplish these tasks and arrive at unexpected solutions for data-driven decision-making. By working with students taking this curriculum, we are putting ourselves in an excellent position to work with health informatics and automated customer services.

Being fortunate enough to have led numerous successful companies, I understand the value programs like those offered at the University of Tennessee Knoxville bring. Incorporating AI into advanced materials, semiconductor design, vision processing, and mobility solutions would have made my past journeys more efficient and is paramount for the growth and sustainability of future companies.

CECS's emphasis on internships, interdisciplinary research, collaborative team projects, and community engagement is a vision of the future. By providing students with practical, firsthand experience, CECS ensures they are well-prepared to meet the demands of tomorrow's workforce.

Moreover, CECS's role as an incubator for customizable and stackable degrees is inspiring. By fostering collaborations across disciplines, CECS stimulates innovative research and teaching strategies. This approach enriches students' educational journeys and enables companies to access diverse graduates.

We are thrilled about the potential partnership between NellOne Therapeutics Inc. and CECS to establish a customized curriculum tailored to our industry's needs. The significant value that CECS brings to the University of Tennessee Knoxville and the East TN Region cannot be overstated. We eagerly anticipate exploring opportunities for mutual growth and success.

Thank you for considering our unwavering support and keen interest in forging a collaborative partnership. We believe in boundless possibilities and look forward to a shared growth and success journey.

Sincerely,

Bill Malkes  
CEO, NellOne Therapeutics Inc.

[hello@nell-one.com](mailto:hello@nell-one.com) | +1.865.567.3351 | 11020 Solway School Road, Ste 101 | Knoxville | Tennessee | 37931





TO  
 University of Tennessee Knoxville  
 College of Emerging and Collaborative Studies  
 513 Andy Holt Tower  
 Knoxville, TN 37996

DATE  
 July 18, 2023

Re: Letter of support for CECS

To whom it may concern,

I am writing this letter to convey our utmost admiration and support for the Data Science B.S. being developed at the College of Emerging and Collaborative Studies (CECS). As a prospective local employer, we are wholeheartedly committed to the progress and advancement of our community. We firmly believe that CECS stands at the vanguard of educational innovation, empowering students with the skills and knowledge necessary to thrive in their careers and engage with future employers.

In an era of unprecedented technological advancements and rapidly evolving industries, it is vital for academic institutions to adapt swiftly and equip their graduates to meet the challenges of tomorrow. We strongly assert that CECS's tailored degree programs not only allow students to align their education with the careers of the future, but also provide them with invaluable practical experiences that will greatly benefit our organization's educational requirements. The emphasis on internships, interdisciplinary research, collaborative team projects, and community engagement ensures that CECS graduates possess the sought-after workforce skills that employers like us actively seek.

The Data Science B.S. program being developed by CECS is meaningful for our industry sector as we see the importance in making data-driven decisions. There is a large component of our operations that relies on testing of batteries and the data generated from those tests. It is important for us to engage with students who are being taught these skills to ensure that we can be successful and provide our customers and stakeholders with accurate information.

Moreover, CECS's commendable role as an incubator for the creation of new, customizable, and stackable degrees deserves the utmost recognition. By fostering collaboration across multiple disciplines and serving as a central hub, CECS acts as a catalyst for innovative research and teaching methodologies. This approach not only enriches the educational journey for students but also enables local employers such as ourselves to access a highly talented pool of graduates with a diverse skill set and specialized knowledge relevant to our industry.

We are extremely eager to forge a partnership with CECS in order to develop a tailor-made curriculum and work with students that addresses the specific needs of our industry. The immense value that CECS brings to the University of Tennessee Knoxville and the East TN Region is profoundly recognized and appreciated by our organization.

Thank you for considering our genuine support and sincere interest in establishing a collaborative relationship. We eagerly anticipate the remarkable possibilities that lie ahead and look forward to exploring opportunities for mutual growth and prosperity.

Sincerely,

**Edward Chiang**

**Edward Chiang**  
 Co-founder & CEO | Moment Energy Edward@momentenergy.com





JTEKT NORTH AMERICA CORPORATION

7 Research Drive, Greenville, SC 29607  
(864) 770-2100 [www.JTEKT-NA.com](http://www.JTEKT-NA.com)

I am writing to express, on behalf of JTEKT North America, enthusiastic support for the University of Tennessee's visionary initiative in establishing the Data Science B.S. degree program at the College of Emerging and Collaborative Studies (CECS).

As a global 'Top 20' automotive manufacturer, JTEKT recognizes the immense value in the University's willingness to adapt and evolve in response to the rapidly changing technological landscape. By embracing innovation and fostering collaboration with industry, the CECS is poised to quickly become a driving force in shaping the future of Tennessee's economic landscape.

The decision to create CECS showcases the University's commitment to preparing students for the challenges of the modern workforce, where emerging technologies are transforming industries at an unprecedented pace. By offering specialized programs and cutting-edge research opportunities, such as the B.S. in Data Science, CECS will undoubtedly produce a new generation of highly skilled graduates ready to tackle real-world challenges and also advise industry, such as JTEKT, regarding opportunities for future business success. This adaptability is not only commendable but essential to bridge the gap between academia and industry, ensuring that Tennessee's businesses remain competitive on a global scale.

As a large manufacturer calling Tennessee home for over 35 years, such a program will provide to us and others a direct channel to collaborate with the College's students and faculty, where we would gain access to fresh perspectives, innovative ideas, and a highly skilled talent pool. Simultaneously, these industry partnerships will provide invaluable real-world experiences to the students, preparing them to be versatile professionals capable of making an immediate impact upon graduation. This symbiotic relationship creates a strong foundation for a prosperous future for both the State of Tennessee and its businesses that call it home.

In conclusion, we commend the University of Tennessee for its bold steps in establishing the CECS. The foresight to adapt to a rapidly changing technological environment, and the commitment to fostering collaboration between academia and industry exemplify the University's dedication to excellence and progress. We at JTEKT are confident that the CECS will play a pivotal role in positioning Tennessee at the forefront of innovation, thereby enriching the lives of its citizens and driving economic growth for years to come and are eager to learn more regarding how we may participate.

Thank you for your time and dedication to advancing the University's mission.

Scott Craig

GM, Corporate Strategy & Planning



July 18, 2023

University of Tennessee Knoxville  
 College of Emerging and Collaborative Studies  
 513 Andy Holt Tower  
 Knoxville, TN 37996

To Whom It May Concern,

Please accept this letter of support on behalf of Viridi Parente, Inc. for the Data Science B.S. degree program being developed at the College of Emerging and Collaborative Studies (CECS). While not a local employer, Viridi does business in the area and is invested in the growth and development of the East TN Region. Viridi believes that CECS offers novel and innovative educational programs that equip students with the skills and knowledge they need to land meaningful opportunities with employers and to develop their careers.

Viridi designs fail-safe lithium-ion battery products to fulfill energy needs in a range of applications and settings, including commercial, industrial, and state and local government. Viridi's scalable 50-kWh battery pack, which has been integrated into a 600-kWh installation in a medical research facility, passively detects and stops thermal runaway, allowing the pack to be installed in buildings where energy is used. Alongside the stationary energy storage options, Viridi's fail-safe pack has been incorporated into a 150-kWh mobile power unit that can be towed anywhere power is needed. Safe, point-of-use storage, whether stationary or mobile, is a critical component of a stable, resilient, and clean energy system, enabling companies and governments to shift to a low-carbon energy supply while minimizing disruptions and costly infrastructure investments.

Headquartered in a low-income neighborhood with few economic opportunities, Viridi created GreenForce, a job-opportunity agency that recruits and trains workers from the surrounding neighborhood to work for Viridi, thereby helping people who may not have formal education attain, navigate and sustain successful careers in the green energy future.

However, the unprecedented pace of technological advancement in today's rapidly changing world necessitates academic institutions to adapt their programming to prepare their graduates to meet the demands of the future. Viridi firmly believes that a customized degree program offered by CECS allows students to align their education with the careers of the future and provides them with the practical, hands-on experiences that add value to organizations like Viridi. Further, the emphasis on internships, interdisciplinary research, collaborative team projects, and community engagement that CECS programs provide ensures that graduates possess the necessary workforce skills that employers like Viridi seek in prospective employees.

The Data Science B.S. program is designed to instill students with the skills to help organizations extract meaningful patterns and insights to make data-driven decisions. This Data Science B.S. program focuses begins with data analytic skills and statistical inference, and moves into practical application of supervised and unsupervised learning, time series analysis, neural networks, regression, and visualization techniques. Students also learn the ways in which machine learning and artificial intelligence can accomplish these tasks and arrive at unexpected solutions for data-driven decision-



making. These skills put students in an excellent position to work with case studies in our industry sector.

CECS's role as an incubator for the creation of new, customizable, and stackable degrees distinguishes CECS among educational programs. CECS's innovative and collaborative approach catalyzes multidisciplinary research and teaching strategies, an approach that not only enhances the educational experience for students but also allows employers like Viridi to access a talented pool of graduates with a diverse skill set and industry-specific knowledge.

Viridi is very interested in partnering with CECS to establish a customized curriculum that addresses the specific needs of the battery storage industry. Viridi recognizes and appreciates the significant value that CECS brings to the University of Tennessee Knoxville, the East TN Region, and the labor market beyond.

Thank you for considering Viridi's support and interest in forging a collaborative partnership that will create opportunities for mutual growth and success.

Sincerely,

*/s/ Patrick M. Hanley, Jr.*

Patrick M. Hanley, Jr., Esq.

Head of Government Affairs

716.968.8658 | 1001 E. Delavan Ave, Buffalo NY 14215 | [viridiparente.com](http://viridiparente.com)



University of Tennessee Knoxville  
 College of Emerging and Collaborative Studies  
 513 Andy Holt Tower  
 Knoxville, TN 37996

To whom it may concern,

The purpose of this letter is to express our support for the Data Science B.S. degree program being developed at the College of Emerging and Collaborative Studies (CECS). As a local employer, we are deeply invested in the growth and development of our region. We firmly believe that CECS is at the forefront of educational innovation, equipping students with the skills and knowledge they need as they develop their careers and partner with employers.

In today's rapidly changing world, where new technologies and industries emerge at an unprecedented pace, it is crucial for academic institutions to adapt and prepare their graduates to meet the demands of the future. We firmly believe that a customized degree program offered by CECS not only allows students to align their education with the careers of the future but also provides them with practical, hands-on experiences that will be invaluable to our educational requirements within our organization. The emphasis on internships, interdisciplinary research, collaborative team projects, and community engagement ensures that graduates possess the necessary workforce skills that employers like us seek in prospective employees. It also enables organizations like iO Urology to develop the pipeline of organizational talent needed to move our company forward.

Furthermore, CECS's role as an incubator for the creation of new, customizable, and stackable degrees is truly commendable. By providing a central point of contact and facilitating collaborations across multiple disciplines, CECS acts as a catalyst for innovative research and teaching strategies.

We are very interested in partnering with CECS to establish a customized curriculum that addresses the specific needs of our organization. We recognize and appreciate the significant value that CECS brings to the University of Tennessee Knoxville and the East TN Region.

Thank you for considering our support and interest in forging a collaborative partnership. We are excited about the possibilities that lie ahead and look forward to exploring opportunities for mutual growth and success.

Sincerely,

Britton Garrett

Britton Garrett, CEO

iO Urology



June 6, 2023

Alex Bentley, Ph.D.  
 Professor and Associate Dean of Academic Affairs  
 458E Zeanah Engineering Complex  
 863 Neyland Drive  
 Knoxville, TN 37996-2346

Dear Professor Bentley:

On behalf of the new Baker School of Public Policy and Public Affairs, I write to share our enthusiasm for the proposal to elevate the Bachelor of Science in Data Sciences into the College of Emerging and Collaborative Studies (CECS) at the University of Tennessee, Knoxville (UT).

The Baker School sees data science as highly complementary to our mandate to prepare leaders for public service. We host an undergraduate minor in Public Policy Analytics that helps students see the relevance of data skills for solving public problems. A major in data science would complement the minor, allowing interested students to invest further in their data skills to help solve public challenges. In addition, the Baker School hosts a thesis program, Baker Scholars, where students from across campus participate in a two-year thesis writing exercise on a public policy challenge. The topics underlying these Baker School theses are increasingly data-driven. These data might be on geopolitical security threats and disinformation, or on the socio-economic bases of public health, crime, demographics, and infrastructures. Again, students with more advanced data skills would be complementary to the goals of this thesis program.

By pairing programs from CECS with programs from the Baker School, UT would be preparing students for a growing career field in public data collection, management, and use. Students entering public service need to stay abreast of advances in public data collection, storage, security, and/or user technologies with specific interest in technologies that enable the broad availability of government data for public use. Governments at all levels collect data as a matter of course, and a complex set of rules and regulations governs how these collected data can be used and shared. In recent years, policy makers and researchers have sought to expand the use of government-collected data, including making federally collected data available for artificial intelligence and other purposes. Doing so is critical for the competitiveness of American businesses, who are competing with other national ecosystems without such stark divisions between the private and public sectors. Policymakers in Tennessee are also interested in making more state-collected data available for public and private use. Major federal agencies such as the Census Bureau, as well as private data collectors, such as Microsoft and Google are making large investments into technologies such as differential privacy that allow data to be shared while

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Alex Bentley, Ph.D.  
June 6, 2023  
Page 2

protecting individual confidentiality. In all cases, progress requires advances in computer science that meet required privacy standards, minimize disclosure risks, and address the needs of public and private stakeholders. This field is getting more complicated by the second, and UT is well situated to equip students for its growing labor needs.

In sum, the CECS proposal would meet a growing need for data skills in the public sector by building on existing campus resources and strengths. The Baker School is happy to stand in support of the proposal.

Best,



Marianne Wanamaker, Ph.D.  
Incoming Dean (Effective July 1, 2023)  
Howard H. Baker Jr. School of Public Policy and Public Affairs

MW/sr





August 17, 2023

Alex Bentley  
508 Strong Hall  
CAMPUS

Dear Dr. Bentley:

As Dean of the Tickle College of Engineering (TCE), UTK, I am writing to support the proposal for a B.S. in Data Science in the UTK College of Emerging Collaborative Studies. I am confident that this is a sound proposal and that it will succeed as a sustainable program with successful outcomes for students.

The Data Science major was the result of intercollegiate planning for several years, in which TCE was an active participant. With input from both an intercollegiate faculty committee of data science researchers and instructors across the UTK campus, as well as an Executive committee of industry and community partners invested in data science, the intercollegiate Data Science minor and the Data science major (as an IDP concentration) were launched in Spring 2022. The initial home for the degree was chosen to College of Arts and Sciences, with the mutual agreement that once CECS was launched as a budgeted college at UTK the Data Science program would be moved to CECS.

The current Data Science IDP been successful for its first two years, with the introductory course (DATA 201) being enrolled to capacity, with at least a third or more of the students being from Engineering. Engineering students have thus had the opportunity to minor in Data Science which not only imparts the applied skills of data analysis and data wrangling but also puts engineering students into productive interactions with other students from Arts and Sciences, Business, and other colleges at UTK. This expands the perspectives of all students involved, our students becoming more aware about the business world, for example, or the ethics of data collection, and some of those students getting help with their coding or quantitative analysis skills from the engineering students.

Additionally, the B.S. version of this Data Science degree elevates from the solid curriculum of the IDP B.A. concentration into a 120-credit standalone B.S. in Data Science. The CECS B.S. in Data Science adds several core courses, an additional capstone course and internship, research and service courses to the degree. This will make graduates of the Data Science B.S. ready for the workforce, in which the number of data science job openings are growing every year in Tennessee and in the nation.

Office of the Dean  
456 Zeanah Engineering Complex Knoxville, TN 37996-2346  
865-974-5321 tickle.utk.edu

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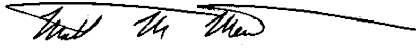
Flagship Campus of the University of Tennessee System 

Alex Bentley  
 August 17, 2023  
 Page 2

One difference in the CECS B.S. degree from the existing IDP B.A. is that it does not require introductory computer science courses taught by TCE as pre-requisites. Instead, CECS is teaching these coding skills through its own sequence of courses, beginning with what will be called DATA 101. CECS has hired a lecturer from the TCE with a CS background to teach this course in CECS. I have been assured that other relevant classes that have been taught in the TCE will remain part of the program and taught out of TCE when possible, so that there will be no additional loss to the TCE, only a gain in terms of credit hours taught in TCE through this program, rather than a switch of credit hours from the TCE to CECS. I do believe that this will also expose non-engineering students to engineering principles in computer science, and help broaden the horizons of the non-engineering students enrolled in this program. Thus, I expect there to be a positive financial impact on the TCE from this program as well as a better exposure to engineering to students in this program.

Overall, I support this B.S. in Data Science because there is a strong job market in need of non-engineering students with an applied data science education.

Sincerely,



Matthew M. Mench, PhD, MBA  
 Dean, Tickle College of Engineering  
 Wayne T. Davis Dean's Chair and  
 Chancellor's Professor  
 The University of Tennessee, Knoxville

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**MEMO**

**To:** Dr. Alex Bentley, CECS *LTT* *CC*  
**From:** Associate Dean Liem Tran and Executive Associate Dean Charles Collins, College of Arts and Sciences  
**Date:** August 10, 2023  
**Re:** Support for moving the Data Science major from A&S to CECS

The College of Arts and Sciences (CAS) supports the move of the Data Science major, currently a concentration within our Interdisciplinary Programs major to the new College of Emerging and Collaborative Studies (CECS). We support the proposal to THEC for the creation of the stand-alone B.S. version of the major in Fall 2024.

The creation of the stand-alone degree was part of the original plan during the creation of the Data Science degree. It was an intercollegiate plan to start with the degree as a concentration in the CAS Interdisciplinary Program to get a quick start and to gauge the demand. Then once we had enrollment to support a stand-alone major, the plan was to create such in an intercollegiate college. CECS is the formalization of the intercollegiate/interdisciplinary college and is a natural home for this degree program.

Students that are currently in the CAS Interdisciplinary Program Concentration in Data Science, or any students that join that program under a catalog with that program still available (through 2023-24 catalog), will still be able to complete the program without any hardship. The core courses: DATA 201, 202, 301, 302, and 499, will still be regularly offered and available to those students. And the other options for the major were existing courses in various programs on campus and will still be available as they are part of other existing majors, and as they will also be part of the CECS Data Science major.

College of Arts and Sciences  
 1403 Circle Drive  
 Knoxville, TN 37996-1330  
 865-974-5332 865-974-4352 fax arts@utk.edu

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## Appendix B: THEC Financial Projection Form

<b>Institution</b>	University of Tennessee Knoxville					
<b>Program Name</b>	Data Science, Bachelor of Science					
<b>Projected One-Time Expenditures</b>						
<b>Category</b>	<b>Planning</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>	<b>Year 5</b>
Faculty & Instructional Staff	\$10,000					
Non-Instructional Staff						
Graduate Assistants						
Accreditation					\$21,900	
Consultants		\$2,000				
Equipment						
Information Technology			\$2,000			
Library resources						
Marketing						
Facilities						
Travel						
Other	\$62,006					
<b>Total One-Time Expenditures</b>	<b>\$72,006</b>	<b>\$2,000</b>	<b>\$2,000</b>	<b>\$0</b>	<b>\$21,900</b>	<b>\$0</b>
<b>Projected Recurring Expenditures</b>						
<b>Category</b>	<b>Planning</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>	<b>Year 5</b>
Faculty & Instructional Staff	\$105,600	\$165,200	\$188,168	\$230,831	\$278,742	\$282,204
Non-Instructional Staff		\$51,600	\$68,524	\$121,476	\$145,648	\$160,273
Graduate Assistants						
Accreditation						
Consultants						
Equipment		\$500	\$500	\$500	\$500	\$500
Information Technology		\$500	\$500	\$500	\$500	\$500
Library						
Marketing		\$2,000	\$2,000	\$2,000	\$1,000	\$1,000
Facilities						
Travel						
Other						
<b>Total Recurring Expenditures</b>	<b>\$105,600</b>	<b>\$219,800</b>	<b>\$259,692</b>	<b>\$355,307</b>	<b>\$426,390</b>	<b>\$444,477</b>
<b>Grand Total (One-Time and Recurring)</b>	<b>\$177,606</b>	<b>\$221,800</b>	<b>\$261,692</b>	<b>\$355,307</b>	<b>\$448,290</b>	<b>\$444,477</b>
<b>Projected Revenue</b>						
<b>Category</b>	<b>Planning</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>	<b>Year 5</b>
Tuition		\$158,940	\$333,774	\$654,833	\$948,872	\$1,091,918
Grants						
Other						
<b>Total Revenues</b>	<b>\$0</b>	<b>\$158,940</b>	<b>\$333,774</b>	<b>\$654,833</b>	<b>\$948,872</b>	<b>\$1,091,918</b>

Note 1: Include Program Director, Faculty Fellows (Years 1 and 2), and lecturers.

Note 2: Include student graders, lab assistants, program coordinator, and internship coordinator (beginning in year 3).

## Appendix C: Course Syllabi

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### *List of Syllabi:*

1. DATA 101: Data Knowledge and Discovery
2. DATA 102: Data Stewardship and Ethics
3. DATA 202: Data Management and Visualization
4. DATA 203: Analytical Methods of Data Science
5. DATA 303: Advanced Data Analysis
6. DATA 304: Data Wrangling
7. DATA 375(N): Internship with Data Science
8. DATA 385(R): Research Project in Data Science
9. DATA 399: Junior Capstone
10. DATA 401: Visual Analytics
11. DATA 475(N): Internship with Data Science
12. DATA 485(R): Research Project in Data Science
13. DATA 499: Senior Capstone

# DATA 101: Data Knowledge and Discovery

## DATA 101: Data Knowledge and Discovery

Fall 2024

LECTURES: Mondays and Wednesdays, 11:30am – 12:20, Perkins Hall 319

LAB SESSIONS: Fridays, 11:30am – 12:20pm, online via Zoom

INSTRUCTOR: Alex Bentley, [rabentley@utk.edu](mailto:rabentley@utk.edu)

LAB INSTRUCTOR: Nick Sokol [nsokol44@gmail.com](mailto:nsokol44@gmail.com)

**Course Overview:** DATA 101 will focus on data from a variety of fields. The course will introduce the essential elements of data science: (i) collection and management; (ii) exploring and visualizing data, (iii) modeling, (iv) computing, and (v) larger picture. Students will also gain hands-on experience using basic Python programming commands. *No prerequisites, satisfies Gen Ed-QR.*

In this semester, we use a powerful, freely-available software platform, Anaconda (Installation: see last two pages of this syllabus), which we use all semester. For this reason, we ask that all students use their own laptop computer Friday labs and assignments.

Text: Weekly class Jupyter notebooks, via Canvas (online, free)

**Methods of Instruction:** Mondays and Wednesdays lectures in the classroom; Fridays are online coding lab sessions (via Zoom) where students are assisted with a practical exercise (Jupyter notebook) made available on Canvas earlier in the week. If students finish the practical before Friday, they do not need to attend the lab session. The Friday coding labs are on Zoom, because it facilitates sharing of screens and is good for learning coding in a group.

**Objectives. By the end of this course, you should be able to:**

- Understand the steps of data science from data collection to interpretation.
- Distinguish different ways of collecting data.
- Manage, summarize and visualize data using the Python programming language.
- Apply regression methods and assess the quality of predictions.

### Assessment (all submitted via Canvas)

- Ten homework/lab assignments: 10pts each, 100 pts total
- Final exam (December, TBA): 25 points
- Attendance to Monday & Wednesday lectures: 25 points
- Total: 150 points

Each lab is posted on Canvas on Monday, we work on it/discuss it on Friday, and it is due on the next Monday evening (you can turn it in early). See schedule below. If you have completed and turned in the lab before Friday, you don't have to attend lab.

Schedule of topics covered

Lecture Monday	Lecture Wednesday	Coding lab Friday	Read
	23 Aug: Data science	25 Aug: Install Anaconda	1
28 Aug: Causality and observation	30 Aug: Python & Jupyter	1 Sept: Lab 1–Python	2,3
4 Sept: LABOR DAY (Lab 1 due)	6 Sept: Data Types	8 Sept: Lab 2–Data types	4
11 Sept: Sequences (Lab 2 due)	13 Sept: Sequences practice	15 Sept: 3–Arrays	5
18 Sept: Data frames (Lab 3 due)	20 Sept: Data frames practice	22 Sept: Lab 4–Data frames	6
25 Sept: Visualizing (Lab 4 due)	27 Sept: Visualizing practice	29 Sept: Lab 5–Plots	7
2 Oct: Functions (Lab 5 due)	4 Oct: Functions practice	6 Oct: Lab 6–Functions	8
14 Oct: FALL BREAK	11 Oct: Conditionals	13 Oct: Catch-up	9
16 Oct: Probability (Lab 6 due)	18 Oct: Sampling	20 Oct: Lab 7–Randomness	10
23 Oct: Hypotheses (Lab 7 due)	25 Oct: A/B testing	27 Oct: Lab 8–Hypotheses	11,12
30 Oct: Estimation (Lab 8 due)	1 Nov: Confidence intervals	3 Nov: Lab 9–A/B testing	13,14
6 Nov: Correlation (Lab 9 due)	8 Nov: Regression	10 Nov: Lab 10–Prediction	15
13 Nov: Prediction (Lab 10 due)	15 Nov: Multivariate prediction	17 Nov: Chat GPT	16
20 Nov: Chat GPT	22 Nov: THANKSGIVING	24 Nov: THANKSGIVING	
4 Dec: Looking ahead	6 Dec: Review		
December TBA: EXAM			

# DATA 102: DATA STEWARDSHIP AND ETHICS

## Meeting Time and Place:

Tuesday & Thursday, 11:20 am - 12:35pm  
HSS 206

**Sections:** All sections

**Course Credit Hours:** 3 credit hours

support these activities. Students will also learn differences among data and records management principles and practices across diverse settings and data types, and examine the legal, ethical, and technological challenges in developing and implementing policies for managing data.

Satisfies Gen. Ed. - Global Challenges.

## Student Learning Objectives

- Students completing DATA 301 should be able to...
- be ethical and responsible managers and users of data
- consider the consequences of data use and its impact on various stakeholders,
- know how to maintain and add value to data to increase its usability, usefulness, and quality.

## Course Design

This course will include a mix of traditional readings and multimedia materials. Students will complete weekly quizzes, as well as larger assignments throughout the semester. The course includes a mix of individual and group work.

## Required Text(s)

All required and recommended course materials will be provided via Canvas.

## Assignments

This table provides a brief summary of assignment by name, due date, point value and percentage of final grade. A full description of the assignments can be found in Canvas.

All assignments will be submitted and graded in Canvas.

Assignment	Point Value	Percentage of Final Grade	Due Date
<a href="#">Weekly Quizzes</a>	15	15	ongoing
<a href="#">Weekly Labs/Activities</a>	30	30	ongoing
<a href="#">Discussion Lead</a>	15	15	ongoing
<a href="#">Open Science Comic</a>	15	15	Week 5
<a href="#">Dataset Selection</a>	p/f	-	Week 7
<a href="#">What Gets Counted Counts</a>	25	25	Week 14
<i>Course Evaluation*</i>	2	*	-
<b>TOTAL</b>	<b>100</b>	<b>100</b>	

*\*If 90% of the students in class complete the course evaluation at the end of the semester, I will add up to 2 points to everyone's final grade as a bonus.*

Week	Tuesday	Thursday	Topic
1	1/24	1/26	Introduction: What Are Data?
2	1/31	2/2	Understanding Digital Objects, Data Lifecycle Models
3	2/7	2/9	Open Science & Open Data
4	2/14	2/16	Repositories, Roles, & Responsibilities
5	2/21	2/23	Data Management Planning & Data Curation Profiles
6	2/28	3/2	Organization, Description, & Metadata
7	3/7	3/9	Data Quality
-	-	-	<i>spring break</i>
8	3/21	3/23	Access & FAIRness
9	3/28	3/30	Sharing & Reuse
10	4/4	-	Privacy
11	4/11	4/13	Threat Assessments & Risk Management
12	4/18	4/20	Long-Term Preservation
13	4/25	4/27	Climate & Sustainability
14	5/2	5/4	Presentations/Wrap-Up
15	5/9	-	Presentations/Wrap-Up



# DATA 202: Data Management and Visualization

## Spring 2023 Data Science 202 Section 001 Data Management/Visualization

[Jump to Today](#) 

### DATA202: Data Management & Visualization

CRN: 35117

Course Credit Hours: 03

Prerequisite(s): COSC 102 or COSC 111; DATA 201

Meeting Days and Time: MWF 09:10AM-10:00AM

Meeting Place: Strong Hall, Room 103 (Fully In-Person)

### Instructor and Contact Information

Dr. Joshua Fagan, Zeanah 260B ([jfagan2@utk.edu](mailto:jfagan@utk.edu) (<mailto:jfagan@utk.edu>)).

This is my first year as a lecturer at UTK. I finished my PhD in computer science from UTK (Go VOLS!) this summer. The area of study for my PhD was in Human-Robot Interactions. I have been a GTA at UTK for a few years but this is my first year as a lecturer and I am very excited to have the opportunity to work with each of you in this new role!

### Course Description

DATA 202 introduces foundational concepts and techniques in the management and presentation of data for effective data-informed decision making. Students will explore data storage and indexing strategies, data warehousing, metadata management, visualization of time-series and geospatial data, and best practices for presenting data to inform decision making, such as heat maps and infographics.

### Course Design

The course has two main components: lectures and labs.

**Lectures:** the lecture component is to provide students with both intellectual and practical knowledge on the subject. For this reason, topics to be covered range from conceptual/theoretical ones (e.g. data warehouse, relational database, etc.) to those on the technical side (e.g. Python programming skills, SQL, noSQL). See the tentative schedule for more detail on the covered topics.

**Labs:** the lab component is to provide students with hands-on experience on Python programming skills for data management and visualization. A series of eight lab exercises and assignments is designed to assist students experience several key data science skills.

#### Textbook

Selected reading will be taken from the following books which are all available online, free of cost.

- E-BOOK (available via UTK library): Data Science from Scratch: First Principles with Python (2015), by Joel Grus. O'Reilly Media. (ProQuest Ebook Central).
- E-BOOK (available via UTK library): The Data Science Handbook (2017), By Field Cady. Hoboken, NJ: Wiley.
- E-BOOK from UCLA: Computational and Inferential Thinking: The Foundations of Data Science, 2nd Edition by Ari Adhikari, John DeNero, David Wagner. <https://inferentialthinking.com/chapters/intro.html> (<https://inferentialthinking.com/chapters/intro.html>), (use in DATA 201)
- E-BOOK from UCLA: Principles and Techniques of Data Science, by Sam Lau, Joey Gonzalez, and Deb Nolan. <https://www.textbook.ds100.org/intro.html> (<https://www.textbook.ds100.org/intro.html>)

Extra readings will be made available on Canvas. Students are expected to read the assigned materials before classes so they can understand the lectures and actively participate in class discussion.

**DATA 202 (continued)**

Week #	Start Date	Days	Topics	Lab
Week 1	1/23	MWF	Intro to course, Data Science Life Cycle, DATA 201 Review	Lab 1
Week 2	1/30	MWF	DATA 201 Review, Data types, Flow control, Functions	
Week 3	2/6	MWF	Data science languages, techniques, packages, indexing	Lab 2
Week 4	2/13	MWF	Data science languages, techniques, packages, indexing	
Week 5	2/20	MWF	Time series visualization	Lab 3
Week 6	2/27	MWF	Geospatial visualization	
Week 7	3/13	MWF	Spring Break	Lab 4
Week 8	3/20	MWF	Statistics, Mid-term review/midterm exam	
Week 9	3/27	MWF	SQL	Lab 5
Week 10	4/3	MW	NoSQL	
Week 11	4/10	MWF	Infographics and dashboards	Lab 6
Week 12	4/17	MWF	Data Warehouses	Lab 7
Week 13	4/24	MWF	Hadoop/Spark	
Week 14	5/1	MWF	ML, Data Mining	Lab 8
Week 15	5/8	M	Final Review	

# DATA 203: Analytical Methods of Data Science

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Class sessions: TR 9:45 am – 11:00 am, Perkins Hall 218

Instructor: Nana Bryan (PhD)

Office hours: MW 10:00 am – 12:00 pm or by appointment

SMC 205

Email: [nvepkhva@utk.edu](mailto:nvepkhva@utk.edu)

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## Course Description and Information

DATA 302 examines modern algorithms and methods in data science with a focus on how, why, and when each of these tools work. Topics will be drawn from statistics, machine learning, and optimization.

**Course Notes:** Course lecture notes will be available through Canvas.

**Software:** Nearly all work in this course will be done using Python.

## Course objectives

At the end of the class students should be able to

- propose an appropriate probability model based on the phenomenon being studied, fit it using data, and assess the fit;
- develop the most appropriate predictive model by auditioning and assessing a variety of machine learning models using the Python programming language;
- explain how each model in the predictive analytics toolbox works;
- be comfortable using popular clustering methods like K-Means and understand what they do and do not tell us about the data

## Topics covered

- Probability models
- Monte Carlo simulation
- Market Basket Analysis
- Maximum likelihood estimation
- Linear and Logistic Regression
- Tree-based models for learning, numerical prediction, and classification
- Selecting and validating a predictive model
- K-means and hierarchical clustering and its uses

## DATA 303: Advanced Data Analysis

**Course Overview:** This course focuses on advanced data analytic skills, starting with a review of Python coding skills and statistical inference. What follows are sessions on the theory and practical application of supervised and unsupervised learning, time series analysis, neural networks, regression, and visualization techniques. The course finishes with how machine learning and artificial intelligence can accomplish these tasks and arrive at unexpected solutions for data-driven decision-making. We will focus on case studies on real estate, finance, health informatics, and traffic, as well as other examples of interest to the class.

All course materials are provided via Canvas (online, free)

**Methods of Instruction:** Mondays and Wednesdays lectures in the classroom; Fridays are online coding lab sessions (via Zoom) to work through practical exercises and plan for final assignments.

### Learning objectives

By the end of this course, you should be able to

- Demonstrate competence in advanced data analytic skills, including time series analysis, neural networks, regression, and visualization techniques.
- Understand the theory and practical application of supervised and unsupervised learning.
- Apply machine learning and artificial intelligence for data-driven decision-making.
- Work individually or on a team on a project involving real-world data

### Assessment (all submitted via Canvas)

- Four homework/lab assignments: 10 pts each, 40 pts total
- Final project: 45 points
- Attendance to Monday & Wednesday lectures: 15 points
- Total: 100 points

### Topic schedule

<b>Week 1:</b>	Review of Python (Pandas, NumPy) Arrays and Matrix handling,
<b>Week 2:</b>	Review of Visualization, Exploratory Data Analysis
<b>Week 3:</b>	Descriptive Statistics, Distributions (Binomial, Poisson), Bayes, Inferential Statistics
<b>Week 4:</b>	Exploratory Data Analysis, Visualization (PCA, MDS, t-SNE), batch correction
<b>Week 5:</b>	Unsupervised Learning and Clustering: Hierarchical, DBSCAN, Gaussian Mixture
<b>Week 6:</b>	Networks: Data as a network, identifying key nodes, edges, and clusters
<b>Week 7:</b>	Machine learning (Supervised Learning) for Regression and Classification
<b>Week 8:</b>	Model Evaluation-Cross Validation and Bootstrapping
<b>Week 9:</b>	Decision Trees, Random Forest
<b>Week 10:</b>	Time Series practice – financial data
<b>Week 11:</b>	Deep Learning, Neural Networks, Convolutional Neural Networks,
<b>Week 12:</b>	Practice with real-world examples
<b>Week 13:</b>	Project work – collecting and wrangling the data
<b>Week 14:</b>	Project work—analyzing data
<b>Week 15:</b>	Project work—writing up the project report.

## DATA 304: Data Wrangling

**Overview:** Over two quintillion bytes of data are created every day. As organizations are deluged by data, they need efficient ways of extracting meaningful patterns and insights to make data-driven decisions. Data wrangling describes the systematic process of transforming any raw data into a more structured form and organizing multiple sources into a singular coherent whole for either qualitative or quantitative analysis.

**Materials:** Provided (or linked to) online via Canvas. We will be using the free software RStudio, OpenRefine, Tableau, and SQL. Students should install R Studio from [www.rstudio.com](http://www.rstudio.com). The free online textbook *R for Data Science* (<http://r4ds.had.co.nz>) is recommended.

**Format:** Mondays and Wednesdays lectures in the classroom; Fridays are online coding lab sessions (via Zoom) to work through practical exercises and plan for final assignments.

### Learning objectives.

By the end of this course, you should be able to

- Import, modify, and reshape data from its “wild” form.
- Convert raw data to formats suitable for data analysis.
- Efficiently clean and modify data.
- Program interactions with databases to efficiently write and receive data.

### Assessment (all submitted via Canvas)

- Four homework/lab assignments: 10 pts each, 40 pts total
- Final project: 45 points
- Attendance to Monday & Wednesday lectures: 15 points
- Total: 100 points

### Topic schedule

<b>Week 1:</b>	Data wrangling: Discovery, Structuring, Cleaning, Enriching, Validating, Publishing.
<b>Week 2:</b>	Project management and GitHub.
<b>Week 3:</b>	Structuring and Unifying (Tableau Prep)
<b>Week 4:</b>	Cleaning and Validating (OpenRefine, Tableau Prep)
<b>Week 5:</b>	RStudio, R, ggplot, R Markdown
<b>Week 6:</b>	Data frames, pipes, filter, select, mutate, group by, and summarize.
<b>Week 7:</b>	Tidytex; R and databases; Joins in R.
<b>Week 8:</b>	Map functions
<b>Week 9:</b>	Writing functions, missing values, rowwise operations. Data cleaning methodology.
<b>Week 10:</b>	Importing, Scraping and Exporting (Excel, OpenRefine)
<b>Week 11:</b>	Webscraping in R
<b>Week 12:</b>	APIs, packages
<b>Week 13:</b>	SQL and relational databases via the R interface
<b>Week 14:</b>	Project work—wrangling data
<b>Week 15:</b>	Project work—writing up the project report

## DATA 375(N): Internship with Data Science

College of Emerging and Collaborative Studies, University of Tennessee-Knoxville

Instructor: TBA

Program Director: Dr. Xiaopeng Zhao xzhao9@utk.edu

### Course Description

DATA 475: Internship (3 hrs.). Designed to offer students practical work experience related to Data Science in a professional setting. This course facilitates applying classroom learning to real-world situations, fostering personal and professional growth. Students will work closely with industry professionals, apply their knowledge and skills, and reflect on their experiences to enhance their readiness for future career opportunities. Prerequisite: completion of required and pertinent advanced courses relevant to the student's internship. Written permission of advisor and approval of internship coordinator. May be repeated with written permission.

*This course counts towards credit hours earned, but it does not contribute to your GPA, which is why you might notice a discrepancy between hours earned and GPA hours on your transcript.*

### Requirements

Items (1) and (2) require ongoing attention throughout the semester. Items (3) and (4) should be completed after you finish your work hours and are due by [DEADLINE] Eastern time.

1. **Complete 120 hours of work. Due: [DEADLINE – end of semester].** For three hours of academic credit, the internship is **120 clock hours** or about 8 hours per week of on-site activity (e.g., instruction, work, consultation, supervision, review, evaluation) for one 15-week semester. If you cannot complete the 120 hrs by [DATE], you can be assigned a temporary grade of incomplete for the course. If you anticipate difficulties meeting this requirement, please let us know ASAP.

**Mid-Semester Check-In.** Please submit a brief report (1-2 paragraphs) by [DEADLINE – mid-semester] about how things are going for you so far. This report functions as a check-in into your experiences. You can also include questions for us in your report.

2. **Activity Log.** While you do this work, maintain a record of your activities. The log should have an entry for each day you work, with the number of hours served on that date and a brief description of the tasks/responsibilities performed during those hours. You might also include a few notes reflecting on the activities of that day (connections to Data Science courses?), as this might help you when completing item (4) below. Upload your activity log to the Assignments section of Canvas. Submit your partial activity log on [DEADLINE – 4<sup>th</sup> week of the semester] for feedback. Your complete activity log is due: [DEADLINE – end of semester].

3. After finishing your work hours, ask your site **supervisor** to complete the **Evaluation of Internship Student Form [URL here]** by **[DEADLINE – end of semester]**.
4. After finishing your work hours, submit the **Student Internship Experience Evaluation Form: [URL here]**, which is due by **[DEADLINE – end of semester]**. This form first asks you to identify your objectives and indicate the extent to which you met them. It then asks you to provide some ratings of your experience, and it ends with several open-ended questions. For each open-ended question, you are asked to write a 150-200-word response. You can also stop midway and continue completing the form at another time. The open-ended questions are:
  - What did you learn that was especially valuable? How will you apply this in other settings?
  - Describe any connections you made to things you have learned in other DATA courses.
  - Give 2-3 insights about the professional work you experienced—the nature of the work, the workplace, your role, and/or the role of others in your experience.
  - If you did the experience over again, describe 2-3 things you would do differently and why.

**Exit Requirement:** You will need to submit a *Student Learning Collection* to demonstrate your competencies as related to the Data Science B.S. program outcomes (below). Your responses should be Program Outcome 5 (below) at a minimum. This Internship will likely reflect Learning Outcomes 1-4 as well.

**Learning outcomes. Students with the B.S. in Data Science should:**

1. Develop relevant programming abilities.
2. Demonstrate proficiency with statistical analysis of data.
3. Develop the ability to build and assess data-based models.
4. Demonstrate skill in data management.
5. Apply data science concepts and methods to address problems in real-world contexts.

## DATA 385(R): Research Project in Data Science

INSTRUCTOR: TBA

### Overview:

The Research in Data Science is a hands-on data science project that entails an in-depth study of a current problem in data science. Focusing on the topic/field of the student's choice, or by suggestion of the instructor, this course will involve a supervised data science project involving data reduction and statistical analysis and either written or oral presentation of the results. Students will need to develop research questions to be addressed by analyzing re-world data. A central focus of the course will be on how to interpret results, understanding of statistical significance, and statistical hypothesis testing. Students will synthesize their knowledge of probability and statistics, data, and computational science.

Students will work independently, with supervision and feedback from a CECS faculty mentor in the College of Emerging and Collaborative Studies (CECS). Additional mentorship from an interested partner company or UTK faculty member in the field of the student's interest is welcome. If feasible, students are welcome to work with data from external companies or organizations partnering with CECS. Students are also encouraged to find a research professor at UTK who will agree to serve as a mentor before beginning their research (prior to making contact with a UTK research professor to work on data in their field, students are encouraged to learn about the work they do through the department's faculty web page or publications of that faculty member).

Research projects must involve significant application of data science. Data science is ubiquitous in business, natural science, social sciences, and engineering, from peer-reviewed science to public health, product testing, communications, and marketing.

To be successful in this course, you should know how to use a coding language such as Python or R to do novel data science research, using students' own laptop (using open-source software such as R Studio or the many Python platforms).

### Course objectives

- Develop competency for original data science research using real-world data set(s), including developing and testing specific research questions by identifying and analyzing those data.
- Work independently and continuously on the project throughout the semester (5-10 hours/week)
- Use data science methods such as data frame manipulation, regression analysis, network visualization, data visualization, or data wrangling.
- Deepen the student's understanding of the chosen field of research.
- Improve fluency in chosen data science coding environments, such as Python or R.
- Synthesize a project in an oral presentation for a conference.
- Synthesize a project in a written paper in the format of a scholarly journal submission.



**Assessment:**

**Oral presentation 40%:** Students are required to present their work at a Data science colloquium to be hosted by the CECS near the end of the semester. The presentation should be about 10 minutes in length and include:

- A short description of the project.
- Methods employed.
- Results obtained, and
- Conclusions reached.

Creating and giving a research presentation develops professional skills and is a great way to show potential employers or graduate/professional programs your oral communication skills.

**Written project report 60%:** Due at the end of the semester. Each student will have a chance to consult with their supervisor/mentor about their project. The project report should contain about 2,000 (max 3,000) words of text. The report should include a brief background section mentioning relevant studies from the peer-reviewed journal literature. Following this background, the report should clearly present a **research question, data set(s), and hypothesis**: what hypothesis does the project set out to test on these data? What statistical tests are used? The project should then describe the methods and **present the results** of the analysis, including all statistical tests. The report should conclude with a brief discussion that relates back to the research question.

The potential for this project is boundless. Below are some examples of the kinds of data science projects that have been completed in a one-semester course context. (These are purely, for example – the research topic is entirely up to the student in consultation with the faculty mentor.)

- Multivariate clustering analysis of mass-spectrometry data on multiple compounds
- Time series analysis of seismic data, oscillator data, and/or mechanical outputs
- Analysis of EEG brain wave patterns
- Early warning signals in time series data
- Multi-variate analysis and mapping of county-scale public health data
- Predicting real estate price change with multiple covariates
- Time series analysis of traffic data
- Topic modeling research by type of data source
- Network Analysis of open-source software developers
- Measuring text complexity through neural networks
- Water proximity and home values: Using Census Block Group Data
- Multivariate analysis of a dataset of musical qualities to determine music genre.
- A multiple regression model to predict public visits to a public museum or library.
- Effects of early intervention in public health matters
- Sentiment analysis of social media.
- Factors influencing immigration from 1971-2000.

## DATA 399: Junior Capstone

**Overview:** The Data Science Junior Capstone course allows students to work on a team to integrate data science and computational science knowledge to produce an end-to-end solution to a complex real-world problem. Projects are selected so that current statistical, machine learning, computational, and engineering methods can be used. Most projects have been designed to address important contemporary business and societal issues.

**Format:** During the semester, students will work in teams of 4-5 on a single project for one Capstone partner organization. This experience will help students build skills in public speaking, technical reading/writing, management of team dynamics, and examination of their work under the lenses of diversity and inclusion.

Junior Capstone students will work in small teams on projects provided by CECS partner organizations. In addition to technical merit, students will be evaluated on how well they manage their relationships with different stakeholders throughout the semester. Many employers consider the ability to engage in productive teamwork a requirement for success. Thus, in this class, we expect you to actively build your collaborative skills, such as team management, interpersonal communication, and conflict resolution. In fact, a significant component of the course will consist of students soliciting and incorporating feedback from multiple diverse perspectives (from the teaching staff, partners, project mentors, team members, and other teams).

### Learning outcomes

In this course, students will develop skills to:

- Manage the dynamics of a diverse team (both peers and supervisors)
- Communicate with multiple stakeholders (both technical and non-technical) on a project
- Synthesize and apply technical knowledge acquired in other courses to real-life problems
- Understand all aspects of the data science/machine learning pipeline.
- Think broadly and critically about the implications of technical design choices, from data collection to assessment of the downstream socio-technical impact

Upon completion of the Capstone course, students will be better prepared for data science work in a professional setting (both academic and industry).

**Class Meetings:** The class will meet once weekly. A typical class session will begin with a guest lecture (led by an expert on a topic at the intersection of data science and broader social issues) or a project-related hands-on group activity.

**Meetings with Mentors and/or Partners:** Each group will meet with its project mentor on a weekly basis. These meetings can take place during class (if there is no scheduled guest lecture or other activities). Students are expected to maintain and structure communication with their project

mentors and instructors in ways that best suit their needs and everyone's schedules. Each group will meet with their respective partner on a regular basis to provide updates. The exact frequency will be collectively decided upon by the partner, your group, and your instructor; however, the partner should be aware of your work through some means of communication at least once every two weeks.

### Structure and assessment

#### Phase 1 (10 pts)

- Lightning Talk (5 pts): 4 minutes from each team to set the stage for their project and problem.
- Problem Statement (5 pts)

#### Phase 2 (15 pts)

- Milestone #1 Presentation (7 pts)
- Partner Progress Report (6 pts)
- Feedback on other groups' reports (2 pt)

#### Phase 3 (15 pts)

- Milestone #2 Presentation (7 pts)
- Partner Progress Report (6 pts)
- Feedback for other groups' reports (2 pt)

#### Phase 4 (50 pts)

- Final Presentation to class (10 pts)
- Partner Progress Report (10 pts)
- Final write-up (15 pts)
- Poster (5 pts)
- Code base (runs, is organized, and readable) (10 pts)

**Feedback:** Students will receive feedback and guidance on all aspects of the project and its implementation. This feedback process will begin with the data acquisition and data exploration phase and extend through the design and implementation phase of the project. Students will also meet with their project partner organizations throughout the semester for consultation and feedback.

## DATA 401: Visual Analytics

**Overview:** Covers basics of data visualization and exploratory data analysis. This course is project-oriented and focuses on foundational concepts, recent research results, and best practices for combining raw data from a variety of domains with automated analytical methods and interactive visual interfaces to support analytical reasoning. Potential case studies in text mining, social and natural sciences, healthcare, networks, system performance analysis.

**Materials:** Students should download and install the free version of Tableau for class use here: <http://www.tableau.com/academic/students>.

**Format:** Mondays and Wednesdays lectures in the classroom; Fridays are online coding lab sessions (via Zoom) to work through practical exercises and plan for final assignment.

### Learning objectives.

By the end of this course, students should be able to

- Model and visualize data for research projects based on the intended audiences
- Producing visual reports and interactive charts
- Use design principles to communicate and persuade using storytelling with data.
- Develop charts, maps, tables, and other visual representations of data.
- Use visualization tools to exploration an unfamiliar dataset.
- Perform visual analytics on very large datasets.

### Assessment (all submitted via Canvas)

- Four homework/lab assignments: 10 pts each, 40 pts total
- Final project: 45 points
- Attendance to Monday & Wednesday lectures: 15 points
- Total: 100 points

### Topic schedule

<b>Week 16:</b>	Design Principles
<b>Week 17:</b>	Configuring Data the Environment
<b>Week 18:</b>	Exploratory data analysis
<b>Week 19:</b>	Chart Types
<b>Week 20:</b>	Exploratory data visualization
<b>Week 21:</b>	Large datasets and visualization parameters
<b>Week 22:</b>	Visualizing Geospatial Data
<b>Week 23:</b>	Optimal visualization types
<b>Week 24:</b>	Binning values, table calculations
<b>Week 25:</b>	Calculated fields, level of detail
<b>Week 26:</b>	Storytelling with data, user-centered Design
<b>Week 27:</b>	Working with stakeholders and creating analytical products
<b>Week 28:</b>	Project Presentations
<b>Week 29:</b>	Project Presentations

## DATA 475(N): Internship with Data Science

College of Emerging and Collaborative Studies, University of Tennessee-Knoxville

Instructor: TBA

Program Director: Dr. Xiaopeng Zhao xzhao9@utk.edu

### Course Description

DATA 475: Internship (3 hrs.). Designed to offer students practical work experience related to Data Science in a professional setting. This course facilitates applying classroom learning to real-world situations, fostering personal and professional growth. Students will work closely with industry professionals, apply their knowledge and skills, and reflect on their experiences to enhance their readiness for future career opportunities. Prerequisite: completion of required and pertinent advanced courses relevant to the student's internship. Written permission of advisor and approval of internship coordinator. May be repeated with written permission.

*This course counts towards credit hours earned, but it does not contribute to your GPA, which is why you might notice a discrepancy between hours earned and GPA hours on your transcript.*

### Requirements

Items (1) and (2) require ongoing attention throughout the semester. Items (3) and (4) should be completed after you finish your work hours and are due by [DEADLINE] Eastern time.

5. **Complete 120 hours of work. Due: [DEADLINE – end of semester].** For three hours of academic credit, the internship is **120 clock hours** or about 8 hours per week of on-site activity (e.g., instruction, work, consultation, supervision, review, evaluation) for one 15-week semester. If you cannot complete the 120 hrs by [DATE], you can be assigned a temporary grade of incomplete for the course. If you anticipate difficulties meeting this requirement, please let us know ASAP.

**Mid-Semester Check-In.** Please submit a brief report (1-2 paragraphs) by [DEADLINE – mid-semester] about how things are going for you so far. This report functions as a check-in into your experiences. You can also include questions for us in your report.

6. **Activity Log.** While you do this work, maintain a record of your activities. The log should have an entry for each day you work, with the number of hours served on that date and a brief description of the tasks/responsibilities performed during those hours. You might also include a few notes reflecting on the activities of that day (connections to Data Science courses?), as this might help you when completing item (4) below. Upload your activity log to the Assignments section of Canvas. Submit your partial activity log on [DEADLINE – 4<sup>th</sup> week of the semester] for feedback. Your complete activity log is due: [DEADLINE – end of semester].

7. After finishing your work hours, ask your site **supervisor** to complete the **Evaluation of Internship Student Form** [URL here] by [DEADLINE – end of semester].
8. After finishing your work hours, submit the **Student Internship Experience Evaluation Form**: [URL here], which is due by [DEADLINE – end of semester]. This form first asks you to identify your objectives and indicate the extent to which you met them. It then asks you to provide some ratings of your experience, and it ends with several open-ended questions. For each open-ended question, you are asked to write a 150-200-word response. You can also stop midway and continue completing the form at another time. The open-ended questions are:
  - What did you learn that was especially valuable? How will you apply this in other settings?
  - Describe any connections you made to things you have learned in other DATA courses.
  - Give 2-3 insights about the professional work you experienced—the nature of the work, the workplace, your role, and/or the role of others in your experience.
  - If you did the experience over again, describe 2-3 things you would do differently and why.

**Exit Requirement:** You will need to submit a *Student Learning Collection* to demonstrate your competencies as related to the Data Science B.S. program outcomes (below). Your responses should be Program Outcome 5 (below) at a minimum. This Internship will likely reflect Learning Outcomes 1-4 as well.

**Learning outcomes. Students with the B.S. in Data Science should:**

1. Develop relevant programming abilities.
2. Demonstrate proficiency with statistical analysis of data.
3. Develop the ability to build and assess data-based models.
4. Demonstrate skill in data management.
5. Apply data science concepts and methods to address problems in real-world contexts.

## DATA 485(R): Research project in Data Science

INSTRUCTOR: TBA

### Overview:

The Research in Data Science is a hands-on data science project that entails an in-depth study of a current problem in data science. Focusing on the topic/field of the student's choice, or by suggestion of the instructor, this course will involve a supervised data science project involving data reduction and statistical analysis and either written or oral presentation of the results. Students will need to develop research questions to be addressed by analyzing re-world data. A central focus of the course will be on how to interpret results, understanding of statistical significance, and statistical hypothesis testing. Students will synthesize their knowledge of probability and statistics, data, and computational science.

Students will work independently, with supervision and feedback from a CECS faculty mentor in the College of Emerging and Collaborative Studies (CECS). Additional mentorship from an interested partner company or UTK faculty member in the field of the student's interest is welcome. If feasible, students are welcome to work with data from external companies or organizations partnering with CECS. Students are also encouraged to find a research professor at UTK who will agree to serve as a mentor before beginning their research (prior to making contact with a UTK research professor to work on data in their field, students are encouraged to learn about the work they do through the department's faculty web page or publications of that faculty member).

Research projects must involve significant application of data science. Data science is ubiquitous in business, natural science, social sciences, and engineering, from peer-reviewed science to public health, product testing, communications, and marketing.

To be successful in this course, you should know how to use a coding language such as Python or R to do novel data science research, using your own laptop (using open-source software such as R Studio or the many Python platforms).

### Course objectives

- Develop competency for original data science research using real-world data set(s), including developing and testing specific research questions by identifying and analyzing those data.
- Work independently and continuously on the project throughout the semester (5-10 hours/week)
- Use data science methods such as data frame manipulation, regression analysis, network visualization, data visualization, or data wrangling.
- Deepen the student's understanding of the chosen field of research.
- Improve fluency in chosen data science coding environments, such as Python or R.
- Synthesize a project in an oral presentation for a conference.
- Synthesize a project in a written paper in the format of a scholarly journal submission.

**Assessment:**

**Oral presentation 40%:** Students are required to present their work at a Data science colloquium to be hosted by the CECS near the end of the semester. The presentation should be about 10 minutes in length and include:

- A short description of the project.
- Methods employed.
- Results obtained, and
- Conclusions reached.

Creating and giving a research presentation develops professional skills and is a great way to show potential employers or graduate/professional programs your oral communication skills.

**Written project report 60%:** Due at the end of the semester. Each student will have a chance to consult with their supervisor/mentor about their project. The project report should contain about 3,000 (max 5,000) words of text. The report should include a brief background section mentioning relevant studies from the peer-reviewed journal literature. Following this background, the report should clearly present a **research question, data set(s), and hypothesis**: what hypothesis does the project set out to test on these data? What statistical tests are used? The project should then describe the methods and **present the results** of the analysis, including all statistical tests. The report should conclude with a brief discussion that relates the results back to the research question.



## DATA 499: Senior Capstone

**Overview:** The Data Science Senior Capstone course allows students to work on a team to integrate data science and computational science knowledge to produce an end-to-end solution to a complex real-world problem. Projects are selected so that current statistical, machine learning, computational, and engineering methods can be used. Most projects have been designed to address important contemporary business and societal issues.

**Format:** During the semester, students will work in teams of 4-5 on a single project for one Capstone partner organization. This experience will help students build skills in public speaking, technical reading/writing, management of team dynamics, and examination of their work under the lenses of diversity and inclusion.

Senior Capstone students will work in small teams on projects provided by CECS partner organizations. In addition to technical merit, students will be evaluated on how well they manage their relationships with different stakeholders throughout the semester. Many employers consider the ability to engage in productive teamwork a requirement for success. Thus, in this class, we expect you to actively build your collaborative skills, such as team management, interpersonal communication, and conflict resolution. In fact, a significant component of the course will consist of students soliciting and incorporating feedback from multiple diverse perspectives (from the teaching staff, partners, project mentors, team members, and other teams).

### Learning outcomes

In this course, students will develop skills to:

- Manage the dynamics of a diverse team (both peers and supervisors)
- Communicate with multiple stakeholders (both technical and non-technical) on a project
- Synthesize and apply technical knowledge acquired in other courses to real-life problems
- Understand all aspects of the data science/machine learning pipeline.
- Think broadly and critically about the implications of technical design choices, from data collection to assessment of the downstream socio-technical impact

Upon completion of the Capstone course, students will be better prepared for data science work in a professional setting (both academic and industry).

**Class Meetings:** The class will meet once weekly. A typical class session will begin with a guest lecture (led by an expert on a topic at the intersection of data science and broader social issues) or a project-related hands-on group activity.

**Meetings with Mentors and/or Partners:** Each group will meet with its project mentor on a weekly basis. These meetings can take place during class (if there is no scheduled guest lecture or other activities). Students are expected to maintain and structure communication with their project mentors and instructors in ways that best suit their needs and everyone's schedules. Each group will

meet with their respective partner on a regular basis to provide updates. The exact frequency will be collectively decided upon by the partner, your group, and your instructor; however, the partner should be aware of your work through some means of communication at least once every two weeks.

### **Structure and assessment**

#### Phase 1 (10 pts)

- Lightning Talk (5 pts): 4 minutes from each team to set the stage for their project and problem.
- Problem Statement (5 pts)

#### Phase 2 (15 pts)

- Milestone #1 Presentation (7 pts)
- Partner Progress Report (6 pts)
- Feedback on other groups' reports (2 pt)

#### Phase 3 (15 pts)

- Milestone #2 Presentation (7 pts)
- Partner Progress Report (6 pts)
- Feedback for other groups' reports (2 pt)

#### Phase 4 (50 pts)

- Final Presentation to class (10 pts)
- Partner Progress Report (10 pts)
- Final write-up (15 pts)
- Poster (5 pts)
- Code base (runs, is organized, and readable) (10 pts)

**Feedback:** Students will receive feedback and guidance on all aspects of the project and its implementation. This feedback process will begin with the data acquisition and data exploration phase and extend through the design and implementation phase of the project. Students will also meet with their project partner organizations throughout the semester for consultation and feedback.

## Appendix D: Assessment Documents

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### Sample Accreditation Document

**Institution:** University of Tennessee Knoxville

**Program:** Bachelor of Science in Data Science

**Date:** [Date]

#### Program Accreditation Request

We hereby submit our request for accreditation of the Bachelor of Science in Data Science offered at the University of Tennessee Knoxville.

1. **Program Overview:**

- **Objective:** The BS Data Science program aims to provide students with a comprehensive understanding of data science concepts, techniques, and their applications across various domains.
- **Duration:** 4 years (8 semesters)
- **Total Credit Hours:** 120

2. **Faculty:**

A team of dedicated faculty members with PhDs and extensive experience in data science and related fields.

3. **Facilities:**

Newly furnished classrooms equipped with updated AV displays and projection software.

4. **Curriculum:**

A blend of core data science courses, electives, and real-world data projects. The curriculum is designed to keep in mind the latest industry trends and research advancements.

5. **Industry Collaboration:**

Partnerships with regionally invested data science companies for internships, research, and placement opportunities.

6. **Feedback Mechanism:**

Regular feedback is taken from students, faculty, and industry partners to ensure continuous improvement.

We kindly request the accreditation body to review our application and provide feedback.

## Sample Assessment Document

**Institution:** University of XYZ

**Program:** Bachelor of Science in Data Science

**Date:** [Date]

### Annual Program Assessment Report

1. **Program Objective:**

Ensure students gain comprehensive knowledge and practical skills in data science to excel in the industry or further studies.

2. **Enrollment & Graduation:**

- Total students enrolled: [Number]
- Total graduates: [Number]

3. **Student Performance Metrics:**

- Average GPA: [Value]
- Capstone project success rate: [Value]%

4. **Faculty Metrics:**

- Faculty-student ratio: [Value]
- Faculty publications: [Number]

5. **Feedback Analysis:**

- Student satisfaction rate: [Value]%
- Faculty satisfaction rate: [Value]%

6. **Industry Collaboration Outcome:**

- Internships secured: [Number]
- Placement rate: [Value]%

7. **Areas of Improvement Identified:**

- [Area 1]: [Suggested improvements]
- [Area 2]: [Suggested improvements]

8. **Future Plans:**

- Curriculum Updates with an Emphasis on Advanced Data Science Techniques.
- Enhance industry partnerships.

This assessment report is based on data collected throughout the academic year and aims to ensure continuous improvement of the Data Science B.S. program.

## Sample Employer Survey: Data Science Program Graduates

**Institution:** University of Tennessee, Knoxville

**Program:** Bachelor of Science in Data Science

**Date:** [Date]

Dear [Employer Name],

We kindly request your feedback on the performance of our graduates employed at your organization from the Data Science B.S. program at UTK. Your insights will help us evaluate and continuously improve our program.

**Company Name:** \_\_\_\_\_

**Respondent's Name and Position:** \_\_\_\_\_

**Duration of employing the graduate(s):** \_\_\_\_\_

Please rate the following statements on a scale of 1 to 5, where:

1 = Strongly Disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly Agree

1. The graduate demonstrates a strong foundational knowledge of data science concepts and techniques.
  - Rating: \_\_\_\_
2. The graduate applies data science techniques effectively to solve real-world problems.
  - Rating: \_\_\_\_
3. The graduate is aware of the ethical, social, and legal implications of data science applications.
  - Rating: \_\_\_\_
4. The graduate collaborates well with team members from diverse disciplines.
  - Rating: \_\_\_\_
5. The graduate exhibits strong problem-solving skills.
  - Rating: \_\_\_\_
6. The graduate adapts quickly to emerging trends and technologies in data science.
  - Rating: \_\_\_\_
7. The graduate communicates complex data science concepts effectively to both technical and non-technical team members.
  - Rating: \_\_\_\_
8. The graduate demonstrates professionalism and a strong work ethic.
  - Rating: \_\_\_\_

**Open-ended Questions:**

1. Please provide specific strengths you have observed in our Data Science program graduate(s).
  - Response: \_\_\_\_\_
2. Are there any areas of improvement you suggest for our Data Science program based on your experience with our graduate(s)?
  - Response: \_\_\_\_\_
3. Would you be interested in continuing to hire graduates from our Data Science program in the future?
  - Response: Yes/No
4. Any additional comments or feedback:
  - Response: \_\_\_\_\_

Thank you for taking the time to complete this survey.

## Sample Data Science (DS) Program Assignment Rubric

Criteria	Excellent (5)	Good (4)	Satisfactory (3)	Needs Improvement (1-2)
<b>Technical Accuracy</b>	Comprehensive understanding and flawless application of DS concepts.	There are a few minor errors but shows a strong understanding of DS concepts.	Some significant errors, but basic understanding is evident.	Numerous errors indicate a lack of understanding.
<b>Complexity and Depth</b>	Tackles a challenging problem with depth and sophistication.	Addresses a moderately challenging problem with some depth.	Takes on a basic problem without much depth.	Chooses a simplistic problem or lacks depth in addressing it.
<b>Creativity and Innovation</b>	Displays originality and innovative thinking in approach and solution.	Shows some creative thinking in parts of the project.	Mostly, it uses standard approaches without much creativity.	Lacks creativity; relies heavily on existing solutions.
<b>Ethical Considerations</b>	Thoroughly considers and addresses potential ethical implications of data science.	Addresses some ethical implications but might miss a few.	Mentions ethical considerations but lacks depth.	Neglects or superficially addresses ethical considerations.
<b>Collaboration</b>	Collaborates effectively contributes significantly and facilitates teamwork.	Collaborates well with minor issues; overall, good teamwork.	Collaborates, but teamwork skills are lacking.	Struggles with collaboration or contribution.
<b>Presentation &amp; Documentation</b>	Clear, comprehensive documentation and presentation of findings and methodologies.	Mostly clear documentation with minor areas lacking clarity.	Adequate documentation but with gaps or unclear sections.	Poorly documented or presented; lacks clarity and organization.

## Appendix E: Elective Course Descriptions

Mathematical & Statistical Foundations			
Course Number	Course Title	# SCH	Course Type
<b>MATH 323</b>	<b>Probability and Statistics</b>	<b>3</b>	<b>Existing</b>
Discrete and continuous random variables. Conditional probability, expectation, moment generating functions. Law of large numbers. Central limit theorem. Elements of statistical inference, estimation, and hypothesis testing.			
<b>MATH 371</b>	<b>Numerical Algorithms</b>	<b>3</b>	<b>Existing</b>
Development and application of fundamental algorithms for finding roots of equations, solving systems of linear equations, interpolating, fitting data using least-squares, differentiation, integration, and solving ordinary differential equations.			
<b>MATH 423</b>	<b>Probability</b>	<b>3</b>	<b>Existing</b>
Axiomatic probability, univariate and multivariate distributions, conditional distributions and expectations, moment generating functions, laws of large numbers and central limit theorem.			
<b>MATH 424</b>	<b>Stochastic Processes</b>	<b>3</b>	<b>Existing</b>
Markov chains, Poisson processes and Brownian motion. Other topics as selected by instructor.			
<b>MATH 425</b>	<b>Statistics</b>	<b>3</b>	<b>Existing</b>
Standard statistical distributions, independence of mean and variance for a Gaussian sample, basic limit theorems; point and interval estimation, tests of statistical hypotheses, Neyman-Pearson theorem; likelihood ratio and other parametric and nonparametric tests.			



<b>Methods of Data Science</b>			
<b>BAS 320</b>	<b>Regression Modeling</b>	<b>3</b>	<b>Existing</b>
Simple linear regression and correlation analysis, time series analysis, multiple regression, variable selection, regression diagnostics, partial correlation, and categorical data analysis techniques. Use of statistical computing software. Applied course appropriate for a general audience.			
<b>BAS 471</b>	<b>Statistical Methods</b>	<b>3</b>	<b>Existing</b>
Numeric and graphic description of data, probability and probability distributions, simulation, and sampling distributions. Estimation and hypothesis testing for one and two samples, parametric and nonparametric approaches, bootstrapping, and randomization tests. Multiple linear regression review and further issues, diagnostics and validation, and analysis of count data. Data Screening. Use of SAS and other statistical software.			
<b>BAS 474</b>	<b>Data Mining and Business Analytics</b>	<b>3</b>	<b>Existing</b>
Understanding and application of data mining methods. Data preparation, exploratory data analysis and visualization, cluster analysis, logistic regression, decision trees, neural networks, association rules, model assessment, and other topics. Applications to real world data. Use of standard computer packages.			
<b>COSC 422</b>	<b>Applied Machine Learning</b>	<b>3</b>	<b>Existing</b>
Will focus on understanding key machine learning (ML) concepts and an overview of ML techniques for practical applications. Introduces important ML approaches and learning methods in modeling and prediction of complex systems. Specific topics include issues with data acquisition and preprocessing, training, classification and prediction, modeling tools, and postprocessing and evaluation.			
<b>COSC 425</b>	<b>Introduction to Machine Learning</b>	<b>3</b>	<b>Existing</b>
Machine learning is concerned with computer programs that automatically improve their performance through experience. Covers the theory and practice of machine learning from a variety of perspectives. We cover topics such as learning decision trees, neural network learning, statistical learning methods, genetic algorithms, Bayesian learning methods, explanation-based learning, and reinforcement learning. Programming assignments include hands-on experiments with various learning algorithms.			
<b>COSC 426</b>	<b>Intro to Data Mining &amp; Analytics</b>	<b>3</b>	<b>Existing</b>
Modern data science methods, tools of the trade, real-world data sets, and leveraging the power of high performance and cloud resources to extract insights from data. Upon completing the course, students will learn to create reproducible and explanatory data science workflows, to implement parallel clustering methods, to address imperfections in real-world datasets, and to extract insights from a high-dimensional dataset.			
<b>COSC 453</b>	<b>Data Visualization</b>	<b>3</b>	<b>Existing</b>
The goal of this course is to develop a broad understanding of the principles, methods, and techniques for designing effective data visualizations. The course will span a wide range of topics related to interactive data visualization. The course will teach key elements of scientific visualization techniques, which graphically encode data with some physical or geometric correspondence, and information visualization techniques, which focus on abstract data without such correspondences such as symbolic, tabular, networked, hierarchical, or textual information sources. The course will follow a lecture/seminar style with discussion of assigned readings, as well as viewing of videos and hands-on experience with creating visualization tools.			
<b>IE 301</b>	<b>Operations Research I: Deterministic Methods</b>	<b>3</b>	<b>Existing</b>

Integrated system modeling concepts. Linear mathematical programming models including modeling, the simplex procedure, sensitivity analysis, dual theory, transportation, transshipment, and assignment problems, and integer linear programming.			
<b>IE 310</b>	<b>Operations Research II: Probabilistic Methods</b>	<b>3</b>	<b>Existing</b>
Probabilistic Models, including decision makings under uncertainty, inventory models, Markov Chains, and queuing theory.			
<b>IE 340</b>	<b>Design of Experiments</b>	<b>3</b>	<b>Existing</b>
Development and discussion of fundamental theory, concepts and procedures required for the efficient design and analysis of industrial experiments. Topics covered include the statistical approach, screening procedures for factor and interaction effects in one-factor and multiple-factor experiments with and without restrictions on randomization, two-level and mixed-level full and fractional factorial designs with and without blocks, response surface methodology, and Taguchi methods. Integrated treatment of these topics provides knowledge and skills for process and product improvement in engineering applications. Use of specialized software for experimental data analysis.			
<b>INSC 486</b>	<b>Data Analytics</b>	<b>3</b>	<b>Existing</b>
Visual, intuitive and interactive representation of information. Fundamental understanding of human perceptual and cognitive capabilities, computer graphics, user interface and creativity. Designs and techniques for visualizing various types of data.			
<b>Data Management and Visualization</b>			
<b>ARCH 321</b>	<b>Representation IV: Information Modeling</b>	<b>3</b>	<b>Existing</b>
Exploration of advanced information modeling programs. Emphasis is placed on learning how the digital model can assist in the design process through the representation of construction and analysis. Content includes the use of building information modeling to predict building performance and to document material properties.			
<b>BAS 476</b>	<b>Data Engineering and Visualization</b>	<b>3</b>	<b>Existing</b>
Fundamentals of programming using Python with particular focus on data preparation, visualization, and data understanding. Topics include but are not limited to reading data, object-oriented programming, loops, conditional processing, aggregating, merging, and dynamic visualization. Experience gained in producing repeatable data products in Python that automatically ingest, process, and display data in interactive plots			
<b>COSC 111</b>	<b>Computational Thinking and the Art of Programming</b>	<b>3</b>	<b>Existing</b>
An introduction to the thought processes of computer science and the art of programming. Topics include learning to think algorithmically, and solve problems efficiently, using a high-level programming language and a variety of software tools and technologies. Skills learned include designing programs to solve problems, developing the algorithms needed, using abstractions, data structures and encapsulation, writing code to implement algorithms, testing the code for errors, and documenting the process and the outcome. This course welcomes students with limited or no programming experience.			
<b>COSC 465</b>	<b>Databases and Scripting Languages</b>	<b>3</b>	<b>Existing</b>
Introduction to database theory, models, and query formation. Survey of scripting languages, their uses, and their interconnectivity with databases.			
<b>GEOG 311</b>	<b>Geovisualization and GIS</b>	<b>3</b>	<b>Existing</b>

Basic concepts and methods of geovisualization and geographic information science, including properties, sources, uses, design, and production of maps and basic spatial analysis functions.			
<b>IARC 321</b>	<b>Advanced Representation</b>	<b>3</b>	<b>Existing</b>
Advanced digital workflow for building information management software as applicable to creative and professional development for interior architecture.			
<b>INDS 321</b>	<b>Digital Representation and Fabrication for Industrial Design</b>	<b>3</b>	<b>Existing</b>
Exploration of basic computer-aided design programs in the representation of three dimensions. The use of digital fabrication machines such as 3D printer, and CNC computer numerical control mill.			
<b>INSC 260</b>	<b>Programming for Info. Applications</b>	<b>3</b>	<b>Existing</b>
Programming languages with emphasis on data structures, in-built functions, user-defined variables, syntax and control structures for processing and visualizing datasets.			
<b>INSC 384</b>	<b>Database Design</b>	<b>3</b>	<b>Existing</b>
The course introduces the student to the process of database development, including data modeling, database design, and database implementation. Students learn basic interactive SQL for both data definition and queries. Students practice design skills by developing a small database projec			
<b>INSC 484</b>	<b>Database Applications</b>	<b>3</b>	<b>Existing</b>
Applying database models to develop applications using a database management system. Developing prototype client/server applications. Advanced Structured Query Language (SQL).			
<b>INSC 489</b>	<b>Information Visualization</b>	<b>3</b>	<b>Existing</b>
This course offers basic principles and techniques in data analytics; methods for the collection of, storing, accessing, and manipulating standard-size and large datasets. Data visualization is the visual representation of data in the form of visuals, such as charts, maps, graphs, and diagrams. This course introduces the fundamental principles that inform data visualization: creative processes, cognitive thinking and semiotics.			

<b>Ethics and Policy in Data Science</b>			
<b>EEB 451</b>	<b>Research Ethics</b>	<b>3</b>	<b>Existing</b>
Ethics of scientific research with emphasis on biological sciences from genetic to ecological research. Ethics of intellectual property, allocation of resources for research, genetic engineering, research on marginalized and vulnerable populations, research on non-human animals, conservation biology, ecological fieldwork, and more.			
<b>GEOG 421</b>	<b>Maps, Society, Power</b>	<b>3</b>	<b>Existing</b>
Exploration of maps as historical and contemporary technologies of social power and resistance; wider political lives and place-making power of maps; ethical and social justice implications of cartography and geospatial analysis.			
<b>GEOG 425</b>	<b>Human Dimensions in GIScience</b>	<b>3</b>	<b>Existing</b>
The connections and interactions between GIS&T and society range in scale from institutions and business enterprises down to the individual level. This course covers fundamental drivers behind those interconnections (e.g., political, economic, legal, and cultural). Topics include how rapidly developing GI technology and infrastructures generate various forms of public GIS practice as part of citizen science, VGI and social media, and how these activities provoke questions and critiques around governance, democracy, diversity, and ethics.			
<b>INSC 305</b>	<b>Internet and Society</b>	<b>3</b>	<b>Existing</b>
This course covers the architecture, design, and regulation of the Internet, including topics of intellectual property, privacy, security, censorship, e-commerce, and other information policies, laws, and ethics as well as related research on the societal implications of the Internet.			
<b>PHIL 360</b>	<b>Philosophy of science</b>	<b>3</b>	<b>Existing</b>
An introduction to major problems in the philosophy of science. Specific issues vary but may include the nature of causality; the relationship between experiments, theories, and scientific practice; how theories change and how scientific disputes get settled; the role played by social organization in science (e.g., gender and race issues); and others. Writing-emphasis course.			
<b>PHIL 371</b>	<b>Epistemology</b>	<b>3</b>	<b>Existing</b>
An introduction to central debates in the theory of knowledge and rational belief.			
<b>Data and Society</b>			
<b>BCMB 422</b>	<b>Computational Biology &amp; Bioinformatics</b>	<b>3</b>	<b>Existing</b>
An introduction to the cutting-edge tools and approaches biologists and clinicians use to extract information from the vast amounts of genomic and proteomic data becoming available. Students gain hands-on experience with computational biology tools such as data mining, protein structure manipulation and prediction, interaction network analysis, DNA sequence analysis, gene function analysis, R studio for statistics and data visualization, and dimensionality reduction for large datasets. Students apply these tools to biomedical research questions in course projects.			
<b>CLAS/ANTH 446</b>	<b>Archaeological Statistics</b>	<b>3</b>	<b>Existing</b>
Introduction to quantitative methods within the field of archaeology. Case studies are used to introduce students to basic statistical and computational concepts germane to archaeological problems and questions, involving active learning and problem solving. Topics include logic, probability, sampling, exploratory data analysis, modeling, inference, introductory linear algebra, and introductory multivariate statistics. Students will be trained in R as a programming language.			

<b>COSC 445</b>	<b>Fundamentals Digital Archeology</b>	<b>3</b>	<b>Existing</b>
This is an advanced topic course focused on developing multi-disciplinary skills of discovering, retrieving, analyzing, and presenting operational data. Students will use critical thinking and intense practice solving real-world problems to recognize and address key operational issues: the lack of context, missing observations, and incorrect values. At the end of the course students will be able to discover operational data, to retrieve and store it, to recover context, to estimate the impact of missing events, to identify unreliable or incorrect values, and to present the results.			
<b>EEB 411</b>	<b>Biostatistics</b>	<b>3</b>	<b>Existing</b>
Experimental design and hypothesis testing for ecology and evolutionary biology research. Parameter estimation, general linear models, generalized linear models, maximum likelihood, and permutation approaches, and their application to problems in ecology and evolutionary biology.			
<b>FWF 313</b>	<b>Measurements and Sampling</b>	<b>3</b>	<b>Existing</b>
Measurement techniques and sampling methods for vegetation. Estimation of animal populations. Map and aerial photo use.			
<b>FWF 430</b>	<b>Introduction to GIS for Natural Resources</b>	<b>3</b>	<b>Existing</b>
Introductory course in geographic information systems (GIS), with applications in natural resources. This course emphasizes creating detailed, professional grade maps, but also includes the basics of the theory, data collection, and analyses associated with GIS.			
<b>GEOG 414</b>	<b>Spatial Data Management</b>	<b>3</b>	<b>Existing</b>
Types, sources, acquisition, and documentation of spatial data. Spatial database management methods and strategies for data sharing.			
<b>IE 465</b>	<b>Applied Data Science</b>	<b>3</b>	<b>Existing</b>
An introduction to applied data science including machine learning and data mining tools. Topics include supervised and unsupervised algorithms, techniques for improving model performance, evaluation techniques and software packages for implementation. Emphasis will be put on real-world applications in various domains including healthcare, transportation systems, etc.			

*Source: 2023-24 UTK Undergraduate Catalog*

## Appendix F: Faculty Curricula Vita

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Xiaopeng Zhao, Ph.D.

Interim Program Director, College of Emerging and Collaborative Studies, University of Tennessee, Knoxville  
 Phone: (865) 974-7682 (O), (865) 258-8857 (C)  
 Email: xzhao9@utk.edu

### **Educational History**

<b>Ph.D.</b> , Engineering Science and Mechanics Virginia Tech, Blacksburg, VA	August 2004
<b>M.S.</b> , Engineering Mechanics Tsinghua University, Beijing, China	June 1999
<b>B.S.</b> , Engineering Mechanics Tsinghua University, Beijing, China	June 1996

### **Professional Experience**

2023-present	Interim Program Director, College of Emerging and Collaborative Studies, University of Tennessee, Knoxville
2022-present	Joint Faculty Professor, Bredesen Center, University of Tennessee, Knoxville
2019-present	Professor, Department of Mechanical, Aerospace and Biomedical Engineering University of Tennessee, Knoxville
2019-2020	Faculty Fellow for Strategic Research Initiatives, University of Tennessee
2019-2022	Co-Founder, Rocky Top Chess, Inc. Secretary (2019-2020), President (2020-2021), Past President (2021-2022)
2016-2020	Advisory Board, T&T Scientific Inc.
2016-2017	Visiting Scientist, Institute for Medical Engineering and Science, Massachusetts Institute of Technology
2015-2017	Scientific Advisor on Intelligent Patient Monitoring, Zhejiang Medzone Medical Equipment Co., Ltd.
2014-2019	Adjunct Associate Professor, Department of Mathematics, University of Tennessee, Knoxville
2013-2019	Associate Professor, Department of Mechanical, Aerospace and Biomedical Engineering, University of Tennessee, Knoxville
2013-2016	Core Faculty, Institute of Biomedical Engineering, University of Tennessee, Knoxville
2012-2020	Senior Personnel, National Institute for Mathematical and Biological Synthesis University of Tennessee, Knoxville
2011-2012	Visiting Scientist, Wyss Institute for Biologically Inspired Engineering Harvard University
2007-2013	Assistant Professor, Department of Mechanical Engineering, Aerospace and Biomedical Engineering, University of Tennessee, Knoxville
2005-2007	Research Associate, Department of Biomedical Engineering, Duke University
2004-2005	Research Associate, Department of Engineering Science and Mechanics, Virginia Tech

### **Selected Publications**

I have published more than 150 peer-reviewed journal and conference articles

1. Liao, Yo-Jen; Jao, Ying-Ling; Boltz, Marie; Adekeye, Olayemi; Berish, Diane; Yuan, Fengpei; Zhao, Xiaopeng, Use of a Humanoid Robot in Supporting Dementia Care: A Qualitative Analysis, SAGE Open Nursing, 2023
2. Fengpei Yuan, Marie Boltz, Dania Bilal, Ying-Ling Jao, Monica Crane, Joshua Duzan, Abdurhman Bahour, Xiaopeng Zhao, Cognitive Exercise for Persons with Alzheimer's Disease and Related Dementia Using a Social Robot, IEEE Transactions on Robotics (T-RO), 2023

3. Fengpei Yuan, Wenjun Zhou, Hiroko Dodge, Xiaopeng Zhao, Causal Structural Learning of Conversational Engagement for Socially Isolated Older Adults, *Journal of Smart Health*, 2023
4. Min Xiong, Kai Sun, Xiaowen Su, Alena Talkachova, Xiaopeng Zhao, Dynamics study of constant diastolic interval and constant TR control for cardiac alternans based on a two-dimensional cellular automata model, *Nonlinear Dynamics*, 2022
5. Ziming Liu, Jordan Grant, Skylar Simpson, Asad Khattak, Joel Anderson, and Xiaopeng Zhao, Driving Ability Evaluation and Rehabilitation for People with Alzheimer's Disease and Related Dementia, *Alzheimer Disease & Associated Disorders*, 36 (4), 374-381, 2022
6. Fengpei Yuan, Amir Sadovnik, Ran Zhang, Devin Casenhiser, Eun Jin Paek and Xiaopeng Zhao, A simulated experiment to explore robotic dialogue strategies for people with dementia, *Journal of Rehabilitation and Assistive Technologies Engineering (RATE)*, volume 9, 2022
7. Yang Jiang, William Jessee, Stevie Hoyn, Soheil Borhani, Ziming Liu, Xiaopeng Zhao, Lacey K Price, Walter High, Jerry Suhl, & Sylvia Cerel-Suhl, Sharpening Working Memory with Real-time Electrophysiological Brain Signals: Which Neurofeedback Paradigms Work? *Frontiers in Psychology*, 2022
8. Liu, Z., D., Paek, E.J., Yoon, S.O., Casenhiser, D., Zhou, W., and Zhao, X., Detecting Alzheimer's Disease Using Natural Language Processing of Referential Communication Task Transcripts, *Journal of Alzheimer's Disease*, 2022
9. Andrea Vranic, Yang Jiang and Xiaopeng Zhao, Editorial: Individual Differences in Cognition and Affects in the Era of Pandemic and Machine Learning, *Frontiers in Psychology Cognition*, 2022
10. Fengpei Yuan, Joel Anderson, Tami Wyatt, Ruth Lopez, Monica Crane, Austin Montgomery, Xiaopeng Zhao, Assessing the Acceptability of a Humanoid Robot for Alzheimer's Disease and Related Dementia Care Using an Online Survey, *International Journal of Social Robotics*, 2022

### **Selected Research Grants**

Source: NIH-NIA, 1R21AG082210

The predicative values of vascular and metabolic disorders for risk of incident mild cognitive impairment and dementia

PI: Longjian Liu

Duration: 06/01/2023-05/31/2025

Source: AI TENNessee Initiative

Social Machines and AI Robotics Technology (SMART)

PI: Xiaopeng Zhao

Duration: May 2023-May 2025

Source: Office of Naval Research

Title: STEM Education and Apprenticeship Liaison (SEAL) for Navy

PIs: Ozlem Kilic, Bruce LaMattina, Xiaopeng Zhao, John Schmisser

Duration: 4/1/2022-03/31/2025

Source: HHS - NIH - NIA - National Institute on Aging, R01AG077003

Title: SCH: Robotic Caregiver to Comprehend, Assist, Relieve, and Evaluate for Patients with Alzheimer's Disease (Robotic CARE for AD)

PIs: Xiaopeng Zhao, Hairong Qi, Joel Anderson, Ruth Lopez

Duration: 2/1/2022-1/31/2026

Source: US - VA - Lexington VA Health Care System

Title: Tuning up memory-related brain potentials using real-time neurofeedback in older veterans

PIs: Yang Jiang and Xiaopeng Zhao

Duration: 6/1/2019 – 10/31/2022



**Professional Services**

- University of Tennessee AI in Education Taskforce, Spring 2023
- Tennessee Dementia Action Collaborative (TDAC), Tennessee Department of Health Data Evaluation, and Surveillance Workgroup, Chair
- Steering Committee, Cherokee Health Systems (CHS) and University of Tennessee (UT) Partnership, Fall 2022-
- Associate Editor, Journal of Alzheimer’s Disease, 2023-
- Associate Editor, Smart Health Journal, 2022-
- Associate Editor, Frontiers in Rehabilitation Science, 2022-
- Task Group on “Creative Living and Aging through Cross-disciplinary Utilization of Data and Knowledge”, Committee on Data (CODATA) of the International Science Council (ISC), 2021
- Brain-Computer Interface Society, Early Career Award Committee, 2020
- Organizing Committee and Publicity Chair, the 14th International Conference on Social Robotics, Florence Italy, December 13-16, 2022
- Technical Program Committee of the IEEE/ACM Conference on Connected Health Applications, Systems, and Engineering Technologies (CHASE), November 17-20, 2022
- Organizing Committee and Chair of the Emerging Technologies Session, 2022 Southeastern Neurodegenerative Disease Conference (SENDCon).
- General Chair, Emerging Technologies for Aging and Dementia, Hybrid Research Symposium, June 8-9, 2022, Knoxville, TN
- Organizing Committee, the 13th International Conference on Social Robotics, Singapore, November 10-13, 2021
- Chair, Biomedical and Rehabilitation Systems, 2020 Dynamic Systems and Control Conference
- Chair, Neurocomputation workshop for the Interdisciplinary Graduate Minor in Neuroscience, Knoxville, TN, August 6-13, 2018
- Growing Access in Mathematics, Engineering, and Science (GAMES), Chair, 2018- GAMES is an outreach program to expose K-12 girls and their parents to STEM education and research. GAMES sponsors the 2019 Tennessee All-girls Chess Championship on March 30, 2019
- UTK Brain Computer Interface Community of Scholars, Faculty Lead, 2018-2019
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**Selected Honors and Awards**

- Best Paper Finalist and Honorable Mention, The International Society of Service Innovation Professionals Human-Side of Service Engineering Conference, 2023
- Charles E. Ferris Faculty Award, University of Tennessee, 2023
- B. Ray Thompson Endowed Excellence in Research Award, University of Tennessee, 2023
- Official Nominator of the VinFuture Prize, 2023
- Global Catalyst Award, University of Tennessee, 2023
- Best Paper Award, The International Society of Service Innovation Professionals Human-Side of Service Engineering Conference, 2022
- Faculty Research Assistants Funding Award, University of Tennessee, 2022
- Faculty Fellow for Expanding Horizons, University of Tennessee, 2022
- Global Catalyst Award, University of Tennessee, 2022
- Healthy Longevity Global Competition Finalist, National Academy of Medicine, 2021
- Best Paper Finalist, International Conference on Social Robotics, 2021
- Game Changer Academies Panel Fellow, NSF CMMI, 2021
- Center for Transportation Research Fellow, University of Tennessee, 2020
- Healthy Longevity Global Competition Finalist, National Academy of Medicine, 2020

## Michael W. Berry

EECS Department, University of Tennessee, Min H. Kao Building, Suite 401 • Knoxville, TN 37996  
Phone: (865) 974-3838 • Fax: (865) 974-5483 • E-Mail: mberry@utk.edu

### Education

- Ph.D. Computer Science, University of Illinois at Urbana-Champaign, 1990
- M.S. Applied Mathematics, North Carolina State University, 1983
- B.S. Mathematics, University of Georgia, Magna Cum Laude, 1981

### Academic Experience

- Assist. Professor, Dept. of Comp. and Info. Sci., Univ. Alabama at Birmingham [9/90-7/91]
- Assistant Professor, Dept. of Computer Science, Univ. of Tennessee [8/91-7/97]
- Associate Professor, Dept. of Computer Science, Univ. of Tennessee [8/97-7/02]
- Professor, Dept. of Computer Science, Univ. of Tennessee [8/02-6/07]
- Department Head, Dept. of Computer Sci., Univ. of Tennessee [1/04-6/07]
- Visiting Professor, Dept. of Computer Sci., Wake Forest University [8/06-12/06]
- Professor, Dept. of Elec. Eng. and Comp. Sci., Univ. of Tennessee [8/07-Present]
- Coordinator for Comp. Sci., EECS Dept., Univ. of Tennessee [8/07-12/07]
- Assoc. Dept. Head, EECS Dept., Univ. of Tennessee [1/08-8/12]
- Assoc. Director, Ctr. For Intel. Sys. and Mach. Learning, UTK [1/10-7/12]
- Director, Ctr. For Intel. Sys. and Mach. Learning, UTK [8/12-6/16]
- Professor, Dept. of Mathematics (Joint Appointment) [3/13-Present]
- Program Manager, ASCR Division, Office of Science, US Department of Energy [8/14-12/14]
- Computing Accreditation Commission (CAC) Program Evaluator, ABET [5/18-Present]
- Faculty Fellow for Academic and Student Affairs, TCE/.UTK [8/22-Present]

### Recent Grants and Contracts (\$10,041,972 in total since 1992; \$1,993,089 since 2014)

- NSF, NSF-IIS-04-27471, ITR: Grid Computing for Ecological Modeling and Spatial Control, \$1,416,610; Co-PI. [9/04-8/08]
- NIH HD52472-01, Mapping Cerebellar Development in Time and Space, \$141,942; Co-PI [9/05-6/10]
- NASA, Grant No. 07024004, An Evaluation of Nonnegative Matrix Factorization for Anomaly Detection, \$62,748; PI [10/06-9/09]
- UT-Battelle, LLC, Oak Ridge National Laboratory, Subcontract No. 4000122083, UT-Graduate Research Assistantship Program, \$155,469; PI [5/13-3/14]
- HHS-NIH-NIGMS 1R01GM11855301A1, Mathematical Modeling of Immune Response to Malaria, \$1,535,422; co-PI [3/17-2/22]
- UT-Battelle, LLC, Oak Ridge National Laboratory, Subcontract No. 4000122083, UT-Graduate Research Assistantship Program, \$140,026; PI. [4/14-5/18]

## Michael W. Berry

### Selected Refereed Journal Articles (88 in total)

1. Gene Clustering by Latent Semantic Indexing of MEDLINE Abstracts, R. Homayouni, K. Heinrich, L. Wei, and M.W. Berry, **Bioinformatics** 21(1), 2005, pp. 104-115.
2. Computing Sparse Reduced-Rank Approximations to Sparse Matrices, M.W. Berry, S.A. Pulatova, and G.W. Stewart, **ACM Trans. on Mathematical Software** 31(2), 2005, pp. 252-269.
3. Computational Science for Natural Resource Management, M.M. Fuller, D. Wang, L.J. Gross, and M.W. Berry, **Computing in Science & Engineering** 9(4), 2007, pp. 40-48.
4. Algorithms and Applications for Approximate Nonnegative Matrix Factorization, M.W. Berry, M. Browne, A.N. Langville, V.P. Pauca, and R.J. Plemmons, **Computational Statistics & Data Analysis** 52(1), 2007, pp. 155-173.
5. The Effects of Tabular-Based Content Extraction on Patent Document Clustering, D. R. Koessler, B.W. Martin, B.E. Kiefer, and M. W. Berry, **Algorithms** 5(4):490-505, 2012.
6. Using Semidiscrete Decomposition and Vector Space Models to Identify Users of Social Networks, Denise K. Gosnell and Michael W. Berry, **Numerical Linear Algebra and Its Applications** 22(5):833-844, 2015.
7. Frequent Traffic Flow Identification through Probabilistic Bloom Filter and its GPU-based Acceleration, Sisi Xiong, Yanjun Yao, Michael W. Berry, Hairong Qi, and Qing Cao, **Journal of Network and Computer Applications** 8(C):60-72, 2017.

### Thesis/Project Direction

**BS Senior Thesis:** Michael C. Stricklin (1993), Safer Ladha (1998)

**MS:** Theresa H. Do (1992), Douglas J. Sept (1993), Brian H. LaRose (1993), Karen S. Minser (1993), Ethel J. Comiskey (1993), Vijay K. Krishna (1994), Gavin W. O'Brien (1994), Paul G. Young (1994), Ember Uziel (1994), Susan C. Allen (1994), Rhonda L. MacIntyre (1994), Amy T. Shippy (1995), Brett C. Hazen (1995), Catherine A. Abbott (1995), Jeffrey M. Constantin (1995), Todd A. Letsche (1996), Linda E. Mellott (1997), Jingqian Jiang (1997), Dian I. Witter (1997), Melanie K. Hughey (1998), Luo Jian Chen (1998), Dax M. Westerman (1998), Stefen O. Howard (1998), Kanchan Maduhkar (1999), Xiaoyan Zhang (1999), Haibin Tang (1999), Min Liang (1999), John S. Warden (2000), Bryan L. Baker (2000), Shama Y. Quazi (2000), Yaser M. Ali (2000), Richard D. Thursby (2000), David Guo (2001), John D. Eblen (2001), Anne-Scott Whitmire (2001), Colton A. Smith (2001), Alphons Immanuel (2002), Patrick A. Lynn (2002), Justin T. Giles (2002), Svetlana Y. Mironova (2003), John C. England III (2003), Wade H. Spires (2004), Joshua K. Lothian (2004), Fariyal Shahnaz (2004), Shakhina A. Pulatova (2004), Kevin E. Heinrich (2004), Michael J. Harmon (2005), Kristen J. Bains (2006), Barry L. Britt (2007), Nicholas A. Buchanan (2007), Gregory L. Shutt (2008), Tabitha K. Samuel (2009), Brian S. Zachary (2010), Papa S. Diaw (2010), Jeremy R. Cowan (2011), Joshua M. Strange (2012), Ryhan O. Pathan (2012), James S. Ferguson (2016), Andrew W. Nash (2016), Ty Vaughan (2018)

**PhD:** Sowmini Varadhan (1995), Eric P. Jiang (1998), Kevin E. Heinrich (2007), Matthew L. Aldridge (2008), Elina Tjioe (2009), Andrey Pureskiy (2010), Denise Koessler Gosnell (2014), John C. Martin (2016), Dian I. Martin (2018), Robert E. Lowe (2018)

**Michael W. Berry****Courses Taught**

**Undergraduate:** Introduction to Computer Science (COSC 102), Data Structures (COSC 140), Fundamental Algorithms (COSC 302), Discrete Structures (COSC 311), Theory of Computation (COSC 312), Programming Languages (COSC 365), Introduction to Scientific Computing (COSC 370), Numerical Methods (MATH 371), Ethics and Computing (COSC 411), Advanced Hardware Systems (COSC 430), Data and Information Management (COSC 460), Advanced Theory of Computation, Study Abroad in London (COSC 482), Information Retrieval (COSC 494), Information Processing and Management (COSC 494), Development of Computation, Study Abroad in London (COSC 494), Data Mining (COSC 494), Circuits and Electromechanical Components (ECE 301), Differential Equations (MATH 231), Honors Differential Equations (MATH 237)

**Graduate:** Data Mining (COSC 526), Computer Systems Organization (COSC 530), Information Retrieval Systems Seminar (COSC 593), Objected-Oriented Programming Seminar (COSC 593), Computer Performance Evaluation (COSC 594), Iterative Solution of Linear Systems (COSC 594), Data and Information Management (COSC 594), Information Processing and Management (COSC 594), Computational Science for Natural Resource Management (COSC 594), Parallel and Distributed Computation (COSC 690), Numerical Mathematics I (MATH/COSC 571)

**Awards, Patents, Startups**

• Nine Consecutive Science Alliance Awards	[1992-2000]
• U.S. Dept. of Energy Undergraduate Computational Science Education Award	[10/1997]
• Faculty Fellow Appointment, UTK Energy, Environ. and Resources Center (EERC)	[11/1997]
• UTK Chancellor's Award for Prof. Promise in Research and Creative Achievement	[4/1998]
• United States Patent no. 20060047441 (Semantic Gene Organizer)	[3 /2006]
• Co-founded Computable Genomix, LLC	[7 /2007]
• TCOE Moses E. and Mayme Brooks Distinguished Professor Award	[4 /2009]
• TCOE Allen and Hoshall Engineering Faculty Award	[4/2010]
• Top Cited Author for Computational Statistics and Data Analysis for 2005-2010	[9/2010]
• L.R. Hesler Award for Excellence in Teaching and Service, UTK Chancellor's Honors	[4 /2011]
• Tickle College of Engineering Charles Edward Ferris Faculty Award	[4/ 2011]
• Computer Science Faculty Member of the Year, EECS Department Award	[5/2015]
• TCOE Charles and Julie Wharton Teaching Fellow Award	[4/2018]
• Gonzalez Family Award for Excellence in Teaching, EECS Department	[4/2019]

**NANA BRYAN, PhD.**

[nvepkhva@utk.edu](mailto:nvepkhva@utk.edu)

## **EDUCATION**

August 2013      PhD, Management Science, The University of Tennessee, Knoxville, TN  
 June 1991        BA in Mathematics, Tbilisi, Georgia (Republic of)

## **TEACHING EXPERIENCE**

**The University of TN, Knoxville Campus - January 2021 to Current  
 Lecturer**

**The University of TN, Knoxville Campus - January 2013 to December 2020  
 Term Lecturer**

### **Classes at the Business Analytics and Statistics department:**

- Lean Operations (The Theory of Constraints, Lean Operations/ Toyota Production System, Intro in Queuing Theory, Project Management)
- Decision Optimization (Linear and Non-Linear Optimization applied to business problems, Integer programming for scheduling problems)
- Decision Support Systems (Python, Visual Basic for Applications, Graphical User Interfaces in Excel, running Python scripts from Excel VBA)
- Simulation Modeling (Business process modeling via Monte-Carlo and discrete-event simulation using ExtendSim)
- Data Visualization using Python (python language basics, pandas module for data manipulation, Dash module for data visualization)
- Regression Modeling (Intro to R programming, Simple and Multiple linear regression, Logistic regression)
- Data Mining and Business Analytics (Clustering, Association rules, Predictive modeling, Tree based models, Support Vector Machines, Neural Networks)
- Served as a secondary instructor for
  - Time Series Forecasting (ARIMA models)
  - Operations/Lean Supply Chain Management (The Theory of Constraints approach to Accounting, Distribution and Retail. Hands on simulations to demonstrate TOC vs Traditional ways of process management)

**Classes at the Mathematics department:**

- Intro to Statistics (Descriptive statistics, Sampling distributions, Hypothesis testing, Confidence Intervals)
- Pre-calculus (Algebraic expressions, Function transformations, Exponential and Trigonometric equations)
- Basic Calculus (Derivatives and Integrals)

**SKILLS AND EXPERTISE**

- MS Office: Word, Excel, Access, PowerPoint
- Python, R, Visual Basic for Applications, ExtendSim, JMP
- Fluent in English, Georgian, and Russian

**PUBLICATIONS**

1. Bowers, A., Bowers, M.R., Bryan, N., Letizia, P., Murphy, S. (2022). "Forming Student Teams to Incorporate Soft Skills and Commonality of Schedule". *Informs Journal of Applied Analytics*. Published Online: 29 Jul 2022 <https://doi.org/10.1287/inte.2022.1129>
2. Bowers, M.R., Bichescu, B.C., Bryan, N., Polak, G. G., Gilbert, K., Keene, D. (2022). "The maintenance conversion scheduling problem: Models and insights". *Naval Research Logistics*. Published Online: 12 May 2022 <https://doi.org/10.1002/nav.22059>
3. Bryan, N., Srinivasan, M. M. & Viswanathan, S. (2016). "Managing supply systems with partial information on shipment locations". *International Journal of Production Research*, v 54, Issue 9, 2771-2779
4. Bryan, N., Srinivasan, M. M. (2014). "Real-time order tracking for supply systems with multiple transportation stages", *European Journal of Operational Research*, v 236, Issue 2, 548–560
5. Liu M, Srinivasan, M. M. & Vepkhvadze, N. (2009). "What is the value of real-time shipment tracking information?" *IIE Transactions*, v 41(12), 1019 - 1034.

## **Brianne R. Dosch**

John C. Hodges Library, 1015 Volunteer Blvd. Knoxville, TN 37996  
bdosch@utk.edu

### EDUCATION

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Master of Science in Information Sciences, University of Tennessee, Knoxville, TN 2018

Bachelor of Arts, English Literature, Brigham Young University – Hawaii, Laie, HI 2013

### EXPERIENCE

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#### **Head, Data and Digital Scholarship, Assistant Professor**

John C. Hodges Library, University of Tennessee, Knoxville, Aug 2023- Present

Provides vision and strategic direction for the University Libraries in support of a broad range of digital and data-intensive scholarly activities. Helps foster a responsive, user-oriented department that works collegially to build relationships with students, staff, faculty, organizations and people Knoxville and Tennessee, and the greater research community. The Data and Digital Scholarship department supports the research data life cycle and digital scholarship by convening research support in digital humanities, geographic information systems, computational social science support, data discovery, and data management across all disciplines.

#### **Social Sciences Data Librarian, Assistant Professor**

John C. Hodges Library, University of Tennessee, Knoxville, 2019-2023

Provided in-depth consultation, engagement and instruction to the Department of Psychology and developed specialized expertise in data support to serve interdisciplinary research needs in the social sciences. Proactively built relationships with faculty and students across the social sciences to understand and anticipate research needs. Worked closely with other social sciences librarians to provide in depth and discipline specific data services to students, staff, faculty, and Tennessee community members.

#### **Grant Program Manager, Research Associate**

Center for Information & Communication Studies, University of Tennessee, Knoxville 2018-2019

Directly supervised and managed the research work of MSIS graduate students sponsored by the UX-A IMLS grant. Planned and lead information meetings and instruction for MSIS graduate students. Compiled and communicated the final grant report to IMLS and other key grant program members. Worked directly with Dr. Carol Tenopir to update the bibliographic database associated with the ARL Lib-Value project in addition to work on the IMLS grant.

#### **Information Management Specialist**

Spallation Neutron Source, Oak Ridge National Laboratory, Oak Ridge, TN Jan-May 2019

Proactively developed relationships with laboratory staff to understand their user-experience and support their information and document management needs. Collaborated with laboratory programmers to develop and test interfaces which meet staff needs and improve the overall

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usability and user-experience of laboratory interfaces. Developed protocols within the document management system ProjectWise to capture critical metadata and integrate processes to address unique staff member needs. Developed and delivered training and training resources for staff to use the electronic document management system ProjectWise.

## HONORS AND AWARDS

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2022, Library Society Service Endowment Award for Extraordinary Customer Service, UT Libraries' Spirit Awards

## PUBLICATIONS

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### *Articles Published in Refereed Journals*

Dosch, B., & Martindale, T. (2021). Reading the fine print: A review and analysis of business journals' data sharing policies. *Journal of Business & Finance Librarianship*, 25(3–4), 261–280. <https://doi.org/10.1080/08963568.2020.1847549> (Primary author)

Kaufman, J., Dosch, B., & Clement, K.A. (2019) “No Failure, Just Feedback: A Reflection on Experiential Space Assessment in an Academic Library,” *Serials Review*, 44:3, 221-227, <https://doi.org/10.1080/00987913.2018.1513749> (Equal author)

Clement, K. A., Carr, S., Johnson, L., Carter, A., Dosch, B. R., Kaufman, J., ... Walker, T. (2018). Reading, writing, and ... running? Assessing active space in libraries. *Performance Measurement and Metrics*, 19(3), 166–175. <https://doi.org/10.1108/PMM-03-2018-0011> (Equal author)

### *Contributions to Edited Volumes*

Dosch, B. (2024). Building a campus-wide lifelong learning book club: Supporting faculty ideas and centering the library in community building. In A. Dye-Reeves & E. Watson (Eds.), *How to Work with Academic Faculty: Partnerships, Collaborations, and Services in the Academic Library*. Association of College and Research Libraries. (Solo and primary author)

Ortiz-Baco, J. & Dosch, B. (2024). In W. Kramer, E. Muzzall, I. Burgos (Eds.), *Text and Data Mining Literacy for Librarians*. Association of College and Research Libraries. (Equal author)

### *Papers Published in Refereed Conference Proceedings*

Dosch, B., Urquieta-Cortes, C. (2023). Building the Holistic E-resource Acquisition Transparency (HEAT) Communication Tool for Academic Librarians. *15th International Conference on Performance Measurement in Libraries*, 15(1). (Primary author)

Cannon, L., Dosch, B., & Gunderman, H. (2020). Preparing, Not Repairing. *Qualitative And Quantitative Methods In Libraries*, 9(1), 9-18. <http://www.qqml.net/index.php/qqml/article/view/546> (Equal author)

### *Articles published in non-refereed journals*



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Dosch, B. (2022). How academic liaison librarians can self-assess – and why they should. *Elsevier's Library Connect*. <https://www.elsevier.com/connect/library-connect/how-academic-liaison-librarians-can-self-assess-and-why-they-should> (Primary author)

### ***Invited Workshops/Seminars/Presentations***

Dosch, B. “Data sources and services for academic librarians.” Presentation LS 502 Research Methods Course, School of Library and Information Studies, University of Alabama, virtual, January 26, 2023.

Dosch, B. (2021, October) “Finding Available Data Related to Sensitive Topics.” Invited webinar for the University of Michigan’s Inter-university Consortium for Political and Social Research (ICPSR), Virtual, October 27, 2021.

### GRANTS, FELLOWSHIPS, AND SCHOLARSHIPS

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2021 ICPSR Visiting Representative Fellow, Inter-university Consortium for Political and Social Research at the University of Michigan, \$2800

2019, Conference Travel Grant, Institute of Museum and Library Services, User Experience and Assessment, Center of Information and Communication Studies, University of Tennessee, \$4,000  
2016-present, Conference Travel Grant, Institute of Museum and Library Services via University of Tennessee, \$2,000

2016-present, Institute of Museum and Library Services funded Master’s degree, User Experience and Assessment, School of Information Science University of Tennessee, \$9,000

### SERVICE

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#### *Committees and Task Forces*

Data Science Curriculum Committee, member, 2023-Present  
AI Curriculum Committee, member, 2023-Present  
UT Promise Mentoring Program, mentor, 2020-Present  
Data Science Librarian Search Committee, member, December 2022-February 2023  
Strategic Visioning Committee, co-chair, March 2022 – January 2023  
ACRL Academic Library Trends & Statistics Survey Editorial Board, member, 2022 - Present

#### *Service and Leadership Roles*

Lifelong Learning Book Club, University of Tennessee, organizer and leader, 2020-Present  
Inter-university Consortium for Political and Social Research (ICPSR), Official Representative for University of Tennessee, July 2019-present  
Tennessee State Data Center, Affiliate Representative for UT Libraries, July 2019-Present

Updated 10/13/2023

# Joshua D. Fagan, Ph.D.

## Home Address

8920 Colchester Ridge Road  
Knoxville, TN 37922  
(804) 627-2366  
jfagan2@utk.edu

## EDUCATION

2014 – 2022	<p>Doctor of Philosophy in Computer Science University of Tennessee, Knoxville, TN Graduate Research Advisor: Dr. Lynne Parker Committee Members: Dr. Lynne Parker, Dr. Hairong Qi, Dr. Daniel Rucker, Dr. Amir Sadovnik Dissertation: Constrained Collective Motion in Human-Robot Teams</p>
2014 – 2017	<p>Masters of Science in Computer Science University of Tennessee, Knoxville, TN Graduate Research Advisor: Dr. Lynne Parker Area of Study: Machine Learning</p>
2010 – 2014	<p>Bachelor of Science in Computer Science, Double Major in Mathematics University of Richmond, Richmond, VA Undergraduate Research Advisor: Dr. Arthur Charlesworth</p>

## RESEARCH EXPERIENCE

UNIVERSITY OF TENNESSEE, KNOXVILLE, DEPARTMENT OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

2017 – 2022	<p><b>Constrained Collective Motion of Human-Robot Teams</b> <i>Graduate Student</i> Advisor: Dr. Lynne Parker</p> <ul style="list-style-type: none"> <li>• Research focuses on enabling a robot to observe a team of human experts performing a task, infer the standard operating procedure influencing the team members, and adopt the inferred behaviors when placed on the team.</li> <li>• Research searches to accomplish a goal by merging capabilities of high-level, graph-based framework and low-level, end-to-end variational neural network, delivering rich, complex behaviors that are transparent and explainable to human team members.</li> <li>• Research extends the applications of serious games by utilizing the game development engine Unity for near photo-realistic simulation environments with accurate real-world physics.</li> </ul>
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## ARMY RESEARCH LABORATORY, ADELPHI, MD

Summer 2017 | **Human-Robot Formation Control via Deep Learning***Graduate Student*

Advisor: Dr. Christopher Reardon and Dr. Jonathan Fink

- Designed and participated in a project to incorporate robots into human team formation via deep learning.
- Designed a deep neural network with stacked CNN+LSTM architecture for robot end-to-end sensing and moving.
- Designed and performed experiments to collect data in ROS driven simulation and real world.

## NATIONAL TRANSPORTATION RESEARCH CENTER, OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TN

Summer 2015 | **Vehicle Security Analysis***Graduate Student*

Advisor: Dr. Jens Gregor

- Participated in developing a vehicle security analysis platform.
- Designed and developed a front-end vehicle user interface website and data analysis database.

**TEACHING EXPERIENCE**

## LECTURER AT THE UNIVERSITY OF TENNESSEE, KNOXVILLE

2022-2023	<b>Computer Solutions of Engineering Problems (EF 230)</b> Collaboratively taught an engineering-based programming course with Dr. Amy Biegalski. I designed lectures, projects, and assessments on course material that spans the fundamentals of programming for engineering students. I maintain a toolbox based on ROS for the students to program a fleet of 60 mobile robots.
2022-2023	<b>Data Management and Visualization (DATA 202)</b> Develop and teach class focusing on using programming tools in Python for managing data (including metadata), cleaning and processing data, and visualizing data.
2022-2023	<b>Introduction to the World of AI (AI 101)</b> Participated on interdisciplinary team to develop syllabus and content for class to introduce AI to the campus at large.
2023	<b>Introduction to Cybersecurity Concepts (CYBR 101)</b> Class to introduce Cybersecurity concepts to the campus at large.

**DEPARTMENTAL/UNIVERSITY SERVICE**

Spring 2023	<b>ChatGPT Taskforce</b> Participate on subcommittees dedicated to shaping UTK's response to ChatGPT with respect to policy, technology outreach, research practices, philosophy, and pedagogy.
Spring 2023	<b>AI Education Strategic Visioning Committee</b> Participate on committee to report on and shape advances of AI education at UTK.
2022 - 2023	<b>UTK Campus AI Curriculum</b> Participate on committee to design and develop a campus wide AI course.
Fall 2023	<b>AI in Higher Ed: Transforming the Teaching and Learning Experience</b> Participate on committee to design and develop AI symposium.

**PUBLICATIONS**

2022	<b>Joshua D. Fagan</b> , Amy Biegalski, "Work-in-Progress: Bridging the Gap Between MATLAB and Python via ROS to Build Skills in an Introductory Programming Course," in <i>2022 ASEE Annual Conference &amp; Exposition</i> .
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**PRESENTATIONS**

2021	Amy Biegalski, <b>Joshua D. Fagan</b> , <i>Using MATLAB's ROS Toolbox with Raspberry Pi Controlled Robots to Build Skills in an Introductory Programming Course</i> , Workshop Talk, Teaching Computation with MATLAB at the Science Education Resource Center at Carleton College, Virtual, October 17-19, 2021.
2012	Joshua Armstrong, <b>Joshua D. Fagan</b> , Kirstin Ladas, Gavin McGrew, and Rosa Romano, <i>Turing Patterns via Agent-Based Modeling</i> , Poster Session, Mathematical Association of America MathFest 2012, August 1-4, 2012.

**AWARDS, HONORS, AND LEADERSHIP ROLES**

Fall 2021	Engineering Fundamentals Outstanding Graduate Teaching Assistantship (GTA) Award
2015 – 2018	Funding from National Science Foundation for research in human-robot interactions.

**PROFESSIONAL SOCIETIES**

- American Society for Engineering Education (ASEE)
- IEEE Robotics and Automation Society

## Rebecca D. Frank, PhD

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**CONTACT** School of Information Sciences [rfrank7@utk.edu](mailto:rfrank7@utk.edu)  
 University of Tennessee, Knoxville <http://rebeccadfrank.com>  
 1345 Circle Park Drive ORCID: [0000-0003-2064-5140](https://orcid.org/0000-0003-2064-5140)  
 451 Communications Building  
 Knoxville, TN 37996-0341

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### EDUCATION

2018 **PhD, Information Science**  
 University of Michigan School of Information

2012 **MSI, Information Science**  
 University of Michigan School of Information

2004 **BA, Organizational Studies**  
 University of Michigan, College of Literature, Science, and the Arts

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### ACADEMIC POSITIONS

2022 - present **Assistant Professor**  
 University of Tennessee, Knoxville, School of Information Sciences

2019 - 2022 **Einstein Centre Digital Future Assistant Professor for Information Management**  
 Humboldt-Universität zu Berlin, Berlin School of Library and Information Science

2019 **Research Fellow**  
 University of Michigan, School of Information

2012 – 2018 **Graduate Student Research Assistant**  
 Dissemination Information Packages for Information Reuse (DIPIR) Project (2012-14)  
 Qualitative Data Reuse (QDR): Records of Practice in Educational Research and Teacher Development (2014-18)  
 University of Michigan, School of Information

2010 – 2012 **University Library Associate**  
 University of Michigan, MLibrary: Art, Architecture, and Engineering Library

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### AFFILIATIONS

2019 – present Associated Member, [Einstein Center Digital Future](#)  
 2021 – 2022 Network: Climate Change & Artificial Intelligence, Berlin-Brandenburg (CC&AI:BB)

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## HONORS & AWARDS

2023	Provost's Scholarship, National Center for Faculty Diversity & Development Faculty Success Program, University of Tennessee, Knoxville
2020	Award for Outstanding Service in Digital Teaching (Besondere Leistungen in der Digitalen Lehre), Philosophische Fakultät, Humboldt-Universität zu Berlin
2016	Rackham Graduate Student Research Grant
2014	Summer Institute Scholarship, Archival Education and Research Institute
2013	Summer Institute Scholarship, Archival Education and Research Institute
2012	Summer Institute Scholarship, Archival Education and Research Institute
2010 – 2012	University Library Associate Scholarship Award, University of Michigan
2004	JetBlue Airways London School of Economics Scholarship Award
2002	Residential College Student Community Building Award

## EXTERNAL FUNDING

2023 – present	<b>Citizen-Based Monitoring for Peace &amp; Security in the Era of Synthetic Media and Deepfakes (co-PI)</b> (PI: Prof. Dr. Felix Bießmann, Berliner Hochschule für Technik; co-PI: Prof. Dr. Alex Glaser, Princeton University) <i>Deutsche Stiftung Friedensforschung (German Foundation for Peace Research)</i> <a href="#">FP 06/22   01/21-FB3-Add-Pro</a> Award amount: € 180,000
2019 – 2022	<b>SCoR-TDR: The Social Construction of Risk in Trustworthy Digital Repository Audit and Certification (PI)</b> <i>Einstein Centre Digital Future</i> Award amount: approx. € 700,000 (€ 100,000 per year for 7 years) <i>*Note: funding linked to Humboldt-Universität zu Berlin position</i>
2020 – 2021	<b>Data Feminism in Information Science (workshop grant)</b> <i>Humboldt-Universität zu Berlin Frauenbeauftragte</i> Award amount: € 1,000
2020	<b>Open Data for Public Infrastructure and the Social Construction of Risk (PI)</b> (co-PI: Prof. Dr. Max von Grafenstein, Universität der Künste Berlin) <i>InfraLab Berlin</i> Award amount: € 5,000
2015	<b>Understanding the Development of Sustainable Information Infrastructures for Digital Preservation to Support Marginalized Communities (PI)</b> <i>National Science Foundation (NSF)</i> <a href="#">1515303</a> Award amount: \$ 5,070

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Rebecca D. Frank, PhD

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## PUBLICATIONS

(Underline indicates doctoral or graduate student)

### Dissertation/Thesis

**Frank, R. D.** (2018). *The Social Construction of Risk in Trustworthy Digital Repository Audit and Certification*. (Dissertation). University of Michigan, Ann Arbor, MI. Open Access: <http://hdl.handle.net/2027.42/147539>

**Frank, R. D.** (2012). *Disaster Planning for Digital Repositories*. (Master's Thesis). University of Michigan, Ann Arbor, MI. Open Access: <http://hdl.handle.net/2027.42/137664>

### Peer Reviewed Journal Articles

**Frank, R. D., & Rothfritz, L.** (2023). Designated Community: Uncertainty and Risk. *Journal of Documentation*, 79(4), 880-897. <https://doi.org/10.1108/JD-07-2022-0161>. Open Access: [https://trace.tennessee.edu/utk\\_infosciepubs/467/](https://trace.tennessee.edu/utk_infosciepubs/467/)

Reistad, O., Glaser, A., **Frank, R. D.**, & Kaald, S. H. (2022). Document-Based Nuclear Archaeology. *Science & Global Security*, 30(2), 95-107. <https://doi.org/10.1080/08929882.2022.2111880>

**Frank, R. D.** (2022). Risk in Trustworthy Digital Repository Audit and Certification. *Archival Science* 22, no. 1: 43–73. Open Access: <https://doi.org/10.1007/s10502-021-09366-z>.

Yakel, E., **Frank, R. D.**, Suzuka, K., & Smith, J. (2022). Visibilities and Invisibilities in Data Reuse: Video Records of Practice in Education. *Qualitative Research*, 146879412110059. <https://doi.org/10.1177/14687941211005955>. Open Access: <http://hdl.handle.net/2027.42/167728>

**Frank, R. D.**, (2020). The Social Construction of Risk in Digital Preservation. *Journal of the Association for Information Science and Technology*. 71:474-484. <https://doi.org/10.1002/asi.24247>. Open Access: <http://hdl.handle.net/2027.42/149147>

**Frank, R. D.**, Suzuka, K., & Yakel, E. (2020). Tool Selection Among Qualitative Data Reusers. *International Journal of Digital Curation*, 15(1), 15. <https://doi.org/10.2218/ijdc.v15i1.710>. Open Access: <http://hdl.handle.net/2027.42/162592>

Faniel, I., **Frank, R.**, & Yakel, E. (2019), Context from the Data Reuser's Point of View. *Journal of Documentation*, Vol. 75 No. 6, pp. 1274-1297. <https://doi.org/10.1108/JD-08-2018-0133> Open Access: <https://www.oclc.org/research/publications/2019/context-from-data-reuser-point-of-view.html>

**Frank, R. D.**, Tyler, A. R. B., Gault, A., Suzuka, K., & Yakel, E. (2018). Privacy Concerns in Qualitative Video Data Reuse. *International Journal of Digital Curation*. <https://doi.org/10.2218/ijdc.v13i1.492>. Open Access: <http://hdl.handle.net/2027.42/148322>

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# Jianguen He

1345 Circle Park Drive, Room 449, Knoxville, TN 37996-0332, United States  
 jianguen@utk.edu • jianguenhe.com • (865) 974-5882

## RESEARCH INTERESTS

- Information Visualization, Visual Analytics, Machine Learning
- Quantitative Studies of Science, Informetrics, Science Mapping, Open Science, Peer Review
- Human-AI Interaction, Conversational AI

## WORK EXPERIENCE

- School of Information Sciences, The University of Tennessee, Knoxville
- **Assistant Professor** Aug 2020 – present
- College of Computing and Informatics, Drexel University
- **Research Assistant**, Visual Analytics and Text Mining Sep 2014 – Jun 2020
- Social Network Business Group, Tencent Inc
- **Front-end Development Engineer** Jul 2012 – May 2014
    - Development of web games and web apps.

## EDUCATION

- Drexel University**, Philadelphia, USA
- Doctor of Philosophy in Information Studies Sep 2014 – Jun 2020
    - Dissertation topic: Predictive and Visual Analytics of Scientific Development
- Wuhan University**, Wuhan, China
- Master of Management Science in Information Science Aug 2010 – Jun 2012
    - Graduated with Outstanding Dissertation Award.
- Nanjing Tech University**, Nanjing, China
- Dual Bachelor in Business Administration & Computer Science Sep 2006 – Jun 2010
    - Graduated with Honors and Outstanding Dissertation Award.

## GRANTS

- [4] 2022 The University of Tennessee, Student/Faculty Research Awards, \$5,000.
- [3] 2021 - 2024, Erjia Yan. (lead PI), Jianguen He (site PI), Chaoquan Ni (site PI), Robert Palmer (site PI), & Mat Kelly (co-PI). Collaborative Research: Examining the effects of academic mobility on individual professors' research activity and institutional human capital at HBCUs. **NSF SOS:DCI**, #2122691, \$737,596 (UT share: \$191,102).
- [2] 2021 The University of Tennessee, Research Development Academy, \$4,000.
- [1] 2018 Drexel University ExCITe Center Research Funding Award, \$5,000.

## PUBLICATIONS

### Journal Papers

- [13] Lou, W., He, J., Zhang, L., Zhu, Z., and Zhu, Y. (2023). Support behind the scenes: the relationship between acknowledgement, coauthor, and citation in Nobel articles. *Scientometrics*, 1-24.
- [12] Luo, Z., He, J., Qian, J., Wang, Y., and Lu, W. (2023). Do the paper's connections to existing work disclose its citation impact? A study based on graph representation learning. *Journal of Information Science*.
- [11] Lou, W., He, J., Xu, Q., Zhu, Z., Lu, Q. and Zhu, Y. (2023), "Rhetorical structure parallels research topic in LIS articles: a temporal bibliometrics examination", *Aslib Journal of Information Management*, Vol. ahead-of-print No. ahead-of-print.
- [10] Zhuoran Luo, Wei Lu, Jianguen He, and Yuqi Wang. "Combination of Research Questions and Methods: A New Measurement of Scientific Novelty", *Journal of Informetrics*, Accepted, 2022.
- [9] Yang Li, Jianguen He, and Chuanren Liu, "Peer Influence in the Adoption of Video Games", *International Journal of E-Business Research*, Accepted, 2022
- [8] Wen Lou, Zilong Su, Jianguen He, Kai Li, "A temporally dynamic examination of research method usage in the Chinese library and information science community," *Information Processing & Management*, 58(5), 102686, 2021.



- [7] Erjia Yan, Yongjun Zhu, Jianguan He, “Analyzing academic mobility of U.S. professors based on the ORCID data and the Carnegie Classification,” *Quantitative Science Studies*, 1(4), pp. 1451-1467, 2020.
- [6] Jianguan He, Qing Ping, Chaomei Chen, Wen Lou, “PaperPoles: Toward Supporting Exploration of Citations Based on Evolving Information Needs,” *Journal of the Association for Information Science and Technology*, vol. 70, issue. 8, pp. 843-857, 2019.
- [5] Jianguan He, Chaomei Chen, “Temporal Representations of Citations for Understanding the Changing Roles of Scientific Publications,” *Frontiers in Research Metrics and Analytics*, vol. 3, pp. 27, 2018.
- [4] Jianguan He, Chaomei Chen, “Predictive Effects of Novelty Measured by Temporal Embeddings on the Growth of Scientific Literature,” *Frontiers in Research Metrics and Analytics*, vol. 3, pp. 9, 2018.
- [3] Wen Lou, Hui Wang, and Jianguan He, “Of the People for the People: Digital Literature Resource Knowledge Recommendation Based on User Cognition,” *Information Technology and Libraries*, vol. 37, issue. 3, pp. 66–83, 2018 .
- [2] Qing Ping, Jianguan He and Chaomei Chen, “How many ways to use CiteSpace? A study of user interactive events over 14 months,” *Journal of the Association for Information Science and Technology*, vol. 68, issue. 5, pp. 1234–1256, 2017 .
- [1] Wei Lu, Jianguan He, Xiaoguang Wang and Jiaxin Wu, “A Visualization Technique for Multidimensional Data with Hierarchical and Temporal Structure,” *Journal of the China Society for Scientific and Technical Information*, vol. 31, no. 11, pp. 1131–1139, 2012.

#### Conference Papers

- [14] He, Jianguan; Feng, Changyang; Lou, Wen; Song, Bo; Zang, Yizhou “The Role of Open Code in Scholarly Communication: A Citation Analysis in Computational Linguistics”, *2023 International Conference on Scientometrics & Informetrics*.
- [13] Yan, Erjia; Kelly, Mat; Zarrillo, Deanna; He, Jianguan; Ni, Chaoqun; Palmer, Robert, “Examining the academic mobility at Historically Black Colleges and Universities in the U.S.”, *2023 International Conference on Scientometrics & Informetrics*.
- [12] Zhijie Zhu, Lingxin Zhang, Jianguan He, & Wen Lou, “The impact of acknowledgement on coauthorship and citation: who were acknowledged in Nobel Price Laureates’ publications?”, *Metrics 2021: Workshop on Informetric and Scientometric Research (SIG-MET)*. October 2021. Salt Lake City, United States
- [11] Jianguan He, Erjia Yan, and, Chaoqun Ni, “Examining International Research Collaboration under the COVID-19 Pandemic by arXiv Preprints”, *2021 International Conference on Scientometrics & Informetrics*.
- [10] Wen Lou, Zilong Su, Shaodan Zheng, and Jianguan He, “The Effects of Rhetorical Structure on Citing Behavior in Research Articles”, *2021 International Conference on Scientometrics & Informetrics*.
- [9] Yuting Liao, Jianguan He, “The Effects of Racial Mirroring in Chatbot-Based Psychotherapeutic Conversation ” *The 25th International Conference on Intelligent User Interfaces (ACM IUI 2020)*. Cagliari, Italy.
- [8] Jianguan He, Wen Lou, and Kai Li, “How were science mapping tools applied? The Application of science mapping tools in LIS and non-LIS domains” *ASIST 2019*. October 19 - 25, 2019. Melbourne, Australia.
- [7] Zhen Yang, Yanliu Huang, Barbara Kahn, and Jianguan He, “Voice or Click? How Shopping by Voice Influences Consumer’s Product Choices” *2019 Association for Consumer Research Conference (ACR 2019)*. October 17 - 20, 2019. Atlanta, United States.
- [6] Jianguan He, Chaomei Chen, “The Citations of Papers with Conflicting Reviews and Confident Reviewers” *ISSI 2019*. September 2 - 5, 2019. Rome, Italy.
- [5] Zhen Yang, Jianguan He, YanLiu Huang, Barbara Kahn, “Understand Consumer Behavior and Product Decision Making in Voice-Assisted vs. Mouse-Click Shopping” *Theory + Practice in Marketing (TPM) Conference*. May, 2019. New York, United States.

- [4] Yang Li, Chuanren Liu, and Jiangen He, “Do Recommendation from Friends Matter? Evidence from Video Game Platforms” *Northeast Decision Sciences Institute 2019 Annual Conference*. April 4-6, 2019. Philadelphia, United States.
- [3] Jiangen He, Chaomei Chen, “Visualizing Temporal Patterns in Representation Data,” *2017 Workshop on Visual Analytics for Deep Learning*. October 1, 2017. Phoenix, United States.
- [2] Jiangen He, Chaomei Chen, “Understanding the changing roles of scientific publications via citation embeddings,” *Proceedings of 2nd Workshop on Mining Scientific Papers: Computational Linguistics and Bibliometrics*, pp. 42-48. October 16, 2017. Wuhan, China.
- [1] Jiangen He, Chaomei Chen, “Spatiotemporal Analytics of Topic Trajectory,” *Proceedings of the 9th International Symposium on Visual Information Communication and Interaction*, pp. 112-116. September 24-26, 2016. Dallas, Texas, United States.

**AWARDS**

- 2021 The University of Tennessee, Research Development Academy Scholar.
- 2020 Beta Phi Mu Eugene Garfield Doctoral Dissertation Fellowship (\$3,000).
- 2019 ISSI Eugene Garfield Doctoral Dissertation Scholarship (\$3,000)
- 2019 *Publications* Travel Award (\$850).
- 2018 Drexel University International Presentation Award (\$750).
- 2016, 2017, 2018 Drexel University CCI Travel Award (\$3,000).
- 2011, 2012 Wuhan University the First Prize Scholarship for Graduate Students.
- 2009 National Computer Design Competition for Chinese College Students, National First Prize.

**TEACHING****Instructors**

- INSC 486 Data Analytics (Undergraduate), University of Tennessee, 2021 Spring, 2021 Fall.
- INSC 489 Data Visualization (Undergraduate), University of Tennessee, 2021 Spring.
- INSC 210 Foundations of Information Technology (Undergraduate), University of Tennessee, 2020 Fall, 2021 Fall.
- INFO 210 Database Management System (Undergraduate), Drexel University, 2019.

**SERVICE****Internal**

- Research Advisory Committee Member, College of Communication and Information, University of Tennessee, 2021-2022, 2022-2023.
- Data Science Curriculum Committee Member, University of Tennessee, 2021-2022
- Tenure-track Assistant Professor Search Committee Member, School of Information Sciences, University of Tennessee, 2021-2022

**External**

- Committee Member, **ALISE Bohdan S. Wynar Research Paper Competition**, 2021.
- Committee member, 2nd Workshop on Extraction and Evaluation of Knowledge Entities from Scientific Documents, 2021.
- Committee member, IEEE International Workshop on Data Quality for Intelligent Systems, 2021.
- Associate Editor, **Frontiers in Research Metrics and Analytics**, 2021-present.
- Instructor and Advisory Board Member, **IDEA Institute on Artificial Intelligence**, 2021, 2022.
- Panel & Alternative Events Co-Chair, **ASIS&T**, 2021.
- Doctoral Dissertation Committee Member, Kathleen Padova, Drexel University, 2021.
- Program Committee Member, The 10th International Symposium on Visual Information Communication and Interaction, **VINCI**, 2017.

[CV compiled on 2023-10-11]

## Benjamin D. Horne

School of Information Sciences, The Bredesen Center  
The University of Tennessee Knoxville

<https://benjamindhorne.github.io>  
bhorne6@utk.edu

### *Education*

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<b>Rensselaer Polytechnic Institute</b>	Troy, NY
Ph.D. in Computer Science	<i>Fall 2014 – Spring 2020</i>
<b>Union University</b>	Jackson, TN
B.S. in Computer Science, Minor in Mathematics	<i>Fall 2010 – Spring 2014</i>
<b>Union University</b>	Jackson, TN
B.S. in Business Administration, Concentration in Management	<i>Fall 2010 – Spring 2014</i>

### *Academic and Research Appointments*

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<b>The University of Tennessee Knoxville</b>	Knoxville, TN
Founding Fellow, CCI Information Integrity Institute ( <i>I</i> <sup>3</sup> )	<i>Fall 2023 – Present</i>
Affiliate, National Security and Foreign Affairs, The Baker School of Public Policy	<i>Fall 2023 – Present</i>
Assistant Professor (Joint), Data Science and Engineering, The Bredesen Center	<i>Fall 2023 – Present</i>
Assistant Professor, School of Information Sciences	<i>Fall 2020 – Present</i>
<b>Rensselaer Polytechnic Institute</b>	Troy, NY
Graduate Research Assistant, Computer Science	<i>Fall 2014, Fall 2017 – Spring 2020</i>
NSF GK-12 Teaching Fellow, Science and Technology Studies	<i>Summer 2015 - Fall 2016</i>
Graduate Teaching Assistant, Computer Science	<i>Spring 2015</i>
<b>U.S. Army Research Laboratory</b>	Adelphi, MD
Visiting Graduate Researcher, Network Science Research Laboratory	<i>Summer 2017</i>
<b>Cornell University</b>	Ithaca, NY
NSF Undergraduate Researcher, Information Sciences	<i>Summer 2013</i>
<b>Texas Tech University</b>	Lubbock, TX
NSF Undergraduate Researcher, Computer Science	<i>Summer 2012</i>

### *Selected Project Relevant Publications*

- 
- Climate Complacency Reflects Cultural Values of Nations  
Current Research in Ecological and Social Psychology (CRESP) 2023  
R. Alexander Bentley, Joshua Borycz, and Benjamin D. Horne
  - Cultural Evolution, Disinformation and Social Division  
Adaptive Behavior 2023  
R. Alexander Bentley, Benjamin D. Horne, Joshua Borycz, Simon Carrignon, Garriy Shteynberg, Blai Vidiella, Sergi Valverde, Michael O'Brien
  - Generational Effects of Culture and Digital Media in Former Soviet Republics  
Humanities and Social Sciences Communications (HSSCOMMS) 2023  
Benjamin D. Horne, Natalie Rice, Catherine Luther, Damian Ruck, Joshua Borycz, Suzie L. Allard, Michael Fitzgerald, Oleg Manaev, Brandon C. Prins, Maureen Taylor, R. Alexander Bentley
  - Monitoring Event-driven Dynamics on Twitter: A Case Study in Belarus  
Springer Nature Social Sciences (SNSS) 2022  
Natalie M. Rice, Benjamin D. Horne, Catherine Luther, Joshua Borycz, Suzie L. Allard, Damian J. Ruck, Michael Fitzgerald, Oleg Manaev, Brandon C. Prins, Maureen Taylor, and R. Alexander Bentley

5. Characterizing YouTube and BitChute Content and Mobilizers During U.S. Election Fraud Discussions on Twitter  
14th ACM Web Science Conference (WebSci) 2022  
Matthew C. Childs\*, Milo Trujillo, Cody Buntain, and Benjamin D. Horne
6. Local News Online and COVID in the U.S.: Relationships among Coverage, Cases, Deaths, and Audience  
The 16th International Conference on Web and Social Media (ICWSM) 2022  
Kenneth Joseph, Benjamin D. Horne, Jon Green, John P. Wihbey
7. The Reasoning Behind Fake News Assessments: A Linguistic Analysis  
AIS Transactions on Human-Computer Interaction (THCI) 2022  
Lydia Manikonda, Dorit Nevo, Benjamin D. Horne, Clare Arrington, and Sibel Adalı
8. How Topic Novelty Impacts the Effectiveness of News Veracity Interventions  
Communications of the ACM (CACM) 2022  
Dorit Nevo and Benjamin D. Horne
9. Partisanship over security: Public narratives via Twitter on Foreign Interferences in the 2016 and 2020 U.S. Presidential Elections  
First Monday 2021  
Catherine Luther, Benjamin D. Horne, and Xu Zhang
10. Tailoring Heuristics and Timing AI Interventions for Supporting News Veracity Assessments  
Computers in Human Behavior Reports (CHB Reports) 2020  
Benjamin D. Horne, Dorit Nevo, Sibel Adalı, Lydia Manikonda, Clare Arrington
11. What is BitChute? Characterizing the "Free Speech" Alternative to YouTube  
31st ACM Conference on Hypertext and Social Media (HT'20) 2020  
Milo Trujillo, Mauricio Gruppi, Cody Buntain, and Benjamin D. Horne
12. Different Spirals of Sameness: A Study of Content Sharing in Mainstream and Alternative Media  
The 13th International Conference on Web and Social Media (ICWSM) 2019  
Benjamin D. Horne, Jeppe Nørregaard, and Sibel Adalı
13. Rating Reliability and Bias in News Articles: Does AI Assistance Help Everyone?  
The 13th International Conference on Web and Social Media (ICWSM) 2019  
Benjamin D. Horne, Dorit Nevo, John O'Donovan, Jin-Hee Cho, and Sibel Adalı
14. Identifying the Social Signals that Drive Online Discussions: A Case Study of Reddit Communities  
International Conference on Computer Communications and Networks (ICCCN) 2017  
Benjamin D. Horne, Sibel Adalı, and Sujoy Sikdar

#### *Selected Project Relevant Funding*

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1. Co-PI, Minerva Research Initiative, United States Department of Defense, Office of Naval Research  
**Title:** Monitoring the Content and Measuring the Effectiveness of Russian Disinformation and Propaganda Campaigns in Selected Former Soviet Union States  
**Funding:** \$1.3 Million over 6 years.

#### *Selected Awards & Honors*

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1. **2023**, Bonnie Carroll and Roy Cooper Faculty Enrichment Award (\$2,500)
2. **2020**, Robert McNaughton Prize at RPI, for Ph.D. Dissertation: *Robust News Veracity Detection*
3. **2017**, Best Research Paper Award at MIT Sloan Sports Analytics Conference (\$10,000)

## Curriculum Vitae

### Mingzhou Jin

John D. Tickle Professor

Industrial and Systems Engineering Department, The University of Tennessee at Knoxville (UTK)

Institute for a Secure and Sustainable Environment, UTK

525E John D. Tickle Engineering Building, TN, 37996, jin@utk.edu

## EDUCATION

- Ph.D. (2001) Industrial and Systems Engineering, Lehigh University
- M.S. (1998) Management Science, Business School of Zhejiang University
- B.S. (1995) Electrical Engineering, Zhejiang University, China

## APPOINTMENTS

### ✓ 2012 – Present UTK

Department Head of Industrial and Systems Engineering, 2023~present

Director of the FERSC Center, a DOT/UTC Tier Center, 2023~present

Director of the Institute for a Secure and Sustainable Environment, 2018~present

Professor of Industrial and Systems Engineering, 2015~present

Associate Department Head of Industrial and Systems Engineering, 2012~2023

Director of Graduate Studies, Industrial and Systems Engineering, 2017~2018

Affiliated Faculty of the Bredesen Center, 2017~present

Associate Professor of Industrial and Systems Engineering, 2012~2015

### ✓ 2002 – 2011, Mississippi State University (MSU)

Assistant and then Associate Professor of Industrial and Systems Engineering, 2002~2021

## TEACHING

**Courses taught at UTK and MSU** (average teaching evaluation: 4.5/5.0)

IE 301 Operations Research I, IE 310 Operations Research II, IE 404 Senior Design I, IE 405 Engineering Economy, IE 430/530 Supply Chain Engineering, IE 422 Senior Design II, IE 550 Graduate Seminar, IE 522 Optimization Method in Industrial Engineering, IE 530 Research Methods, IE 692 Stochastic Processes. IE 4373/6373 Linear Programming, IE 4623/6623 Engineering Statistics II, IE 4753/6753 Systems Engineering and Analysis, IE 4543/6543 Logistics Engineering (Supply Chain Management), IE 8353 Manufacturing Systems Modeling, IE 8723 Operations Research II (Stochastic Processes), IE 8990 Special Topics in Industrial Engineering: Optimization, IE 8753 Nonlinear Programming, IE 8990 Special Topics in Industrial Engineering: Network Flows

## RESEARCH

### Research Grants in the Last Three Years

1. *Center for Freight Transportation for Efficient and Resilient Supply Chain (FERSC)*, US DOT, 2023-2028, PI, \$10,000,000.
2. *U.S.-Japan Exchange Program for Green Growth Collaboration through Clean Energy Technologies (EXCET)*, US Embassy in Tokyo, 2023-2025, PI, \$70,000 with \$140,000 matching.
3. *A Community Co-design-based Weatherization and Micro-grid Plan for an Equitable Energy Security and Environmental Health*, Welcome Trust, 2023~2026, Co-PI, \$1,675,910.
4. *East Tennessee Initiative for Smart Energy Management (ETISE)*, DOE, 2023-2026, PI, \$396,813.
5. *Realization of energy efficiency and carbon emission reduction of semiconductor supply chains through cybersecurity*, The Cybersecurity Manufacturing Innovation Institute, 2022-2023, PI, \$60,000.
6. *SRS RN: People-Centric Integrated Assessment Model for Regional Sustainability (PIAMRS): Focusing on the Central Appalachian Region*, NSF, 2022, PI, \$145,749.
7. *US Food, Loss, and Waste and Its Relationship with Energy consumption and Carbon Emissions*, Oak Ridge National Lab, 2022-2024, PI, \$125,145.
8. *Administrative Support for East Tennessee Clean Fuels*, Tennessee Clean Fuels, 2018-2024, PI, \$2,7179,774.
9. *Support for Land Freight Lifecycle*, OnTrackNorthAmerica, 2021-2022, PI, \$54,839.
10. *CPS: Medium: Bio-socially Adaptive Control of Robotics-Augmented Building-Human Systems for Infection Prevention by Cybernation of Pathogen Transmission*, NSF, 2021-2023, Co-PI, \$1,199,129.

11. *Machine Learning Methods for Predicting Irregularities, trip coverage and duty deformation*, 2021-2022, FedEx, PI, \$256,888.
12. *Workplace Charging Requirement Analysis*, Tennessee Valley Authority, 2021, PI, \$100,000.
13. *UNS: International Research Coordination Network for Creating Transdisciplinary Nodes of Food-Energy-Water to Support Sustainable Urban Systems*, NSF, 2020-2023, co-PI, \$500,000.
14. *Coupled FEWS Modeling for Sustainability of the Global Crop Supply Chain with a Focus on US-China Interactions*, NSF, 2019-2023, PI, \$500,000.
15. *Smart Manufacturing Readiness Evaluation*, Oak Ridge National Lab, 2020-2021, PI, \$57,556.
16. *Materials Management Optimization via Technology Deployment*, DOE/Consolidated Nuclear Security, 2019-2022, PI, \$554,072.
17. *Analysis for Regional and Global Land Ecosystem Modeling*, Oak Ridge National Lab, 2015-2022, PI, \$244,379.
18. *Data Analytics Support for Integrated Earth Model*, Oak Ridge National Lab, 2019-2022, Co-PI, \$178,649.
19. *Additive Manufacturing Support and Research*, DOE/Consolidated Nuclear Security, 2017-2022, PI, \$261,466.
20. *Industrial Landfill Waste Management (Reduce, Recycle, and Reuse) Technology Assessment*, Oak Ridge National Lab, 2018-2022, PI, \$55,051.
21. *Flight Reserve Optimization*, FedEx, 2018-2021, PI, \$74,834.
22. *Flight Risk Analysis, Validation, and Optimization Phases I-IV*, FedEx, 2014-2021, PI, \$284,000.
23. *Policy Study - Adoption of Alternative Fuel Vehicles*, Oak Ridge National Lab, 2018-2022, PI, \$193,698.

#### Selected Journal Papers in the Last Three Years

1. W. Dong and **M. Jin\***, “Automated Storage and Retrieval System Design with Variant Lane Depths,” Accepted by *European Journal of Operational Research*, 2023.
2. Y. Zhang, J. Mao, D. M. Ricciuto, **M. Jin**, Y. Yu, X. Shi, S. Wullschleger, R. Tang, and J. Liu. "Global fire modelling and control attributions based on the ensemble machine learning and satellite observations." *Science of Remote Sensing* 7, 2023.
3. D. Vance, **M. Jin\***, C. Price, S. U. Nimbalkar, and T. Wenning. "Smart manufacturing maturity models and their applicability: a review." *Journal of Manufacturing Technology Management* ahead-of-print, 2023,
4. T. Cokoyasar and **M. Jin\***, “Additive Manufacturing Capacity Allocation Problem over a Network,” *IIEE Transactions*, 55(8), 807-820, 2023.
5. M. Erkoc, H. Gurnani\*, S. Ray, and **M. Jin**, “Quality Investment, Inspection Policy and Pricing Decisions in a Decentralized Supply Chain,” *Production and Operations Management*, 32 (1), 2023.
6. Y. Wang, J. Mao\*, F. Hoffman, C. Bonfils, H. Douville, **M. Jin**, P. Thornton, D. Ricciuto, X. Shi, H. Chen, S. Wullschleger, S. Piao, and Y Dai, “Quantification of human contribution to soil moisture–based terrestrial aridity,” *Nature Communications*, 13(1), 1-11, 2022.
7. R. Zhou, Y. Wang, **M. Jin\***, J. Mao, and X. Zheng, “Coffee Supply Chain Planning under Climate Change,” *the Journal of Integrative Environmental Sciences*, 19, 1-15, 2022.
8. C. Griffin, J. Hale, and **M. Jin\***, “A Framework for Assessing Investment Costs of Additive Manufacturing,” *Progress in Additive Manufacturing*, 7, 903-915, 2022.
9. W. Dong, K. Armstrong, **M. Jin\***, S. Nimbalkar, W. Guo, J. Zhuang and J. Cresko, “A framework to quantify mass flow and assess food loss and waste in the US food supply chain,” *Communications Earth & Environment*, 3(1), pp.1-11, 2022.
10. S. Zhou, Z. Jia, **M. Jin\***, and N. Du, “Minimizing makespan on parallel batch processing machines with two-dimensional rectangular jobs”. *Computers & Industrial Engineering*, 169, p.108167, 2022.
11. Y. Wang, Z. Yu, L. Shen, and **M. Jin\***, “Operational modes of E-closed loop supply chain considering platforms’ services,” *International Journal of Production Economics*, p.108551, 2022.
12. S. Zhou, **M. Jin\***, C. Liu, X. Zheng, and H. Chen, Scheduling a single batch processing machine with non-identical two-dimensional job sizes. *Expert Systems with Applications*, 201, p.116907, 2022.
13. H. Sun, Y. Sun, **M. Jin**, S.A. Ripp, G.S. Saylor, and J. Zhuang\*, “Domestic plant food loss and waste in the United States: Environmental footprints and mitigation strategies. *Waste Management*, 150, pp.202-207, 2022.

14. R. Li, **M. Jin**<sup>\*</sup>, Z. Pei, and D. Wang, "Geometrical Defect Detection on Additive Manufacturing Parts with Curvature Feature and Machine Learning," *The International Journal of Advanced Manufacturing Technology*, 120 (5), pp.3719-3729, 2022.
15. K. Zhang, X. Li<sup>\*</sup>, **M. Jin**, "Efficient Solution Methods for A General R-Interdiction Median Problem with Fortification," *INFORM Journal on Computing*, 34(2), pp.1272-1290. 2022.
16. R. Chai, J. Mao<sup>\*</sup>, H. Chen, Y. Wang, X. Shi, **M. Jin**, T. Zhao, F.M. Hoffman, D.M. Ricciuto, and S.D. Wullschleger, "Human-caused Long-Term Changes in Global Aridity," *npj Climate and Atmospheric Science*, 4(1), pp.1-8, 2021
17. W. Dong and **M. Jin**<sup>\*</sup>, "Travel Time Models for Tier-To-Tier SBS/RS with Different Storage Assignment Policies and Shuttle Dispatching Rules," *Transportation Research Part E: Logistics and Transportation Review*, 155, p.102485, 2021
18. R. Tang, J. Mao, **M. Jin**, A. Chen, Y. Yu, X. Shi, Y. Zhang, F. M. Hoffman, M. Xu, and Y. Wang, "Interannual Variability and Climatic Sensitivity of global Wildfire Activity", *Advances in Climate Change Research*, 12(5), pp.686-695, 2021.
19. W. Dong, **M. Jin**<sup>\*</sup>, Y. Wang, and P. Kelle, "Retrieval Scheduling in Crane-based 3D Automated Retrieval and Storage Systems with Shuttles," *Annals of Operations Research*, 302, 111-135, 2021.
20. Y. Wang, J. Mao, **M. Jin**, F.M. Hoffman, X. Shi, S.D. Wullschleger, and Y. Dai, "Development of Observation-based Global Multi-layer Soil Moisture Products for 1970 to 2016," *Earth System Science Data*, 13, 4385-4405, 2021.
21. J. Hale and **M. Jin**<sup>\*</sup>, "A Conceptual Framework for Witness Builds and Witness Artifacts in Additive Manufacturing", *Rapid Prototyping Journal*, 27 (6), 2021
22. R. Li, **M. Jin**<sup>\*</sup>, and V. Paquit, "Geometrical Defect Detection for Additive Manufacturing with Machine Learning Models," *Materials & Design*, 206, 109726, 2021.
23. N. Liu, F. Xie, Z. Lin<sup>\*</sup>, and **M. Jin**, "Empirical Estimation of Route Length Along U.S. Interstate Highways Based on Great Circle Distance," *Transportation Research Record*, 2675(10), pp.1248-1253, 2021.
24. Y. Wang, Z. Yu, **M. Jin**<sup>\*</sup>, and J. Mao, "Decisions and Coordination of Retailer-led Low-carbon Supply Chain under Altruistic Preference," *European Journal of Operational Research*, 293, (3) 910-925, 2021.
25. T. Cokiyasar<sup>\*</sup>, W. Dong, **M. Jin**, I.O. Verbas, "Designing a Drone Delivery Network with Automated Battery Swapping Machines", *Computers and Operations Research*, 129, 105177, 2021.
26. Z. Liu, Y. Wang, **M. Jin**<sup>\*</sup>, H. Wu, and W. Dong, "Energy Consumption Model for Shuttle-Based Storage and Retrieval Systems", *Journal of Cleaner Production*, 282, 124480, 2021.
27. Y. Gong, **M. Jin**, and Z. Yuan<sup>\*</sup>, "Robotic Mobile Fulfillment System Considering Customer Classes", *International Journal of Production Research*, 59(16), 5032-5049, 2021.
28. Y. Ding, **M. Jin**, S. Li, and D. Feng<sup>\*</sup>, "Smart Logistics Based on the Internet of Things Technology: An Overview", *International Journal of Logistics Research and Applications*, 24(4), 323-345, 2021.

#### **Selected Professional Service**

- Editor-in-Chief of Cleaner and Circular Bioeconomy, 2021 – present
- Executive Editor of the Journal of Cleaner Production, 2020 – present
- Editorial board member of the International Journal of Production Economics, 2014 - 2021
- Editorial board member of the Engineering Economist, 2013 – present
- Proposal panelist for National Science Foundation and Department of Energy, 2015, 2020, 2021

#### **HONORS IN THE LAST THREE YEARS**

- 2023 Dr. Kenneth Kirby Endowed Faculty Award
- John D. Tickle Professorship, UTK, 2021-present
- 2021 UTK Success in Multidisciplinary Research Award
- 2020 UTK Chancellor's Research and Creative Achievement Award
- 2020 Tickle College of Engineering Research Achieve Award

#### **PH.D. STUDENT ADVISEES**

**Ongoing (9):** David Vance, Jingwei Chen, Beau Groom, Rui Zhou, Yue Yao, Adam Thomas, Ziwei Liu, Sarita Rattanakunuprakarn, Robin Clark

## Curriculum Vita

### Nicholas N. Nagle

University of Tennessee-Knoxville  
 Burchfiel Geography Building 307  
 Knoxville, Tennessee 37996-0925  
[nnagle@utk.edu](mailto:nnagle@utk.edu)  
 865-974-6035

#### Research Expertise

*Geographic Information Science:* spatial data science, survey statistics,  
*Population Geography:* applied demography

#### Teaching Expertise

*Quantitative Methods in Geography:* Spatial and temporal statistics, sample design  
*Population Geography:* data collection, demography, migration

#### Education

Ph.D., University of California, Santa Barbara, 2005, Geography. Dissertation: "Continuous field statistical methods for spatial analysis in the social sciences"

#### Appointments

2021-present Professor & Head, Department of Geography, University of Tennessee, Knoxville  
 2015–2021 Associate Professor, Department of Geography, University of Tennessee, Knoxville  
 2009–2015 Assistant Professor, Department of Geography, University of Tennessee, Knoxville  
 2012–2015 UT Joint Faculty Affiliate, Oak Ridge National Laboratory.  
 2009–2012 Research Assistant Professor, Center for Business and Economic Research,  
 University of Tennessee.  
 2005–2009 Assistant Professor, Department of Geography, University of Colorado at Boulder.

#### Courses Taught

##### University of Tennessee, Department of Geography (2009–present)

611 Seminar in GIS: Spatial Data Fusion and Classification  
 611 Seminar in GIS: Spatio-Temporal Bayesian Data Analysis  
 599 Geographic Concept & Method  
 515 Quantitative Methods in Geography  
 509: Special Topics: Introduction to Bayesian Data Analysis  
 509 Special Topics in Geography: Spatial Demography  
 441 Geography of US Cities  
 415 Introduction to Quantitative Methods  
 344 Population Geography  
 111 Our Digital World

##### University of Colorado at Boulder, Department of Geography (2005–2009)

1992 Introduction to Human Geographies  
 3023 Statistics for Earth Sciences  
 3612 Geography of American Cities  
 3662 Economic Geography



4023/5023 Quantitative Methods in Geography  
4622 City Life

**Selected Publications** (\* indicates student first author)

- Tuccillo, J., Stewart, R., Rose, A., Trombley, N., Moehl, J., Nagle, N., & Bhaduri, B. (2023). UrbanPop: A spatial microsimulation framework for exploring demographic influences on human dynamics. *Applied Geography*, 151, 102844. doi:[10.1016/j.apgeog.2022.102844](https://doi.org/10.1016/j.apgeog.2022.102844)
- Hipp, J. R., Boessen, A., Butts, C. T., Nagle, N. N., & Smith, E. J. (2023). The spatial distribution of neighborhood safety ties: Consequences for perceived collective efficacy?. *Journal of Urban Affairs*. doi:[10.1080/07352166.2023.2192940](https://doi.org/10.1080/07352166.2023.2192940)
- Stewart, R., Erwin, S., Piburn, J., Nagle, N., Kaufman, J., Peluso, A., . . . Bhaduri, B. (2022). Near real time monitoring and forecasting for COVID-19 situational awareness. *Applied Geography*, 146, 102759. doi:[10.1016/j.apgeog.2022.102759](https://doi.org/10.1016/j.apgeog.2022.102759)
- Schroeder, T. A., Nagle, N. N., & McCollum, J. M. (2022). RegRake: A Web-Based Application for Custom Small Area Estimation and Mapping of Forest Survey Data With Regularized Raking. *Frontiers in Forests and Global Change*, 5. doi:[10.3389/ffgc.2022.769268](https://doi.org/10.3389/ffgc.2022.769268)
- Rose\*, M Brooke, Nagle, Nicholas N. (2021) Characterizing Forest Dynamics with Landsat-Derived Phenology Curves. *Remote Sensing* 13(2) 267. <https://doi.org/10.3390/rs13020267>
- Nagle, Nicholas N, Todd A Schroeder, Brooke Rose. (2019) A Regularized raking estimator for small-area mapping from forest inventory surveys. *Forests*, 10(11), 1045 <https://doi.org/10.3390/f10111045>
- Bohon, Stephanie A and Nicholas N Nagle. (2019) Method for measuring gender Diversity among college and university faculty. *Journal of Higher Education Theory and Practice* 19(6):28—39. <https://doi.org/10.33423/jhetp.v19i6.2302>
- Odoi\*, E. W., Nagle, N., Roberson, S., & Kintziger, K. W. (2019). Geographic disparities and temporal changes in risk of death from myocardial infarction in Florida, 2000-2014. *BMC PUBLIC HEALTH*, 19, 13 pages. doi:[10.1186/s12889-019-6850-x](https://doi.org/10.1186/s12889-019-6850-x)
- Fowler, Christopher S, Nathan Frey, David C. Folch, Nicholas N. Nagle, and Seth Spielman. (2019) Who are the people in my neighborhood?: The “Contextual Fallacy” of measuring individual context with census geographies. *Geographical Analysis* 52(2): 155—168. <http://doi.org/10.1111/gean.12192>
- Grace, K., Nagle, N. N., Burgert-Brucker, C. R., Rutzick, S., Van Riper, D. C., Dontamsetti, T., & Croft, T. (2019). Integrating Environmental Context into DHS Analysis While Protecting Participant Confidentiality: A New Remote Sensing Method. *POPULATION AND DEVELOPMENT REVIEW*, 45(1), 197-+. doi:[10.1111/padr.12222](https://doi.org/10.1111/padr.12222)
- Jurjevich, J. R., Griffin, A. L., Spielman, S. E., Folch, D. C., Merrick, M., & Nagle, N. N. (2018). Navigating Statistical Uncertainty: How Urban and Regional Planners Understand and Work With American Community Survey (ACS) Data for Guiding Policy. *JOURNAL OF THE AMERICAN PLANNING ASSOCIATION*, 84(2), 112-126. doi:[10.1080/01944363.2018.1440182](https://doi.org/10.1080/01944363.2018.1440182)
- Schmidt, E. H., Bhaduri, B. L., Nagle, N., & Ralston, B. A. (2018). Supervised classification of electric power transmission line nominal voltage from high-resolution aerial imagery. *GIScience & Remote Sensing*, 55(6), 860-879. doi:[10.1080/15481603.2018.1460933](https://doi.org/10.1080/15481603.2018.1460933)

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- Amy Rose\* and Nicholas N. Nagle. 2017. "Validation of Spatiodemographic Estimates Produced Through Data Fusion of Small Area Census Records and Household Microdata." *Computers, Environment and Urban Systems*. 63: 38—49.. <http://dx.doi.org/10.1016/j.compenvurbsys.2016.07.006>
- Kathryn Grace, Nicholas N. Nagle and Greg Husak. 2016. "Can small-scale agricultural production improve children's health? Examining stunting vulnerability among very young children in Mali, West Africa" *Annals of the Association of American Geographers*.
- Kathryn Grace and Nicholas N. Nagle. 2015. "Using high resolution remotely sensed data to examine the relationship between agriculture and fertility in a pre-transitional setting: A case study of Mali." *The Professional Geographer* 67(4): 641-654. <http://dx.doi.org/10.1080/00330124.2015.1032899>
- Adam Boessen, John R. Hipp, Emily J. Smith, Carter T. Butts, Nicholas N. Nagle, and Zack Almquist. 2014. "Networks, space and residents' perception of cohesion." *American Journal of Community Psychology*. 53(3-4): 447-461. <http://dx.doi.org/10.1007/s10464-014-9639-1>
- Nicholas N. Nagle, Barbara P. Battenfield, Stefan Leyk, and Seth Spielman. 2014. "Dasymetric Modeling and Uncertainty." *Annals of the Association of American Geographers*. 104(1): 80–95. <http://dx.doi.org/10.1080/00045608.2013.843439>
- ]Stefan Leyk, Matt Ruther, Barbara P. Battenfield, Nicholas N. Nagle, and Alexander Stum. 2014. "Modeling residential developed land in rural areas: A size-restricted approach using parcel data." *Applied Geography*. 47: 33–45. <http://dx.doi.org/10.1016/j.apgeog.2013.11.013>
- Seth E. Spielman, David Folch and Nicholas N. Nagle. 2014. "Understanding uncertainty in the American Community Survey." *Applied Geography*. 46: 147–157. <http://dx.doi.org/10.1016/j.apgeog.2013.11.002>
- Stefan Leyk, Barbara P. Battenfield, Nicholas N. Nagle, and Alexander Stum. 2013. "Establishing relationships between parcel data and landcover for demographic small area estimation." *Cartography and Geographic Information Science*. 40(4): 305–315. <http://dx.doi.org/10.1080/15230406.2013.782682>.
- John R. Hipp, Carter T. Butts, Ryan Acton, Nicholas N. Nagle, and Adam Boessen. 2013. "Extrapolative simulation of neighborhood networks based on population spatial distribution: Do they predict crime?" *Social Networks*. 35(4): 614–625. <http://dx.doi.org/10.1016/j.socnet.2013.07.002>.
- Matt Ruther, Galen Maclauren, Stefan Leyk, Barbara Battenfield, and Nicholas N. Nagle. 2013. "Validation of spatially allocated small area estimates for 1880 census demography." *Demographic Research*. 29: 579–616. <http://dx.doi.org/10.4054/DemRes.2013.29.22>
- Stefan Leyk, Barbara Battenfield, and Nicholas N. Nagle. 2013. "Modeling ambiguity in census microdata allocations to improve demographic small area estimates." *Transactions in Geographic Information Science*. 17(3): 406–425. <http://dx.doi.org/10.1111/j.1467-9671.2012.01366.x/>

1  
CURRICULUM VITA

William Robert Nugent, Ph.D.

EDUCATION

- Ph.D. Florida State University, April, 1986  
School of Social Work; Dissertation Chair: Walter W. Hudson, Ph.D.
- M.S.W. Florida State University, May, 1982  
School of Social Work; Major in Clinical Practice.
- M.S. Florida State University, March, 1977  
College of Education; Major in Counseling and Human Systems.
- B.S. Florida State University, June, 1972  
School of Engineering Science.

PROFESSIONAL EXPERIENCE - UNIVERSITY OF TENNESSEE

- Aug 2016 to Aug 2019: Associate Dean for Research, College of Social Work, University of Tennessee, Knoxville
- Aug, 2016 to Aug 1, 2017: Interim Director Ph.D. Program, College of Social Work, University of Tennessee, Knoxville
- Jan 2010 to Jan 2019: University Faculty Ombudsman, University of Tennessee, Knoxville.
- Aug 1996 to July 2013: Director, Ph.D. Program in Social Work
- Aug 1 2001 to Present: Responsible for the Ph.D. Program, including management of program budget; recruitment of students; and supervision for Ph.D. program faculty.
- Aug 1991 to Aug 2001: Associate Professor then Professor, College of Social Work, University of Tennessee, Knoxville

TEACHING

- Courses taught:
- SW 506 – (MSW) Masters Foundation Research
  - SW 516 – (MSW) Clinical Evaluation Research
  - SW 519 – (MSW) Foundation of Social Work Research (virtual)
  - SW 527 – (MSW) Cognitive-behavior therapy
  - SW 530 – (MSW) Seminar in mediation
  - SW 521 – (MSW) Social work practice with individuals
  - SW 540 – (MSW) Mediation

## 2

SW 612 – (PhD) Issues in Direct Practice  
 SW 608 – (PhD) Statistics I  
 SW 660 – (PhD) Statistics II  
 SW 601 – (PhD) Research for Social Work Practice 1  
 SW 602 – (PhD) Research for Social Work Practice 2  
 SW 620 – (DSW program) Clinical Research and Applied Statistics  
 (taught virtually)  
 SW 417R – (BSSW) Honors Social Work Research  
 SW 467R – (BSSW) Honors Integrative Seminar

## SERVICE

College: Treatment Committee; Foundation Committee; Computer Committee; Search and Screen Committee (chair and member); Retention, Promotion, and Tenure Committee (Chair and member); College IRB (Chair and member); Diversity, Inclusion, and Equity Committee (Chair and member); Doctoral Program Committee (Chair and member); BSSW Program Committee (member); DSW Program Committee (member); Dean Search Committee.

University: Faculty Senate; Graduate Council (member of credentials subcommittee); Dean Search Committee; Chair of Search Committee for University Faculty Ombudsperson.

Community: Volunteer in HABIT (Human Animal Bond in Tennessee) Program.

National: Serve on Awards Committee for the Society for Social Work and Research (1998, 1999, 2000); Member of GADE Steering Committee (1999 - 2004; Secretary 2001 to 2004); Abstract Reviewer for Society for Social Work and Research (2021, 2020, 2019, 2018).

## AWARDS

2021 Faculty Research Mentor Award for Undergraduate Research

2015 Nominee for Chancellor's Excellence in Teaching Award

2014 Named as a Society for Social Work and Research Fellow

Recipient of 1997 Jefferson Award - Chancellor's Award to University Faculty

Recipient of one of six national research awards (Honorable Mention, 1997) given by the Society for Social Work and Research.

## 3

## GRANTS FUNDED

Co-PI AlignCare grant from Maddie's Fund, \$2,633,420. May 2018 – December 2021.

PI Improving the Research Culture in the College of Social Work. Office of Research Engagement Grant, \$10,796. June 13, 2019 – August 2021.

PI SARIF Grant recipient, Summer 1997 (\$3,000), from the University of Tennessee.

Co-PI on \$2.3 million NIMH funded Social Work Research Development Center. Led research team focusing on antisocial children and adolescents.

Dissertation Committees Chaired:

- Darlene Grant (graduated 1993).
- Jeffrey Paddock (graduated 1995).
- Heenyon Kim (graduated 1997).
- Lizabeth Wiinimaki (graduated 1997).
- Bev McKee (graduated 1997).
- Laurie White (graduated 1998).
- June Rose (graduated 1998).
- Cinda Sagnes (graduated summer, 2000).
- Roxie Massey (Clinical Psychology student; graduated 1999).
- Mona Williams-Hayes (graduated spring, 2003).
- Charlene Bruley (graduated summer 2002).
- Sylvia Sergent (graduated in fall 2005).
- Shakira Kennedy (graduated 2006).
- Stephanie Harness (graduated 2010).
- Michael Burford (graduated 2012).
- Denise Black (graduated 2017).
- Jeff McCabe (graduated 2017).
- Erin Story (graduated 2018).
- Alison Lloyd (graduated 2021).
- Omotola Akinsola (graduated 2021).
- Rebecca Hnilica (graduated 2021).

## Adam G. Petrie

SMC 219  
916 Volunteer Blvd.                      865-789-5028 (cell)  
University of Tennessee                apetrie@utk.edu  
Knoxville, TN 37996

### Education

- 2003–2007 Rensselaer Polytechnic Institute  
M.S. (2004) in Operations Research and Statistics  
Ph.D. (2007) in Decision Sciences and Engineering Systems  
dissertation title: *Spanning Trees as Tools for Data Analysis*  
dissertation committee: Thomas Willemain (chair), Mark Embrechts, John Mitchell, Malik Magdon-Ismael
- 1998-2001 The University of California, Santa Cruz  
M.S. in Astronomy and Astrophysics
- 1994-1998 California Institute of Technology  
B.S. in Astronomy

### Academic Positions

- 2020-            The University of Tennessee, Knoxville  
Senior Lecturer, Department of Business Analytics and Statistics
- 2014-2019 The University of Tennessee, Knoxville  
Lecturer, Department of Business Analytics and Statistics
- 2007-14        The University of Tennessee, Knoxville  
Assistant Professor, Department of Statistics, Operations, and Management Science
- 2006            Williams College  
Visiting Instructor, Department of Mathematics and Statistics
- 2001–2002 Cañada College  
Adjunct Instructor, Department of Science and Technology

### Teaching Experience

- University of Tennessee    BAS 479: Business Analytics Capstone (11 semesters)  
  BAS 474: Data Mining for Business Analytics (5 semesters)  
  BAS 320: Regression and Modeling with R (11 semesters)  
  BAS 471: Statistical Methods (8 semesters)  
  BZAN 533: Mathematical Methods and Statistics for Business Analytics (8 semesters)  
  STAT 201: Introduction to Statistics (6 semesters)  
  STAT 207: Honors: Introduction to Statistics (6 semesters)  
  STAT 563: Introduction to Probability and Mathematical Statistics (4 semesters)  
  STAT 564: Statistical Inference II (1 semester)  
  STAT 483/583: R for Statistical Programming (1 semester)  
  MGSC 532: Stochastic Models in Management Science (1 semester)

Williams College	MATH 102: Precalculus (1 semester)
Cañada College	ASTR 100: Introduction to Astronomy (3 semesters) ASTR 101: Astronomy Laboratory (2 semesters) PHYS 210: General Physics (1 semester)
Kaplan	MCAT Physics (1 section)
Rensselaer Polytechnic Institute	ENGR 2600: Modeling and Analysis of Uncertainty (TA) DSES 4140: Statistical Analysis (TA) DSES 6160: Applied Regression Analysis (TA)
UC Santa Cruz	LING 80G: The Nature and Language of Computers (TA) ASTR 2: Overview of the Universe (TA) ASTR 3: The Solar System (TA) ASTR 12: Stars and Stellar Evolutions (TA) ASTR 14: Observational Astronomy (TA)

## Publications

- 2017 Unleashing the Potential of Supply Chain Analytics. *MIT Sloan Management Review*, August 2017
- 2016 Graph-theoretic Multisample Tests of Equality in Distribution for High Dimensional Data. *Computational Statistics & Data Analysis*, April 2016
- 2016 Regression and Modeling with R. Cognella Academic Publishing.
- 2013 An Empirical Study of Tests for Uniformity in Multidimensional Data. *Computational Statistics & Data Analysis*, August 2013, pp. 253–268
- 2013 Prediction of ICU In-Hospital Mortality Using Artificial Neural Networks. *Proceedings of the 6th Annual Dynamic Systems and Control Conference* (to appear October 2013)
- 2012 Estimating Eigenvalues of Dynamical Systems from Time Series with Applications to Predicting Cardiac Alternans. *Proceedings of Royal Society A*, Published online before print July 4, 2012, doi: 10.1098/rspa.2012.0098
- 2011 Reconstruction of physiological signals using iterative retraining and accumulated averaging of neural network models. *Physiological Measurement*, 32, pp. 661-675
- 2011 Assessing the Change in Student Attitudes Toward Statistics at the University of Tennessee *2011 Proceedings of the American Statistical Association, Section on Statistical Education [CD-ROM]*. Alexandria, VA: American Statistical Association.
- 2011 Identifying the Intrinsic Dimensionality Using the Minimum Spanning Tree *2011 Proceedings of the American Statistical Association, Section on Statistical Computing [CD-ROM]*. Alexandria, VA: American Statistical Association.
- 2010 Detection of Cardiac Alternans via Statistical Analysis of the Eigenvalues of a Dynamical System *2010 Proceedings of the American Statistical Association, IMS Section [CD-ROM]*. Alexandria, VA: American Statistical Association.
- 2010 The Snake for Visualizing and for Counting Clusters in Multivariate Data. *Statistical Analysis and Data Mining*, Volume 3 Issue 4, pp. 236–252

- 2009 Distributions That Approximately Satisfy Benford's Law. *2009 Proceedings of the American Statistical Association, IMS Section [CD-ROM]*. Alexandria, VA: American Statistical Association.
- 2008 Visualizing Labeled Multivariate Data in Input and Feature Spaces with the Snake. *2008 Proceedings of the International Conference on Multivariate Statistical Modeling & High Dimensional Data Mining*. Kayseri, Turkey. CRC Press.
- 2008 Graph-Theoretic Multisample Tests of Equality for Multivariate Data with Applications to Detecting Changes in Data Streams. *2008 Proceedings of the American Statistical Association, Statistical Computing Section [CD-ROM]*. Alexandria, VA: American Statistical Association.
- 2007 Uniformity Testing in High Dimensions. *2007 Proceedings of the American Statistical Association, Statistical Computing Section [CD-ROM]*. Alexandria, VA: American Statistical Association.
- 2006 Using Spanning Trees as Data Analysis Tools. *2006 Proceedings of the American Statistical Association, Statistical Computing Section [CD-ROM]*. Alexandria, VA: American Statistical Association.
- 2006 New Methods for Detecting Bimodality in Histograms. *Technical Report. Decision Sciences and Engineering Systems at RPI*.

## Research Positions

- 2005 Rensselaer Polytechnic Institute, Department of Decision Sciences and Engineering Systems  
Research Assistant  
Principal Investigator: Ananth Krishnamurthy  
Topic: Numerical approximations for kanban systems in queueing networks
- 1999–2000 University of California, Santa Cruz, Department of Astronomy  
Research Assistant  
Principal Investigator: Sandra Faber  
Topic: STIS spectra of the cores of giant elliptical galaxies
- 1997 California Institute of Technology, Department of Astronomy  
Research Assistant  
Principal Investigator: Wallace Sargent  
Topic: Quasar absorption lines and the detection of H- $\alpha$  regions
- 1996 California Institute of Technology, Department of Astronomy  
Summer Undergraduate Research Fellow  
Principal Investigator: Charles Steidel  
Topic: Filter systems for detecting galaxies at  $z > 4$
- 1994 Northwestern University  
NASA Fellow  
Principal Investigator: Mel Ulmer  
Topic: Detecting gamma-ray pulsars



# Marshall Prado

Marshall Prado is an Assistant Professor of Design and Structural Technology at the University of Tennessee, where he teaches courses on integrative computational design, digital-robotic fabrication, additive manufacturing, and large-scale composite construction. His research is situated at the convergence of multiple disciplines, from architecture to engineering, biology to computer science, to develop a fundamental change in design and production methodologies.

## EDUCATION

### University of Stuttgart - Institute for Computational Design (ICD)

2013-Current    Doctoral Candidate

### Harvard University - Graduate School of Design (GSD)

2011-2012    Master in Design Studies (Advanced Placement) | Technology - with Distinction

2009-2011    Master in Architecture | Post-Professional

### North Carolina State University - College of Design

2004-2005    Bachelor of Architecture | Magna Cum-Laude - with Honors

1998-2004    Bachelor of Environmental Design in Architecture | Magna Cum-Laude with Honors  
*minor: (1) Art + Design, (2) Art Studies, (3) Spanish*

## ACADEMIC APPOINTMENTS

### University of Tennessee, Knoxville (UTK)

2017 -    Assistant Professor of Design and Structural Technology

### University of Stuttgart, Institute for Computational Design

2013 - 2017    Adjunct Professor (equiv) and Research Associate

### University of Hawaii at Manoa

2012    Visiting Assistant Professor

### Harvard University

2011    Research Associate

## SELECTED HONORS/ DESIGN AWARDS

### UTK Filament Tower

2020    Award for Composites Excellence (ACE): Most Creative Application, American Composites Manufacturing Association

2019    University Design Research Fellowship awarded by Exhibit Columbus

### B.Arch Technology Curriculum

2019    Innovation Award in the category of Development of Design or Design Thinking, American Institute of Architecture National

## SCHOLARSHIP AND RESEARCH

### Journal Articles

- 2020 Prado, M., 2020. "Skeletal composites: robotic fabrication processes for lightweight multi-nodal structural components." *Construction Robotics Journal*, 4(3), pp.217-226.
- 2020 Vasey, L., Felbrich, B., Prado, M., Tahanzadeh, B., Menges, A.: 2020, "Physically distributed multi-robot coordination and collaboration in construction: A case study in long-span coreless filament winding for fiber composites." *Construction Robotics Journal*/vol. 4 no. 1–2, pp. 3–18. (DOI: 10.1007/s41693-020-00031-y)
- 2019 Prado, M., 2019, "Morphogenic Spatial Analysis: A Novel Approach for Visualizing Volumetric Urban Conditions and Generating Analytical Morphology," *Technology/Architecture + Design*, 3:1, pp. 65-75, DOI: 10.1080/24751448.2019.1571827

### Book Contributions

- 2023 Prado, M. (2023) "Wind-up Architecture." Interviewed by Zach Cohen, *Homing the Machine*. pending publication expected in 2023
- 2018 Dörstelmann, M., Prado, M., Menges, A.: 2018, "Explorative Design and Fabrication Strategies for Fibrous Morphologies in Architecture." In Yuan, P., Menges, A., Leach, N. (eds): 2018, *Digital Fabrication*, Tongji University Press, Shanghai, pp. 168-181. (ISBN 978-7-5608-7334-3)

### Conference Papers

- 2023 Prado, M., Van Son, N.: 2023, "Hybrid Additive Manufacturing Processes for Lightweight Fiber Composite Structural Components." Abstract accepted to the IASS Annual Symposium 2023, 10-14 July 2023, Melbourne, Australia. *not published*
- 2023 Prado, M., Van Son, N.: 2023, "Hybrid Thermoplastic-Composite Building Components." In the proceedings of the 41st eCAADe Conference, Graz University of Technology, Austria, Sept. 2023, pending publication
- 2022 Van Son, N., Prado, M.: "Computational Schematic Design Utilizing Self-Organizing Programmatic Agents: a Novel approach to visualizing and organizing urban architectural data." In the proceedings of the 40th eCAADe Conference – Volume 2, KU Leuven Faculty of Architecture, Sint-Lucas Ghent, Belgium, Sept. 2022
- 2020 Prado, M.: 2020, "Computational Design of Lightweight Composite Tower Structures," in ACADIA - Distributed Proximities Proceedings of the ACADIA Conference. pp. 556-563.
- 2018 Solly, J., Früh, N., Saffarian, S., Prado, M., Vasey, L., Felbrich, B., Reist, D., Knippers, J., Menges, A.: 2018, "ICD/ITKE Research Pavilion 2016/2017: Integrative Design of a Composite Lattice Cantilever." In the proceedings of the IASS Annual Symposium 2018, 16-19 July 2018, MIT, Boston, Caitlin Mueller, Sigrid Adriaenssens (eds.), 2018
- 2017 Felbrich, B., Früh, N., Prado, M., Saffarian, S., Solly, J., Vasey, L., Knippers, J., Menges, A.: 2017, "Multi-Machine Fabrication: An Integrative Design Process Utilizing an Autonomous UAV and Industrial Robots for the Fabrication of Long-Span Composite Structures," in *Disciplines & Disruption the proceedings of the ACADIA Conference 2017*, Cambridge, MA, pp. 248-259. (ISBN: 978-0-692-96506-1)

## SERVICE

### Service to University

2022-2023	Advanced Construction Initiative, <i>co-chair with S.Swaminathan and H. Zhou</i>
2022	Future of Manufacturing Working Group
2021- Current	College of Emerging and Collaborative Studies, Data Science Committee
2020-2021	Technology-enhanced Teaching Fellow - CoAD Representative

### Service to College

2022-2023	Dean's Advisory Committee
2019-2021	Space and Technology Advisory Committee
2019-2020	CoAD Transition Task Group on Faculty Support and Research
2018-2019	Tenure-Track Faculty Search Committee, Interior Architecture
2018-2019	Lecturer Faculty Search Committee, Interior Architecture
2017	CoAD Undergraduate Research Assistant - Jury Member

### Service to Department

2022-2023	Master of Science Working Group
2022-2023	Director's Advisory Committee member
2021	Third-year Studio coordinator
2019-2021	Graduate Admissions Committee
2018-2021	Undergraduate Curriculum Committee
2020-2021	School of Architecture Director Search Committee
2019-2020	Visualization and Representation Working Group
2017-2018, 2023	Tennessee Architecture Fellow Search Committee ( <i>2018 committee chair</i> )

### Service to Discipline

2021	The Journal of Building Engineering, Peer Review Committee
2021, 2019	International Journal of Architectural Computing, Peer Review Committee
2020 - Current	Construction Robotics Journal, Associate Editor, Peer Review Committee
2020, 2022	Technology   Architecture + Design (TAD), Peer Review Committee
2020	Automation in Construction Journal, Peer Review Committee
2019	Architectural Science Review, Peer Review Committee
2019	ACM Symposium on Computational Fabrication, Peer Review Committee
2019	CAADRIA Conference, Peer Review Committee
2018 - Current	ACADIA Conference, Scientific Committee
2017, 2019	Fabricate Conference, Review Committee
2016	Journal of Composite Materials, Peer Review Committee
2015 - Current	Rob Arch Conference, Paper Committee

## Jonathan J. Ring

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CONTACT INFORMATION	311 Baker Center for Public Policy 1640 Cumberland Avenue University of Tennessee Knoxville, TN 37996	Tel: (865) 974-8574 Fax: (865) 974-7037 E-mail: jring7@utk.edu
ACADEMIC POSITIONS	<i>Director of Student Programs</i> Howard Baker Jr. Center for Public Policy University of Tennessee, Knoxville	<b>2019 - present</b>
	<i>Lecturer</i> Department of Political Science University of Tennessee, Knoxville	<b>2017 - present</b>
	<i>Assistant Professor</i> Cleveland State University	<b>2016 - 2017</b>
	<i>Postdoctoral Research Fellow &amp; Lecturer</i> University of Michigan	<b>2014 - 2016</b>
EDUCATION	Ph.D., Political Science, University of Iowa Dissertation: <i>The Diffusion of Norms in the International System</i>	<b>2014</b>
	M.A., Political Science, University of Iowa	<b>2010</b>
	B.A., Political Science & French, University of South Dakota	<b>2007</b>
PEER-REVIEWED PUBLICATIONS	Ring, Jonathan J. and Gary Uzonyi. 2022. "Rethinking Tests of the IO Effectiveness Hypothesis: Evidence from Counter-Piracy Efforts in the Global South." <i>International Studies Review</i> 24(3).	
	Cohen, Alexander H, John Alden, and Jonathan J. Ring. 2021. "Using a "Gateway Game" to Stimulate Student Interest and Build Foundational Knowledge." <i>Journal of Political Science Education</i> . 17(S1):104-115.	
	Ring, Jonathan J. and Wonjae Hwang. 2020. "Military and Economic Power Networks, Hedging, and Cooperation on the Korean Peninsula." <i>Asian Survey</i> 60(6): 1090-1115	
	Nieman, Mark David and Jonathan J. Ring. 2015. "The Construction of Human Rights: Accounting for Systematic Bias in Common Human Rights Measures." <i>European Political Science</i> . 14(4):473-495.	
	Mitchell, Sara McLaughlin, Jonathan J. Ring, and Mary K. Spellman. 2013. "Domestic Legal Traditions and States' Human Rights Practices." <i>Journal of Peace Research</i> 50(2): 189-202.	

- BOOK** Cohen, Alexander H, John Alden, and Jonathan J. Ring. 2019. *Gaming the System: Nine Games to Teach American Government through Active Learning*, New York: Routledge.
- OTHER PUBLICATIONS** Ring, Jonathan J. 2021. "The Savvy Consumer of Political Science Research." In Julia M. Hellwege, Eric D. Loepp, and Dan J. Mallinson (Eds). *Handbook of Political Research Pedagogy*. New York: Palgrave Macmillan.
- CONFERENCE PARTICIPATION & INVITED TALKS**
- International Studies Association – Annual Meeting, Nashville, TN 2022
  - International Studies Association – Midwest Annual Meeting, St. Louis, MO 2021
  - International Studies Association – Midwest Annual Meeting, Online 2020
  - Southern Political Science Association Annual Meeting, San Juan, Puerto Rico 2020
  - International Studies Association – Midwest Annual Meeting, St. Louis, MO 2019
  - The World Congress for Korean Politics and Society, Seoul, Republic of Korea 2019
  - International Studies Association Annual Meeting, Toronto, ON 2019
  - International Studies Association – Midwest Annual Meeting, St. Louis, MO 2018
  - International Studies Association Innovative Pedagogy conference, St. Louis, MO 2018
  - Facultad Latinoamericana de Ciencias Sociales Sede Ecuador (FLACSO) and ISA Meeting, Quito, Ecuador 2018
  - Midwest Political Science Association Annual Meeting, Chicago, IL 2018
  - International Studies Association – Midwest Annual Meeting, St. Louis, MO 2017
  - International Studies Association – Midwest Annual Meeting, St. Louis, MO 2016
  - Peace Science Society (International) Annual Meeting, South Bend, IN 2016
  - American Political Science Association Annual Meeting, San Francisco, CA 2015
  - Midwest Political Science Association Annual Meeting, Chicago, IL 2015
  - American Political Science Association Annual Meeting, Washington D.C. 2014
  - Shambaugh Conference: New Frontiers in the Study of Policy Diffusion, University of Iowa, Iowa City, IA 2014

- International Studies Association Annual Meeting,  
Toronto, ON 2014
- Midwest Political Science Association Annual Meeting,  
Chicago, IL 2014
- International Studies Association – Midwest Annual Meeting,  
St. Louis, MO 2013
- EITM Summer Institute,  
University of Houston 2013
- International Studies Association Annual Meeting,  
San Francisco, CA 2013
- St. Louis Area Methods Meeting,  
Iowa City, IA 2013
- Peace Science Society (International) Annual Meeting,  
Knoxville, TN 2013

PROFESSIONAL REVIEWER: American Political Science Review, Foreign Policy Analysis, International Interactions, International Studies Quarterly, International Studies Review, Journal of Peace Research, Political Research Quarterly, International Area Studies Review

MEMBER: American Political Science Association, International Studies Association, Midwest Political Science Association,

COMPUTER SKILLS  
Typesetting:  $\text{\LaTeX}$   
Statistical and Programming Software: R, Stata, Excel, Python, Netlogo

UPDATED March 8, 2023

**Curriculum Vita**  
**Louis M. Rocconi, Ph.D.**  
<https://lrocconi.github.io/>

**Contact Information:**

Educational Leadership and Policy Studies Department

Phone: 865-974-5479

Email: lrocconi@utk.edu

**Education**

- Ph.D., Educational Psychology & Research, University of Memphis, 2010
- B.S., Mathematics, Delta State University, Cleveland, MS, 2005

**Professional Experience**

- Associate Professor (tenured), Evaluation, Statistics, and Methodology; Affiliated Faculty, Intercollegiate Graduate Statistics and Data Science Program; The University of Tennessee, 2022-Present
- Assistant Professor, Evaluation, Statistics, and Methodology; Affiliated Faculty, Intercollegiate Graduate Statistics and Data Science Program; The University of Tennessee, 2016-2022
- Assistant Research Scientist, Center for Postsecondary Research, Indiana University, Bloomington, 2011 – 2016
- Post-Doctoral Research Fellow, University of Memphis Office of the Vice Provost Academic Programs & Assessment, 2010 - 2011

**Honors & Awards**

- Outstanding Graduate Professor from the Graduate Student Senate at the University of Tennessee, 2023
- Helen B. Watson Faculty/Student Award for Outstanding Doctoral Dissertation from the College of Education, Health, and Human Sciences at the University of Tennessee, 2023
- Excellence in Graduate Student Mentorship Award from the Department of Educational Leadership and Policy Studies, 2023
- Louie M. and Betty M. Phillips Faculty Support in Education Award from the College of Education, Health, and Human Sciences at the University of Tennessee, 2022

**Research** Published over 30 refereed articles in various journals including *Numeracy*, *The Quantitative Methods for Psychology*, *Practical Assessment, Research, and Evaluation*, *Evaluation and the Health Professions*, *School Psychology Review*, *Teaching and Teacher Education*, *Research in Higher Education*, *Journal of Research in STEM Education*, *Research and Practice in Assessment*, *Social Science & Humanities Open*, among others.

**Selected Publications**

- Traga Philippakos, Z., MacAuthur, C., & Rocconi, L. M. (2023). Effects of genre-based writing professional development on K to 2 teachers' confidence and students' writing quality. *Teaching and Teacher Education*, 135.

- Boyd, A., Morrow, J. M., & Rocconi, L. M. (2022). Development and validation of the Parasocial Relationship in Social Media Survey. *The Journal of Social Media in Society*, 11(2), 192-208.
- Traga Philippakos, Z., Rocconi, L. M., Blake, K., & Summers, J. (2022). Teachers' practices during COVID-19: Practices and perspectives in elementary and secondary settings. *Social Science & Humanities Open*, 6, 1-10.
- Peterson, C., Ortiz, R., & Rocconi, L.M., &. (2022). Community food security: The multi-level association between social capital, economic capital, and diet quality. *International Journal of Community Well-Being*, 5, 571-585.
- Rocconi, L. M. & Boyd, A. T. (2022). Measuring Quality in Legal Education: Examining the Relationship between Law School Rank and Student Engagement. *Research in Higher Education*, 63, 1261-1282.
- Wright, S., Skinner, C. H., Crewdson, M., Moore, T., McCurdy, M., Coleman, M. B., & Rocconi, L. M. (2022). Using a tootling intervention to sequentially enhance and maintain at-risk elementary students' performance of multiple social skills. *School Psychology*, 37(3), 248-258.
- McCallum, R., Kirkpatrick, B., Heidel, R., Rocconi, L. M., Price, C., Gee, K., Lewis, J. (2022). Validating a Novel Emotional Intelligence Instrument for Resident Physicians. *Evaluation & the Health Professions*, 45(3), 277-287.
- Pacheco Diaz, N. & Rocconi, L. M. (2021). Science achievement in Chilean students: A multilevel model approach. *Journal of Research in STEM Education*, 7(2), 93-116.
- Parlier, R., Rocconi, L. M., Davison, C., & Skolits, G. (2022). The effects of learning community participation on community college students' learning outcomes and student engagement. *Community College Journal of Research and Practice*, 46(4), 272-283.
- Boyd, A. T. & Rocconi, L. M. (2021) Formatting data for one and two mode undirected social network analysis. *Practical Assessment, Research, and Evaluation*, 26(24), 1-10.
- Walker, J. P. & Rocconi, L. M. (2021). Experiential Learning Student Surveys: Indirect Measures of Student Growth. *Research and Practice in Assessment*, 16(1), 21-35.
- Richardson, R., Rocconi, L.M., & Crewdson, M. (2020). Evaluating English Learner Progress in Reading: How Much Growth Can We Expect? *School Psychology Review*.
- Rocconi, L, Xiqian, L., & Pike, G. R. (2020). Holland's theory and the impact of person-environment fit on grades, perceived gains, and satisfaction. *Higher Education* (80)5, 857-874.
- Gibson, T., Morrow, J. A., & Rocconi, L. M. (2020). A modernized heuristic approach to robust exploratory factor analysis. *The Quantitative Methods for Psychology*, 16(4), 295-307.
- Rocconi, L. M., Dumford, A. D., & Butler, B. (2020). How often is 'often': Examining the meaning of vague quantifiers in higher education. *Research in Higher Education*, 61(2), 229-247.
- Rocconi, L. M., & Gonyea, R. (2018). Contextualizing student engagement effect sizes: An empirical analysis. *Research & Practice in Assessment*, 13, 22-38.
- Zilvinski, J., & Rocconi, L. M. (2018). Revisiting the relationship between institutional rank and student engagement. *The Review of Higher Education*, 41(2), 253-280.
- Dumford, A., & Rocconi, L. M. (2015). Development of the quantitative reasoning items on the National Survey of Student Engagement. *Numeracy*, 8(1), Article 5.



- Rocconi, L. M. (2013). Analyzing multilevel data: Comparing findings from hierarchical linear modeling and ordinary least squares regression. *Higher Education*, 66(4), 439-461.
- Rocconi, L. M., Lambert, A. D., McCormick, A. C., & Sarraf, S. A. (2013). Making college count: An examination of quantitative reasoning activities in higher education. *Numeracy*, 6(2), Article 10.
- Rocconi, L. M. (2011). The impact of learning communities on first year students' growth and development in college. *Research in Higher Education*, 52(2), 178-193.
- Rocconi, L. M., & Ethington, C. A. (2009). Assessing longitudinal change: Adjustment for regression to the mean effects. *Research in Higher Education*, 50(4), 368-376.

**Statistical Analysis Software** Developed multiple R packages including mlmhelp and snafu.

**Current Grants/Contracts** Involved in multiple grants/contracts as a Statistical Consultant with total funding exceeding \$400k.

- Statistical Consultant: "Developing Multisyllabic Decoding and Encoding Skills for Upper Elementary Learners." Reading Reimagined (AERDF). \$388,150
- Statistical Consultant: "From Multiple ACEs to Flourishing Learners in Rural Morgan County Schools." Youth Endowment Fund 2023. \$10,000

**Under Review** Co-PI for multiple grants under review with total funding exceeding \$6m.

- Co-PI: "Early Intervention for Self-Efficacy and Self-Regulation to Prevent Escalating Aggression and Violence." National Institutes of Health. PAR-21-130. \$2,873,182
- Co-PI: "Developing Strategic High School Writers." Institute of Education Sciences. ED 022023-001. \$1,999,997
- Co-PI: "Synthesis Writing Using a Writing-Reading Connections Approach." Institute of Education Sciences. \$1,643,305

**Funded Past Grants/Contracts** PI or Co-PI for multiple funded grants/contracts with total funding exceeding \$120k.

- Co-PI: "Striving to Improve Literacy Instruction and Learning for All. Tennessee Reading Research Center: A Reading 360 Initiative." Proposal funded by the Tennessee Department of Education. \$5,000,000
- Co-PI: "Education Preparation Providers (EPP) Landscape Analysis." Funded by the Tennessee Department of Education: EPP Landscape Analysis 2021 Request for Applications. \$50,000
- Co-PI: "PreK-12 District Landscape Analysis." Funded by the Tennessee Department of Education: PreK-12 District Landscape Analysis 2021 Request for Applications. \$50,000
- PI: "Launching a Microcredential in Educational Data Analytics" College of Education, Health, and Human Sciences Strategic Initiatives. \$10,000
- PI: "Developing easy-to-use and accessible statistical tools for applied researchers." 2020 Summer Graduate Research Assistantship. University of Tennessee, Knoxville. \$3,600
- PI: "Measuring Quality in Legal Education: Examining the Relationship between Law School Rank and Student Engagement." 2018 AccessLex Institute/AIR Research Program. March 2019 – February 2020. \$50,000

**Vandana Singh Avasty**

Interim Program Director

College of Emerging and Collaborate Studies

Professor

School of Information Sciences

University of Tennessee Knoxville

Email: [vandana@utk.edu](mailto:vandana@utk.edu) Website: <https://sis.utk.edu/vandana>**EDUCATION**

B.Sc.	G.B. Pant University, Pantnagar, India	Economics,	1998
M.S.	Wageningen University, the Netherlands,	Knowledge Management Systems,	2001
M.S.	University of Chicago	Computer Science,	2006
Ph.D.	University of Illinois at Urbana Champaign,	Library and Information Science,	2008

**AREAS OF INTEREST**

Human Computer Interaction, Computer Supported Cooperative Work, Open Source Software, Online Communities, Integrated Library Systems, Library & Information Sciences Education, User Experience, Usability, Gender and Information Technology

**WORK EXPERIENCE****College of Emerging and Collaborate Studies**

Interim Program Director	July 2023 – current
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**College of Communication, University of Tennessee, Knoxville**

Director of Diversity, Equity, and Inclusion	July 2022 – June 2023
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**School of Information Sciences, University of Tennessee, Knoxville**

Professor	July 2022 – current
Associate Professor,	August 2014 to July
2022	
SIS Director of Undergraduate Studies	May 2017 to April 2019
Assistant Professor,	Aug 2008 to July 2014
Acting Associate Director,	Jan 2013 to Aug 2013
Coordinator, Information Science and Technology Minor	Aug 2008 to July 2011

**School of Library and Information Science, University of North Texas**

Assistant Professor,	Aug 2007 to July 2008
Coordinator, Digital Imaging Track	Aug 2007 to July 2008

**University of Illinois at Urbana Champaign, iSchool**

Instructor, Undergraduate Minor	August 2003-July 2004
Research Assistant,	Academic years 2001-2002, 2002-2003, 2005-2006
Teaching Assistant, Graduate and Undergraduate	

**TEACHING EXPERIENCE****COURSES TAUGHT AT THE UNIVERSITY OF TENNESSEE**

INSC (567) 581: Information Networking Application Spring 2009, Fall 2009, Spring 2010, Fall 2010, Spring 2011, Summer 2011, Fall 2011, Spring 2012, Fall 2013, Spring 2013, Fall 2013, Fall 2014, Spring 2015, Fall 2015, Fall 2016, Spring 2017

INSC 598: Web Design, Spring 2012, Spring 2015, Fall 2016, Fall 2017, Fall 2018  
 INSC 585: Information Technologies Fall 2008, Spring 2009, Fall 2009  
 INSC 590: Web Development Using Content Management Systems Summer 2015  
 INSC 591: Independent Study, 31 since Fall 2008

#### **COURSES TAUGHT AT THE UNIVERSITY OF NORTH TEXAS**

SLIS Topics on Digital Imaging for Information Professional

#### **COURSES TAUGHT AT THE UNIVERSITY OF ILLINOIS AT URBANA CHAMPAIGN**

LIS 201 Information, Technology and Organizations  
 LIS 202 Social Aspects of Information Systems  
 LIS 210 Computing in the Humanities  
 LIS 290 Programming Web Mashups  
 LIS 310 Information, Organization and Access (on Campus and Online)  
 LIS 320 Libraries, Information and Society

#### **SELECTED PUBLICATION**

- Mehra, B., Black, K., Singh, V., Nolt, J., Williams, K.C., Simmons, S., and Renfro, N. (2014). The Social Justice Framework in the Information Technology Rural Librarian Master's Scholarship Program: Bridging the Rural Digital Divides. *Qualitative and Quantitative Methods in Libraries Journal*, Special Issue 2014: Social Justice, Social Inclusion (pp 5-11).
- Mehra, B., and Singh, V. (2014). Recruitment and Retention in the Information Technology Rural Librarian Master's Scholarship Program (Part I and Part II): Implications of Social Justice in the Southern and Central Appalachian Region. *Qualitative and Quantitative Methods in Libraries Journal*, Special Issue 2014: Social Justice, Social Inclusion (pp 13-22).
- Singh, V. (2017). "Long-Term Experiences of Open Source ILS Migration: Maintaining, Adapting, and Learning" *Journal of Librarianship and Information Science*
- Mehra, B., and Singh, V. (2017). Library Leadership-In-Training as Embedded Change Agents to Further Social Justice in Rural Communities: Teaching of Library Management Subjects in the ITRL and ITRL2. In Nicole A. Cooke and Miriam E. Sweeney (Eds.), *Teaching for Justice: Implementing Social Justice in the LIS Classroom*. Sacramento, CA: Library Juice Press.
- Mehra, B., Singh, V., Hollenbach, N. and Partee II, R.P. (2017). "A Community Informatics Model in ICT Use to Train Rural Librarians in the Southern and Central Appalachian Region as Change Agents in the 21 Century" Book Chapter proposal in *Rural and Small Public Libraries: Challenges and Opportunities* (Advances in Librarianship book series). Bingley, United Kingdom: Emerald Group Publishing.
- Mehra, B., Black, K., and Singh, V. (Editors). (under preparation). *Voices of Rural Librarians in the Appalachia: Current Realities and Future Possibilities of Information Technology in the 21st Century*. Manuscript in progress of development. Peer-reviewed Conference Proceedings (last 5 years)
- Singh, V., and Holt, L. (2013). Online Technical Support: How it Works and Why it Fails? *Proceedings of the Hawaii International Conference on System Science (HICSS – 46)*, IEEE, January 2013.
- Singh, V. (2013). A Case Study of Migration to an Open Source ILS: Partnership among State Libraries. *Proceedings of the Qualitative and Quantitative Methods in Libraries International Conference (QQL 2013)*, 3 - 6 June 2013, Rome, Italy.
- Singh, V. (2013) "Evaluating and Improving an Information Portal for Open Source Integrated Library Systems" *Proceedings of the 15th International Conference on Human Computer International 2013 (HCI 2013)*, 21-26 July 2013, Las Vegas, USA.
- Singh, V., (2013). "Challenges of Open Source ILS Adoption" Poster, *Proceedings of 76th Annual Meeting of the Association for Information Science and Technology, Beyond the Cloud: Rethinking Information Boundaries*, November 1-6, 2013, Centre Sheraton, Montreal, Quebec, Canada

- Mehra, B., and Singh, V. (2015). A Social Justice Framework to Further Community Engagement in Pakistan's Information Management and Library Professions, Proceedings of the International Conference on Information Management & Libraries, Department of Information Management, University of Punjab, Quaid-i-Azam Campus, Lahore-Pakistan, from 10-13 November, 2015.
- Singh, V. (2017) "Personas and Scenarios as a methodology for Information Sciences Research: Strengths, Weakness and Example" Proceedings of the Qualitative and Quantitative Methods in Libraries International Conference (QQML 2017), 3 - 6 June 2017, Limerick, Ireland
- Upadhyay, P., Reddy, J., Proctor, T., Sorel, O., Veereshlingam, H., Gandhi, M., Wang, X. and Singh, V., 2023. Expanded PCR Panel Testing for Identification of Respiratory Pathogens and Coinfections in Influenza-like Illness. *Diagnostics*, 13(12), p.2014.
- Malhotra, V., Javed, D., Bharshankar, R., Singh, V., Gautam, N., Mishra, S., Chundawat, D.S., Kushwah, A., Singh, G. and Deep, A., 2023. Prevalence and Predictors of Depression, Anxiety and Stress among Elderly during COVID-19: A Cross-sectional Study from Central India. *Mymensingh Med J*, 32(2), pp.556-566.

## HONORS

- Selected as a 3C Fellow at Duke University Computer Science Program on inclusive computing (2022-2024)
- Awarded College of Communication and Information Faculty Research Award 2021
- Keynote Speaker at ThriveWise Conference, June 30<sup>th</sup>, 2021
- Two Featured Articles relevant for practitioners – for informed Librarian Online July/August 2019 & July/August 2020 issues
- Awarded College of Communication and Information Service and Outreach Award for 2018-2019
- Paper nominated for the best paper award at the 15<sup>th</sup> International Conference of Open Source Systems, 2019
- Nominated by the Dean, College of Communication and Information, for Faculty Appreciation Week, February 2019
- Selected for the UTK Leadership Institute, 2017-2018
- Recognized by Office of Community Engagement & Outreach, University of Tennessee, recognizes 50 Partnerships that Make a Difference: Rural Library Professionals Program [Spring 2015].
- One of Top Five Papers at IFLA 2011, Mehra, B., Black, K., Singh, V., and Nolt, J. (2011). Mapping the Education of Rural Librarians' Technology Literacy and Management Training: Use of Mixed Data Collection Methods in the ITRL Program. Proceedings of the World Library and Information Congress: 77th International Federation of Library Associations and Institutions General Conference and Assembly, 13-18 August 2011, San Juan, Puerto Rico
- Best Conference Paper ALISE 2011, What is the Value of LIS Education? A Qualitative Analysis of the Perspectives of Tennessee's Rural Librarians. Bharat Mehra, Kimberly Black, Vandana Singh Junior Faculty Fellow to Provost, 2010 nominated and selected by School of Information Sciences and College of Communication and Information, July 2010
- Innovative Technology Award 2010, given by College of Communication and Information, University of Tennessee May 2010
- Outstanding Assistant Professor 2010 for the year given by School of Information Sciences, College of Communication and Information, University of Tennessee, May 2010
- Scholar of the Week, University of Tennessee, Week of 7/11/09.
- Best Note of CSCW 2008 - Singh, V. and Twidale, M., "The Confusion of Crowds: non-dyadic help interactions" Short Paper Computer Supported Cooperative Work Conference, 2008.

**Dr. JORGE E. VARIOGO**

**SELECT CURRICULUM VITA**

1923 Fall Haven Ln, Knoxville, TN 37932  
Email: jvariego@yahoo.com • Web: www.jorgevariego.com

**EDUCATION**

- 2011 **PhD**, University of Florida, Gainesville, Florida. Major: Composition.
- 2006 **Master of Music**, Carnegie Mellon University, Pittsburgh, Pennsylvania. Double Major: Composition and Clarinet Performance (Fulbright Scholar)
- 2003 **Bachelor degree**, JD equivalent, National University of Rosario, Argentina

**TEACHING EXPERIENCE**

**2014 - today**

University of Tennessee, Knoxville, Assistant Professor of Composition and Technology  
Sewanee Summer Music Festival, Composition Program Director (started 2018)

**2013 - 2014**

Institute of Sonology, The Hague

**2011 - 2013**

Valley City State University, Assistant Professor: Music Theory/Composition/Woodwinds

**2009 - 2011**

University of Florida, Summer 2011, Assistant Professor: Theory II  
University of Florida, Summer 2011, Assistant Professor: Analytical techniques  
University of Florida, Spring 2011, Plant Instructor: Theory I  
University of Florida, Fall 2010, Composition Skills III  
University of Florida, Summer Plant Instructor: Theory II  
University of Florida, Teaching Assistant: Theory I and II  
College of Central Florida Adjunct Instructor

**2005 - 2007**

Carnegie Mellon University, Teaching Assistant: Theory I

**2004 - 2007**

Musikinnovations, Pittsburgh. Clarinet Instructor  
Pittsburgh Center for the Arts, Resident Artists – School outreach programs

**2000 -2003**

Instituto Pro-Musica de Rosario, Rosario, Argentina: Music Theory and Clarinet  
Municipality of Rosario Youth Band, Argentina: arranger, clarinet and saxophone instructor

**1998 – 2003**

Conservatory of Music, Pergamino, Buenos Aires, Argentina: Music Theory, Music Appreciation and Clarinet Performance

**SELECTED PERFORMANCES OF CREATIVE WORKS**

**2023**

- *Música del Río de la Plata* (Big Ears, Walters State, UT)
- *"Blink" Commissioned by the Knoxville Symphony* (Bryan Symphony, Knoxville Symphony)
- *Recompensa* (Tybee Post Theater and U Georgia Southern, Savannah)

**2022**

- *"Blink" Commissioned by the Knoxville Symphony* (Tennessee Theater)
- *"What is home" Commissioned by the Roane Chorus* (Princess Theater and by the Oak Ridge Chorus)
- *Hispanic Heritage Celebrations* (With guest performers and original music at the UT Student Union Auditorium)

**Recordings**

- *"Purple Ego"* (Centaur) as leader of the Domino Ensemble. The album is exclusively dedicated to new music and was released in 2019.
- *"La jungla"* was selected for the REDASLA CD series to be released in 2015 in Latin America. This work was also selected for the *Electronic Masters Series* Vol. 4 by Ablaze Records

- “*Quedate con el cambio*” was selected for the REDASLA CD series to be released in 2018 at the Visiones Sonoras Festival in México.
- *60 bandos 60* – included in the CD “*Punto de encuentro*” produced by the Universidad Nacional de Rosario and the University of Tennessee
- *Quedate con el cambio* included in the CD *Stannum* by J.M. Solare.
- *Nunca tan lejos* included in the CD *Discordia*, by Empires
- *Regress* (solo CD). Recorded at the CMMAS (México) exclusively dedicated to the music by Argentine composers. Project funded by the North Dakota Council on the Arts, Valley City State University, CMMAS, and Kickstarter (CMMAS 2013)
- “*Walls*” was selected for the SCI CD series with Capstone Records (*Pendulum* 2014)
- Publications in the field of music and architecture: with the University of Rome, Italy; UT Austin; and Universidad de Lanús, in Argentina
- *Necessity* (solo CD) Albany Records, New York
- “*Lamngen*”, for String Orchestra “*Música para Peña Hen*” by the Fundación de Orquestas Juveniles e Infantiles de Chile
- “*Variaciones sobre la puñalada*”, for tango sextet, Ediciones Musicales of the Municipality of Rosario, Argentina
- “*Static Motion*”, for solo piano, Society of Composers Inc. Student Chapter at the University of Florida Vol. VI
- “*Walls*”, for flutes nonet, Society of Composers Inc. Student Chapter at the University of Florida Vol. VII
- *Calle 6 en vivo* (CD recording) Epsa Editorial, Buenos Aires, Argentina

#### Invited presentations and publications

- *Algorithmic composition: matemáticas y ciencias de la computación en la composición musical*. Published by the Universidad de Quilmes as part of their series of publications about Music and Science. ISBN: 978-987-558-502-7
- 18 + 3 Etudes for Solo Viola. Published by Lalarva Music in October 2018. ISBN-13: 978-0578210865.
- Composing with Constraints. ISBN-13: 978-0190057244. Oxford University Press.
- Universidad Autónoma de Madrid – Ciclo de Conferencias del Espacio e investigación. Invited presenter in May 2018.
- *Vantablack* – First CD production by the UT Electroacoustic Ensemble.
- *Purple Ego* – First album release with the Domino Ensemble.
- “*Architecture in Motion: a model for music composition*” at the MIA-AIM Conference at UT Austin, 2014 (that paper was also published by the University of Rome, in Italy). This work was also published in the ICMC 2015 proceedings.
- “*Charlie Markov: an algorithmic approach to the style of Charlie Parker*” – paper to be presented at the North American Saxophone Alliance region 3 conference in April 2013 and at the Manchester College New Music Festival. This work was published in 2013 by the Centro Mexicano para la Música y las Artes Sonoras (CMMAS) in the latest edition of *Ideas Sónicas*.
- Paper presented, “*The music identity of Astor Piazzolla*”, Society of Composers Inc. National Convention, Austin, Texas, 2006
- CD reviews in the *Fanfare Magazine* (Sept-Oct 2010)
- Presentation “*Approaches on interactive music for clarinet*”, Carnegie Mellon University, 2008
- Review, Society of Electroacoustic Music in the United States, SEAMUS, 2010
- Paper “*Architecture in motion: a model for music composition*” published by UT Austin, in the 18<sup>th</sup> volume of “*Center*”
- International research collaboration between Valley City State University, University of Florida and the University of Lanús in Argentina, which will appear in the next edition of “*En el límite*” by UNLa.

#### Research/Creative

- Commissioned by the Knoxville Symphony Orchestra for the 20-21 Season.
- Resident Artist at the Visby Centre for Composers, Sweden (2013 and 2018).
- Guest faculty at the Universidad Javeriana (Colombia).
- Thesis Director and Co-Director respectively with students from the Universidad Católica Argentina and Universidad de Galicia.
- Invited presenter at the Universidad Autónoma de Madrid (2018). Title of the presentation: *La creación artística es algorítmica?*
- Member of the Patterns of intuition – Point Project at the Kunst Uni Graz, Austria (2013)
- Resident Artist at the CMMAS, Morelia, Mexico (2012 and 2013)
- Guest Artist at the Studio Phonos, Barcelona, Spain (2010)
- Guest Artists at the Escuela de Musica de Catalunya (ESMUC) (2010)
- Guest Composer, Charleston School for the Arts, South Carolina (2009)
- Guest Composer, New World School for the Arts, Miami (2009)
- Guest Artist, Carnegie Mellon University (2008)
- Guest Lecturer at the CAPA High School, Pittsburgh (2008)
- Artists-in-residence, Pittsburgh Center for the Arts (2005-present)

#### Management / administrative activities

- UT New Music Festival 2015-2016 and 2019 Co-Director
- Adjudicator Ohio Composer of the Year Competition 2020.
- SCI Region IV Co-chair in the National Council
- Domino Ensemble 501(c)(3) Founder Director
- UT Electroacoustic Ensemble Founder Director
- Nacusa National Conference, Organizer and Host, Spring 2016
- Adjudicator – composers competition Manchester New Music Festival 2015
- Adjudicator – Society of Composers Inc. Journal of Scores 2015
- Adjudicator – SEAMUS 16 and 17 National Conferences

- Clarinet Day at VCSU 2012 (with the Sponsor of Vandoren USA)
- Online Composition Major development (undergraduate at VCSU)
- NDUS Arts and Humanities Summit
- Woodwind area head at VCSU, founded the "Tritones" ensemble, and also directs the saxophone quartet
- Band day at VCSU (Spring 2012)
- Committee member at VCSU, worked on curriculum and course development (emphasizing the links between music and technology)
- Student representative at the National Board (2010-2011), Society of Composers Inc. Coordinated the "Chapter interactions series" (2010)
- Student Chapter Secretary (2009-2010), Society of Composers Inc. at University of Florida.
- Student Chapter President (2008-2009), Society of Composers Inc. at University of Florida. Producer of the Chapter's CD Vol. VI., organized 4 concerts with 2 international guests and master classes.
- Producer, recording engineer of the CD "Necessity" (2010)
- Program coordinator, Florida Electroacoustic Music Festival, (2008)

#### ORGANIZATIONS

- SCI Member of the National Council (2017 – today)
- Seamus and SCI adjudicator (2015-2019)
- Undergraduate Awards – international research judging 2017
- Leonardo Music Journal, reviewer.
- Society of Composers, Inc., Student Representative at the National Committee (2010)
- Society of Composers, Inc., University of Florida Chapter President (2009)
- Phi Kappa Lambda Music Honors Society.
- Society of Electro-Acoustic Music in the United States
- International Clarinet Association
- International Society of Improvised Music
- ASCAP
- Grammy

#### GRANTS / SCHOLARSHIPS

- Nora Roberts Foundation 2019, 2020 and 2021
- TN Arts Commission, ABC Grant, 2021, 2022, and 2023.
- Bailey Opportunity Grant.
- PSDA – UT grant 2019 and 2022.
- UT Catalyst Programming Grant 2019-2020.
- Swedish Council on the Arts Grant for the Residency at the VICC in Gotland, June 2018.
- UT Professional Development Grant – for the edition and publication of my book *Composing with constraints* with the Oxford University Press. This grant included funds for international travel and editing costs.
- University of Tennessee, SARIF Grant 2015, 2016 and 2017. These grants supported the presentation of new works in Europe and Taiwan.
- SEC Grant 2017/18 and 19-20 for activities at UA in Tuscaloosa and UG in Athens.
- CMS Seed Grant 2017
- University of Tennessee, Teaching for Impact Grant, 2016 (purchase of equipment for the Sound Synthesis course)
- University of Tennessee, International Travel Grant 2014 (School of Music supported the presentation of new works in the Netherlands in Dec. 2014)
- North Dakota Council on the Arts, Professional Development 2013
- Secretary of External Relations of the Mexican Government 2013
- Visby Centre for Composers, Sweden (residency - 2013)
- CMMAS, Morelia, Mexico (residency - 2012)
- VCSU, research grant 2012-2013
- VCSU, travel grant 2011, 2012 and 2013
- ASCAP 2007 – 2013
- CDMC – Liem, Museo Reina Sofia, Madrid, Spain
- University of Florida, D'Albora Scholarship
- Meet the Composer Grant, Net life creative connections
- University of Florida Sung Scholarship
- University of Florida Didier Graeffe Scholarship
- University of Florida Grinter Fellowship
- Carnegie Mellon University Travel Grant for Festival in Europe
- Pittsburgh Concert Society, Seamen Wickline grant
- Fulbright Commission Scholar
- Antorchas Foundation, Argentina
- Fondo Nacional de las Artes, Argentina
- Universidad de Santiago de Compostela, Spain

# New Academic Program Proposal

## Bachelor of Science Applied Artificial Intelligence CIP 11.0102



Updated February 6, 2024



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## Section I: Overview

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### *Program Information*

<b>Institution:</b>	University of Tennessee at Knoxville
<b>College:</b>	College of Emerging and Collaborative Studies
<b>Title of Degree:</b>	Bachelor of Science in Applied Artificial Intelligence
<b>Degree Designation:</b>	Bachelor of Science
<b>Formal Degree Abbreviation:</b>	BSAAI
<b>CIP Code:</b>	11.0102
<b>CIP Code Title:</b>	Artificial Intelligence
<b>Proposed UT BOT Approval:</b>	February 2024
<b>Proposed THEC Approval:</b>	May 2024
<b>Proposed Implementation Date:</b>	August 2024
<b>Academic Program Liaisons:</b>	<p>Karen Galicia, Director of Academic Affairs            505 Summer Place / 1268-B UT Tower            Phone: 865-974-2140            Email: <a href="mailto:galicia@tennessee.edu">galicia@tennessee.edu</a></p> <p>Professor Xiaopeng Zhao, Interim Program Director            College of Emerging and Collaborative Studies            Claxton Education Building, Suite 106            1122 Volunteer Boulevard            Knoxville, TN 37996            Email: <a href="mailto:xzhao9@utk.edu">xzhao9@utk.edu</a>            Phone: 865-974-7682</p>

*System Letter of Support*

## THE UNIVERSITY OF TENNESSEE SYSTEM

ACADEMIC AFFAIRS AND STUDENT SUCCESS

August 3, 2023

Dr. Bob Smith, Interim Executive Director  
 Tennessee Higher Education Commission  
 312 Rosa L Parks Ave. 9<sup>th</sup> Floor  
 Nashville, TN 37243

Dr. Smith:

On behalf of the University of Tennessee, Knoxville (UTK), I am writing to submit a Letter of Notification (ELON) for a proposed Bachelor of Science in Applied Artificial Intelligence (AAI), which will be housed in UTK's new College of Emerging and Collaborative Studies. The program will offer a foundational understanding of AI concepts, data sources, and tools in a less technical context than a traditional computer science degree. This program accentuates real-world applications across various disciplines. It will also explore methods and components of AI solutions, assessing potential sources of bias, social impacts, and other ethical considerations related to AI, which are integral skills for the rapidly expanding AI sector. Given the compelling evidence of high demand from employers and students outlined in the proposal, the proposed AAI program is well-positioned to fulfill these needs and significantly contribute to the regional and state economy.

We look forward to receiving an evaluation this proposed program by THEC staff.

Bernie Savarese, Ed.D.  
 Acting Vice President of Academic Affairs and Student Success  
 University of Tennessee System

CC: Donde Plowman  
 John Zomchick  
 Ozlem Kilic  
 Xiaopeng Zhao  
 Heather Hartman  
 Karen Etzkorn

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[aass.tennessee.edu](http://aass.tennessee.edu)

*Campus Letter of Support*

July 29, 2023

President Randy Boyd  
505 Summer Place / UT Tower  
Knoxville, TN 37902

President Boyd:

As Provost of the University of Tennessee Knoxville (UTK), I am writing in support of the B.S. degree in Applied Artificial Intelligence (AAI) to be offered by the College of Emerging and Collaborative Studies (CECS) at UTK.

As approved by the U.T. Board of Trustees in February 2023, CECS is a new interdisciplinary college created specifically to facilitate emerging, interdisciplinary undergraduate programs at UTK. Applied Artificial Intelligence is a field identified by CECS as not only rapidly increasing in workforce demand and student interest, but also multi-disciplinary and therefore highly collaborative.

The proposed BS in Applied AI responds to the increasing global interest in Artificial Intelligence and rapidly growing job opportunities for AI skills across almost every sector of the workforce. The AAI degree is also timely, as UTK makes substantial investments in building faculty clusters in Artificial Intelligence: one cluster in the foundations of artificial intelligence and the other in its strategic use in conducting scientific research. With the addition of as many as twelve new faculty in AI, we have the opportunity to teach our undergraduate students the interdisciplinary skills and competencies related to AI in the workforce.

The CECS degree in Applied AI takes a pragmatic approach to instilling the skills of using AI across a variety of sectors. While the CECS AAI degree will include coding skills and mathematical fundamentals, it is ultimately an applied program that emphasizes breadth of application. It complements rather than competes with the in-depth computer science offerings from the Tickle College of Engineering (TCE) at UTK (see accompanying letter from TCE). In the CECS degree program, students will learn to apply AI: they will learn how to approach data science with AI solutions and tools, understand different AI domains, and use no-code AI tools for machine learning, deep learning, and natural language processing. As an interdisciplinary degree, students will also explore the history and current scope of AI for better understanding ethical and socio-economic aspects of AI.

As an applied degree, students will also gain practical experience via capstone projects and workforce placements, where they will learn to collaborate in teams to apply AI techniques to real-world problems. Crucially, students will gain experience building applications through hands-on activities using no-code AI platforms and learning key skills in collaboration, critical thinking, and problem-solving. This is essential to our student employment in the data-intensive knowledge economy. The CECS AAI degree will be a launchpad for employment in a wide range of sectors across non-computer science fields. The

Office of the Provost and Senior Vice Chancellor  
527 Andy Holt Tower, Knoxville, TN 37996-0152  
865-974-2445 865-974-4811 fax provost.utk.edu

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ZBS\_AAI\_proposal request

AAI degree will be part of a suite of inter-related subjects offered by CECS in Fall 2024, including new BS degrees in Data Science, a Customizable BS degree, and a minor in Cybersecurity.

CECS is resourced sufficiently to deliver these courses for the AAI degree. CECS instructors will deliver the core courses. Upper-level elective courses will be selected from existing course offerings from multiple colleges on campus. Students interested in the legal/ethical ramifications of AI, for example, can choose relevant electives offered by the College of Law or by the Philosophy Department. This CECS degree is designed to keep pace with the fast-developing applications of artificial intelligence in all fields, from engineering to agriculture, business to digital humanities, and law to arts and sciences.

Complete with the internship requirement (see letters from our business partners), the CECS AAI Degree will position students to enter the workforce with a skill highly in demand. This aligns with the "Drive to 55" objective of the THEC Master Plan for postsecondary education. According to the U.S. Bureau of Labor and Statistics (USBLS), jobs requiring knowledge of AI are expected to increase substantially over the next 5 years, as most companies today are either using AI already or are planning to use it in the near future to automate IT, business or network processes, to address sustainability goals, and to interact with customers.

The CECS AAI degree will contribute to the UT mission and the goals of UTK by (i) enhancing educational excellence, (ii) creating value through economic, social, and technological development, and (iii) fostering outreach and engagement. In terms of *educational excellence*, as mentioned above the AAI degree would benefit from new UTK cluster hires in Artificial Intelligence, with applications in areas such as food security, future mobility, sustainability and precision agriculture. The AAI will *create value* and foster *engagement* by requiring service courses and off-campus internship experiences in this highly sought-after skill. CECS has administrators dedicated to industry engagement to secure workforce internships for upper-level students. The capstone project will further instill teamwork skills and creativity in students working on real-world research and outreach projects.

For these reasons, I strongly support the CECS degree in Applied Artificial Intelligence.

This new program has has the full support of campus administration. No additional resources will be required in order to implement this change. At this time, we request transmission to Tennessee Higher Education Commission for approval. Please contact me if you have any questions or need additional documentation. Thank you in advance for your attention to this matter.

Sincerely,



John Zomchick  
Provost and Senior Vice Chancellor

CC: Bernie Savarese  
Karen Etzcorn  
Donde Plowman  
Ozlem Kilic  
Heather Hartman

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Flagship Campus of the University of Tennessee System 



## Section II: Background

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### *Background Concerning Academic Program Development*

The substantial growth in the Artificial Intelligence (AI) job market has been widely noted in recent years and has been fueled by the rapid adoption and integration of AI models across various applications. Several industry reports from 2023, including the OECD Employment Outlook<sup>1</sup>, the World Economic Forum Future of Jobs Report<sup>2</sup>, LinkedIn's AI in the IT Job Market report<sup>3</sup>, and Indeed & Glassdoor's Hiring and Workplace Trends Report<sup>4</sup>, provide an in-depth analysis of this significant growth.

The Future of Jobs Report (2023) by the World Economic Forum forecasts the evolution of jobs and skills over the coming five years. The report suggests that about 75% of the companies surveyed expect to adopt AI. This adoption is predicted to cause a high churn rate, with 50% of organizations expecting job growth and 25% predicting job losses. The rise of jobs in green industries, education, and agriculture is also underlined in the report. LinkedIn's AI in the IT Job Market 2023 publication discusses AI's potential benefits and challenges within human resources. The automation of repetitive tasks and increased efficiency are among the advantages offered by AI. Conversely, AI poses challenges, such as the need for continuous upskilling and reskilling to keep pace with changing technology. Indeed & Glassdoor's 2023 report highlights key trends in the job market. AI-related job postings in the United States experienced a notable surge of about 20% in May 2023. The most sought-after AI jobs in 2023 include AI engineers, machine learning engineers, data engineers, data scientists, and software engineers. AI is anticipated to significantly impact labor markets, serving as a potent support tool for professionals and managers by taking over mundane tasks and providing robust, real-time data analysis. While AI is expected to automate some human tasks, it is also predicted to unveil new opportunities and jobs that have yet to be created. While AI is creating new tasks and jobs, especially for highly skilled workers equipped with AI competencies, tracking the distribution of job loss and job creation is crucial to promote inclusiveness.

Supporting this trend, the US Department of Education released a report<sup>5</sup> highlighting the increasing interest in employing AI in education to enhance learning, teaching, assessment, and education research and development. The report underscores the potential of AI to revolutionize education by enabling more personalized learning experiences. However, it also brings attention to potential risks such as privacy concerns, algorithmic bias, and the possible adverse impact on teaching jobs if AI is not thoughtfully implemented. Therefore, the growing interest in AI applications for education, the advancements in AI capabilities, and the recognition of both the opportunities and risks associated with AI have collectively spurred the demand for degree

<sup>1</sup> <https://read.oecd.org/10.1787/08785bba-en?format=html>

<sup>2</sup> <https://www.weforum.org/reports/the-future-of-jobs-report-2023/digest/>

<sup>3</sup> <https://www.linkedin.com/pulse/ai-job-market-2023-advantages-challenges-human-resources>

<sup>4</sup> <https://www.indeed.com/career-advice/resumes-cover-letters/high-value-skills>

<sup>5</sup> <https://www2.ed.gov/documents/ai-report/ai-report.pdf>



programs specializing in AI. In response to the rapid growth of the AI job market and the increasing adoption of AI in various industries, we, the College of Emerging and Collaborative Studies (CECS) at the University of Tennessee, Knoxville (UTK), propose the establishment of a Bachelor of Science (B.S.) program on Applied Artificial Intelligence. This program aims to meet the demand for skilled professionals in AI and address the evolving challenges and opportunities in the job market.

### *Purpose and Nature of Academic Program*

#### **Description of the Academic Program**

The four-year Applied AI (AAI) degree program is designed to offer a foundational understanding of AI concepts, data sources, and tools in a less technical context than a computer science degree. This program accentuates real-world applications across various disciplines. Furthermore, it aims to delve into the methods and components of AI solutions, assessing potential sources of bias, social impacts, and other ethical considerations related to AI. These skills are integral to the burgeoning sector of applied AI.

The proposed Applied AI program at UTK aligns seamlessly with the university's mission as a leading land-grant research institution. The program mirrors UTK's commitment to applied research and community engagement by emphasizing hands-on learning and community impact. It strengthens ties with strategic partners like the Oak Ridge National Laboratory, driving innovation in intelligent machines and society. Furthermore, the program aligns with UTK's goal of preparing its graduates to be industry, government, and community leaders. Given the high demand for AI professionals, many of these graduates will likely remain in Tennessee, contributing to the state's growth. The Applied AI program fits seamlessly within UTK's organizational structure, reinforcing its mission, partnerships, and vision for its graduates.

#### **Total Credit Hours**

The AAI program is a 120-credit, 4-year B.S. program. Out of the total 120 credit hours, 27 will be CECS core courses taught by CECS full-time faculty and CECS Faculty Fellows appointed from across disciplines at UTK. Additionally, students will complete 6 to 12 credit hours in research, service, and internships to further strengthen their employable skills, expertise, and network. These courses will be taught by CECS faculty and supported by the CECS Director for Partnerships and Engagement and the UTK Center for Career Development to connect CECS students with future employers.

The Applied AI BS program follows the curriculum structure in **Table 1**. Students at UT-Knoxville must fulfill their mandatory VolCore requirement, typically between 50 and 60 credit hours in multiple themes. The core courses (AI 101, AI 102, AI 201, AI 202, AI 301, AI 399, AI 302, AI 401, and AI 499) are typically taken in the order outlined in Table 1. Students can take a maximum of 6 credit hours in each of the R, S, or N categories. The capstone courses, AI 399 and AI 499 are offered in both Spring and Fall semesters. Overall, the program offers a comprehensive, real-world, relevant, and ethically focused education in applied AI.

Table 1.

**Generalized Structure for the 4-year BSAAI degree.**

Year 1		Year 2		Year 3		Year 4	
Sem. 1	Sem. 2	Sem. 3	Sem. 4	Sem. 5	Sem. 6	Sem. 7	Sem. 8
AI 101	AI 102	AI 201	AI 202	AI 301	AI 302	AI 401	AI 499
Gen Ed	Gen Ed	Gen Ed	Gen Ed	AI 399			
		Electives R/N/S	Electives R/N/S	Electives R/N/S	Electives R/N/S	Electives R/N/S	Electives R/N/S

*Abbreviations with courses: R, research-oriented; S, service-oriented; N, Internship.*

**Target Audience**

The target audience is multifaceted, reflecting the dynamic nature of today's academic and professional landscapes. One significant demographic includes highly focused and motivated students who are eager to harness the potential of emerging fields like AI for specific career trajectories, aiming to be at the forefront of the workforce after graduation. In contrast, there is a segment of students uncertain about their ideal career paths, seeking a platform to explore diverse options while building robust and employable skills. Our collaboration with the Center for Career Development advising team and esteemed industry partners ensures that these students can optimize their credit hours towards gainful employment. Additionally, our program extends its reach to individuals who have completed community college studies or have garnered relevant work experience and now aspire to elevate their academic and professional portfolios with a 4-year degree in an emerging and impactful field. This custom degree is designed to be inclusive, accommodating a wide array of learners: from UTK honors students and those transitioning with relevant AAS skills via the Tennessee Transfer Pathway (TTP) to professionals aiming to refine their skills in alignment with evolving industry demands. High school graduates from both within Tennessee and beyond are invited to embark on this transformative journey, tailoring their bachelor's degree at CECS to fit their unique aspirations and career visions.

**Purpose**

Rooted in an environment that celebrates interdisciplinary instruction and collaboration, the BSAAI program operates alongside other forward-thinking CECS majors like Data Science and Cybersecurity. This setup fosters a rich, collaborative intellectual environment where students, regardless of their major, can delve into the applications of AI and related technologies across diverse fields such as design, music, social sciences, natural sciences, business, and communications. To ensure consistent guidance and support, CECS offers a dedicated drop-by advising office, assisting students in course planning, internship placements, and bespoke career advice, ensuring that their educational journey seamlessly aligns with their future professional aspirations. The AI program at CECS aims to produce graduates equipped with a blend of technical prowess and

interdisciplinary acumen, ready to navigate and influence the dynamic landscape of the AI-driven future.

### **Program Outcomes**

The Bachelor of Science in Applied Artificial Intelligence (BS-AAI) program is meticulously crafted to ensure students are primed to navigate and excel amidst the swift and multifaceted evolution of the AI landscape. Upon successful completion of this program, students will be able to:

1. Demonstrate a comprehensive understanding of the core principles, algorithms, and models underpinning artificial intelligence.
2. Be adept at applying AI techniques to solve real-world problems across diverse industries and disciplines.
3. Possess the capability to evaluate the ethical, social, and legal implications of AI applications, ensuring responsible implementation.
4. Exhibit proficiency in interdisciplinary collaboration, integrating AI knowledge with insights from fields such as business, social sciences, design, and more.
5. Exhibit robust problem-solving skills, employing AI solutions creatively and effectively to address complex challenges.
6. Showcase an ability to adapt to emerging AI trends, emphasizing the importance of lifelong learning in this rapidly evolving field.
7. Acquire experience in AI research and development, cultivating a mindset of innovation and exploration.
8. Be effective communicators, articulating complex AI concepts to both technical and non-technical audiences.
9. Through internships and practical projects, gain real-world experience that ensures job readiness upon graduation.

### **Delivery Method**

CECS intends to increase access to timely workforce skills by providing online versions of its face-to-face programs. Therefore, all CECS courses will be offered in online modality as well as face-to-face. Furthermore, CECS will collaborate with other colleges to transition specific electives to an online format, with the long-term goal of offering the BS program in an online format as well.

## *Alignment with State Master Plan and Institutional Mission*

### **Alignment with State Master Plan**

The proposed AAI program aligns with the Tennessee Higher Education Commission's (THEC) Master Plan. The AAI program addresses emerging economic needs by responding to the growth in AI-related job opportunities and industries. As noted in the Master Plan,

*Tennessee's economy is at great risk for disruption resulting from automation and artificial intelligence, according to Dr. Bill Fox (pictured below), professor of economics at the University of Tennessee, Knoxville. For this reason, all individuals employed in Tennessee must learn to interact with artificial intelligence using critical thinking, data analysis, and diverse communication skills rather than simply rely on artificial intelligence to complete a variety of tasks. (p. 35)<sup>6</sup>*

The program focuses on applied AI, which involves the practical implementation of AI technologies in various sectors. It caters to the demand for professionals skilled in AI applications, which is anticipated to rise, given the increasing integration of AI models across various applications. This alignment with market needs aids in fulfilling the THEC's strategic priority to align programs with the state's economic needs. The AAI program includes real-world experiences through research, service, or internship courses. Through these courses, students will gain practical experience in the AI field, allowing them to apply the theoretical knowledge acquired from the classroom in a real-world setting.

The AAI program also encourages interdisciplinary study and collaboration by incorporating electives from various UTK colleges into its curriculum. This will enable students to explore AI applications in diverse fields such as healthcare, finance, education, and many more. By promoting interdisciplinary learning and collaboration, the AAI program adheres to THEC's strategic priority of facilitating a well-rounded education and preparing graduates for various career paths. Moreover, the AAI program recognizes the necessity of technical skills and emphasizes the importance of broader competencies. Along with offering a foundational understanding of AI concepts, tools, and data sources, the program covers ethical considerations, potential sources of bias, and social impacts related to AI. This approach aligns with THEC's mission to develop graduates who are not only technically skilled but also ethically aware and socially responsible.

The comprehensive design of the program, covering foundational AI concepts in a less technical context, makes the program more accessible to a broader audience. The emphasis on real-world applications could also attract students from various disciplines, promoting diversity in AI education. The requirement for continuous upskilling and reskilling, indicated by the various industry reports, aligns with THEC's commitment to lifelong learning. Furthermore, by preparing students for emerging roles in AI and related fields, the AAI program supports THEC's objective of

<sup>6</sup> State Master Plan: 2020 Update [finalmp.pdf \(tn.gov\)](#)

workforce development. In conclusion, the proposed AAI program addresses the growing demand for AI professionals. It aligns with the THEC's strategic priorities and mission, offering a relevant and comprehensive AI education that balances technical proficiency with ethical awareness and social responsibility.

### **Alignment with UTK's Mission Profile**

The proposed AAI program aligns well with UTK's organizational structure and overall mission as a state's flagship land-grant research institution. The program adds to the portfolio of UTK's forward-thinking academic offerings, reflecting its commitment to staying at the forefront of technology and innovation. The cross-disciplinary nature of the AAI program would encourage collaboration among various academic departments, leveraging the strength of over 1,800 full-time faculty members across diverse fields.

The applied nature of this program aligns with UTK's dedication to hands-on coursework and real-world research experiences. Students would be able to conduct research and develop AI solutions that directly impact their communities, echoing the university's commitment to community engagement. Furthermore, the program will complement UTK's partnerships with entities like the Oak Ridge National Laboratory, supporting the drive for innovation in critical fields like intelligent machines and society. With its establishment, the Applied AI program could contribute to UTK's standing as a top institution for research activity and community engagement and amplify its reputation for producing Fulbright and Rhodes Scholars. The Applied AI program aligns with UTK's goal to equip its graduates to become industry, government, and community leaders, particularly in the growing AI sector. With the high demand for AI professionals, many of these graduates will likely remain in Tennessee, fulfilling UTK's vision of giving back to the state through its alumni. The proposed Applied AI program integrates seamlessly into UTK's organizational structure and supports and enhances its mission, vision, and strategic partnerships.

### *Institutional Capacity to Deliver the Proposed Program*

The BSAAI program will significantly bolster the reputation of UT-Knoxville as a forward-thinking institution at the forefront of technological education. By addressing the demands of the rapidly evolving AI industry, UT-Knoxville not only demonstrates its commitment to providing relevant and industry-aligned education but also positions itself as a leader in producing the next generation of AI professionals, further enhancing its prestige and influence in the academic world. CECS has developed a straightforward rubric for revenue sharing via student credit hour (SCH) allocation, given that UTK now uses a budget allocation model (BAM) under which colleges manage their revenues and expenditures. The basic model is that 80% of the SCH goes to the college teaching the course, with 20% going to the student's home college. Students majoring in the AAI degree would be CECS students, so when they take a AI core course such as AI 101, CECS keeps 100% of the SCH. When students from other colleges take AI 101, CECS retains 80% of the SCH; when CECS students take electives in other colleges, those colleges retain 80% of the SCH. It is a simple and effective resource allocation model.

For sustainability, this program is supported by CECS at multiple levels. The Program Directors and Program Coordinators, both appointed by CECS, oversee the curriculum and enrollment, course scheduling, assessment, accreditation, capstone, and research course contents. The Program Directors collaborate with the faculty across UTK to develop and approve new certifications and minors. The CECS Director of Marketing oversees advertising, outreach, and prospective student recruitment. The CECS Director of Advising oversees the advising of all CECS majors in their degree program operations. The Director of Partnerships and Economic Development will also engage campus, community, and industry partners to support experiential learning in the program, fostering pathways to student employment. The Internship Coordinator will oversee student appointments as interns with industry partners, monitor and assess the learning outcomes and coordinate scheduling of these courses and placement of students.

The staffing of CECS means that the Applied AI program will be sustainable, consistent, adaptable, and flexible for the wide range of students interested in this rapidly evolving field. The Applied AI program has established a program curriculum committee that votes on curriculum matters and has met regularly since Summer 2023, comprising 20 UTK faculty from 9 colleges across all undergraduate degree-serving colleges. Additionally, CECS will establish a standalone Applied AI advisory board comprising external industry leaders<sup>7</sup>. All these stakeholders will provide valuable feedback on the curriculum of Applied AI program as well as its external partnerships and internship placement opportunities.

<sup>7</sup> <https://cecs.utk.edu/for-industry>

### *Existing Programs Offered at TN Institutions*

While many US universities have Artificial Intelligence (AI) and Machine Learning (ML) concentrations or focus areas in their computer science majors, only a small number of universities in the US have undergraduate degrees in AI<sup>8</sup>. In the state of Tennessee, there are no universities that offer standalone undergraduate degrees in Artificial Intelligence. There are a few universities in Tennessee that offer undergraduate programs in Computer Science (CIP code 11.0701) that allow students to concentrate in AI or take AI courses; see details in Table 2. However, these programs do not utilize the same CIP code as the proposed AI program; instead, they fall under computer science (11.0701).

The University of Tennessee Knoxville offers a graduate certificate program in Artificial Intelligence and Machine Learning, as detailed in Table 3. This program was established in 2021. While several students have enrolled and are currently taking courses within the certificate program, none have been awarded the certificate to date.

**Table 2.**  
**Similar Programs in Tennessee**

Institution Name	Program Title and Degree Designation	CIP Code	Description/ Focus of Program	Miles from UT Campus	Degrees Awarded for 3 Years
University of Tennessee, Knoxville	Artificial Intelligence and Machine Learning Graduate Certificate	11.0102	The Department of Electrical Engineering and Computer Science (EECS) offers the graduate certificate program. The applicants are expected to have a bachelor's degree in computing or related field with an undergraduate GPA of 3.00 or better. Recommended background knowledge includes Programming, Linear Algebra, and Probability Theory. Applicants may be admitted to the certificate or complete the certificate as part of an MS or PhD.	--	0 (Created in 2021)

<sup>8</sup> <https://datausa.io/profile/cip/artificial-intelligence>

Tennessee Technological University	Decision Science Artificial Intelligence concentration in the Computer Science Program	11.0701	Students in the Data Science and Artificial Intelligence concentration will learn the full data science lifecycle through classes and real-world projects that cover data management, statistical inference, data mining and machine learning algorithms, and data visualization.	103	3 (Created in 2020)
University of Memphis	Computer Science, Artificial Intelligence Concentration (B.S.)	11.0701	The Artificial Intelligence Concentration, consisting of 12 credit hours, include the following 4 course: COMP 4118 - Introduction to Data Mining Credit Hours: (3) COMP 4480 - Introduction to Natural Language Processing Credit Hours: 3 COMP 4720 - Intro Artificial Intelligence Credit Hours: (3) COMP 4741 - Intro to Neural Networks Credit Hours: (3)	383	N/A (created in 2019)
Middle Tennessee State University	No Concentration	11.0701	Offer Artificial Intelligence and Machine Learning courses	165	
East Tennessee State University	No Concentration	11.0701	Offer Artificial Intelligence and Machine Learning courses	108	
Tennessee State University	No Concentration	11.0701	Offer Artificial Intelligence and Machine Learning courses	182	



Vanderbilt University	No Concentration	11.0701	Offer Artificial Intelligence and Machine Learning courses. Has an Artificial Intelligence research unit	180
Belmont University	No Concentration	11.0701	Offer Artificial Intelligence and Machine Learning courses	181
Belmont University	No Concentration	11.0701	Offer Artificial Intelligence and Machine Learning courses	181
Christian Brothers University	No Concentration	11.0701	Offer Artificial Intelligence and Machine Learning courses	385
Rhodes College	No Concentration	11.0701	Offer Artificial Intelligence and Machine Learning courses	384

### *Accreditation*

Due to the interdisciplinary nature of the proposed AAI program, UTK plans to have the program accredited by the Artificial Intelligence Board of America (ARTIBA). ARTIBA is a non-profit organization that offers accreditation and certification programs in artificial intelligence and machine learning. ARTIBA's accreditation program is designed for programs that emphasize interdisciplinary applications of AI.

To initiate the process of ARTIBA accreditation, the program will obtain DASCA accreditation first. The process to get accredited by the Data Science Council of America (DASCA) is as follows:

- Meet eligibility requirements. These requirements include having a full-time faculty member dedicated to the program, having a curriculum that meets DASCA's standards, and having sufficient students.
- Submit a Request for Evaluation (RFE). The program must submit an RFE to DASCA. The RFE must include a self-study report that describes the program's curriculum, faculty, resources, and student outcomes.
- On-site visit. A team of DASCA evaluators will conduct an on-site visit to the program. The evaluators will review the program's self-study report and interview faculty, staff, and students.

- Accreditation decision. DASCA will make an accreditation decision based on the results of the on-site visit. The decision will be made public on the DASCA website.
- The DASCA accreditation process ensures accredited programs meet the highest standards for quality education. The process is rigorous, but it is also fair and transparent.

We have contacted DASCA for detailed requirements and a timeline for the accreditation application; see Appendix B.

The process to obtain ARTIBA accreditation for the Bachelor of Science program in Applied AI will involve the following steps:

- Apply Online: If your institution has obtained DASCA accreditation, you can begin applying for ARTIBA accreditation online. If your application is approved, you will receive an email with a link to create your account on PartnerDirect, the digital platform where your accreditation process will be conducted.
- Complete the Sign-Up Procedure: Sign the ARTIBA contract and pay the subsidized fee for accreditation. Once you have done that, you can log in to your PartnerDirect account and begin the accreditation process. The PartnerDirect dashboard will provide you with updates and communication about the accreditation process, so remember to check it regularly.
- Submit Necessary Documents and Information: Fill out the questionnaires available on your PartnerDirect dashboard and upload the required documents. Completion of this step may take anywhere from 6 to 14 weeks, depending on the accreditation track that your institution is pursuing.
- Wait for Your Accreditation Result: Your accreditation decision will be shared via email and on your PartnerDirect dashboard. The decision may take anywhere from 2 to 4 weeks to arrive, depending on the accreditation track that your institution is pursuing.”<sup>9</sup>

### **Institutional Accreditation**

Dr. Heather Hartman, UTK’s SACSCOC liaison and Associate Vice Provost for Institutional Effectiveness, has confirmed that this program will require a substantive change action with the institution’s accreditor. The campus is currently working to advance this effort with SACSCOC.

<sup>9</sup> <https://www.artiba.org/get-started/certification-process>

### Administrative Structure

The AAI major will be housed in the College of Emerging and Collaborative Studies at the University of Tennessee, Knoxville. The administrative structure for the CECS is provided in Figure 1. Figure 2 is the administrative structure for the proposed AAI program.

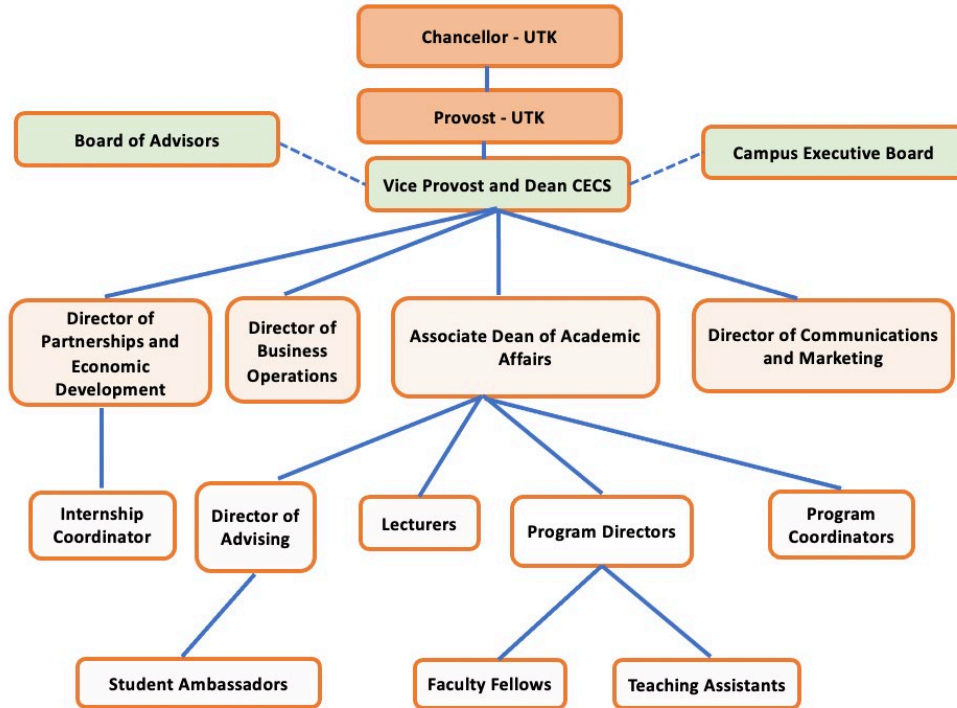


Figure 1. Administrative Structure of the College of Emerging and Collaborative Studies

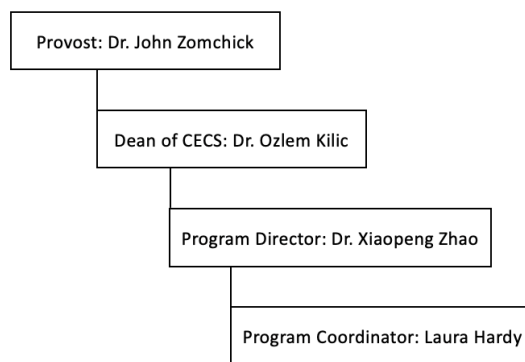


Figure 2. Administrative Structure of the AAI Program

## Section III: Feasibility Study

### *Student Interest*

We distributed an online survey to 3716 undergraduate students at the Tickle College of Engineering at UTK to gauge their interest in the AAI program. The survey data were collected between July 18-26, 2023, and we received 526 responses, resulting in a response rate of 14.2%. See the following for detailed results from the survey.

*Q1: If a BS in Artificial Intelligence with opportunities for multidisciplinary education (with potential concentrations in Cybersecurity, Healthcare, Human-Robot Interaction, Law Tech, Game Design, Sustainability, Business, etc.) had been available when you were choosing your major at UT, how interested would you have been in this major?*

**Table 3**

#### Student Responses to the Likelihood of Choosing Major

Response	Count	Percentage (%)
Extremely unlikely	92	17.49
Neither likely nor unlikely	246	46.77
Extremely likely	178	33.84

*Q2: If a multidisciplinary BS in Artificial Intelligence had been available to you and offered a choice of different areas of concentration, how interested would you have been in pursuing each concentration or major:*

**Table 4**

#### Student Likelihood of Pursuing Concentrations

Concentration	Not likely at all	Moderately likely	Extremely likely
AI in Healthcare	179 (34.49%)	225 (43.35%)	115 (22.16%)
Human-Centered AI	125 (24.13%)	265 (51.16%)	128 (24.71%)
AI for Cybersecurity	138 (26.64%)	204 (39.38%)	176 (33.98%)
AI in Education	230 (44.40%)	205 (39.58%)	83 (16.02%)
Human-Robot Interaction	109 (21.04%)	196 (37.84%)	213 (41.12%)
Ethics in AI	156 (30.06%)	184 (35.45%)	179 (34.49%)
AI in Sustainability	143 (27.55%)	206 (39.69%)	170 (32.76%)
AI in Business	200 (38.68%)	194 (37.52%)	123 (23.79%)
AI in Social Sciences	265 (51.06%)	190 (36.61%)	64 (12.33%)
AI in Law and Policy	258 (49.71%)	176 (33.91%)	85 (16.38%)

*Q3: If a multidisciplinary BS in Artificial Intelligence had been available to you and offered a choice of different areas of concentration, how interested would you have been in selecting this concentration or major?*

**Table 5**  
**Student Responses to Interest in Selected Concentrations**

Concentration	Not interested at all	Moderately interested	Extremely interested
AI in Healthcare	261 (50.39%)	167 (32.24%)	90 (17.37%)
Human-Centered AI	214 (41.31%)	221 (42.66%)	83 (16.02%)
AI for Cybersecurity	201 (38.95%)	183 (35.47%)	132 (25.58%)
AI in Education	320 (61.78%)	153 (29.54%)	45 (8.69%)
Human-Robot Interaction	189 (36.63%)	196 (37.98%)	131 (25.39%)
Ethics in AI	263 (51.07%)	167 (32.43%)	85 (16.50%)
AI in Sustainability	230 (44.49%)	188 (36.36%)	99 (19.15%)
AI in Business	275 (53.29%)	145 (28.10%)	96 (18.60%)
AI in Social Sciences	349 (67.64%)	125 (24.22%)	42 (8.14%)
AI in Law and Policy	308 (59.81%)	146 (28.35%)	61 (11.84%)

### *Local and Regional Need/Demand*

A study commissioned by the UT's Office of Research, Innovation, and Economic Development, and executed by the Boston Consulting Group, sheds light on the burgeoning demand for AI skills in Tennessee. The findings are staggering—a 40% compound annual growth rate in AI-related job postings since 2019, significantly outpacing the national growth rate of 19% over the identical period. This stark rise in demand underscores the pivotal role of AI in modern-day industries and the imminent necessity for a well-rounded education in AI. These job postings span across a plethora of major economic sectors including, but not limited to, manufacturing and materials, transportation and logistics, health, information technology, agriculture and farming, energy, and hospitality and entertainment. The varied sectors delineate a two-pronged demand. Firstly, there is a palpable need for deep AI experts—individuals well-versed with the nuances of AI technologies. Secondly, and equally crucial, is the demand for professionals embodying an interdisciplinary perspective, capable of synergizing AI with their domain expertise to drive innovation and efficiency.

As indicated in the 2023 Hiring and Workplace Trends Report by Indeed & Glassdoor<sup>10</sup>, there was a 20% surge in AI-related job postings across the United States in May 2023. This demonstrates a robust and expanding demand for AI professionals. On a regional level, AI-related jobs are in high demand across almost every economic sector in Tennessee. The Bureau of Labor Statistics projects a growth rate of 3.3% for positions such as computer and information research scientists, including AI specialists, in Tennessee for 2022<sup>11</sup>.

Local enterprises throughout Tennessee have expressed significant interest in hiring graduates proficient in AI. Key sectors such as healthcare, manufacturing, and technology, all of which have increasingly incorporated AI into their operations, particularly demonstrate this interest. In addition, there has been a noticeable uptick in inquiries and applications for AI and related programs at our institution<sup>12</sup>, indicating strong student demand for this area of education.

The demand for professionals adept at integrating AI into their work environments is rapidly increasing. A recent study, commissioned by UT's Office of Research, Innovation, and Economic Development and undertaken by the Boston Consulting Group, revealed that AI-related job postings in Tennessee demanding AI skills have seen a 40% compound annual growth rate since 2019. This growth significantly outpaces the robust 19% growth rate observed for AI-related job postings across the entire United States during the same period. These job opportunities span diverse key economic sectors such as manufacturing, materials, transportation, logistics, healthcare, information technology, agriculture, farming, energy, hospitality, and entertainment. Not only are these sectors in pursuit of specialists, but they also value professionals with an interdisciplinary approach capable of applying AI within their specific domains.

<sup>10</sup> <https://www.indeed.com/career-advice/resumes-cover-letters/high-value-skills>

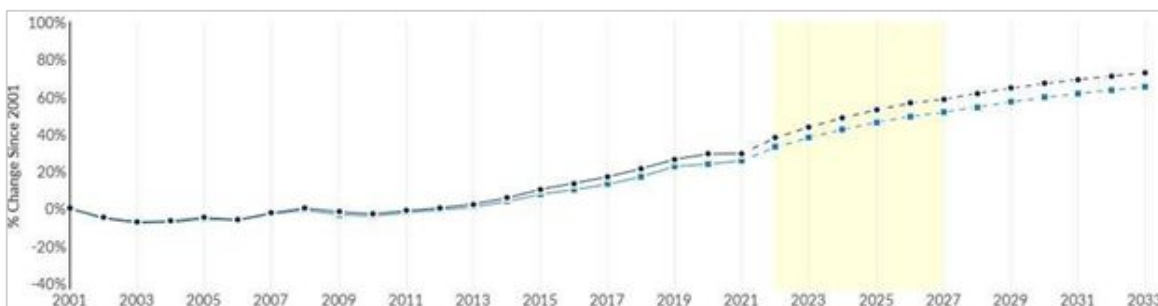
<sup>11</sup> [https://www.bls.gov/oes/current/oes\\_tn.htm](https://www.bls.gov/oes/current/oes_tn.htm)

<sup>12</sup> <https://research.utk.edu/oried/research-innovation-initiatives/ai-tennessee-initiative/>

We conducted our analysis for assessing the local, regional, and employer demand through Lightcast (a labor market analytics firm that combines data from government sources from agencies like the Bureau of Economic Analysis, U.S. Census Bureau, and Bureau of Labor Statistics into one dataset that details industries, occupations, demographics, academic programs, and more.). According to our analysis, the regional trends for target occupations from this degree are projected to increase by 16% in the region from 2022-2027.

**Table 6**  
**Regional Trends for Target Populations (Source: Lightcast)**

Occupation	2022 Jobs*	Annual Openings*	Median Earnings	Growth (2022 - 2027)*
Software Developers	98,803	11,061	\$53.62/hr	+19.79%
Computer Systems Analysts	41,438	3,904	\$43.76/hr	+10.03%
Computer and Information Systems Managers	33,234	3,595	\$65.95/hr	+14.85%
Engineers, All Other	13,989	1,162	\$47.01/hr	+7.71%
Computer Programmers	12,151	992	\$41.46/hr	+2.60%
Computer and Information Research Scientists	1,120	121	\$49.41/hr	+16.16%
Electro-Mechanical and Mechatronics Technologists and Technicians	419	50	\$27.37/hr	+5.49%



**Figure 3: % Change in regional trends of occupation growth for the proposed field (Source: Lightcast)**

Table 7

**Regional Trends of Occupation Growth – 5-year projection (Source: Lightcast)**

Region	2022 Jobs	2027 Jobs	Change	% Change
Region	366,625	421,970	55,345	15.1%
Nation	3,074,730	3,508,382	433,652	14.1%

*Employer Demand*

This program offered by UTK is poised to bridge a critical skills gap in the region, as the demand for expertise in AI continues to surge. The unique job postings in this field are regularly increasing, indicating a robust market appetite for AI-skilled professionals. Tennessee, along with neighboring states, is experiencing a burgeoning demand for such specialized talent. By furnishing students with in-demand AI skills, this program will not only serve the immediate regional demand but also foster interdisciplinary prowess. Graduates will be equipped with AI knowledge that can significantly augment other subject domains such as business analytics, healthcare, engineering, and social sciences, thereby broadening their career prospects and contributing to the workforce needs diversely. The complementary nature of AI skills amplifies the value proposition of this program, making graduates more adaptable and sought-after in the modern job market. A survey of the job market in the region surrounding Tennessee showed a substantial number of job postings related to AI skills. From July 2022 to June 2023, there were 201,513 total job postings, out of which 124,375 were unique, underscoring the pressing demand from employers for individuals adept in AI alongside other subject matters. Through this program, UTK is well-positioned to produce a cadre of graduates who are not only proficient in AI but also capable of melding this expertise with other disciplinary knowledge to meet the evolving workforce needs.



**Table 8****Unique Job Title regional breakdown for last 12 months (Source: Lightcast)**

Job Title	Total/Unique (Jul 2022 - Jun 2023)
Software Engineers	22,824 / 8,963
Software Developers	5,433 / 2,467
Business Systems Analysts	4,459 / 2,382
Java Developers	3,368 / 2,058
DevOps Engineers	2,942 / 1,572
Full Stack Developers	2,945 / 1,506
.NET Developers	2,609 / 1,454
Systems Analysts	2,710 / 1,446
Principal Software Engineers	3,636 / 1,382
Lead Software Engineers	2,998 / 1,266

**Table 9****Job postings regional breakdown for last 12 months (Source: Lightcast)**

State	Unique Postings (Jul 2022 - Jun 2023)
North Carolina	31,585
Georgia	30,785
Missouri	17,564
Alabama	13,974
Tennessee	12,474

The market analysis for AI shows 106,382 total job postings from July 2022 to June 2023 in our region. Out of these postings, there were 12,474 in the state of Tennessee. For Game Design – there was a 16.9% increase expected in the target occupations in our region for the target occupations for students with this specialization. The need for graduates with human-centered design skills is increasing at a much higher rate – project at + 20.2% for this region and + 17.6% for the nation.

## *Community and Industry Partnerships*

As mentioned, CECS will establish an industry advisory board for the BS in AAI program to guide the development and delivery of the curriculum. We have already formed strong partnerships with industry leaders across multiple sectors. We have received letters of support from organizations like AI Tennessee Initiative, CGI Reelay, Eonix Energy, RobotLAB, NellOne, Philips, Atmosera, and Advai, who express interest in collaborating with CECS, providing internships, sponsoring capstone projects, and hiring graduates. These letters highlight CECS's role in developing innovative and customizable degree programs that equip students with practical skills and experiences aligned with emerging careers. We expect more collaboration to follow, and for these partners to join in the site visit.

Specific details from the letters:

- **The AI Tennessee Initiative**, a new venture in research and education centered on the State of Tennessee's unique AI strengths and opportunities, is collaborating with academic, industry, and community partners across Tennessee to harness the benefits of AI across all disciplines and economic sectors. This initiative aims to develop innovative AI solutions to tackle some of the world's most pressing challenges, such as climate change, healthcare, and economic development. It is also dedicated to making AI accessible and inclusive for all Tennesseans.
  - **CGI**, renowned as a global IT powerhouse, has a specialized focus on AI. Given their deep AI acumen, they stand out as a potential collaborator for an applied AI B.S. degree program. Notably, CGI is eager to forge strategic alliances with UTK.
  - **Reelay**, an AI software company, supports the proposal for a Bachelor of Science in Applied AI, seeing alignment with their mission and potential for partnerships.
  - **Eonix Energy**, a battery materials company, is excited to collaborate on the applied AI program, given UTK's strengths in agriculture, manufacturing, transportation, healthcare, and data science.
  - **RobotLAB**, a robotics integrator, wants to contribute its expertise in robotics deployment across various sectors to the applied AI program.
  - **NellOne Therapeutics Inc.**, a pioneering biotech company based in Knoxville, is interested in partnering with CECS to create a customized curriculum tailored to the industry's needs.
  - **Philips**, a diversified technology company focused on improving people's lives through meaningful innovation in Healthcare, Consumer Lifestyle, and Lighting, is interested in supporting the AI program by collaborating with faculty, students, and industry partners.
  - **Atmosera**, a local employer, is interested in collaborating with CECS to create a customized curriculum tailored to their needs and develop a talent pipeline.
- Advai**, a pioneer in robust, fair, and responsible AI, specializes in identifying and mitigating AI vulnerabilities. They offer user-friendly tools for enhanced AI deployment.

We are actively building new partnerships with employers, focusing on providing internships, projects, and career placements for students in emerging fields. This aligns with our goal of equipping graduates with interdisciplinary skills and practical workforce experience.

## Section IV: Enrollment and Graduation Projections

The enrollment and graduation projections for the Applied AI program are based on several factors. Firstly, there is a strong indication of student interest in the program. Through a recent survey conducted with students in the Tickle College of Engineering at UTK, we received 526 responses, and 178 of these students expressed an extremely high likelihood of choosing the Applied AI major if it were available when they were selecting their majors. This significant level of interest gives us confidence in achieving our projected cohort number. Considering the program's credit requirements, we anticipate that a full-time undergraduate student at the University of Tennessee, Knoxville, would typically enroll in 15 credit hours each semester. With the program's requirement of 120 credit hours, a full-time student could successfully complete the Applied AI program in 4 years. Based on these data and considerations, Table 10 outlines our projected enrollment of students and anticipated graduates between the years 2024 and 2029. These projections consider the student interest shown in the survey and the expected completion timeline for a full-time student in the program. Overall, the enrollment and graduation projections for the Applied AI program are grounded in the tangible interest demonstrated by prospective students and the feasible timeline for program completion, ensuring a robust and well-informed outlook for the program's growth and success in the coming years.

**Table 10**

### Projected Enrollments and Graduates

Year	Academic Year	Projected Total Fall Enrollment	Projected Attrition	Projected Graduates
1	2024-2025	15	2	--
2	2025-2026	25	3	--
3	2026-2027	35	4	--
4	2027-2028	40	4	10 (70% graduation rate)
5	2028-2029	50	5	17 (70% graduation rate)

The projected fall enrollment reflects the number of *new* students admitted to the program each year. The University of Tennessee-Knoxville has a first-year retention rate of 90%<sup>13</sup>. Retention rate is the percentage of a school's first-time, first-year undergraduate students who continue at that school the next year.

<sup>13</sup> <https://studentsuccess.utk.edu>

## Section V: Projected Costs to Deliver the Proposed Program

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### *Faculty and Instructional Staff*

The Applied AI Program at UTK is spearheaded by a Program Director, a tenured faculty member, who is responsible for the program's initiation, delivery, and continuous progression. The program director's salary is \$160,000 annually plus benefits at a rate of 32% with an increment of three percent annually. Half of the of the Program Director's salary and benefits are allocated to the BSAAI program, as the position also oversees another program at CECS.

Based on the Student Credit Hour (SCH) estimate, we estimate the number of FTE Lecturers needed based on a 4/4 teaching load. SCH estimates are based on a slowly growing number of classes and students: Two AI core courses are taught in Year 1, four courses in Year 2, ten in Year 3, and twelve in Year 4. It's important to note that a 10% yearly attrition rate is anticipated, which is applied to all student levels each year, thereby affecting the number of students progressing to the subsequent year. With this attrition rate in mind, for Year 1, the recruitment target is set at 15 first-year students, with 13 of them expected to return the following year. Year 2 will recruit 25 first-year students, with 23 of those expected to advance to the next year. Year 3 will recruit 35 first-year students, with 31 expected to advance to the next year. Year 4 will recruit 40 first-year students, with 36 expected to advance to the next year. Based on these estimations, we project having 15 students in Year 1, 38 students in Year 2, 69 students in Year 3, 102 students in Year 4, and 132 students in Year 5. The lecturer's salary is estimated at \$90,000 annually plus benefits at a rate of 32%. This is a maximum cost estimate, as UTK TT faculty could be bought out occasionally to teach. The planned hiring of lecturers is as follows: 1 in Years 1-2, and 2 in Years 3-5.

In addition to the Program Director, a Faculty Lead is engaged in program planning and curriculum development as the head of the program curriculum committee. This role is filled from the planning phase (Academic Year 2023) through Year 2 (Academic Year 2025) at an annual cost of \$10,000. This is reflected as one-time expenditure in the THEC Financial Projections Form.

In Year 1 and Year 2 two Faculty Fellows are recruited annually to contribute to curriculum development, teaching, and program service, each at a cost of \$10,000 per semester.

### *Non-Instructional Staff*

Support across all programs at CECS is provided by a Program Coordinator. Currently supporting three proposed programs, the Program Coordinator's cost to the BSAAI program is 1/3 of their salary and benefits as they also manage other programs at CECS. The Program Coordinator's annual salary is \$70,000, with a fringe rate of 32%.

To enhance the practical experience of the students, an Internship Coordinator will be recruited in Year 3 (Academic Year 2026). This position supervises all internship courses across the three

programs at CECS. The requested cost for the Internship Coordinator is 1/3 of their annual salary (\$60,000) plus benefits (a fringe rate of 32%), as CECS expects to oversee 3 programs starting in year 3.

For the introductory courses, there are weekly assignments to be graded, and we expect class sizes to increase over the five years. Across all the courses in the degree, we increase from 1 grader in year 1 to 2, 4, 6, and 8 in years 2-5, respectively. We assume ten assignments per student to grade in each large class, with the graders needing two hours to grade every 40 assignments at \$20/hr.

A Lab Instructor is needed for the introductory course (AI 102), which is offered in both Spring and Fall semesters in all years. The cost for lab instructors is budgeted for \$8,000.

### *Graduate Assistants*

None – Lecturers, UTK faculty, and undergraduate graders will deliver instruction.

### *Accreditation*

The specific costs of accreditation by DSCA and ARTiBA are not available on their websites. We estimate the accreditation costs based on our experience with accreditation for other programs at UT Knoxville. The detailed estimates are as follows. Note the accreditation cost for ARTiBA is estimated to be lower since it is done online.

Accreditation Cost by DSCA: total = \$21,900  
 Readiness review: \$1100  
 Base fee: \$3700  
 Evaluators: \$3700 \*3  
 Additional fees (lodging, etc.) \$2000\*3

Accreditation Cost by ARTiBA: \$15,900  
 Readiness review: \$1100  
 Base fee: \$3700  
 Evaluators: \$3700 \*3

### *Consultants*

\$2,000 for the external evaluator for the program.

### *Equipment*

\$500 per year equipment budget for the Applied AI program will be utilized for acquiring and upgrading essential hardware and software, ensuring students have access to current technologies for hands-on learning and research in AI.

### *Information technology*

The \$500 annual budget for Information Technology will cover maintaining online learning platforms and addressing unforeseen IT issues in the Applied AI program.

### *Marketing*

For the first three years, marketing expenses are budgeted at \$2,000 and will decrease to \$1,000 for the remaining two years.

### *Library resources*

No additional costs associated with library resources are needed for this program.

### *Facilities*

*Ongoing renovations in the Claxton Education Building.* The cost of renovation associated with the BSAAI program is estimated to be \$62,006. The renovation cost includes the following items: 1.) a lab area will be shared between the programs at CECS (Applied AI, Data Science, Cybersecurity, Innovative Transdisciplinary Studies); 2.) space for lecturers of the program; 3.) office for the program director; and 4.) office for a program coordinator.

### *Travel*

No travel expenses are specifically associated with this program.

### *Other resources*

No additional costs are anticipated for other resources.

## Section VI: Projected Revenues for the Proposed Program

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The THEC Financial Projections Form in Appendix B reflects anticipated revenues associated with the proposed program.

### *Tuition*

Income is \$378 per SCH for Tennessee residents and \$759 per SCH for non-residents. We assume that 20% of undergraduate students pay non-resident tuition.



## Section VII: Implementation Timeline

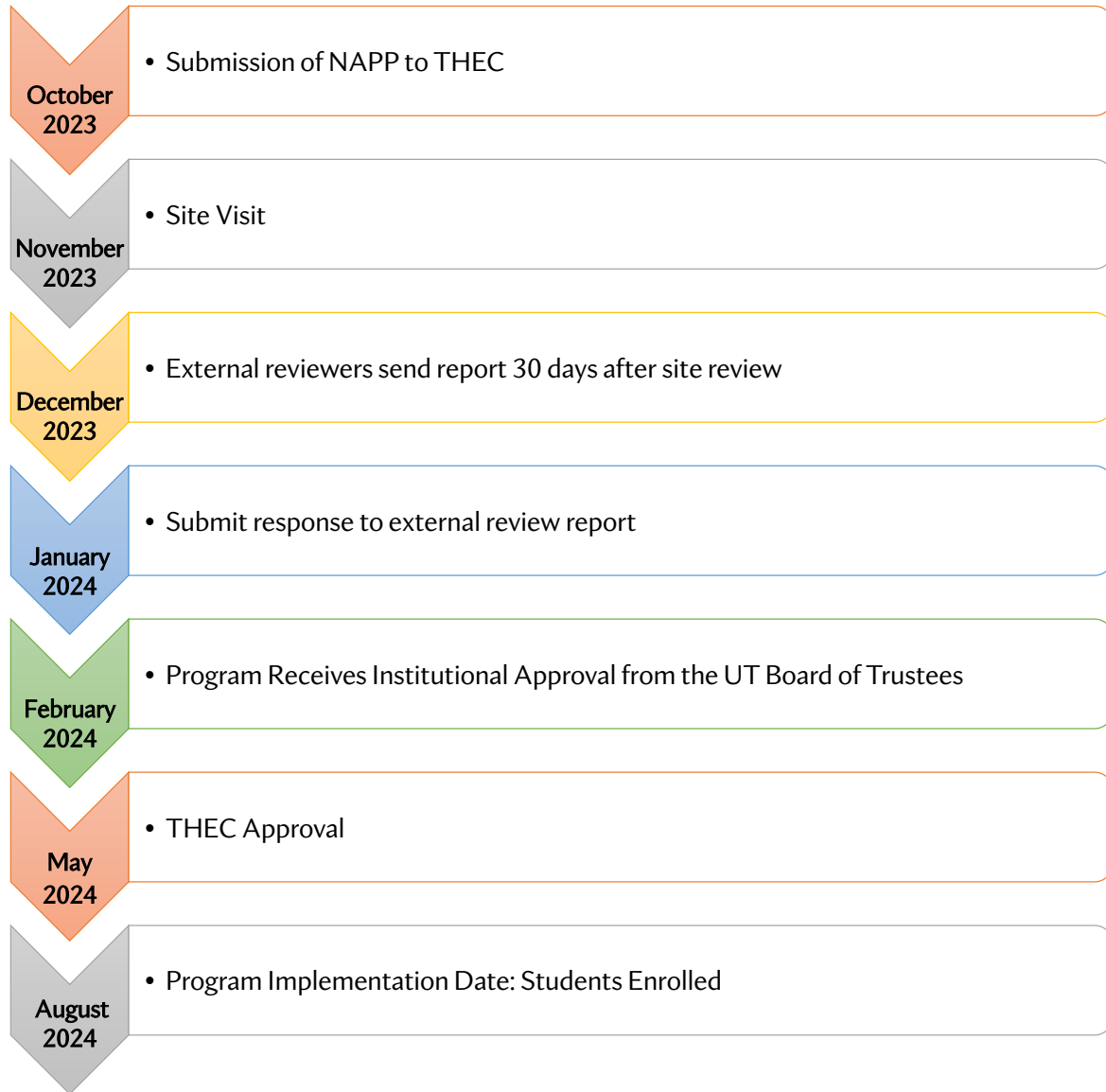


Figure 4. *Implementation Timeline*

### *Accreditation Considerations*

SACSCOC Accreditation:

We have notified SACSCOC of a substantial change via Dr. Heather Hartman, UTK's SACSCOC liaison and Associate Vice Provost for Institutional Effectiveness, who confirmed that this program will require only notification (i.e., not a new prospectus) of the substantive change with SACSCOC.<sup>14</sup>

Programmatic Accreditation:

In AY 2024-25, the program will obtain accreditation from the Data Science Council of America (DASCA) at a cost of \$21,900 (see **Appendix B**) by completing the following steps:

- Meeting eligibility requirements, which include having a full-time faculty member dedicated to the program, a curriculum that meets DASCA's standards, and sufficient students.
- Submitting a Request for Evaluation (RFE) to DASCA. The RFE must include a self-study report that describes the program's curriculum, faculty, resources, and student outcomes.
- Hosting an on-site visit by a team of DASCA evaluators, who will review the program's self-study report and interview faculty, staff, and students.
- DASCA will make an accreditation decision based on the results of the on-site visit. The decision will be made public on the DASCA website.
- The DASCA accreditation process ensures accredited programs meet the highest standards for quality education. The process is rigorous, but it is also fair and transparent.

We have contacted DASCA for requirements and a timeline for the accreditation application.

### *UT Board of Trustees*

- February 29 -- March 1, 2024

### *Tennessee Higher Education Commission*

- Commission Meeting, May 16, 2024

<sup>14</sup> <https://sacscoc.org/app/uploads/2019/08/SubstantiveChange.pdf>

## Section VIII: Curriculum

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### *Program-specific Goals/Objectives*

The Bachelor of Science in Applied Artificial Intelligence at the University of Tennessee will comprise 120 total credit hours, consistent with the requirements for any bachelor's degree at the university. Students will complete 50-60 credit hours of VolCore courses, which lay the groundwork for all bachelor's degree students at the University of Tennessee.

In addition to the VolCore requirements, students will undertake 27 hours of core courses specifically tailored for the Applied Artificial Intelligence B.S. program, inclusive of two capstone courses. Designed with the intent of equipping students to excel in the workforce, these 27 credit hours (spanning nine courses) will acquaint students with key concepts such as foundational AI concepts, Natural Language Processing (NLP) and its applications, ethical and legal implications of AI, Human-AI interaction and design principles, AI-driven data handling and visualization techniques, as well as Economic and societal implications of AI.

Furthermore, each student will choose five upper-level elective courses (amounting to at least 15 credit hours), which allow them to delve into the application of Artificial Intelligence technologies in their chosen field of interest. Given that these electives are advanced, the program dedicates approximately 21 credit hours to facilitate students in undertaking the prerequisite courses for these upper-division subjects. These prerequisites will be monitored under the guidance of the Director of Advising.

The foundation of the Applied Artificial Intelligence major predominantly rests on existing core courses, with all the upper-division elective courses already being a part of other colleges at UTK. Several new core courses, namely AI 102, AI 201, AI 202, AI 301, AI 302, AI 399, and AI 499, are currently under development by CECS. A comprehensive list of all new and existing courses is provided below. For detailed syllabi of each course, please refer to Appendix C.

### *Program-specific Goals/Objectives*

The Bachelor's in Applied Artificial Intelligence is designed to provide students with a comprehensive and multifaceted education that merges traditional disciplines with the evolving realm of AI. The Program-specific Goals/Objectives outlined in this section are meticulously aligned with the Program Outcomes detailed in Section II, ensuring a coherent and unified framework for the Bachelor of Science in Applied Artificial Intelligence program. The following goals/objectives mirror the outcomes presented earlier, elaborating on the key competencies and experiences our graduates will acquire through this program:

1. **Advancement of AI Knowledge and Skills:** To provide a comprehensive educational foundation in artificial intelligence, emphasizing both theoretical knowledge and practical skills. The program aims to cover core AI concepts, current technologies, and emerging trends in the field.
2. **Interdisciplinary Integration:** To foster an interdisciplinary approach, integrating AI with other domains such as healthcare, finance, cybersecurity, and robotics. This goal aims to prepare students to apply AI solutions across various sectors effectively.
3. **Innovation and Research Focus:** To encourage innovation and research in AI by engaging students in cutting-edge projects, collaborations with faculty, and partnerships with industry leaders. The goal is to contribute to the advancement of AI through novel research and practical applications.
4. **Ethical AI Development:** To instill an understanding of ethical considerations in AI, focusing on responsible and sustainable AI development. The program will aim to produce graduates who are not only skilled in AI technologies but also mindful of ethical, legal, and social implications.
5. **Real-World Problem Solving:** To equip students with the ability to apply AI methodologies to solve real-world problems. This includes hands-on projects, internships, and collaborations with industry partners to provide practical experiences that mirror real-world scenarios.
6. **Professional and Personal Development:** To promote the overall professional and personal growth of students, including effective communication skills, teamwork, leadership, and lifelong learning. The program aims to prepare students not just for immediate employment but for continuous growth and adaptation in their careers.
7. **Community and Industry Engagement:** To establish strong connections with the local and global AI community, including industry, academia, and public sector partnerships. The goal

is to create opportunities for student internships, collaborative projects, and job placements post-graduation.

8. **Global Perspective and Diversity:** To offer a global perspective on AI, exposing students to diverse AI applications and ethical viewpoints from around the world. The program seeks to promote diversity in AI education and the AI workforce.
9. **Continuous Improvement and Adaptability:** To ensure the program remains current and relevant, adapting to changes in technology, industry demands, and educational best practices. This includes regular curriculum reviews and updates based on feedback from students, faculty, industry partners, and accreditation bodies.

These goals aim to create a comprehensive and dynamic BSAAI program that not only imparts essential AI skills and knowledge but also prepares students for the diverse and evolving challenges in the field of artificial intelligence.

## Student Learning Outcomes

**Table 11**  
Student Learning Outcomes Mapped to Core Courses

Learning Outcome <i>Students will develop/demonstrate</i>	AI 101: Introduction to World of AI	AI 102: Natural Language-based Programming Techniques	AI 201: AI, Ethics, and Legal Frameworks	AI 202: Human-AI Interaction and Experience Design	AI 301: Natural Language Processing and Conversational AI	AI 302: AI-based Data Handling and Visualization	AI 399: Interdisciplinary Capstone Course 1	AI401: Exploring the World of AI	AI 499: Interdisciplinary Capstone Course 2
Comprehensive Understanding of AI	X	X			X	X		X	
Application of AI Techniques	X	X		X	X	X	X		X
Ethical Evaluation and Responsible Implementation	X	X	X	X	X	X	X	X	X
Interdisciplinary Collaboration				X			X		X
Robust Problem-Solving Skills		X			X	X	X		X
Adaptability to Emerging AI Trends	X							X	
Experience in AI Research and Development							X	X	X
Effective Communication Skills	X	X	X	X					
Real-World Experience and Job Readiness							X		X

*Academic Program Requirements*

Table 12

## AAI Program Curriculum

Course Prefix, #, and Title	Course Catalog Description	Credit Hours	New or Existing
<b>Prerequisite Course(s) (General Education): 51-58 Hours</b>			
Vol Core WC	Written Communication (WC): 3 courses, including ENGL 101 and ENGL 102, plus an approved WC course	9	Existing
Vol Core OC	1 Oral Communication (OC) course	1-3	Existing
Vol Core AOC	1 Applied Oral Communication course	1-3	Existing
Vol Core NS	2 Natural Sciences (NS), one 4-credit w/ lab	7-8	Existing
Vol Core QR	2 Quantitative Reasoning (QR) courses	6-8	Existing
Vol Core AH	1 Arts and Humanities	3	Existing
Vol Core EP	2 Expanded Perspectives (EP) courses	6	Existing
Vol Core GCI and GCIUS	1 GCI and 1 GCIUS course	6	Existing
Vol Core SS	1 Social Sciences (SS) course	3	Existing
Vol Core EI	3 Engaged Inquiries (EI) courses	9	Existing
<b>Core Courses: 27 Hours</b>			
AI 101	Introduction to World of AI	3	Existing
AI 102	Natural Language-based Programming Techniques	3	New
AI 201	AI, Ethics, and Legal Frameworks	3	New
AI 202	Human-AI Interaction and Experience Design	3	New
AI 301	Natural Language Processing and Conversational AI	3	New
AI 302	AI-based Data Handling and Visualization	3	New

AI 399	Interdisciplinary Capstone Course 1	3	New
AI 401	Exploring the World of AI	3	Existing
AI 499	Interdisciplinary Capstone Course 2	3	New
<b>Elective Courses: Select 36 Hours</b>			
<b>Mathematical &amp; Statistical Foundations</b>			
BAS 320	Regression Modeling	3	Existing
BAS 471	Statistical Methods	3	Existing
FWF 313	Measurements and Sampling	3	Existing
IE 340	Design of Experiments	3	Existing
MATH 131	Calculus 1A Infused with Precalculus	3	Existing
MATH 132	Calculus 1B Infused with Precalculus	3	Existing
MATH 323	Probability and Statistics	3	Existing
<b>Machine Learning &amp; Data Mining</b>			
BAS 474	Data Mining and Business Analytics	3	Existing
COSC 422	Applied Machine Learning	3	Existing
COSC 426	Intro to Data Mining & Analytics	3	Existing
COSC 425	Introduction to Machine Learning	3	Existing
<b>Data Visualization &amp; Representation</b>			
COSC 453	Data Visualization	3	Existing
GEOG 311	Geovisualization and GIS	3	Existing
IARC 321	Advanced Representation	3	Existing
INDS 321	Digital Representation and Fabrication for Industrial Design	3	Existing
INSC 489	Information Visualization	3	Existing
<b>Databases, Data Engineering &amp; Programming</b>			
ARCH 321	Representation IV: Information Modeling	3	Existing
BAS 476	Data Engineering and Visualization	3	Existing
COSC 111	Computational Thinking and the Art of Programming	3	Existing



COSC 465	Databases and Scripting Languages	3	Existing
DATA 201	Data Knowledge and Discovery	3	Existing
DATA 202	Data Management and Visualization	3	Existing
INSC 360	Programming for Info. Applications	3	Existing
INSC 384	Database Design	3	Existing
INSC 484	Database Applications	3	Existing
INSC 486	Data Analytics	3	Existing
<b>Research, Ethics, &amp; Philosophical Foundations</b>			
EEB 451	Research Ethics	3	Existing
GEOG 421	Maps, Society, Power	3	Existing
GEOG 425	Human Dimensions in GIScience	3	Existing
INSC 305	Internet and Society	3	Existing
PHIL 360	Philosophy of science	3	Existing
PHIL 371	Epistemology	3	Existing
<b>Social Sciences &amp; Humanities</b>			
SOCI 419	Sociology and Science Fiction	3	Existing
SOCI 446	The Modern World System	3	Existing
SOCI 465	Social Values and the Environment	3	Existing
POLS 240	Introduction to Public Administration and Public Policy	3	Existing
POLS 461	Comparative Public Policy	3	Existing
<b>Applied AI in Specialized Domains</b>			
AI 311	AI for Cybersecurity	3	New
BCMB 422	Computational Biology & Bioinformatics	3	Existing
CLAS/ANTH 446	Archaeological Statistics	3	Existing
COSC 445	Fundamentals Digital Archeology	3	Existing
EEB 411	Biostatistics	3	Existing
FWF 430	Introduction to GIS for Natural Resources	3	Existing

GEOG 414	Spatial Data Management	3	Existing
IE 301	Operations Research I	3	Existing
IE 310	Operations Research II	3	Existing
IE 465	Applied Data Science	3	Existing
<b>Additional Requirements (e.g., Thesis, Internship, Practicum, Capstone, etc.): 6 Hours</b>			
AI 375 or 475	Internship in AI	3	New
AI 385 or 485	Research Project in AI	3	New

*Program of Study***Table 13****Sample Course Enrollment Schedule/ Plan of Study for Traditional, Full-time Student**

<b>Semester 1: Fall Year 1</b>		
CRN/Course Abbreviation	Course Title	Credit Hours
AI 101	Introduction to the World of A.I.	3
ENGL 101	English Composition I	3
GEOL 102	Earth, Life, and Time	4
DSGN 130	Basic Design Thinking	3
PHIL 235	Formal Logic	3
Total Semester Credit Hours: 16		
<b>Semester 2: Spring Year 1</b>		
CRN/Course Abbreviation	Course Title	Credit Hours
AI 102	Natural Language-based Programming Techniques	3
ENGL 102	English Composition II	3
BIOL 106	The Living City	3
PSYC 110	General Psychology	3
GEOG 131	Weather, Climate, and Climate Change	4
Total Semester Credit Hours: 16		
<b>Semester 3: Fall Year 2</b>		
CRN/Course Abbreviation	Course Title	Credit Hours
AI 201	AI, Ethics, and Legal Frameworks	3
STAT 201	Introduction to Statistics	3
PUBH 201	Introduction to Public Health	3
ECON 201	Introductory Economics: A Survey Course	4
DATA 201	DATA 201 Data Knowledge and Discovery	3
Total Semester Credit Hours: 16		
<b>Semester 4: Spring Year 2</b>		
CRN/Course Abbreviation	Course Title	Credit Hours
AI 202	Human-AI Interaction and Experience Design	3
ENGL 360	Technical and Professional Writing	3
HIUS 355	United States - 1933 - Present	3
ALEC 202	Leadership and Diversity in Organizations and Communities	3
PHIL 244	Professional Responsibility	3
Total Semester Credit Hours: 15		

<b>Semester 5: Fall Year 3</b>		
CRN/Course Abbreviation	Course Title	Credit Hours
AI 301	Natural Language Processing and Conversational AI	3
AI 311	AI for Cybersecurity	3
AI 375	Internship	3
ALEC 303	Analysis of Leadership Approaches and Styles	3
ENGL 461	Global Communication for Science and Technology	3
Total Semester Credit Hours: 15		
<b>Semester 6: Spring Year 3</b>		
CRN/Course Abbreviation	Course Title	Credit Hours
AI 302	AI-based Data Handling and Visualization	3
AI 385	Research Project in AI	3
AI 399	Interdisciplinary Capstone Course 1	3
ARTN 211	Non-Major Intro to Drawing	3
MGT 201	Introduction to Business Management for Non-Majors	3
Total Semester Credit Hours: 15		
<b>Semester 7: Fall Year 4</b>		
CRN/Course Abbreviation	Course Title	Credit Hours
AI 401	Exploring the World of AI	3
SOCI 419	Sociology and Science Fiction	3
SOCI 465	Social Values and the Environment	3
ELPS 201	Foundations of Leadership Studies	3
PLOS 301	Research Methods	3
Total Semester Credit Hours: 15		
<b>Semester 8: Spring Year 4</b>		
CRN/Course Abbreviation	Course Title	Credit Hours
AI 499	Interdisciplinary Capstone Course 2	3
ANTH 450	Current Trends in Anthropology	3
BAS 474	Data Mining and Business Analytics	3
POLS 461	Comparative Public Policy	3
Total Semester Credit Hours: 12		
<b>TOTAL CREDIT HOURS: 120</b>		

Table 14.

## A tentative two-year plan for study for transfer students via the Tennessee Transfer Pathway

<b>Semester 5: Fall Year 3</b>		
CRN/Course Abbreviation	Course Title	Credit Hours
AI 101	Introduction to the World of A.I.	3
AI 102	Natural Language-based Programming Techniques	3
AI 201	AI, Ethics, and Legal Frameworks	3
ALEC 303	Analysis of Leadership Approaches and Styles	3
ENGL 461	Global Communication for Science and Technology	3
Total Semester Credit Hours: 15		
<b>Semester 6: Spring Year 3</b>		
CRN/Course Abbreviation	Course Title	Credit Hours
AI 202	Human-AI Interaction and Experience Design	3
AI 301	Natural Language Processing and Conversational AI	3
AI 302	AI-based Data Handling and Visualization	3
AI 311	AI for Cybersecurity	3
PLOS 301	Research Methods	3
Total Semester Credit Hours: 15		
<b>Semester 7: Fall Year 4</b>		
CRN/Course Abbreviation	Course Title	Credit Hours
AI 375	Internship	3
AI 399	Interdisciplinary Capstone Course 1	3
AI 401	Exploring the World of AI	3
SOCI 419	Sociology and Science Fiction	3
SOCI 465	Social Values and the Environment	3
Total Semester Credit Hours: 15		
<b>Semester 8: Spring Year 4</b>		
CRN/Course Abbreviation	Course Title	Credit Hours
AI 385	Research Project in AI	3
AI 499	Interdisciplinary Capstone Course 2	3
ANTH 450	Current Trends in Anthropology	3
BAS 474	Data Mining and Business Analytics	3
POLS 461	Comparative Public Policy	3
Total Semester Credit Hours: 15		

**TOTAL CREDIT HOURS: 60**

## *Assessment and Evaluation*

Assessment activities encompass data collection for both the operations of the Applied AI program and the evaluation of the major. The activities pertaining to program operations focus on the faculty delivering the major and the IT infrastructure, services, and resources facilitating the learning. Annual performance reviews gauge faculty teaching and service performance in relation to the major. The assessment activities connected to the evaluation of the major are about (a) recruitment, (b) retention, (c) graduation, (d) placement, (e) curriculum review, (f) student satisfaction, (g) student learning outcomes, and (h) student organization activities. The following are the primary assessment activities:

- **Annual Reports:** These will capture data on recruitment, retention, graduation statistics, student organization activities, and more. The AI Program Curriculum Committee is responsible for developing instruments for data collection and guidelines for the generation of the annual reports. The instruments are expected to be developed by May 2024. It is the responsibility of the CECS program directors and program coordinators to collect the data and produce the annual reports.
- **Triennial Curriculum Review:** Every three years, there will be a systematic review of the curriculum, assessing program learning outcomes via a 20% sample of student work (e.g., papers, projects). Curricular modifications will be initiated if learning outcomes are not achieved. The instrument for this review is under development by the AI Program Curriculum Committee and is expected to be rolled out in the next academic year.
- **Biannual Employer Survey:** This will gauge the curriculum's relevance to current job markets. This will be led by the CECS Director of Partnerships and Economic Development in coordination with the Applied AI Program Curriculum Committee. The survey is being designed and is expected to be distributed next year.
- **Applied AI Advisory Board:** They will offer additional feedback on the major. The responsible party is the Advisory Board Members.

For the initial five years of the program, THEC post-approval monitoring is slated, which will specifically assess accreditation, enrollment rates, retention, and graduation statistics. To gauge how well students are attaining the Applied AI major program learning outcomes, every course must include at least one assignment demonstrating a minimum of one program learning outcome. In their capstone courses (AI 399 and AI 499), Applied AI majors will be required to present a project signifying proficiency in at least half of the program learning outcomes.

Assessment results will be disseminated to the campuswide Applied AI Program Curriculum Committee, which will evaluate the B.S. in Applied AI concerning program efficacy, student outcomes, and the overall impact of the program. Principal student outcome metrics, like GPA, course, and capstone performance, will be harnessed to gauge the overall student achievement. Statistics regarding admission, progression, remediation, dropouts, and completions will be leveraged to appraise the overall success of the program. Such data will be broken down by student subgroups to ensure an equity evaluation of success for students from historically underrepresented

demographics in higher education. Feedback from alumni surveys and employer insights will bestow invaluable perspectives on the impact and effectiveness of the program.

**Table 15**

**Evaluation Process**

<b>Evaluation Process</b>	<b>Timeframe</b>	<b>Responsible Party(ies)</b>
THEC Post Approval Monitoring	Annually for five years	Program Director
Program Outcomes Review Curriculum Student evaluations THEC criteria	Annually	Program Director and Program Curriculum Committee
Capstone Review	Annually	Program Director and Program Curriculum Committee
Review of Recruitment, Enrollment, <b>and</b> Graduation	Annually	Program Director

**Responsible Parties**

The Dean of the College of Emerging and Collaborative Studies (CECS) oversees all faculty and lecturer appointments, reviews, and retention within the Applied AI program. The Program Director for Applied Artificial Intelligence is tasked with implementing all program assessments pertaining to both the operations of the program and the evaluation of the major. Furthermore, several committees have been designated to share the assessment and program evaluation responsibilities:

- The Applied AI Program Curriculum Committee, established in Summer 2023, comprises members from 9 colleges on the Knoxville campus. This committee oversees managing the curriculum of the B.S. in Applied AI program, encompassing both core courses delivered by CECS, and elective courses offered by other UTK colleges. With a broad representation from multiple colleges, the Applied AI Program Curriculum Committee also supervises any modifications to courses from other departments that may be added to or removed from the elective list (e.g., due to discontinuation).
- The Applied AI Advisory Board, which is to be formed, will convene bi-annually. This board is responsible for guiding the development of the Applied AI degree program, ensuring it aligns with academic standards, workforce demands, and potential internship opportunities with participating companies. The Advisory Board features representatives from industry partners (e.g., CGI, Philips, atmosera, RobotLab, etc.) and government offices (e.g., Tennessee Department of Health, Oak Ridge National Laboratory).

### *Articulation and Transfer*

Applicants for admission as degree-seeking students who have been registered at another college or university are classified as transfer students. They must submit to the Undergraduate Admission Office an official high school transcript showing graduation, type of diploma, and complete official transcripts from each previously attended college or university. Transfer students applying for the fall semester must have all supporting credentials listed above on file in the Admission Office by July 1. Transfer students applying for the spring semester must do so by November 1. Transfer students applying for any summer semester must apply by April 15.

We will accept TTP students from Applied Technology, STEM, and Health Science backgrounds and programs<sup>15</sup>. The field of Applied AI encompasses an interdisciplinary approach, drawing upon knowledge from various disciplines. By design, our program integrates theoretical foundations from STEM fields with real-world applications in health science and Applied Technology. We believe that the convergence of these diverse backgrounds enriches our learning environment and fosters innovative problem-solving. To support our incoming TTPs students, our dedicated academic advisors will meet with each student individually to answer any questions they may have and assist in devising a tailored academic plan. We are committed to ensuring a seamless transition into the program and empowering all students to thrive in their academic pursuits.

For students who do not have complete associate degrees, the Applied AI program can offer a credit transfer evaluation. Academic advisors will review their previous coursework and experiences to determine which credits can be transferred to the Applied AI program. This process will ensure that students are given appropriate credit for their prior education and can progress efficiently in the program. Academic advisors will advise students on the specific courses they need to complete to fulfill the requirements of the Applied AI program. They will consider the transferred credits and help students design a personalized academic plan to ensure they meet all the necessary criteria for graduation. The advisors will also provide guidance on course sequencing, elective choices, and any additional requirements.

<sup>15</sup> <https://www.tntransferpathway.org/majors>



## Section IX: Students

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### *Academic Standards*

#### *Admissions*

At the University of Tennessee, Knoxville, the Undergraduate Admissions office is responsible for the administration of all admissions (e.g., high school seniors, international students, transfer students, and so forth) (<https://admissions.utk.edu/>). The processes and deadlines for undergraduate admissions are outlined on the university website. When applying to the University of Tennessee, Knoxville, students choose a major, and if they choose Applied Artificial Intelligence, they will be automatically admitted to the College of Emerging and Collaborative Studies; no additional admission requirements need to be fulfilled. Admissions to the Applied Artificial Intelligence BS program will be handled by the University of Tennessee, Knoxville and will follow the same requirements:

- Completed and submitted an application for admission
- Core GPA evaluated
- Standardized test scores
- High school and/or college official transcripts
- One required essay
- Recommendations from teachers or counselors (optional)
- Personal statement (optional)
- TOEFL or IELTS for international students

Requirements described reflect the minimum requirements for admissions consideration at the University of Tennessee, Knoxville, and do not guarantee acceptance.

Students seeking admission to the B.S. in Applied Artificial Intelligence program may select it upon application to the University. Students seeking to change to the major must be in good academic standing—either both term GPA and cumulative GPA are 2.0 or higher or, if after two consecutive terms, the student's cumulative GPA is 2.0 or higher and at least one term GPA is also 2.0 or higher.

#### *Retention*

- Retention standards for students match those of the University. Students in good academic standing will be retained. Students are placed on Academic Probation when (1) his/her cumulative GPA falls below the minimum acceptable level of 2.0 for one semester or (2) the semester GPA falls below the minimum acceptable level of 2.0 for two consecutive terms of enrollment. During the semester that a student is placed on Academic Probation, and any other semesters in Academic Probation, a student must participate in a special directive advising program to help the student address concerns that are impacting his/her academic performance and to outline a plan for achieving academic success. Other details related to

Academic Probation and Academic Dismissal for the major will match those found in the University of Tennessee, Knoxville Academic Policies and Procedures<sup>16</sup>

### *Graduation*

Program graduation standards for the major follow the University of Tennessee, Knoxville Academic Policies and Procedures (<https://onestop.utk.edu/academic-policies/>). The University of Tennessee, Knoxville, requires a minimum of 120 credit hours to earn a bachelor's degree. At least 36 credit hours should be completed within the major. Students must achieve a grade point average of at least 2.0 on all work attempted at the University of Tennessee, Knoxville.

### *Marketing and Recruitment*

As previously outlined, there is a burgeoning market for Applied Artificial Intelligence, both nationally and in Tennessee, among students and employers. We plan to harness the power of social media for advertising, digital campaigns, and promotional videos to build our brand and engage with prospective students.

CECS will employ diverse mediums to reach students and prospective students. Messaging will be tailored to the student audience, spotlighting the benefits of CECS programs, including the opportunity to tailor their educational journey, particularly within the Applied AI program. Below is a glimpse of the channels CECS will leverage, with a plan to gather data and feedback to identify the most effective avenues for maximizing visibility.

#### **Promotion of Programs:**

- **Social Media:** Our student audience is highly active on Instagram. Engagement will be pursued via Instagram and other relevant social media platforms by sharing content that reflects the innovative and collaborative learning environment within CECS, especially in the Applied AI program. A TikTok account will also be launched to interact with students in a dynamic way.
- **Email:** Students and prospective students will receive periodic emails from CECS concerning programs, events, relevant news and content, and opportunities for interaction with CECS and the Applied AI program.
- **Content:** CECS will craft, publish, and disseminate content that highlights our programs, expertise, and avant-garde approach to higher education, preparing students for the evolving workforce.

<sup>16</sup> <https://onestop.utk.edu/academic-policies>

- **Paid Media:** Targeted paid media campaigns will be deployed on platforms like Google AdWords and Meta to connect with prospective students. Ads will elucidate the advantages of a CECS degree, especially in Applied AI, and its role in gearing them up for the future.
- **Activations/Events:** CECS will mark its presence on campus and in the Knoxville community through student fairs, events, and both campus and community engagements to showcase the programs, especially Applied AI.

#### Recruitment Events:

- **College Fairs:** CECS will engage in and/or provide resources for college fairs aimed at undergraduate recruitment. Materials will encompass handouts on the curriculum and advantages of a CECS degree, alongside CECS swag and an option to subscribe to CECS emails for further information.

**Campus Events:** Participation in campus events like College Connect and Big Orange Preview will continue, promoting CECS degrees to prospective and existing students. CECS will also organize its events in the upcoming months.

#### Industry:

- **Career Fairs:** Where applicable, CECS will partake in career fairs and opportunities to share insights about CECS and the Applied AI program with industry stakeholders and/or prospective students exploring career fields of interest.
- **Industry Opportunities:** CECS will persistently explore opportunities to collaborate with industries, discussing how the Applied AI program can equip students for their careers, available internships, and opportunities for hands-on experience, among others.

### *Student Support Services*

CECS has hired full-time staff for positions in student advising, program coordination, internship placement, and external partnerships. The following student support services are available at CECS:

- **Program Director:** The Program Director plays a pivotal role in overseeing the curriculum and ensuring it remains relevant and cutting-edge. They will also be available for consultations with students, offering advice on career paths, connecting them with faculty research initiatives, and helping navigate any academic challenges specific to the AI field.
- **Tailored Academic Advising:** The Director of Academic Advising at CECS will guide students through course selections, research opportunities, and academic planning. For instance, an advisor might assist a student in selecting electives that align with their interest in AI applications in healthcare.
- **Technical Workshops and Seminars:** Regularly scheduled workshops on current AI technologies and tools will be offered, such as a seminar on 'Advancements in Natural Language Processing' or a hands-on workshop in AI programming. The Director of Partnerships and the Program Director of AI will facilitate these activities.
- **Internship and Research Opportunities:** We provide assistance in securing internships and participating in research projects relevant to Applied AI. An example is a partnership with a local tech company offering internships in AI development. The Director of Partnerships and the Internship Coordinator will support these activities.
- **Peer Support and Study Groups:** We will facilitate peer support groups and study sessions for challenging AI courses, providing a collaborative environment for students to enhance their learning and understanding of complex concepts.

At the University of Tennessee, Knoxville, incoming Students participate in orientation, which includes new student advising. After UTK students settle into their semester, each is assigned an academic advisor to help them stay on track with coursework, career goals, and co-curricular experiences. Through their time at UTK, the Advising office helps students set and achieve their academic, professional, and personal goals. For deep student engagement, the Vol EDGE Program, guided by the Volunteer Experience committee, offers experiential learning and engagement activities that foster well-being and purposeful life-career readiness preparation. The following student support services are available at UTK.

- **[The Writing Center](#):** The Writing Center is to help students with writing papers, citations, and all other paper-writing questions.
- **[Stat Lab](#):** For students needing help with statistics, a tutoring service is available on the second floor of Hodges Library.
- **[The Math Place](#):** Used as both a study space and a tutoring location, the website for this service details the support provided for specific math courses.
- **[OneStop Student Services](#):** One-stop help service for enrollment, academic records, financial aid, and payment; OneStop is located on the ground floor of Hodges Library.

- [Student Disability Services](#): Offers support in the coordination of accommodations in the classroom.
- [Division of Student Success](#): With a wealth of resources, from academic success to career development resources to national scholarships, their mission is to help students recognize and apply their strengths.
- [Student Health Center](#): Taking care of your physical health is important, and the Student Health Center is here to help. Visit their website to learn about eligibility and cost, services, and to book appointments.
- [Counseling Center](#): Just as important as your physical health, taking care of your mental health is essential. Visit their website to learn more about the counseling services available to students.
- [974-HELP](#): Are you or another Vol experiencing distress? Developed to help students reach their academic goals and to help maintain a safe community and learning environment for all students, 974-HELP creates a safe, nonjudgmental place for students to be understood and supported.
- [Pride Center](#): The lesbian, gay, bisexual, transgender, and queer (LGBTQ+) resource center at UTK, the Pride Center provides events, programming, community space, and initiatives to engage and explore issues relating to gender and sexuality.
- [Frieson Black Cultural Center](#): This gathering place offers a library/reading room, computer lab, student lounge, gallery, multipurpose rooms, a student organization suite, conference rooms, and more. It serves as a place for the campus community to learn, share ideas, and discuss experiences.
- [Veterans' Resource Center](#): Located on the ground floor of Hodges Library, this resource provides assistance for active-duty service members, veterans, reservists, guardsmen, and family members using their VA educational benefits.
- [Student Disability Services](#): This service works to establish an inclusive environment where every aspect of the university experience is readily accessible for all students without barriers or bias.
- [Big Orange Meal Share](#): A short-term assistance program that allocates meals to students in need; visit their website to either sign up or donate meals.
- [Big Orange Pantry](#): Open Wednesdays and Fridays from 2-5 p.m., this service provides emergency food assistance to UT students, faculty, and staff.
- [Smokey's Pantry](#): Smokey's Pantry serves the UT community to combat food insecurity. No qualifying information is required.
- [Smokey's Closet](#): Smokey's Closet provides free, gently used professional clothing and accessories to students at UT. Students check in and can receive one free outfit.

- **[The Free Store](#)**: The Free Store is a community share space that allows UT students to shop for free, high-quality, lightly used clothing, kitchenware, accessories, and small appliances at regularly scheduled Free Store Pop-Up events held throughout each academic year. Look out for events on their [Instagram](#) page.
- **[Student Organizations](#)**: Finding a group of people who share your interests is a great way to enhance your university experience. This list details 600+ student organizations at the University of Tennessee, Knoxville.

## Section X: Instructional and Administrative Resources

### Faculty Resources

#### Current Faculty

The table below provides an overview of all program faculty.

**Table 16**

#### Summary of Faculty Who Contribute to the Proposed Program

Faculty Name	Academic Department	Rank or Title	Highest Degree	Role in Program
Ozlem Kilic	College of Emerging and Collaborative Studies	Interim Vice Provost of Academic Affairs, Dean of CECS	D. Sc.	B
Xiaopeng Zhao	College of Emerging and Collaborative Studies	Full Professor, Interim Program Director of CECS, leading the Applied AI Program	Ph.D.	B, A, C, D
Vandana Singh	College of Emerging and Collaborative Studies	Full Professor, Program Director of CECS, leading Innovative Transdisciplinary Studies Program	Ph.D.	A, C
Josh Fagan	College of Emerging and Collaborative Studies	Lecturer	Ph.D.	A, B, C, D
Dania Bilal	College of Communication & Information	Faculty Lead of Applied AI Program Curriculum Committee	Ph.D.	B, C
Harry Dahms	College of Art and Science	Full Professor	Ph.D.	B, C
Vasileios Maroulas	College of Art and Science	Full Professor	Ph.D.	B, C
Mehmet Aydeniz	College of Education, Health, and Human Sciences	Full Professor	Ph.D.	B, A, C, D
Gary Pulsinelli	College of Law	Full Professor	Ph.D.	B, A

Faculty Name	Academic Department	Rank or Title	Highest Degree	Role in Program
Brianne Dosch	Library	Assistant Professor	Ph.D.	B, A
Brendan McConville	College of Music	Full Professor, Associate Dean, College of Music	Ph.D.	B, C
Tom Berg	College of Nursing	Full Professor	Ph.D.	B, C
Deborah Penchoff	Tickle College of Engineering	Associate Director, Innovative Computing Laboratory	Ph.D.	B, C
Gregory Peterson	Tickle College of Engineering	Full Professor	Ph.D.	B
Sergei Kalinin	Tickle College of Engineering	Full Professor	Ph.D.	B, C
Stanimire Tomov	Tickle College of Engineering	Full Professor	Ph.D.	B, C
Agustin Rius	University of Tennessee Institute of Agriculture	Associate Professor	Ph.D.	B, C
Amir Sadovnik	Oak Ridge National Laboratory	Research Scientist	Ph.D.	B, A, C

Note: As shown in the Table above, contributions to the program are keyed as:

- A - Will teach in the program
- B - Will design curriculum for the program
- C - Will conduct related research
- D - Will advise students in the program



***How Faculty Will Support the Program***

The success of the Applied AI program hinges on the dedication and expertise of our faculty members. Spearheading this endeavor, the campuswide Program Curriculum Committee will be instrumental in the meticulous planning and development of the curriculum, certificates, and strategic direction of the program. CECS full-time lecturers, with their specialized knowledge in AI, will take the lead in crafting and delivering the core AI courses, ensuring that the foundational elements of the program are robust and innovative. Moreover, to infuse multidisciplinary perspectives and promote holistic learning, Faculty Fellows will be strategically recruited across all disciplines from campus. These Fellows will collaboratively co-develop and co-teach not only the collaborative AI core courses, such as AI 201, AI 202, AI 301, and AI 302, but also a range of elective AI courses. This integrated approach, leveraging the strengths of diverse faculty expertise, ensures that the Applied AI program remains dynamic, comprehensive, and at the forefront of AI education.

*Anticipated Faculty*

Table 17

**Anticipated Faculty and Instructional Staff**

Faculty Rank or Employment Classification	Part-Time or Full-Time	Anticipated Salary	Anticipated Start Date	Comments
Program Director	Full-time	<b>\$211,200</b>	July 2023	Applied Artificial Intelligence Program Director
Full-time Lecturers	Full-time	<b>\$90,000 / year</b>	Aug 2024	To teach AI 101, 102, 201, 202, 301, 302, 399, 401, 499 as needed
CECS Faculty Lead	Part-time	<b>\$10,000/year</b>	August 2023	Program planning and curriculum development
CECS Faculty Fellows	Part-time	<b>\$10,000 / semester</b>	Aug 2026	To co-develop and co-teach AI 201, 202, 301, 302 as needed.

\*The undergraduate graders are expected to work no more than 10 hours each week.

### *Administrative Support*

The CECS Program Director plays a pivotal role in the smooth functioning of the Applied AI BS program, overseeing critical operations such as enrollment management, grader appointments, promotional campaigns, course scheduling, assessment methodologies, accreditation processes, and refining the content of the capstone courses. Furthermore, to provide students with real-world exposure and employability skills, the Program Director actively engages with campus affiliates, local community stakeholders, and key industry partners. For the Program Director 50% of their salary and benefits is budgeted to the Applied Artificial Intelligence program to reflect their time split between this program and other college activities.

For academic guidance and mentorship, CECS boasts a dedicated full-time Director of Advising (DoA). Recognizing the transdisciplinary nature of the Applied AI program, the DoA works in close liaison with advising counterparts across UTK. This ensures that students enrolled in the Applied AI program can seamlessly plan courses that align with their individual interests, fulfill program prerequisites, and meet the comprehensive requirements of both the degree and the Vol Core. The DoA's responsibilities span academic planning, handling registration issues, spearheading retention initiatives, overseeing graduation processes, and resolving major change requests. The DoA's approach is holistic, focusing on student-centric advising, problem-solving, and fostering an environment where students can openly explore their academic aspirations.

To bolster the experiential learning component of the program, CECS has instituted a Director of Partnerships and Economic Engagement (DPEE). The DPEE has successfully forged strong ties with numerous industry stakeholders, as evident from the support letters in Appendix A and key governmental bodies like the Knoxville Chamber. These collaborations are poised to offer invaluable research and internship experiences to Applied AI students, allowing them to earn academic credits through hands-on roles. The DPEE's role extends to fostering relationships with the U.T. Research Office and premier private-sector collaborators, as well as stimulating industry interactions at local, regional, and national scales. By working in tandem with the UTK Center for Career Development, the DPEE ensures that internship roles align with the students' academic objectives, thereby providing a holistic learning experience.

Table 18

## Anticipated Non-Instructional (Administrative Support) Staff

Job Title	Part-Time or Full-Time	Anticipated Salary	Anticipated/ Start Date	Comments
Program Coordinator	Full-time	\$70,000	Sept 2023	Support all CECS programs
Director of Marketing and Communications*	Full-time	\$90,000	Aug 2023	Supports all CECS programs
Director of Advising*	Full-time	\$80,000	Nov 2023	Supports all CECS programs
Director of Business Operations*	Full-time	\$80,000	Aug 2023	Supports all CECS programs
Director of Partnerships*	Full-time	\$90,000	Aug 2023	Supports all CECS programs
Internship Coordinator	Full-time	\$60,000	Aug 2026	Support all CECS programs
Undergraduate Graders	Part-time	\$20/hour*	Aug 2024	Mark homework (AI 101, 102, 201, 202) as needed
Laboratory Instructor	Part-time	\$4000/course	Aug 2024	To run coding labs for AI 102

\* These positions support college-wide business and their costs are not included in the financial projection for the BSAAI program.

## Section XI: Resources

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### *Equipment*

The hub of the Applied AI program is the Claxton Education Building, centrally located on Volunteer Boulevard within the Knoxville campus. This 3,200-square-foot space emanates a "boutique college" ambiance, aligning perfectly with the ethos of the Applied AI program. Its layout requires minimal modifications, and the classrooms present there, along with the multi-functional seminar room, are perfectly suited for specialized Applied AI courses that are intimate and interactive.

The Claxton environment has been curated to champion interdisciplinary learning and collaboration. Whiteboards adorn hallway walls, fostering spontaneous intellectual exchanges, while dedicated discussion areas and a lounge space further facilitate group interactions. Such a layout is optimal for Applied AI capstone projects, enabling instructors to guide student groups in synergizing their varied skill sets.

In line with the experiential learning approach of the program, a spacious area originally intended as a kitchen is undergoing transformation into the Applied AI Living and Learning Lab. This lab will be a melting pot of state-of-the-art equipment and technology. Students and instructors will have access to innovative tools like extended reality (XR) setups, GPU-enhanced computers tailored for intricate computational tasks like game design, and interactive robots and drones to bring AI concepts to life.

To aid students in their academic journey, a designated drop-in advising office is in place. Here, students can chart their academic paths, plan internships, and discuss placements. Given the comprehensive nature of the Applied AI program, which spans core AI subjects, electives, and the mandatory Vol Core requirements, this dedicated space for face-to-face consultations becomes indispensable. The Claxton facility will also host the Director of Advising and the Director of Partnerships, ensuring seamless collaboration among the faculty. The Claxton Education Building is also poised to be the welcoming point for incoming Tennessee Transfer partnership students joining from affiliate Tennessee community colleges. Moreover, Faculty Fellows associated with the program will have flexible office accommodations within the Claxton space, including shared desks in the primary office suite.

### *Information Technology*

Everywhere on campus, students can connect to the internet through UT's wireless network by registering their devices, including computers, tablets, and smartphones. The Office of Information Technology (OIT) oversees the university's computer labs, ensuring students have access to both Windows and iMac desktop computers, loaner laptops (Windows and MacBook), over 60 printers, and a comprehensive suite of software applications. Additionally, classrooms can be reserved for computer-specific courses. For personal computer issues, Student Computer Support provides both drop-off and quick-help services.

Educational IT resources are streamlined through Canvas, the primary online learning portal, and MyUTK, a student-centric portal that provides quick access to essential online resources like Google Drive and Microsoft Office products, including Outlook, Word, Excel, PowerPoint, and 365 OneDrive. With tools like Google Workspace and Microsoft 365, students can easily collaborate on team projects. For courses with synchronous sessions, students can join online meetings via Zoom using their NetID and password.

The UTK Office of Information Technology (OIT) offers various workshops and training sessions, including live Zoom workshops and self-paced online modules. Furthermore, students can access LinkedIn's online training platform, which covers technology, creative, and business courses, ensuring they are equipped with the latest skills and knowledge.

### *Library Resources*

The [John C. Hodges Library](#) in the heart of campus houses most of the UT Libraries' collections and many unique services. This building is right across from the Claxton Building, where the College of Emerging and Collaborative Studies is located. Research assistance and technology services are available almost all hours of the week in the student-centric [Commons](#) in the Hodges Library; it is a popular venue for both studying and socializing. Hodges Library can seat 2,000 users in its 350,000-square-foot building. Technology-rich facilities and services include a multimedia digital production [Studio](#) and ever-expanding, easily discoverable virtual resources. Unique historical documents and images from the Betsey B. Creekmore Special Collections and University Archives are available as [digital collections](#). Two branch libraries offer specialized collections and services: the [Webster C. Pendergrass Agriculture and Veterinary Medicine Library](#) and the [George F. DeVine Music Library](#).

According to the Association of Research Libraries (ARL), the UT Libraries ranked 23rd among public research university libraries in the United States in 2019. The ARL is a coalition of 124 major research libraries in the United States and Canada and includes the National Library of Medicine and the Library of Congress. The Chronicle of Higher Education currently ranks UT Knoxville libraries 13th in the nation for the most money spent on subscriptions, with 69% of those electronic subscriptions. In 2017, the UT libraries received the 2017 John Cotton Dana Library Public Relations Award for outstanding library public relations sponsored by the American Library Association, the H.W. Wilson Foundation, and EBSCO Information Services. Digital Media Services (DMS) at UT also provides several Information Technology services such as video production, digitization, and image or text scanning. The UT Libraries offer access to hundreds of electronic resources. These include databases, e-books, e-journals, datasets, primary sources, maps, streaming videos, and other electronic research tools.<sup>17</sup> All but a few of these materials are available to authorized users at off-campus locations as well as through the campus network. Providing this access is an absolute necessity for the success of the School's Distance Education Program.

<sup>17</sup> University of Tennessee Libraries. <http://libguides.utk.edu/databases>

The Tennessee Electronic Library (TEL) is a Web-based collection of databases available to every academic, public, school, and special library in Tennessee since November 1999. TEL is comprised of several separate collections of full-text and indexing databases on a variety of topics. A total-access interface allows users to search across databases and selected websites.<sup>18</sup>

The libraries also make available publications related to information technology from computing and engineering societies, including the Association for Computing Machinery (ACM), American Society of Civil Engineers (ASCE), American Society of Mechanical Engineers (ASME), Institute of Electrical Engineers (IEE), Institute of Electrical and Electronics Engineers (IEEE), and the Society for Industrial and Applied Mathematics (SIAM). The UT Libraries is a national leader in [digital collections](#) in support of open access through our digital repository, [Trace](#), and through a rich history of designing innovative spaces and building key partnerships that enhance the teaching/learning enterprise. The UT Libraries is a member of the Association of Research Libraries, the Association of Southeastern Research Libraries, HathiTrust, the Library Publishing Coalition, LYRASIS, and the Center for Research Libraries. The UT Libraries collaborate actively at the state level with the other University of Tennessee System libraries as well as the libraries in the Tennessee Board of Regents system.

UT Libraries offer the following services for undergraduate students at the University of Tennessee.

- **[Study Rooms](#):** All of UT libraries have study rooms for student use - some are first-come, first-served, while others can be [reserved](#) up to two weeks in advance.
- **[The Studio](#):** Multimedia lab located in Commons South in Hodges Library; the Studio is home to a number of helpful resources. From large format printing to audio production rooms, from virtual reality to video production labs, the Studio has both the resources and the people with knowledge to help you with projects, both academic and personal.
- **[Special Collections](#):** Special Collections, located on the first floor of Hodges Library, is home to a vast array of manuscripts, rare books, and materials from University Archives, as well as librarians who are here to help support the UT research community. Check the [Digital Collections](#) to browse unique resources from on or off-campus.
- **[Commons Partners](#):** All student-focused research, technology, and academic support services are in one convenient location at the Hodges Library, which is across from the CECS office in the Claxton building.
- **[Checking Out Material](#):** Using their VolCard, students can check out a book at the public service desk (located at the Melrose entrance on the second floor at Hodges Library). Librarians are available to assist students, or they can opt for the self-checkout kiosks.
- **[Printing](#):** There are two ways students can print at UT Libraries. 1) Log in to one of the available computers and print from there. 2) Print wirelessly from their device using a Vol Card.
- **[3D Printing](#):** 3D printers at Pendergrass Library are available for students, faculty, and staff.

<sup>18</sup> TEL: Tennessee Electronic Library, <http://tntel.tnsos.org/> (last accessed 8/19/23).

- **Patrons with Disabilities:** The University of Tennessee Libraries is committed to providing access to library services and resources to all users. This page provides information about access to Hodges and branch libraries, as well as resources, services, and contacts.

### *Facilities*

The proposed Applied AI program at UTK will be bolstered by state-of-the-art facilities designed to promote innovation, collaboration, and hands-on learning. Every classroom at UTK is outfitted with the latest interactive technology, providing a dynamic setting for lectures and presentations. For practical learning and hands-on experimentation, the AI labs come equipped with high-performance computing clusters, robotics kits, and extended reality (XR) systems. To enhance collaboration and facilitate group projects, the campus features several open-concept spaces dotted with whiteboards and furnished with modular seating. The program also includes dedicated collaboration spaces for students and faculty, fostering an atmosphere conducive to research and peer learning. A central hub acts as a dual-purpose space, serving both as a communal area for students and faculty and as a breeding ground for AI startups and innovative projects. This harmonious fusion of classic and contemporary learning spaces guarantees that students enrolled in the Applied AI program have all the necessary resources and an optimal environment to thrive.

### *Other Resources*

Several entities have expressed their willingness to collaborate with the proposed Applied AI program. Each of the following entities has provided a signed letter of support, which can be found in Appendix A:

- **The AI Tennessee Initiative:** This is a newly established venture that focuses on research and education, leveraging Tennessee's unique strengths and opportunities in AI. By collaborating with academic, industry, and community partners across Tennessee, the initiative seeks to tap into the potential of AI across all disciplines and economic sectors. Its mission is to develop innovative AI solutions addressing significant global challenges, such as climate change, healthcare, and economic development, while also aiming for AI inclusivity for all residents of Tennessee.
- **CGI:** As a global IT behemoth with a specialized focus on AI, CGI stands as a prominent potential collaborator for the Applied AI B.S. program. They have expressed a keen interest in establishing strategic ties with UTK.
- **Reelay:** This AI software company supports the proposed Bachelor of Science in Applied AI, recognizing a synergy with their mission and envisioning future collaborations.
- **Eonix Energy:** As a battery materials company, Eonix Energy sees potential collaboration opportunities given UTK's expertise in fields like agriculture, manufacturing, transportation, healthcare, and data science.



- **RobotLAB:** As a robotics integrator, RobotLAB aims to share its insights on robotics deployment across various sectors with the Applied AI program.
- **NellOne Therapeutics Inc.:** Based in Knoxville, this innovative biotech company is keen on partnering with CECS to develop a curriculum that aligns with industry needs.
- **Philips:** As a multifaceted technology company emphasizing innovations in Healthcare, Consumer Lifestyle, and Lighting, Philips is eager to back the AI program, fostering collaborations with faculty, students, and other industry stakeholders.
- **Atmosera:** This local employer envisions a collaboration with CECS to craft a curriculum that caters to their specific needs while also nurturing a talent pipeline.
- **Advai:** Specializing in detecting and addressing AI vulnerabilities, Advai is at the forefront of ensuring AI is robust, fair, and responsible. They provide user-centric tools designed for optimized AI deployment.

These partnerships underline the robust support structure in place for the success of the Applied AI program at UTK.

## Appendix A: Evidence of Willingness to Partner through Letters of Support



July 26, 2023

College of Emerging and Collaborative Studies (CECS)  
The University of Tennessee, Knoxville  
527 Andy Holt Tower Knoxville, TN 37996-0152

Dear Dr. Kilic,

As the former inaugural director of the National Artificial Intelligence Initiative Office within the White House Office of Science and Technology Policy (2018-2022), and now director of the new AI Tennessee Initiative at UT, one of my top goals is to enable our students to develop interdisciplinary skills and competencies related to AI. This is becoming increasingly critical in today's AI-enabled world, where AI is touching every educational discipline and every economic sector.

The demand for workers who can understand how to use AI in the workplace is increasing quickly. A recent study commissioned by UT's Office of Research, Innovation, and Economic Development and conducted by the Boston Consulting Group found that AI-related job postings in Tennessee that require AI skills has grown at a 40% compound annual growth rate since 2019—far surpassing the strong 19% growth rate of AI-related job postings for the United States as a whole over the same time period. These job postings are occurring across a wide range of major economic sectors, including manufacturing and materials, transportation and logistics, health, information technology, agriculture and farming, energy, and hospitality and entertainment. While these sectors require more workers who are deep AI experts, they are also seeking large numbers of workers who have an interdisciplinary perspective and can apply AI within their area of expertise.

The CECS degree in Applied AI takes this interdisciplinary approach and is tailored for students across a wide array of disciplines. The CECS Applied AI degree includes coding skills and mathematical fundamentals, but as an applied program it will be less technical than a Computer Science concentration in AI, and therefore not in competition. Students will gain skills in applying AI by learning how to approach data science with AI solutions and tools, understand different AI domains, and use no-code AI tools for machine learning, deep learning, and natural language processing. As an interdisciplinary degree, students will also explore AI's history and socio-economic implications, including identifying bias, access, and ethical considerations of AI.

As an applied degree, students will also gain practical experience via capstone projects and workforce experiences, where they will learn to collaborate in teams to apply AI techniques to real-world problems. Crucially, students will gain experience building applications through hands-on activities using no-code AI platforms—instilling key skills in collaboration, critical thinking, and problem-solving. This is essential for student employment in the data-intensive knowledge economy. The CECS Applied AI degree will be a launchpad for employment in a wide range of sectors across non-computer science fields and will help address the modern workforce needs of Tennessee.

Sincerely,

Lynne Parker, Ph.D.  
Associate Vice Chancellor and Director of the AI Tennessee Initiative  
The University of Tennessee, Knoxville  
Email: [leparker@utk.edu](mailto:leparker@utk.edu)

Office of Research, Innovation, and Economic Development  
1331 Circle Park, Knoxville, TN 37996-0100  
865-974-8326 [research.utk.edu/oried/](http://research.utk.edu/oried/)

Flagship Campus of the University of Tennessee System



CGI  
900 South Gay Street  
Suite 1000  
Knoxville, TN 37902  
Tel. 337-281-2066

cgi.com

July 20, 2023

College of Emerging and Collaborative Studies  
The University of Tennessee, Knoxville  
527 Andy Holt Tower Knoxville, TN 37996 0152  
Attention: Ozlem Kilic, Dean

RE: Letter of Support for THEC Proposal – Bachelor of Science in Applied Artificial Intelligence

Dear Dr. Kilic:

I am writing this letter on behalf of CGI, one of the world's largest IT and business consulting firms, to express our enthusiastic support for the proposed Bachelor of Science in Applied Artificial Intelligence (AI) in the College of Emerging and Collaborative Studies (CECS) at the University of Tennessee, Knoxville (UTK). We are delighted by the opportunity to partner with UTK in supporting this applied AI program.

CGI's presence in Knoxville, Tennessee, has allowed us to witness firsthand the exceptional academic environment fostered by UTK. The university's nationally-ranked analytics and data science program, coupled with its renowned graduate supply chain program, showcases UTK's dedication to excellence in emerging fields. By leveraging UTK's interdisciplinary focus, CGI aims to establish an agile center of excellence for emerging technologies in Knoxville. The Knoxville delivery center, which opened its doors in 2021, aligns with CGI's global delivery model for innovative IT and business consulting services. Our professionals at CGI are committed to supporting the communities in which we live and work. Through volunteer activities, we address various community challenges, particularly those involving education, youth, and STEM initiatives. We are proud to support local non-profit organizations that drive impactful change across East Tennessee, with a specific focus on fostering a love for STEM education among the youth.

The proposed Bachelor of Science in Applied AI program perfectly complements UTK's ongoing investments in AI research and development. With the cluster hires in science informed Artificial Intelligence and foundational AI, UTK is set to attract world-leading faculty to drive foundational artificial intelligence research across multiple domains. This comprehensive approach ensures that intelligent engineering systems, additive manufacturing, hypersonic defense systems, and other areas benefit from cutting-edge AI models. By supporting this program, CGI aims to contribute to the development of a strong AI ecosystem in Tennessee.

Moreover, the proposed program's alignment with UTK's AI Tennessee Initiatives resonates with CGI's commitment to advancing the data-intensive knowledge economy. The program's goals, including leveraging Tennessee's unique strengths, advancing interdisciplinary research, preparing students for AI-enabled jobs, and fostering partnerships with industry and organizations, perfectly align with CGI's mission. We believe this collaboration between UTK and CGI will be instrumental in propelling Tennessee to become a national and global leader in the field of AI.

UTK's remarkable strengths in various sectors further reinforce its position as a leader in AI research and innovation. The state's diverse landscape allows for studying AI applications in agriculture and farming, while Tennessee's reputation as a high-tech hotbed enhances UTK's capabilities in sophisticated manufacturing. The Institute of Advanced Manufacturing and Materials (IAMM) exemplifies UTK's commitment to pioneering AI-driven manufacturing processes. Additionally, Tennessee's extensive interstate network and investments in transportation, such as the Center of Transportation at UT, offer unparalleled opportunities for AI research in optimizing routes, traffic management, and logistics operations.

The healthcare sector in Tennessee, along with its complex datasets, provides an ideal environment for conducting cutting-edge AI research to improve healthcare outcomes. UTK's prominence in the field of data science, in collaboration with the Oak Ridge National Laboratory, strengthens the university's AI capabilities and workforce development initiatives. These unique strengths empower UTK to address real-world challenges and drive the adoption of AI technologies not only in Tennessee but also globally.

We are excited about the opportunities this collaboration will create for students, faculty, and the state of Tennessee as a whole. If any additional information or details about CGI are required, please do not hesitate to reach out to me.

Sincerely,



William R. LaBar  
Vice President, U.S. Onshore Delivery  
CGI Federal





University of Tennessee Knoxville  
College of Emerging and Collaborative Studies  
513 Andy Holt Tower  
Knoxville, TN 37996

Date: 7/17/2023

Dear University of Tennessee Knoxville,

I am writing to express our wholehearted support for the exceptional programs being developed at the College of Emerging and Collaborative Studies (CECS). As the CEO of NellOne Therapeutics Inc, a pioneering biotech company, I am committed to fostering regional growth and innovation. CECS will be at the forefront of educational advancement, equipping students with innovative skills that drive economic development and raise the standard of living for all of East Tennessee.

I envision CECS having a similar impact to the partnership between Carnegie Mellon University and the University of Pittsburgh in the Health Data Alliance. By incorporating AI and data analytics, their program achieved groundbreaking advancements in precision medicine, disease prediction, and personalized healthcare. This transformative initiative attracted established and entrepreneurial companies to the region. Knoxville has the potential to experience a similar positive transformation through CECS in multiple fields of innovation.

In our rapidly evolving world, where new technologies and industries emerge unprecedentedly, academic institutions must adapt to prepare graduates for the future. NellOne Therapeutics Inc would benefit from CECS's training programs in computational biology, statistics, and AI, as these disciplines are integral to growing the Life Science Community in East Tennessee. By offering stackable degree programs that combine expertise in microbiology, chemistry, or genetics with entrepreneurial skills, we can attract and retain top talent from both within and outside the region, fueling our economy and ensuring long-term prosperity.

Being fortunate enough to have led numerous successful companies, I understand the value programs like those offered at the University of Tennessee Knoxville bring. Incorporating AI into advanced materials, semiconductor design, and vision processing and mobility solutions would have made my past journeys more efficient and is paramount for the growth and sustainability of future companies.

CECS's emphasis on internships, interdisciplinary research, collaborative team projects, and community engagement is a vision of the future. By providing students with practical, firsthand experiences, CECS ensures they are well-prepared to meet the demands of tomorrow's workforce.

Moreover, CECS's role as an incubator for customizable and stackable degrees is inspiring. By fostering collaborations across disciplines, CECS stimulates innovative research and teaching strategies. This approach enriches students' educational journeys and enables companies to access diverse graduates.

We are thrilled about the potential partnership between NellOne Therapeutics Inc and CECS to establish a customized curriculum tailored to our industry's needs. The significant value that CECS brings to the University of Tennessee Knoxville and the East TN Region cannot be overstated. We eagerly anticipate exploring opportunities for mutual growth and success.

Thank you for considering our unwavering support and keen interest in forging a collaborative partnership. We believe in boundless possibilities and look forward to a shared growth and success journey.

Sincerely,

Bill Malkes  
CEO, NellOne Therapeutics Inc

[hello@nell-one.com](mailto:hello@nell-one.com) | +1.865.567.3351 | 11020 Solway School Road, Ste 101 | Knoxville | Tennessee | 37931





College of Emerging and Collaborative Studies  
The University of Tennessee, Knoxville  
527 Andy Holt Tower Knoxville, TN 37996 0152  
Attention: Ozlem Kilic, Dean

RE: Letter of Support for THEC Proposal – Bachelor of Science in Applied Artificial Intelligence  
Date: 7/20/2023

Dear Dr. Kilic:

I am writing to express our enthusiastic support for the THEC proposal for the Bachelor of Science in Applied Artificial Intelligence (AI) in the College of Emerging and Collaborative Studies (CECS) at the University of Tennessee, Knoxville. As a company that pairs data science and deep learning model development with accelerated laboratory measurements to enable rapid materials design, we view the establishment of a Bachelor of Science in Applied AI as critical for both providing domestic industries with a workforce that can compete globally and UTK students with an education that positions them to professionally excel.

Eonix is an accelerated materials discovery company that designs next generation chemistries for better batteries with funding from the Army, Air Force, Department of Energy, and National Science Foundation. Our automated platform pairs a materials innovation (sensor) with the deep learning/quantum mechanics calculations from Schrodinger Inc. to rapidly design materials solutions, such as a non-flammable battery to improve the safety and reduce the cost of grid storage. We leverage this platform to design next-generation materials that can be seamlessly integrated into existing battery manufacturing processes, addressing specific challenges faced by the industry. The rise in electric vehicles, renewable energy sources, and consumer electronics has significantly increased the demand for advanced Li-ion batteries that enable affordable electric vehicles, safe grid storage, and fast-charging electronics. Eonix collaborates with established battery manufacturers to expedite the scaling of custom chemistry Li-ion batteries for end-users in various industries such as automotive, grid, defense, and electronics. We firmly believe that there is no one-size-fits-all battery chemistry and strive to design superior batteries to enhance the performance of diverse products.

The proposed Bachelor of Science in Applied Artificial Intelligence aligns perfectly with the mission and goals of UTK's AI Tennessee Initiatives, which aim to position Tennessee as a national and global leader in the data-intensive knowledge economy. We are excited about the potential partnership between Eonix and UTK in supporting the applied AI program. Leveraging the unique strengths and opportunities offered by Tennessee, the university's diverse landscape of industries and research institutions creates an ideal environment for the advancement of AI research across disciplines.



UTK's AI capabilities in agriculture and farming, sophisticated manufacturing, transportation and logistics, healthcare, and data science are exceptional. The university's Institute of Advanced Manufacturing and Materials (IAMM) and the Center of Transportation demonstrate the commitment to cutting-edge AI-driven research. Furthermore, the rich healthcare data landscape in Tennessee presents significant opportunities for AI innovation, especially in addressing health challenges faced by socioeconomically disadvantaged populations. UTK's contributions to the field of data science, alongside the Oak Ridge National Laboratory, have solidified its position as a leader in AI and data science education, economy, and workforce development.

The proposed BS in Applied AI program will cater to the growing interest in AI and equip students with practical skills and experience necessary for the future workforce. By engaging in capstone projects, workforce placements, and hands-on activities using no-code AI platforms, students will develop collaboration, critical thinking, and problem-solving abilities. These essential skills will enable them to thrive in the data-intensive knowledge economy, with the CECS Applied AI degree serving as a launchpad for employment in a wide range of sectors.

We wholeheartedly support the THEC proposal for the Bachelor of Science in Applied Artificial Intelligence at the University of Tennessee, Knoxville. We believe that this program, coupled with UTK's AI Tennessee Initiatives, will contribute significantly to advancing AI research, preparing students for AI-enabled jobs, and fostering collaboration between academia and industry. Eonix Energy looks forward to the potential partnership with UTK to support the applied AI program and drive innovation in the battery industry.

We wish you every success with the THEC proposal and the future development of the Applied Artificial Intelligence program at UTK.

Sincerely,

*Don DeRosa*

Don DeRosa, PhD  
CEO, Eonix  
EonixEnergy.com  
516.236.6661





College of Emerging and Collaborative Studies  
 The University of Tennessee, Knoxville  
 527 Andy Holt Tower Knoxville, TN 37996 0152  
 Attention: Ozlem Kilic, Dean

Date: July 26, 2023

RE: Support for Bachelor of Science in Applied Artificial Intelligence Proposal

Dear Dr. Kilic:

I am writing this letter to express my wholehearted support for the Tennessee Higher Education Commission (THEC) proposal to create a Bachelor of Science in Applied Artificial Intelligence at the University of Tennessee, Knoxville (UTK). As the Founder and CEO of Reelay, a leading AI Software as a Service (SaaS) company that provides automated solutions and assistance for administrative tasks in virtual meeting platforms, I am thrilled at the prospect of such a program, especially as it aligns perfectly with the overall mission of our company.

Reelay operates with the vision to automate meeting tasks, improve productivity, and transform meetings into actionable assets using AI. Our innovative platform captures important highlights, creates follow-up engagement, reduces preparation time, and ensures follow-through. By handling meeting overhead and administrative tasks, we enable teams to focus on decision-making and follow-ups. Seeing UTK's commitment to educating the next generation of AI professionals with similar goals excites us about potential partnerships and collaborations.

We are particularly inspired by how the proposed degree program aligns with UTK's AI Tennessee Initiatives. The goals outlined in these initiatives resonate deeply with our mission at Reelay, including the leverage of unique strengths and opportunities of Tennessee, advancing cutting-edge AI research, preparing students for the AI-enabled jobs of the future, and fostering partnerships with industries, organizations, and institutions across the State.

UTK has a track record of cultivating exceptional talent and conducting pioneering research in AI, with unique strengths in various sectors including agriculture, manufacturing, transportation and logistics, healthcare, and data science. We at Reelay acknowledge and appreciate the importance of these sectors and the transformative role AI can play in them. Furthermore, the proposed program's emphasis on practical experience through capstone projects and workforce placements aligns perfectly with our philosophy at Reelay - that the true potential of AI lies in its applied use to solve real-world problems.

The BS in Applied AI degree, as outlined in the THEC proposal, promises to be a catalyst for training a future workforce equipped with the right skills to navigate the data-intensive knowledge economy. The practical application of AI techniques and the no-code AI platforms that students will be trained on will instill critical thinking, problem-solving, and collaboration skills, preparing them for employment in a wide range of sectors, including non-computer science fields.



Reelay strongly supports the proposed Bachelor of Science in Applied AI program at the University of Tennessee, Knoxville. We are excited about the potential of partnering with UTK to support this program and contribute to the advancement of applied AI knowledge and skills among the student community. We look forward to seeing the fruits of this program as it nurtures the next generation of AI professionals who will undoubtedly play a crucial role in the data-intensive knowledge economy.

Sincerely,



Deric Frost  
CEO & Founder  
Reelay Meetings, Inc.  
[dfrost@reelay.ai](mailto:dfrost@reelay.ai)

# PHILIPS

College of Emerging and Collaborative Studies  
The University of Tennessee, Knoxville  
527 Andy Holt Tower Knoxville, TN 37996 0152

Subject: Re: Opportunities at Labcorp

Date: 07/27/2023

Dear Dr. Kilic:

I am writing to express my support for the Bachelor of Science in Applied Artificial Intelligence (AI) program at the University of Tennessee. As a disclaimer, my opinion in this letter does not necessarily reflect my current, past, or future employers'. As a research scientist with extensive experience in machine learning, deep learning, and AI, particularly with applications in public health, I believe this program holds immense value and aligns perfectly with UTK's vision of becoming a national and global leader in the data-intensive knowledge economy.

Throughout my career, I have dedicated myself to advancing the boundaries of AI knowledge and its practical implementation in public healthcare. I graduated with a PhD in Biomedical Engineering from UTK, where my research focused on brain-computer interfaces (BCIs), a technology that represents a remarkable intersection of human cognition and artificial intelligence. BCI showcases the extraordinary potential of cutting-edge AI technology via neural engineering to unlock a world of possibilities for individuals with physical limitations and revolutionizing human-computer interaction. As a scientist, I took advantage of generative AI in predictive analytics and clinical decision support systems via automated analysis of a myriad of multimodal patients' vital signs as well as clinicians' diagnoses to assist hospital systems, something that could take forever for human intelligence.

By leveraging the power of AI, we could help hospitals to optimize their workflows, improve efficiency, and enhance patient care, thereby mitigating the impact of staff shortages and delivering



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Date: 07/27/2023

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quality healthcare services to a larger population. With AI, we could build systems to automate routine clinical tasks, streamline patient triage, alleviate hospital resource planning, and enhance diagnostic accuracy. Via the design and implementation of an AI-enabled remote monitoring system, we could track physiological signals captured via commercial-off-the-shelf (COTS) wearables, such as smartwatches or fitness trackers, and build a system that can detect COVID-19 infection, with high confidence, even ~2 days before showing any infection symptom. Such an AI-based system contributes to a robust early warning system to detect potential outbreaks and alert individuals and healthcare authorities promptly.

The transformative potential of AI is vast and holds immense implications for innovation and societal advancements. AI has the ability to revolutionize industries, drive economic growth, and shape our daily lives in profound ways. As an expert in AI, I deeply understand the transformative power of AI and its potential to create positive change. AI-powered analytics can improve decision-making processes, optimize resource utilization, and address complex challenges faced by societies worldwide. Moreover, AI technologies can enhance accessibility and inclusivity by empowering individuals with disabilities and creating equal opportunities for all.

Not only as a UTK alumnus, but also as an AI researcher, I enthusiastically support this program of “the Bachelor of Science in Applied Artificial Intelligence” at the University of Tennessee, Knoxville, recognizing its significance in preparing the future workforce for this AI-driven era. I am committed to supporting this program by collaborating with faculty, students, and industry partners.

I am passionate about contributing my expertise and insights through mentorship opportunities to foster a deep understanding of AI principles, applications, and ethical considerations. By sharing my knowledge and engaging with the academic community, I aim to support the development of well-rounded graduates who are not only technically proficient in AI but also can solve real-world challenges using AI lens. Furthermore, I am willing to collaborate with industry partners to bridge the gap between academia and real-world AI applications. By forging connections with industry leaders, we can ensure that the program remains aligned with industry needs, providing students

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with practical experience, and enhancing their employability upon graduation. Together, we can shape the future of AI education, innovation, and societal advancements.

If there is any additional information, support, or collaboration that I can provide to further strengthen the Bachelor of Science in Applied AI program, please do not hesitate to reach out to me. I look forward to witnessing the continued growth and success of UTK's AI initiatives and the valuable contributions of the CECS Applied AI program. Thank you for considering my support for the creation of the Bachelor of Science in Applied Artificial Intelligence program. I am confident that this program will elevate UTK's position as a leader in applied AI education and research.

Sincerely,

Soheil Borhani  
Scientist

Philips Research

222 Jacobs Street, Cambridge, MA, 02141, USA

Email: [soheil.borhani@gmail.com](mailto:soheil.borhani@gmail.com)

Phone: (865) 591-8143







July 28, 2023

College of Emerging and Collaborative Studies  
The University of Tennessee, Knoxville  
527 Andy Holt Tower Knoxville, TN 37996 0152  
Attention: Ozlem Kilic, Dean

Dear Dr. Kilic:

I am delighted to provide my full support for the THEC proposal to establish a Bachelor of Science degree program in Applied Artificial Intelligence (AI) at the College of Emerging and Collaborative Studies (CECS), University of Tennessee, Knoxville. This proposal complements UTK's investment in AI research through the cluster hire in science-informed Artificial Intelligence and foundational AI. The proposed program aligns seamlessly with the mission of UTK's AI Tennessee Initiatives, positioning Tennessee as a national and global leader in the data-intensive knowledge economy. These initiatives aim to leverage the unique strengths and opportunities within Tennessee, advance cutting-edge research across all disciplines, prepare students for AI-enabled jobs of today and the future, and foster strong partnerships with industry, organizations, and institutions across the state.

The healthcare sector in Tennessee offers abundant opportunities for AI research, driven by renowned healthcare facilities that generate complex datasets encompassing a broad range of health challenges. UTK's expertise in data science contributes significantly to education, economy, and workforce development in AI and data science. The university's graduates from various data science programs hold key positions in shaping the future of AI and data science in Tennessee and beyond. These unique strengths across agriculture, manufacturing, transportation, healthcare, and data science position UTK as an applied AI research and innovation leader. Through interdisciplinary approaches and collaborative partnerships, UTK is poised to address real-world challenges and drive the adoption of AI technologies.

The proposed program in AI will meet the increasing global interest in AI and the growing demand for AI skills in nearly every sector of the future workforce. The program's emphasis on practical experience through capstone projects and workforce placements enables students to collaborate in teams, applying AI techniques to real-world problems. Additionally, hands-on activities using no-code AI platforms provide students with essential skills in collaboration, critical thinking, and problem-solving. These skills are crucial for student employability in the data-intensive knowledge economy. The CECS Applied AI degree will serve as a launchpad for employment opportunities across a wide range of sectors, transcending traditional computer science fields.

I am a 1982 graduate of the University of Tennessee's College of Engineering. After graduation, I practiced engineering at Oak Ridge National Laboratory and Lawrence Livermore National Laboratory, where I developed a software system that combined thermal and structural finite-element analysis to predict the change in refractive properties of optical elements when exposed to high-power laser beams – a system that I believe is still in use today. I later changed careers and founded a company that builds enterprise software solutions for customers. That company sold in 2021.

For the past 10 years, I have dedicated myself to infusing AI into customers' apps and business processes. I wrote "[Applied Machine Learning and AI for Engineers](#)," which was published by O'Reilly Media in 2022. Today, I am heavily involved in using OpenAI – particularly Large Language Models (LLMs) such as ChatGPT and GPT-4 – as the foundation for cutting-edge software solutions for customers. One of my current projects



involves building a chat-style interface over documents published by the Department of Energy to promote the use and ownership of Electric Vehicles (EVs). Thanks to LLMs, we can build rich semantic-search interfaces over custom knowledge bases and make information more discoverable than ever before.

We are at an inflection point in history. I have witnessed three great technical revolutions since graduating from college: first the personal computer, then the internet, and lastly the smartphone. Machine learning and AI are just as fundamentally important as all three and will have an equally profound impact on our lives. It is vital that we upskill today's university students to understand these technologies and to prepare them to use them to make the world a better place.

In my opinion, it is incredibly important that STEM students have a familiarity with coding and with the basic tenets of AI. This is what will set future engineers apart from the rest. I am delighted to see my alma mater leading the way by offering AI curricula and degrees and pledge to do anything I can to support and promote this endeavor.

I am confident that the Bachelor of Science in Applied Artificial Intelligence program at UTK will play a pivotal role in shaping the future of AI education and research. By providing students with comprehensive training, practical experience, and essential skills, the program will empower them to excel in the evolving field of AI. Together, we can drive innovation, foster collaboration, and position Tennessee as a leader in the data-intensive knowledge economy.

Sincerely,

A handwritten signature in black ink that reads "Jeffrey Prorise".

Jeffrey Prorise  
Chief Artificial Intelligence Officer, Atmosera  
jeff.prorise@atmosera.com  
865-604-8086



19 July 2023

College of Emerging and Collaborative Studies  
The University of Tennessee, Knoxville  
527 Andy Holt Tower Knoxville, TN 37996 0152  
Attention: Ozlem Kilic, Dean

Dear Dr. Kilic:

I am writing this letter to express my enthusiastic support for the proposal of the Bachelor of Science in Applied Artificial Intelligence (AI) in the College of Emerging and Collaborative Studies (CECS) at the University of Tennessee, Knoxville (UTK). As the Vice President of RobotLAB Inc., a leading robotics integrator, I believe this program holds immense potential to shape the future of AI education and contribute significantly to the data-intensive knowledge economy.

RobotLAB has been at the forefront of providing turn-key robotics solutions for over a decade, successfully deploying tens of thousands of robots across various sectors, including schools, universities, assisted-living facilities, banks, restaurants, hospitals, and hotels. We understand the growing importance of AI in transforming these industries, and we are excited about the partnership between RobotLAB and UTK in supporting the applied AI program.

UTK's diverse landscape of industries and research institutions, combined with its strengths in agriculture, manufacturing, transportation and logistics, healthcare, and data science, provide an ideal environment for studying AI applications. RobotLAB recognizes UTK's prominence in these fields and its commitment to fostering groundbreaking research and innovation. The Bachelor of Science in Applied AI program will cater to the increasing global interest in AI and equip students with the practical skills needed to thrive in the future workforce. As highlighted in the THEC proposal, there is a rapidly growing demand for AI skills across almost every sector. This program will provide students with practical experience through capstone projects and workforce placements, where they will collaborate in teams to solve real-world problems using AI techniques. By leveraging UTK's unique strengths and opportunities, this program will advance cutting-edge research, prepare students for AI-enabled jobs, and foster strong partnerships with industry, organizations, and institutions across the state.

One aspect that particularly stands out is the emphasis on hands-on activities using no-code AI platforms. This approach will empower students to build applications, fostering collaboration, critical thinking, and problem-solving skills. These skills are essential for our students to excel in the data-intensive knowledge economy, and the CECS Applied AI degree will serve as an excellent launchpad for employment in a wide range of sectors, even beyond traditional computer science fields.



RobotLAB, as a comprehensive robotics solution provider, understands the importance of integrating robotics and AI into various sectors for improved efficiency and effectiveness. We are excited about the opportunity to collaborate with UTK and support the applied AI program through our expertise and cutting-edge robotic solutions. Our experience in deploying robots across schools, universities, assisted-living facilities, restaurants, and other sectors can contribute significantly to the practical aspects of the program.

I wholeheartedly support the proposal for the Bachelor of Science in Applied AI in the College of Emerging and Collaborative Studies at the University of Tennessee, Knoxville. The program's alignment with UTK's AI Tennessee Initiatives, the university's unique strengths, and the increasing demand for AI skills make this a crucial and timely endeavor. RobotLAB is excited to be a part of this partnership and looks forward to contributing to the success of the applied AI program.

Sincerely,

A handwritten signature in black ink, appearing to read 'Cedric Vaudel', with a large loop and a long, sweeping tail.

Cedric Vaudel

Vice President of Sales at RobotLAB Group  
[cedricv@RobotLAB.com](mailto:cedricv@RobotLAB.com)  
(949) 505 4008



 **Advai**  
 Advai Ltd  
 20-22 Wenlock Road  
 London  
 N1 7GU

23 June 2023

Professor R. Alexander Bentley  
 University of Tennessee,  
 TN, USA

Dear Professor Bentley,

We are writing to express our strong support for the THEC proposal for the creation of a Bachelor of Science program in Artificial Intelligence (A.I.) within the College of Emerging and Collaborative Studies (CECS) at the University of Tennessee, Knoxville. As we delve deeper into the digital era, it's becoming increasingly clear that expertise in A.I. is not just advantageous but essential. We, at Advai, stand testament to this reality, having personally witnessed the explosive growth in A.I.-related careers.

The initiative to invest in A.I. research through a cluster hire for A.I., and subsequently introducing a comprehensive bachelor's degree program, aligns perfectly with global trends. The CECS degree in Applied A.I. will cater to burgeoning student interest in A.I., while also preparing them to seize rapidly growing job opportunities in virtually every future market sector.

Our own experiences within Advai underscore the immense potential and urgency of this field. Understanding the possibilities and limitations of Machine Learning systems necessitates a highly collaborative environment, a quality that the proposed Applied A.I. degree embodies. From Python coding to cloud computing and software development, we've seen firsthand how a well-rounded A.I. education can lead to success.

Furthermore, the interdisciplinary nature of the CECS degree, including exploration of socio-economic aspects such as identifying bias and ethical considerations of A.I., makes it a promising launchpad for employment across diverse fields. Advai sits in this space and the importance of these areas has grown exceptionally fast in the last three years.

We are confident that the proposed degree in Applied A.I. will enhance student employability and capacity to shape our shared digital future.

We hope our words affirm the significance of this initiative and that they resonate with you.

Yours sincerely,



Damian Ruck  
 Chief Researcher/Co-Founder

## Appendix B: THEC Financial Projection Form

<b>Institution</b>	University of Tennessee Knoxville					
<b>Program Name</b>	Applied Artificial Intelligence, Bachelor of Science					
<b>Projected One-Time Expenditures</b>						
<b>Category</b>	<b>Planning</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>	<b>Year 5</b>
Faculty & Instructional Staff	\$10,000					
Non-Instructional Staff						
Graduate Assistants						
Accreditation					\$21,900	\$15,900
Consultants	\$2,000					
Equipment						
Information Technology						
Library Resources						
Marketing						
Facilities	\$62,006					
Travel						
Other						
<i>Total One-Time Expenditures</i>	<i>\$74,006</i>	<i>\$0</i>	<i>\$0</i>	<i>\$0</i>	<i>\$21,900</i>	<i>\$15,900</i>
<b>Projected Recurring Expenditures</b>						
<b>Category</b>	<b>Planning</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>	<b>Year 5</b>
Faculty & Instructional Staff (Note 1)	\$105,600	\$218,264	\$286,772	\$359,135	\$313,788	\$346,950
Non-Instructional Staff (Note 2)		\$45,200	\$52,524	\$92,676	\$107,248	\$121,873
Graduate Assistants						
Accreditation						
Consultants						
Equipment		\$500	\$500	\$500	\$500	\$500
Information Technology		\$500	\$500	\$500	\$500	\$500
Library						
Marketing		\$2,000	\$2,000	\$2,000	\$1,000	\$1,000
Facilities						
Travel						
Other						
<i>Total Recurring Expenditures</i>	<i>\$105,600</i>	<i>\$266,464</i>	<i>\$342,296</i>	<i>\$454,811</i>	<i>\$423,036</i>	<i>\$470,823</i>
<b>Grand Total (One-Time and Recurring)</b>	<b>\$179,606</b>	<b>\$266,464</b>	<b>\$342,296</b>	<b>\$454,811</b>	<b>\$444,936</b>	<b>\$486,723</b>

Projected Revenue						
Category	Planning	Year 1	Year 2	Year 3	Year 4	Year 5
Tuition		\$47,682	\$120,794	\$295,628	\$451,390	\$597,614
Grants						
Other						
<b>Total Revenues</b>	<b>\$0</b>	<b>\$47,682</b>	<b>\$120,794</b>	<b>\$295,628</b>	<b>\$451,390</b>	<b>\$597,614</b>

*Note 1: Include Program Director, Faculty Fellows (Years 1 and 2), and lecturers.*

*Note 2: Include student graders, lab assistants, program coordinator, and internship coordinator (beginning in year 3).*

## Appendix C: Course Syllabi

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Course Abbreviation	Course Title	Credit Hour	New or Existing Course
AI 101	Introduction to World of AI	3	Existing
AI 102	Natural Language-based Programming Techniques	3	New
AI 201	AI, Ethics, and Legal Frameworks	3	New
AI 202	Human-AI Interaction and Experience Design	3	New
AI 301	Natural Language Processing and Conversational AI	3	New
AI 302	AI-based Data Handling and Visualization	3	New
AI 311	AI for Cybersecurity	3	New
AI 375 or 475	Internship in AI	3	New
AI 385 or 485	Research Project in AI	3	New
AI 399	Interdisciplinary Capstone Course 1	3	New
AI 401	Exploring the World of AI (Applied Methods for AI)	3	Existing
AI 499	Interdisciplinary Capstone Course 2	3	New

## AI 101: Intro to the World of AI, Fall 2023

Course Webpage (<https://utk.instructure.com/courses/177618>)

Course Credit Hours: 3

Prerequisite(s): None

Meeting Time and Place: MWF 10:20-11:10 AM

Meeting Place: Ayres Hall G004

Exams: Final - December 8th 3:30-6:00 PM

### Faculty Contact Information

Dr. Joshua Fagan (<https://sites.google.com/vols.utk.edu/jfagan2>)

Email: [jfagan2@utk.edu](mailto:jfagan2@utk.edu)

Office Hours: By appointment only via Zoom (Meeting ID: 845 8563 2050)

### Course Description:

Introduction to foundational concepts, techniques, and applications of Artificial Intelligence (AI) relevant for all disciplines – especially across non-computer science fields. Explores the history and current scope of AI, data sources and tools, and fundamental components of AI solutions. Special attention will be placed on the strengths and weaknesses of the methods as well as on identifying bias, social impacts, and other ethical considerations of AI. Students will gain experience with hands-on activities using no-code AI platforms.

### Student Learning Outcomes/Objectives:

1. Explain the fundamentals of AI and how it relates to other fields.
  - a. Identify and describe different AI domains, such as machine learning, deep learning, natural language processing, and computer vision.
  - b. Summarize and explain the main components and processes involved in AI techniques, such as data preparation, feature engineering, and model evaluation.
  - c. Recall key concepts and terminology related to AI.
2. Evaluate the performance and effectiveness of AI models and techniques.
  - a. Compare and contrast different AI models and techniques to identify strengths, weaknesses, and trade-offs.
  - b. Explain the limitations and challenges of AI, such as interpretability, transparency, robustness, and data quality.
3. Apply AI techniques to real-world problems, using critical thinking and problem-solving skills to analyze data and make decisions.
  - a. Design and implement AI algorithms and models using popular No-Code/Low-Code solutions.
  - b. Collaborate effectively in interdisciplinary teams to develop AI solutions.
4. Evaluate the ethical and social implications of AI to identify potential biases, risks, and fairness concerns.
5. Collaborate and communicate effectively with peers and stakeholders in interdisciplinary

teams.

6. Communicate effectively about AI concepts, techniques, and applications to both technical and non-technical audiences.
7. Be able to stay informed about the latest developments and trends in the field of AI and apply them to their own work.

### **Learning Environment:**

I prefer teaching a "flipped" style classroom where I assign lecture material that you go over outside of class, and then we use class time for more interactive activities. The lecture material assigned for outside consumption could be book readings, videos, AI tool demos, blog readings, or technical paper readings. The typical activities we will do in class will be more interactive discussions and working together on problems and challenges.

### **How to Be Successful in This Course:**

The general guideline for college courses is that students should spend about 2-3 hours per week outside of class for every credit hour. So, for this course, a student should expect to spend approximately 6-9 hours per week working on this course outside of class time. This includes time for reading, studying, completing assignments, preparing for exams/quizzes, and engaging in any other course-related activities. Keep in mind that the actual time required may vary depending on the individual student's learning style and prior knowledge of the subject.

### **Student's Responsibility**

- Be prepared for all classes. Be respectful of others
- Actively contribute to the learning activities in class
- Abide by the UT Honor Code
- Communicate concerns and confusion to me

### **Instructor's Responsibility**

- Be prepared for all classes. Evaluate all fairly and equally Be respectful of all students
- Create and facilitate meaningful learning activities Behave according to university codes of conduct
- Actively listen to concerns and confusions and work to find solutions or alternative methods of explanation

### **Texts:**

There are no selected text books at this time. Extra readings will be made available on Canvas. Students are expected to read the assigned materials before classes so they can understand and actively participate in class discussion.

## Attendance

AI is a highly interdisciplinary field and working in an environment where we can collaborate and have discussions with a diverse group of peers is invaluable. As such, attendance is required in this class. We will discuss finer points in class that likely just reading content on your own would not provide. We will also have more practice in class, and you will be able to ask questions.

Attendance and participation are set at 10% of the final grade. Those with 90% or higher rate of attendance will receive the full 10% of their final course score. The fact that 90% counts for full attendance credit is introduced to adjust for eventual unavoidable situations when students might not be able to attend, so no absence will be excused for the attendance rate, unless it is an extended absence and we have worked out a solution well in advance.

## Assessments and Grading:

We will have:

- No/Low Code problem-based assignments
- Final Exam.

This course will be graded as follows:

Attendance and general participation	10%
Discussions	20%
Lab assignments	50%
Final	20%

## Schedule

Here is our tentative schedule. I reserve the right to make adjustments as needed as we go through the material.

#	Date	Module	Other
1	8/28-9/1	Foundations of Artificial Intelligence	
2	8/6-8/8	Introduction to Ethics in AI	No class Monday: Labor Day
3	9/11-9/15	Understanding Data	
4	9/18-9/20	Evaluating AI Solutions	No class Friday: AI Symposium
5	9/25-9/29	Introduction to AI Tools	
6	10/2-10/6	Machine Learning with No-Code Tools	
7	10/11-10/13	Deep Learning with No-Code Tools	No Class Monday: Fall Break

8	10/16-10/20	Natural Language Processing with No-Code Tools	
9	10/23-10/27	Computer Vision with No-Code Tools	
10	10/30-11/3	Intelligent Agents, Robotics, and Expert Systems	
11	11/6-11/10	Industry Applications of AI	
12	11/13-11/17	Emerging Trends in AI	
13	11/20-11/24	Advanced Topics in AI	No Class on Friday: Thanksgiving Break
14	11/27-12/1	AI in Society and Future Implications	
15	12/4-12/6	Review and Preparation for Final Exam	
	12/8	Final Exam	1:30-3PM

## Course Tools

You will need a laptop that can connect to the internet to use the wide array of AI tools we will explore in our classes.

## Course Policies

### Homework Policy

Homework will be posted on Canvas.

**Assignments are individual!** We will work together during class, and I encourage questions and discussions; you can work with someone else and ask for help, but you should be able to understand the ideas and write your own solutions!

**Note:** Do not use Canvas' assignment comments to contact me about HW. Please just write me an email. I do not get notified about comments made on HW and it will likely go unnoticed for longer than if you email me.

### Web Tools

You are welcome to look up anything you need online to get help understanding concepts.

### Late Homework Policy

Late homework will incur a penalty of 10% per day (prorated accordingly) unless a valid excuse is provided. Moreover, assignments over 5 (calendar) days late will not be graded (and receive 0 points), unless again a valid excuse is provided.



Note that Canvas automatically applies the penalty. If you provided an excuse for a late HW that was accepted, it is your responsibility to check Canvas to make sure that your grade is correct (with no extra penalty). If it is not, you must contact me by email so that I can manually fix it.

## Legal Issues

### Conduct

All students should be familiar with Hilltopics (<https://hilltopics.utk.edu/>), Students Code of Conduct (<https://hilltopics.utk.edu/student-code-of-conduct/>) and maintain their Academic Integrity: Academics (<https://hilltopics.utk.edu/academics/>).

### Integrity

Study, preparation, and presentation should involve at all times the student's own work, unless it has been clearly specified that work is to be a team effort. Academic honesty requires that the student present their own work in all academic projects, including tests, papers, homework, and class presentations. When incorporating the work of other scholars and writers into a project, the student must accurately cite the source of that work. For additional information, see the applicable catalog (<https://catalog.utk.edu/>) or the UT Libraries (<http://www.lib.utk.edu/instruction/plagiarism>) site. See also the Student Code of Conduct (<https://studentconduct.utk.edu/standards-of-conduct-overview/>) and Honor Statement (below).

All students should follow the Honor Statement (also from Hilltopics (<https://hilltopics.utk.edu/>) Academics: <https://hilltopics.utk.edu/academics/>

### Honor Statement

"An essential feature of the University of Tennessee, Knoxville, is a commitment to maintaining an atmosphere of intellectual integrity and academic honesty. As a student at the university, I pledge that I will neither knowingly give nor receive any inappropriate assistance in academic work, thus affirming my own personal commitment to honor and integrity."

You should also be familiar with the Classroom Behavior Expectations (<https://web.math.utk.edu/~finotti/files/ClassroomBehaviorExpectations.pdf>).

**We are in an honor system in this course!**

### Disabilities

Students with disabilities that need special accommodations should contact the Student Disability Services (<https://sds.utk.edu/>) and bring me the appropriate letter/forms.

### Discrimination and Harassment

For Discrimination and Harassment (<https://oed.utk.edu/complaints/>), please visit the Office of Equity and Diversity (<https://oed.utk.edu/>).

### **Campus Syllabus**

Please, see also the Campus Syllabus (<https://utk.instructure.com/courses/55015/pages/ut-knoxville-campus-syllabus-%7C-2022-2023>).

## AI 102: Natural Language-based Programming Techniques

**Course Credit Hours:** 3

**Meeting Time:** TBD

**Meeting Place:** TBD

**Instructor:** TBD

### Course Description:

In this foundational course, students will delve deeply into the field of Natural Language Processing (NLP), exploring its significance and applications in today's tech-driven world. The course will elucidate the intersection of natural language and programming, arming students with the necessary tools and techniques to manipulate, analyze, and interpret human language using computational methods. Emphasizing both theoretical understanding and hands-on experiences, students will gain insights into how machines understand and respond to human language, laying the groundwork for advanced studies in AI and machine learning.

### Student Learning Outcomes/Objectives:

Upon successful completion of this course, students will be able to:

1. Understand and explain the foundational principles of natural language and its computational representations.
2. Employ basic string processing, text normalization techniques, and regular expressions in text processing.
3. Utilize tokenization, stemming, and lemmatization for efficient language processing.
4. Implement simple to intermediate language-based applications using common NLP libraries and tools.
5. Analyze and interpret the results of NLP techniques in real-world applications.

### Recommended Texts:

"Speech and Language Processing" by Daniel Jurafsky and James H. Martin

"Natural Language Processing with Python" by Steven Bird, Ewan Klein, and Edward Loper

### Grading:

- Class Participation: 10%
- Homework Assignments: 50%
- Midterm Exam: 20%
- Quizzes: 10%
- Final Exam: 20%

## AI 201: AI, Ethics, and Legal Frameworks

**Course Credit Hours:** 3

**Meeting Time:** TBD

**Meeting Place:** TBD

**Instructor:** TBD

### Course Description:

"AI, Ethics, and Legal Frameworks" presents a comprehensive exploration of the multifaceted relationship between artificial intelligence, ethics, and the law. Students will delve deep into the ethical dilemmas and challenges posed by current and emerging AI technologies, such as bias in algorithms, decision-making transparency, and issues of accountability. Through detailed case studies, real-world examples, and practical exercises, participants will also become familiar with the diverse legal landscapes governing AI applications across the globe. The course will further engage students in critical discussions around societal implications, data privacy concerns, and the potential consequences of unchecked AI deployments.

### Student Learning Outcomes/Objectives:

1. Understand the ethical implications of AI technologies across various sectors.
2. Analyze potential biases and challenges in AI system designs and outputs.
3. Navigate and interpret global legal standards and regulations relevant to AI.
4. Evaluate the societal and individual impacts of AI decisions, with a focus on fairness, privacy, and accountability.

### Recommended Texts:

"Robot Ethics 2.0: From Autonomous Cars to Artificial Intelligence" edited by Patrick Lin, Keith Abney, and Ryan Jenkins

"Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy" by Cathy O'Neil

### Grading:

- Class Participation: 10%
- Homework Assignments: 40%
- Midterm Exam: 20%
- Quizzes: 10%
- Final Exam: 20%

## AI 202: Human-AI Interaction and Experience Design

**Course Credit Hours:** 3

**Meeting Time:** TBD

**Meeting Place:** TBD

**Instructor:** TBD

### **Course Description:**

The "Human-AI Interaction and Experience Design" course delves into the intricacies of designing seamless interactions between humans and artificial intelligence systems. Students will be introduced to the foundational principles of user experience (UX) specifically tailored for AI-driven platforms. Emphasizing both theoretical knowledge and practical application, the course will explore the dynamics of trust-building, managing user expectations, and ensuring clarity in AI-driven communications. Students will also analyze real-world case studies, gaining insights into the successes and pitfalls of existing AI-human interaction models, and will be challenged to devise innovative solutions that enhance user satisfaction and engagement.

### **Student Learning Outcomes/Objectives:**

1. Grasp the fundamental principles of UX as applied to AI systems.
2. Design and evaluate AI interfaces that prioritize user-friendliness and effectiveness.
3. Understand the psychological aspects of AI-human interactions and design systems that cultivate trust and clarity.
4. Analyze a range of AI-human interaction scenarios, drawing best practices from successful models and learning from flawed implementations.

### **Recommended Texts:**

"Designing Agentive Technology: AI That Works for People" by Christopher Noessel  
Life 3.0: Being Human in the Age of Artificial Intelligence by Max Tegmark

### **Grading:**

- Class Participation: 10%
- Homework Assignments: 40%
- Midterm Exam: 20%
- Quizzes: 10%
- Final Exam: 20%

## AI 301: Natural Language Processing and Conversational AI

**Course Credit Hours:** 3

**Meeting Time:** TBD

**Meeting Place:** TBD

**Instructor:** TBD

### Course Description:

"Natural Language Processing and Conversational AI" offers students an immersive experience in the world of human-computer linguistic interactions. This course delves deeper into the advanced mechanisms of NLP, expanding upon tokenization, sentiment analysis, and machine translation. Through a mix of theoretical lectures and hands-on labs, students will be exposed to the development of chatbots, voice assistants, and other conversational interfaces, understanding the nuances of creating machines that can understand and generate human language effectively and naturally.

### Student Learning Outcomes/Objectives:

1. Understand the advanced principles of natural language processing and its computational applications.
2. Develop and fine-tune conversational agents tailored to specific user needs.
3. Analyze and process large volumes of text data, extracting meaningful insights.
4. Grasp the challenges of machine translation and the current solutions in place.

### Recommended Texts:

"Foundations of Statistical Natural Language Processing" by Christopher D. Manning and Hinrich Schütze

### Grading:

- Class Participation: 10%
- Homework Assignments: 40%
- Midterm Exam: 20%
- Quizzes: 10%
- Final Exam: 20%

## AI 302: AI-based Data Handling and Visualization

**Course Credit Hours:** 3

**Meeting Time:** TBD

**Meeting Place:** TBD

**Instructor:** TBD

### Course Description:

This course focuses on the pivotal role of data in AI systems, teaching students how to manage, process, and visualize information using AI techniques. Emphasizing real-world applications, students will be introduced to various AI tools for data preprocessing, analysis, and visualization. The course will also touch upon the challenges of working with high-dimensional data, and the solutions AI offers in transforming such data into comprehensible and actionable insights.

### Student Learning Outcomes/Objectives:

1. Understand the principles of data handling and management in AI-driven tasks.
2. Utilize AI algorithms to process, analyze, and visualize complex datasets.
3. Transform raw data into meaningful insights using AI tools.
4. Recognize the challenges and pitfalls of data management in AI and devise strategies to overcome them.

### Recommended Texts:

"Python for Data Analysis" by Wes McKinney

"Data Visualization: A Practical Introduction" by Kieran Healy

### Grading:

- Class Participation: 10%
- Homework Assignments: 40%
- Midterm Exam: 20%
- Quizzes: 10%
- Final Exam: 20%

## AI 311: AI for Cybersecurity

**Course Credit Hours:** 3

**Meeting Time:** TBD

**Meeting Place:** TBD

**Instructor:** TBD

### Course Description:

"AI for Cybersecurity" offers a deep dive into the symbiotic relationship between artificial intelligence and cybersecurity. In an era defined by evolving cyber threats, this course equips students with the knowledge to utilize AI-driven solutions for threat detection, mitigation, and response. Through hands-on labs and simulations, students will confront real-world cybersecurity scenarios, devising AI strategies to counteract and prevent cyberattacks.

### Student Learning Outcomes/Objectives:

1. Understand the foundational principles of cybersecurity and the challenges posed by modern cyber threats.
2. Apply AI tools and techniques to detect, analyze, and mitigate cyber threats.
3. Simulate real-world cybersecurity scenarios, leveraging AI for defense and response.
4. Analyze case studies of AI-driven cyberattacks and devise counter-strategies.

### Recommended Texts:

"Machine Learning and Security: Protecting Systems with Data and Algorithms" by Clarence Chio and David Freeman

Kaur, R., Gabrijelčić, D. and Klobučar, T., 2023. Artificial intelligence for cybersecurity: Literature review and future research directions. *Information Fusion*, p.101804.

### Grading:

- Class Participation: 10%
- Homework Assignments: 40%
- Midterm Exam: 20%
- Quizzes: 10%
- Final Exam: 20%



## AI 375 or 475: Internship

**Course Credit Hours:** 3

**Meeting Time:** TBD

**Meeting Place:** TBD

**Instructor:** TBD

### **Course Description:**

The AI Internship course is tailored to provide students with an unparalleled experience in the professional realm of AI. Under industry mentorship, students will undertake real-world AI projects, assimilating professional practices, teamwork dynamics, and industry expectations. The course also includes reflective components, ensuring students draw meaningful connections between academic learning and practical work, setting them up for success in the AI industry.

### **Student Learning Outcomes/Objectives:**

1. Apply academic AI knowledge in a professional setting, addressing real-world challenges.
2. Develop professional skills, including effective communication, teamwork, and problem-solving in an AI context.
3. Reflect on practical experiences, drawing parallels with academic learning and identifying areas of growth.
4. Establish industry connections and gain a clearer perspective of the AI professional landscape.

### **Grading:**

- Class Participation: 10%
- Internship Assignments and Reports: 50%
- Midterm Evaluation: 20%
- Final Evaluation: 20%

## AI 385 or 485: Research Project in AI

**Course Credit Hours:** 3

**Meeting Time:** TBD

**Meeting Place:** TBD

**Instructor:** TBD

### **Course Description:**

AI 385 R offers a comprehensive exploration into AI research, immersing students in the methodologies, challenges, and innovations defining this dynamic field. Over the duration of the course, students will embark on an investigative journey, identifying pertinent research questions, immersing themselves in literature reviews, and applying contemporary research methodologies. By leveraging the tools and knowledge acquired, students will design and execute detailed research experiments or studies, aiming to address the challenges they've identified. The course culminates in a presentation of their findings, allowing students to contribute to the broader academic AI community. This rigorous course experience places emphasis on developing a robust research mindset, fostering critical thinking, and enhancing students' ability to contribute meaningfully to AI's academic discourse.

### **Student Learning Outcomes/Objectives:**

1. Identify pertinent challenges and research questions within the realm of AI.
2. Conduct exhaustive literature reviews, drawing insights from contemporary AI research.
3. Design and implement research experiments or studies, adhering to the highest standards of research methodology.
4. Present research findings in a cogent manner, contributing to the academic discourse on AI.

### **Grading:**

- Class Participation: 10%
- Literature Review & Research Proposal: 25%
- Midterm Research Presentation: 20%
- Research Project Execution: 25%
- Final Research Presentation & Report: 20%

## AI 399: Interdisciplinary Capstone Course 1

**Course Credit Hours:** 3

**Meeting Time:** TBD

**Meeting Place:** TBD

**Instructor:** TBD

### Course Description:

This foundational capstone course emphasizes real-world application, tasking students with integrating and applying their accumulated AI knowledge. Operating in interdisciplinary teams, students will tackle complex problems, leveraging AI to devise innovative solutions. From problem identification to solution implementation and refinement, students will experience the full spectrum of project development, preparing them for the challenges of the AI industry.

### Student Learning Outcomes/Objectives:

1. Synthesize and apply knowledge from previous AI courses to address real-world challenges.
2. Collaborate effectively in interdisciplinary teams to design and implement AI solutions.
3. Critically evaluate AI solutions and iterate based on feedback and testing.
4. Communicate complex AI concepts and solutions to a diverse audience.

### Grading:

- Class Participation: 10%
- Homework Assignments: 40%
- Midterm Exam: 20%
- Quizzes: 10%
- Final Exam: 20%

## AI 401: Exploring the World of AI (Applied Methods for AI)

**Course Webpage** (TBD)

**Course Credit Hours:** 3

**Prerequisite(s):** None

**Meeting Time and Place:** TBD

**Meeting Place:** TBD

**Exams:** Final – TBD

**Associated Term:** Spring Sem 2024

### Faculty Contact Information

**Dr. Joshua Fagan** (<https://sites.google.com/vols.utk.edu/jfagan2>)

**Email:** [jfagan2@utk.edu](mailto:jfagan2@utk.edu)

**Office Hours:** By appointment only via Zoom (Meeting ID: 845 8563 2050)

### Course Description:

Detailed study of concepts, techniques, and applications of Artificial Intelligence (AI) relevant for all disciplines – especially across non-computer science fields. Explores the history and current scope of AI, data sources and procedures for attaining and working with data, and fundamental components of AI solutions. Special attention will be placed on the strengths and weaknesses of the methods as well as on identifying bias, social impacts, and other ethical considerations of AI. Introduces students to AI-relevant programming through hands-on coding projects. This is an undergraduate and graduate course (AI 501) taught concurrently, where graduate students will have additional requirements and assignments.

### Student Learning Outcomes/Objectives:

1. Deepen understanding of AI and its intersection with various fields.
  - a. Explore advanced AI domains like deep learning, reinforcement learning, and multi-agent systems.
  - b. Examine the core components and processes involved in complex AI solutions.
  - c. Stay updated with the latest advancements in AI technology and methodologies.
2. Critically evaluate AI models and techniques.
  - a. Analyze different AI models to identify strengths, weaknesses, and trade-offs.
  - b. Understand and explain the challenges posed by AI in terms of interpretability, transparency, robustness, and data quality.
3. Apply advanced AI techniques to real-world problems.
  - a. Design and implement complex AI algorithms using no-code, low-code, and code-based and solutions.
  - b. Work in interdisciplinary teams to develop innovative AI solutions for real-world challenges.
  - c. Use AI tool APIs for interfacing AI tools with applications and websites.
4. Delve into the ethical and social implications of AI.

- a. Engage in discussions about the ethical considerations of AI advancements.
  - b. Identify potential biases, risks, and fairness concerns in AI applications.
5. Enhance collaboration and communication skills.
- a. Collaborate effectively within interdisciplinary teams.
  - b. Communicate complex AI concepts, techniques, and applications to both technical and non-technical audiences.

### **Learning Environment:**

Similar to AI 101, a "flipped" classroom approach will be employed where students are expected to review lecture materials outside of class, and class time will be utilized for interactive discussions, problem-solving sessions, and hands-on activities. Lecture materials may include academic papers, technical reports, online tutorials, and video lectures.

How to Be Successful in This Course: Success in this course will require a significant commitment of time and effort in studying, completing assignments, engaging in class discussions, and working on projects. It's estimated that students should dedicate around 6-9 hours per week outside of class time for study and course-related activities.

### **Student's Responsibility:**

- Preparation for all classes and active engagement in learning activities.
- Adherence to the UT Honor Code and respectful behavior towards peers and faculty.
- Communication of any concerns or issues to the instructor in a timely manner.

### **Instructor's Responsibility:**

- Provision of a conducive learning environment and meaningful learning activities.
- Fair and equitable evaluation of all students.
- Prompt response to student concerns and queries.

### **Texts:**

No specific textbooks are required; however, supplementary readings will be provided on Canvas.

### **Attendance:**

Attendance is crucial for success in this course as it facilitates collaborative learning and in-depth understanding of advanced AI concepts. The same attendance policy as in AI 101 applies.

### **Grading:**

- Attendance and general participation: 10%
- Discussions: 20%
- Project Assignments: 40%
- Midterm: 15%
- Final: 15%

### Schedule:

A tentative schedule will be provided during the first week of class, with the flexibility to make adjustments as necessary.

### Course Tools:

#### Homework Policy

Homework will be posted on Canvas.

**Assignments are individual!** We will work together during class, and I encourage questions and discussions; you can work with someone else and ask for help, but you should be able to understand the ideas and write your own solutions!

**Note:** Do not use Canvas' assignment comments to contact me about HW. Please just write me an email. I do not get notified about comments made on HW and it will likely go unnoticed for longer than if you email me.

#### Web Tools

You are welcome to look up anything you need online to get help understanding concepts.

#### Late Homework Policy

Late homework will incur a penalty of 10% per day (prorated accordingly) unless a valid excuse is provided. Moreover, assignments over 5 (calendar) days late will not be graded (and receive 0 points), unless again a valid excuse is provided.

Note that Canvas automatically applies the penalty. If you provided an excuse for a late HW that was accepted, it is your responsibility to check Canvas to make sure that your grade is correct (with no extra penalty). If it is not, you must contact me by email so that I can manually fix it.

### Legal Issues

#### Conduct

All students should be familiar with Hilltopics (<https://hilltopics.utk.edu/>), Students Code of Conduct (<https://hilltopics.utk.edu/student-code-of-conduct/>) and maintain their Academic Integrity: Academics (<https://hilltopics.utk.edu/academics/>).

#### Integrity

Study, preparation, and presentation should involve at all times the student's own work, unless it has been clearly specified that work is to be a team effort. Academic honesty requires that the student present their own work in all academic projects, including tests, papers, homework, and class presentations. When incorporating the work of other scholars and writers into a project, the

student must accurately cite the source of that work. For additional information, see the applicable catalog (<https://catalog.utk.edu/>) or the UT Libraries (<http://www.lib.utk.edu/instruction/plagiarism>) site. See also the Student Code of Conduct (<https://studentconduct.utk.edu/standards-of-conduct-overview/>) and Honor Statement (below).

All students should follow the Honor Statement (also from Hilltopics (<https://hilltopics.utk.edu/>) Academics: <https://hilltopics.utk.edu/academics/>

### **Honor Statement**

"An essential feature of the University of Tennessee, Knoxville, is a commitment to maintaining an atmosphere of intellectual integrity and academic honesty. As a student at the university, I pledge that I will neither knowingly give nor receive any inappropriate assistance in academic work, thus affirming my own personal commitment to honor and integrity."

You should also be familiar with the Classroom Behavior Expectations (<https://web.math.utk.edu/~finotti/files/ClassroomBehaviorExpectations.pdf>).

**We are in an honor system in this course!**

### **Disabilities**

Students with disabilities that need special accommodations should contact the Student Disability Services (<https://sds.utk.edu/>) and bring me the appropriate letter/forms.

### **Discrimination and Harassment**

For Discrimination and Harassment (<https://oed.utk.edu/complaints/>), please visit the Office of Equity and Diversity (<https://oed.utk.edu/>).

### **Campus Syllabus**

Please, see also the Campus Syllabus (<https://utk.instructure.com/courses/55015/pages/ut-knoxville-campus-syllabus-%7C-2022-2023>).

## AI 499: Interdisciplinary Capstone Course 2

**Course Credit Hours:** 3

**Meeting Time:** TBD

**Meeting Place:** TBD

**Instructor:** TBD

### **Course Description:**

AI 499 serves as the pinnacle of the AI study journey, pushing students beyond foundational knowledge into the application of advanced interdisciplinary AI concepts. This capstone course is an immersive experience where students are presented with intricate, real-world challenges that necessitate innovative AI solutions. Emphasizing a collaborative approach, students will work in interdisciplinary teams, integrating knowledge from various AI domains to design, implement, and refine AI-driven solutions. A hallmark of this course is the engagement with industry experts and stakeholders, allowing for invaluable feedback that drives iteration and refinement of projects. As a culminating experience, students will be tasked with presenting their solutions to a discerning panel of experts, showcasing not only their technical prowess but also their ability to communicate complex AI concepts.

### **Student Learning Outcomes/Objectives:**

1. Synthesize and integrate knowledge from various AI disciplines to address intricate, real-world challenges.
2. Collaborate effectively in interdisciplinary teams to design, implement, and refine AI-driven solutions.
3. Engage with industry stakeholders, assimilating feedback to drive project iteration.
4. Present complex AI-driven solutions to a panel of experts, demonstrating both technical and communication skills.

### **Grading:**

- Class Participation: 10%
- Interim Project Presentation: 20%
- Project Development and Implementation: 40%
- Final Project Presentation & Report: 25%
- Peer Review Assessment: 5%



## Appendix D: Assessment Documents

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### Sample Accreditation Document

**Institution:** University of Tennessee Knoxville

**Program:** Bachelor of Science in Applied Artificial Intelligence (BS-AAI)

**Date:** [Date]

#### Program Accreditation Request

We hereby submit our request for accreditation of the Bachelor of Science in Applied Artificial Intelligence (BS-AAI) offered at the University of Tennessee Knoxville.

#### 1. Program Overview:

- **Objective:** The BS-AAI program aims to provide students with a comprehensive understanding of AI concepts, techniques, and their applications across various domains.
- **Duration:** 4 years (8 semesters)
- **Total Credit Hours:** 120

#### 2. Faculty:

A team of dedicated faculty members with PhDs and extensive experience in AI and related fields.

#### 3. Facilities:

State-of-the-art labs equipped with high-performance computing clusters, robotics kits, and extended reality setups.

#### 4. Curriculum:

A blend of core AI courses, electives, and hands-on projects. The curriculum is designed keeping in mind the latest industry trends and research advancements.

#### 5. Industry Collaboration:

Partnerships with top-tier AI companies for internships, research, and placement opportunities.

#### 6. Feedback Mechanism:

Regular feedback is taken from students, faculty, and industry partners to ensure continuous improvement.

We kindly request the accreditation body to review our application and provide feedback.

## Sample Assessment Document

**Institution:** University of Tennessee, Knoxville

**Program:** Bachelor of Science in Applied Artificial Intelligence (BS-AAI)

**Date:** [Date]

### Annual Program Assessment Report

**1. Program Objective:**

Ensure students gain comprehensive knowledge and practical skills in AI to excel in the industry or further studies.

**2. Enrollment & Graduation:**

- Total students enrolled: [Number]
- Total graduates: [Number]

**3. Student Performance Metrics:**

- Average GPA: [Value]
- Capstone project success rate: [Value]%

**4. Faculty Metrics:**

- Faculty-student ratio: [Value]
- Faculty publications: [Number]

**5. Feedback Analysis:**

- Student satisfaction rate: [Value]%
- Faculty satisfaction rate: [Value]%

**6. Industry Collaboration Outcome:**

- Internships secured: [Number]
- Placement rate: [Value]%

**7. Areas of Improvement Identified:**

- [Area 1]: [Suggested improvements]
- [Area 2]: [Suggested improvements]

**8. Future Plans:**

- Curriculum updates based on latest AI trends.
- Enhance industry partnerships.
- 

This assessment report is based on data collected throughout the academic year and aims to ensure continuous improvement of the BS-AAI program.

## Sample Employer Survey: Applied AI Program Graduates Feedback

**Institution:** University of Tennessee, Knoxville

**Program:** Bachelor of Science in Applied Artificial Intelligence (BS-AAI)

**Date:** [Date]

Dear [Employer Name],

We kindly request your feedback on the performance of our graduates from the Applied AI program who are currently employed at your organization. Your insights will help us evaluate and continuously improve our program.

**Company Name:** \_\_\_\_\_

**Respondent's Name and Position:** \_\_\_\_\_

**Duration of employing the graduate(s):** \_\_\_\_\_

Please rate the following statements on a scale of 1 to 5, where:

1 = Strongly Disagree

2 = Disagree

3 = Neutral

4 = Agree

5 = Strongly Agree

- 
1. The graduate demonstrates a strong foundational knowledge of AI concepts and techniques.
    - Rating: \_\_\_\_
  2. The graduate applies AI techniques effectively to solve real-world problems.
    - Rating: \_\_\_\_
  3. The graduate is aware of the ethical, social, and legal implications of AI applications.
    - Rating: \_\_\_\_
  4. The graduate collaborates well with team members from diverse disciplines.
    - Rating: \_\_\_\_
  5. The graduate exhibits strong problem-solving skills, especially in AI-driven scenarios.
    - Rating: \_\_\_\_
  6. The graduate adapts quickly to emerging AI trends and technologies.
    - Rating: \_\_\_\_
  7. The graduate communicates complex AI concepts effectively to both technical and non-technical team members.
    - Rating: \_\_\_\_
  8. The graduate demonstrates professionalism and a strong work ethic.
    - Rating: \_\_\_\_

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**Open-ended Questions:**

1. Please provide specific strengths you've observed in our Applied AI program graduate(s).
  - Response: \_\_\_\_\_
2. Are there any areas of improvement you suggest for our Applied AI program based on your experience with our graduate(s)?
  - Response: \_\_\_\_\_
3. Would you be interested in continuing to hire graduates from our Applied AI program in the future?
  - Response: Yes/No
4. Any additional comments or feedback:
  - Response: \_\_\_\_\_

---

Thank you for taking the time to complete this survey. Your feedback is invaluable to us.

## Sample Applied AI Program Assignment Rubric

Criteria	Excellent (5)	Good (4)	Satisfactory (3)	Needs Improvement (1-2)
<b>Technical Accuracy</b>	Demonstrates comprehensive understanding and flawless application of AI concepts.	Few minor errors but shows a strong understanding of AI concepts.	Some significant errors but basic understanding is evident.	Numerous errors indicating a lack of understanding.
<b>Complexity and Depth</b>	Tackles a challenging problem with depth and sophistication.	Addresses a moderately challenging problem with some depth.	Takes on a basic problem without much depth.	Chooses a simplistic problem or lacks depth in addressing it.
<b>Creativity and Innovation</b>	Displays originality and innovative thinking in approach and solution.	Shows some creative thinking in parts of the project.	Mostly uses standard approaches without much creativity.	Lacks creativity; relies heavily on existing solutions.
<b>Ethical Considerations</b>	Thoroughly considers and addresses potential ethical implications of the AI.	Addresses some ethical implications but might miss a few.	Mentions ethical considerations but lacks depth.	Neglects or superficially addresses ethical considerations.
<b>Collaboration</b>	Collaborates effectively, contributes significantly, and facilitates teamwork.	Collaborates well with minor issues; overall good teamwork.	Collaborates, but there are noticeable teamwork issues.	Struggles with collaboration or does not contribute equally.
<b>Presentation &amp; Documentation</b>	Clear, comprehensive documentation and presentation of findings and methodologies.	Mostly clear documentation with minor areas lacking clarity.	Adequate documentation but with gaps or unclear sections.	Poorly documented or presented; lacks clarity and organization.

## Appendix E: Elective Course Descriptions

<b>Mathematical &amp; Statistical Foundations</b>			
<b>Course Number</b>	<b>Course Title</b>	<b># SCH</b>	<b>Course Type</b>
<b>BAS 320</b>	<b>Regression Modeling</b>	<b>3</b>	<b>Existing</b>
Simple linear regression and correlation analysis, time series analysis, multiple regression, variable selection, regression diagnostics, partial correlation, and categorical data analysis techniques. Use of statistical computing software. Applied course appropriate for a general audience.			
<b>BAS 471</b>	<b>Statistical Methods</b>	<b>3</b>	<b>Existing</b>
Numeric and graphic description of data, probability and probability distributions, simulation, and sampling distributions. Estimation and hypothesis testing for one and two samples, parametric and nonparametric approaches, bootstrapping, and randomization tests. Multiple linear regression review and further issues, diagnostics and validation, and analysis of count data. Data Screening. Use of SAS and other statistical software.			
<b>FWF 313</b>	<b>Measurements and Sampling</b>	<b>3</b>	<b>Existing</b>
Measurement techniques and sampling methods for vegetation. Estimation of animal populations. Map and aerial photo use.			
<b>IE 340</b>	<b>Design of Experiments</b>	<b>3</b>	<b>Existing</b>
Development and discussion of fundamental theory, concepts and procedures required for the efficient design and analysis of industrial experiments. Topics covered include the statistical approach, screening procedures for factor and interaction effects in one-factor and multiple-factor experiments with and without restrictions on randomization, two-level and mixed-level full and fractional factorial designs with and without blocks, response surface methodology, and Taguchi methods. Integrated treatment of these topics provides knowledge and skills for process and product improvement in engineering applications. Use of specialized software for experimental data analysis.			
<b>MATH 131</b>	<b>Calculus 1A Infused with Precalculus</b>	<b>3</b>	<b>Existing</b>
Single variable calculus, infused with precalculus, especially for students of science, engineering, mathematics, and computer science. Differential calculus with applications and relevant precalculus.			
<b>MATH 132</b>	<b>Calculus 1B Infused with Precalculus</b>	<b>3</b>	<b>Existing</b>
Continuation of MATH 131.			
<b>MATH 323</b>	<b>Probability and Statistics</b>	<b>3</b>	<b>Existing</b>
Discrete and continuous random variables. Conditional probability, expectation, moment generating functions. Law of large numbers. Central limit theorem. Elements of statistical inference, estimation, and hypothesis testing.			

<b>Machine Learning &amp; Data Mining</b>			
<b>BAS 474</b>	<b>Data Mining and Business Analytics</b>	<b>3</b>	<b>Existing</b>
Understanding and application of data mining methods. Data preparation, exploratory data analysis and visualization, cluster analysis, logistic regression, decision trees, neural networks, association rules, model assessment, and other topics. Applications to real world data. Use of standard computer packages.			
<b>COSC 422</b>	<b>Applied Machine Learning</b>	<b>3</b>	<b>Existing</b>
Will focus on understanding key machine learning (ML) concepts and an overview of ML techniques for practical applications. Introduces important ML approaches and learning methods in modeling and prediction of complex systems. Specific topics include issues with data acquisition and preprocessing, training, classification and prediction, modeling tools, and postprocessing and evaluation.			
<b>COSC 426</b>	<b>Intro to Data Mining &amp; Analytics</b>	<b>3</b>	<b>Existing</b>
Modern data science methods, tools of the trade, real-world data sets, and leveraging the power of high performance and cloud resources to extract insights from data. Upon completing the course, students will learn to create reproducible and explanatory data science workflows, to implement parallel clustering methods, to address imperfections in real-world datasets, and to extract insights from a high-dimensional dataset.			
<b>COSC 425</b>	<b>Introduction to Machine Learning</b>	<b>3</b>	<b>Existing</b>
Machine learning is concerned with computer programs that automatically improve their performance through experience. Covers the theory and practice of machine learning from a variety of perspectives. We cover topics such as learning decision trees, neural network learning, statistical learning methods, genetic algorithms, Bayesian learning methods, explanation-based learning, and reinforcement learning. Programming assignments include hands-on experiments with various learning algorithms.			
<b>Data Visualization &amp; Representation</b>			
<b>COSC 453</b>	<b>Data Visualization</b>	<b>3</b>	<b>Existing</b>
The goal of this course is to develop a broad understanding of the principles, methods, and techniques for designing effective data visualizations. The course will span a wide range of topics related to interactive data visualization. The course will teach key elements of scientific visualization techniques, which graphically encode data with some physical or geometric correspondence, and information visualization techniques, which focus on abstract data without such correspondences such as symbolic, tabular, networked, hierarchical, or textual information sources. The course will follow a lecture/seminar style with discussion of assigned readings, as well as viewing of videos and hands-on experience with creating visualization tools.			
<b>GEOG 311</b>	<b>Geovisualization and GIS</b>	<b>3</b>	<b>Existing</b>
Basic concepts and methods of geovisualization and geographic information science, including properties, sources, uses, design, and production of maps and basic spatial analysis functions.			
<b>IARC 321</b>	<b>Advanced Representation</b>	<b>3</b>	<b>Existing</b>
Advanced digital workflow for building information management software as applicable to creative and professional development for interior architecture.			
<b>INDS 321</b>	<b>Digital Representation and Fabrication for Industrial Design</b>	<b>3</b>	<b>Existing</b>
Exploration of basic computer-aided design programs in the representation of three dimensions. The use of digital fabrication machines such as 3D printer, and CNC computer numerical control mill.			

<b>INSC 489</b>	<b>Information Visualization</b>	<b>3</b>	<b>Existing</b>
This course offers basic principles and techniques in data analytics; methods for the collection of, storing, accessing, and manipulating standard-size and large datasets. Data visualization is the visual representation of data in the form of visuals, such as charts, maps, graphs, and diagrams. This course introduces the fundamental principles that inform data visualization: creative processes, cognitive thinking and semiotics.			
<b>Databases, Data Engineering &amp; Programming</b>			
<b>ARCH 321</b>	<b>Representation IV: Information Modeling</b>	<b>3</b>	<b>Existing</b>
Exploration of advanced information modeling programs. Emphasis is placed on learning how the digital model can assist in the design process through the representation of construction and analysis. Content includes the use of building information modeling to predict building performance and to document material properties.			
<b>BAS 476</b>	<b>Data Engineering and Visualization</b>	<b>3</b>	<b>Existing</b>
Fundamentals of programming using Python with particular focus on data preparation, visualization, and data understanding. Topics include but are not limited to reading data, object-oriented programming, loops, conditional processing, aggregating, merging, and dynamic visualization. Experience gained in producing repeatable data products in Python that automatically ingest, process, and display data in interactive plots			
<b>COSC 111</b>	<b>Computational Thinking and the Art of Programming</b>	<b>3</b>	<b>Existing</b>
An introduction to the thought processes of computer science and the art of programming. Topics include learning to think algorithmically, and solve problems efficiently, using a high-level programming language and a variety of software tools and technologies. Skills learned include designing programs to solve problems, developing the algorithms needed, using abstractions, data structures and encapsulation, writing code to implement algorithms, testing the code for errors, and documenting the process and the outcome. This course welcomes students with limited or no programming experience.			
<b>COSC 465</b>	<b>Databases and Scripting Languages</b>	<b>3</b>	<b>Existing</b>
Introduction to database theory, models, and query formation. Survey of scripting languages, their uses, and their interconnectivity with databases.			
<b>DATA 201</b>	<b>Data Knowledge and Discovery</b>	<b>3</b>	<b>Existing</b>
Introduction to the essential elements of data science through the examination of data sets drawn from a variety of fields. Explores data collection and management, exploration and visualization of data, modeling, computing, and ethical issues associated with data science. Introduces students to programming through hands-on activities.			
<b>DATA 202</b>	<b>Data Management and Visualization</b>	<b>3</b>	<b>Existing</b>
Introduction to foundational concepts and techniques in the management and presentation of data for effective data-informed decision making. Explores data storage and indexing strategies, data warehousing, metadata management, visualization of time-series and geospatial data, and best practices for presenting data to inform decision making, such as heat maps and infographics.			



<b>INSC 360</b>	<b>Programming for Info. Applications</b>	<b>3</b>	<b>Existing</b>
Programming languages with emphasis on data structures, in-built functions, user-defined variables, syntax and control structures for processing and visualizing datasets.			
<b>INSC 384</b>	<b>Database Design</b>	<b>3</b>	<b>Existing</b>
The course introduces the student to the process of database development, including data modeling, database design, and database implementation. Students learn basic interactive SQL for both data definition and queries. Students practice design skills by developing a small database projec			
<b>INSC 484</b>	<b>Database Applications</b>	<b>3</b>	<b>Existing</b>
Applying database models to develop applications using a database management system. Developing prototype client/server applications. Advanced Structured Query Language (SQL).			
<b>INSC 486</b>	<b>Data Analytics</b>	<b>3</b>	<b>Existing</b>
Visual, intuitive and interactive representation of information. Fundamental understanding of human perceptual and cognitive capabilities, computer graphics, user interface and creativity. Designs and techniques for visualizing various types of data.			
<b>Research, Ethics, &amp; Philosophical Foundations</b>			
<b>EEB 451</b>	<b>Research Ethics</b>	<b>3</b>	<b>Existing</b>
Ethics of scientific research with emphasis on biological sciences from genetic to ecological research. Ethics of intellectual property, allocation of resources for research, genetic engineering, research on marginalized and vulnerable populations, research on non-human animals, conservation biology, ecological fieldwork, and more.			
<b>GEOG 421</b>	<b>Maps, Society, Power</b>	<b>3</b>	<b>Existing</b>
Exploration of maps as historical and contemporary technologies of social power and resistance; wider political lives and place-making power of maps; ethical and social justice implications of cartography and geospatial analysis.			
<b>GEOG 425</b>	<b>Human Dimensions in GIScience</b>	<b>3</b>	<b>Existing</b>
The connections and interactions between GIS&T and society range in scale from institutions and business enterprises down to the individual level. This course covers fundamental drivers behind those interconnections (e.g., political, economic, legal, and cultural). Topics include how rapidly developing GI technology and infrastructures generate various forms of public GIS practice as part of citizen science, VGI and social media, and how these activities provoke questions and critiques around governance, democracy, diversity, and ethics.			
<b>INSC 305</b>	<b>Internet and Society</b>	<b>3</b>	<b>Existing</b>
This course covers the architecture, design, and regulation of the Internet, including topics of intellectual property, privacy, security, censorship, e-commerce, and other information policies, laws, and ethics as well as related research on the societal implications of the Internet.			
<b>PHIL 360</b>	<b>Philosophy of science</b>	<b>3</b>	<b>Existing</b>
An introduction to major problems in the philosophy of science. Specific issues vary but may include the nature of causality; the relationship between experiments, theories, and scientific practice; how theories change and how scientific disputes get settled; the role played by social organization in science (e.g., gender and race issues); and others. Writing-emphasis course.			
<b>PHIL 371</b>	<b>Epistemology</b>	<b>3</b>	<b>Existing</b>
An introduction to central debates in the theory of knowledge and rational belief.			

<b>Social Sciences &amp; Humanities</b>			
<b>SOCI 419</b>	<b>Sociology and Science Fiction</b>	<b>3</b>	<b>Existing</b>
Examines how science fiction relates to social problems and issues. Will examine film and texts through the lenses of social theory			
<b>SOCI 446</b>	<b>The Modern World System</b>	<b>3</b>	<b>Existing</b>
Critical examination of the capitalist world-system as a social system, its coherence, boundaries, regions, member groups, cleavages, and patterns of conflict. Analysis of who gets what, why, and how in the global political economy. Writing-emphasis course.			
<b>SOCI 465</b>	<b>Social Values and the Environment</b>	<b>3</b>	<b>Existing</b>
Human dimensions of ecosystem management and public policy. An applied focus on how social values are activated within specific biophysical and social settings. Writing-emphasis course.			
<b>POLS 240</b>	<b>Introduction to Public Administration and Public Policy</b>	<b>3</b>	<b>Existing</b>
Public agencies, their organization, personnel, financial management, and administrative responsibility. The policy-making process and political environment.			
<b>POLS 461</b>	<b>Comparative Public Policy</b>	<b>3</b>	<b>Existing</b>
Discusses differences in the public policies of the industrialized democracies and the causes of those differences. Examples include health care, immigration, taxation, the welfare state, fiscal policy and environmental policy. Writing-emphasis course.			
<b>Applied AI in Specialized Domains</b>			
<b>AI 311</b>	<b>AI for Cybersecurity</b>	<b>3</b>	<b>New</b>
<b>BCMB 422</b>	<b>Computational Biology &amp; Bioinformatics</b>	<b>3</b>	<b>Existing</b>
An introduction to the cutting-edge tools and approaches biologists and clinicians use to extract information from the vast amounts of genomic and proteomic data becoming available. Students gain hands-on experience with computational biology tools such as data mining, protein structure manipulation and prediction, interaction network analysis, DNA sequence analysis, gene function analysis, R studio for statistics and data visualization, and dimensionality reduction for large datasets. Students apply these tools to biomedical research questions in course projects.			
<b>CLAS/ANTH 446</b>	<b>Archaeological Statistics</b>	<b>3</b>	<b>Existing</b>
Introduction to quantitative methods within the field of archaeology. Case studies are used to introduce students to basic statistical and computational concepts germane to archaeological problems and questions, involving active learning and problem solving. Topics include logic, probability, sampling, exploratory data analysis, modeling, inference, introductory linear algebra, and introductory multivariate statistics. Students will be trained in R as a programming language.			
<b>COSC 445</b>	<b>Fundamentals Digital Archeology</b>	<b>3</b>	<b>Existing</b>
This is an advanced topic course focused on developing multi-disciplinary skills of discovering, retrieving, analyzing, and presenting operational data. Students will use critical thinking and intense practice solving real-world problems to recognize and address key operational issues: the lack of context, missing observations, and incorrect values. At the end of the course students will be able to discover operational data, to retrieve and store it, to recover context, to estimate the impact of missing events, to identify unreliable or incorrect values, and to present the results.			
<b>EEB 411</b>	<b>Biostatistics</b>	<b>3</b>	<b>Existing</b>

Experimental design and hypothesis testing for ecology and evolutionary biology research. Parameter estimation, general linear models, generalized linear models, maximum likelihood, and permutation approaches, and their application to problems in ecology and evolutionary biology.			
<b>FWF 430</b>	<b>Introduction to GIS for Natural Resources</b>	<b>3</b>	<b>Existing</b>
Introductory course in geographic information systems (GIS), with applications in natural resources. This course emphasizes creating detailed, professional grade maps, but also includes the basics of the theory, data collection, and analyses associated with GIS.			
<b>GEOG 414</b>	<b>Spatial Data Management</b>	<b>3</b>	<b>Existing</b>
Types, sources, acquisition, and documentation of spatial data. Spatial database management methods and strategies for data sharing.			
<b>IE 301</b>	<b>Operations Research I: Deterministic Methods</b>	<b>3</b>	<b>Existing</b>
Integrated system modeling concepts. Linear mathematical programming models including modeling, the simplex procedure, sensitivity analysis, dual theory, transportation, transshipment, and assignment problems, and integer linear programming.			
<b>IE 310</b>	<b>Operations Research II: Probabilistic Methods</b>	<b>3</b>	<b>Existing</b>
Probabilistic Models, including decision makings under uncertainty, inventory models, Markov Chains, and queuing theory.			
<b>IE 465</b>	<b>Applied Data Science</b>	<b>3</b>	<b>Existing</b>
An introduction to applied data science including machine learning and data mining tools. Topics include supervised and unsupervised algorithms, techniques for improving model performance, evaluation techniques and software packages for implementation. Emphasis will be put on real-world applications in various domains including healthcare, transportation systems, etc.			

*Source: 2023-24 UTK Undergraduate Catalog*

## Appendix F: Faculty Curricula Vitae

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Xiaopeng Zhao, Ph.D.

Interim Program Director, College of Emerging and Collaborative Studies, University of Tennessee, Knoxville  
Phone: (865) 974-7682 (O), (865) 258-8857 (C)  
Email: xzhao9@utk.edu

### **Educational History**

<b>Ph.D.</b> , Engineering Science and Mechanics Virginia Tech, Blacksburg, VA	August 2004
<b>M.S.</b> , Engineering Mechanics Tsinghua University, Beijing, China	June 1999
<b>B.S.</b> , Engineering Mechanics Tsinghua University, Beijing, China	June 1996

### **Professional Experience**

2023-present	Interim Program Director, College of Emerging and Collaborative Studies, University of Tennessee, Knoxville
2022-present	Joint Faculty Professor, Bredesen Center, University of Tennessee, Knoxville
2019-present	Professor, Department of Mechanical, Aerospace and Biomedical Engineering University of Tennessee, Knoxville
2019-2020	Faculty Fellow for Strategic Research Initiatives, University of Tennessee
2019-2022	Co-Founder, Rocky Top Chess, Inc. Secretary (2019-2020), President (2020-2021), Past President (2021-2022)
2016-2020	Advisory Board, T&T Scientific Inc.
2016-2017	Visiting Scientist, Institute for Medical Engineering and Science, Massachusetts Institute of Technology
2015-2017	Scientific Advisor on Intelligent Patient Monitoring, Zhejiang Medzone Medical Equipment Co., Ltd.
2014-2019	Adjunct Associate Professor, Department of Mathematics, University of Tennessee, Knoxville
2013-2019	Associate Professor, Department of Mechanical, Aerospace and Biomedical Engineering, University of Tennessee, Knoxville
2013-2016	Core Faculty, Institute of Biomedical Engineering, University of Tennessee, Knoxville
2012-2020	Senior Personnel, National Institute for Mathematical and Biological Synthesis University of Tennessee, Knoxville
2011-2012	Visiting Scientist, Wyss Institute for Biologically Inspired Engineering Harvard University
2007-2013	Assistant Professor, Department of Mechanical Engineering, Aerospace and Biomedical Engineering, University of Tennessee, Knoxville
2005-2007	Research Associate, Department of Biomedical Engineering, Duke University
2004-2005	Research Associate, Department of Engineering Science and Mechanics, Virginia Tech

### **Selected Publications**

I have published more than 150 peer-reviewed journal and conference articles

1. Liao, Yo-Jen; Jao, Ying-Ling; Boltz, Marie; Adekeye, Olayemi; Berish, Diane; Yuan, Fengpei; Zhao, Xiaopeng, Use of a Humanoid Robot in Supporting Dementia Care: A Qualitative Analysis, SAGE Open Nursing, 2023
2. Fengpei Yuan, Marie Boltz, Dania Bilal, Ying-Ling Jao, Monica Crane, Joshua Duzan, Abdurhman Bahour, Xiaopeng Zhao, Cognitive Exercise for Persons with Alzheimer's Disease and Related Dementia Using a Social Robot, IEEE Transactions on Robotics (T-RO), 2023

3. Fengpei Yuan, Wenjun Zhou, Hiroko Dodge, Xiaopeng Zhao, Causal Structural Learning of Conversational Engagement for Socially Isolated Older Adults, *Journal of Smart Health*, 2023
4. Min Xiong, Kai Sun, Xiaowen Su, Alena Talkachova, Xiaopeng Zhao, Dynamics study of constant diastolic interval and constant TR control for cardiac alternans based on a two-dimensional cellular automata model, *Nonlinear Dynamics*, 2022
5. Ziming Liu, Jordan Grant, Skylar Simpson, Asad Khattak, Joel Anderson, and Xiaopeng Zhao, Driving Ability Evaluation and Rehabilitation for People with Alzheimer's Disease and Related Dementia, *Alzheimer Disease & Associated Disorders*, 36 (4), 374-381, 2022
6. Fengpei Yuan, Amir Sadovnik, Ran Zhang, Devin Casenhiser, Eun Jin Paek and Xiaopeng Zhao, A simulated experiment to explore robotic dialogue strategies for people with dementia, *Journal of Rehabilitation and Assistive Technologies Engineering (RATE)*, volume 9, 2022
7. Yang Jiang, William Jessee, Stevie Hoyn, Soheil Borhani, Ziming Liu, Xiaopeng Zhao, Lacey K Price, Walter High, Jerry Suhl, & Sylvia Cerel-Suhl, Sharpening Working Memory with Real-time Electrophysiological Brain Signals: Which Neurofeedback Paradigms Work? *Frontiers in Psychology*, 2022
8. Liu, Z., D., Paek, E.J., Yoon, S.O., Casenhiser, D., Zhou, W., and Zhao, X., Detecting Alzheimer's Disease Using Natural Language Processing of Referential Communication Task Transcripts, *Journal of Alzheimer's Disease*, 2022
9. Andrea Vranic, Yang Jiang and Xiaopeng Zhao, Editorial: Individual Differences in Cognition and Affects in the Era of Pandemic and Machine Learning, *Frontiers in Psychology Cognition*, 2022
10. Fengpei Yuan, Joel Anderson, Tami Wyatt, Ruth Lopez, Monica Crane, Austin Montgomery, Xiaopeng Zhao, Assessing the Acceptability of a Humanoid Robot for Alzheimer's Disease and Related Dementia Care Using an Online Survey, *International Journal of Social Robotics*, 2022

### **Selected Research Grants**

Source: NIH-NIA, 1R21AG082210

The predicative values of vascular and metabolic disorders for risk of incident mild cognitive impairment and dementia

PI: Longjian Liu

Duration: 06/01/2023-05/31/2025

Source: AI TENNessee Initiative

Social Machines and AI Robotics Technology (SMART)

PI: Xiaopeng Zhao

Duration: May 2023-May 2025

Source: Office of Naval Research

Title: STEM Education and Apprenticeship Liaison (SEAL) for Navy

PIs: Ozlem Kilic, Bruce LaMattina, Xiaopeng Zhao, John Schmisser

Duration: 4/1/2022-03/31/2025

Source: HHS - NIH - NIA - National Institute on Aging, R01AG077003

Title: SCH: Robotic Caregiver to Comprehend, Assist, Relieve, and Evaluate for Patients with Alzheimer's Disease (Robotic CARE for AD)

PIs: Xiaopeng Zhao, Hairong Qi, Joel Anderson, Ruth Lopez

Duration: 2/1/2022-1/31/2026

Source: US - VA - Lexington VA Health Care System

Title: Tuning up memory-related brain potentials using real-time neurofeedback in older veterans

PIs: Yang Jiang and Xiaopeng Zhao

Duration: 6/1/2019 – 10/31/2022

**Professional Services**

- University of Tennessee AI in Education Taskforce, Spring 2023
- Tennessee Dementia Action Collaborative (TDAC), Tennessee Department of Health Data Evaluation, and Surveillance Workgroup, Chair
- Steering Committee, Cherokee Health Systems (CHS) and University of Tennessee (UT) Partnership, Fall 2022-
- Associate Editor, Journal of Alzheimer’s Disease, 2023-
- Associate Editor, Smart Health Journal, 2022-
- Associate Editor, Frontiers in Rehabilitation Science, 2022-
- Task Group on “Creative Living and Aging through Cross-disciplinary Utilization of Data and Knowledge”, Committee on Data (CODATA) of the International Science Council (ISC), 2021
- Brain-Computer Interface Society, Early Career Award Committee, 2020
- Organizing Committee and Publicity Chair, the 14th International Conference on Social Robotics, Florence Italy, December 13-16, 2022
- Technical Program Committee of the IEEE/ACM Conference on Connected Health Applications, Systems, and Engineering Technologies (CHASE), November 17-20, 2022
- Organizing Committee and Chair of the Emerging Technologies Session, 2022 Southeastern Neurodegenerative Disease Conference (SENDCon).
- General Chair, Emerging Technologies for Aging and Dementia, Hybrid Research Symposium, June 8-9, 2022, Knoxville, TN
- Organizing Committee, the 13th International Conference on Social Robotics, Singapore, November 10-13, 2021
- Chair, Biomedical and Rehabilitation Systems, 2020 Dynamic Systems and Control Conference
- Chair, Neurocomputation workshop for the Interdisciplinary Graduate Minor in Neuroscience, Knoxville, TN, August 6-13, 2018
- Growing Access in Mathematics, Engineering, and Science (GAMES), Chair, 2018- GAMES is an outreach program to expose K-12 girls and their parents to STEM education and research. GAMES sponsors the 2019 Tennessee All-girls Chess Championship on March 30, 2019
- UTK Brain Computer Interface Community of Scholars, Faculty Lead, 2018-2019
- 

**Selected Honors and Awards**

- Best Paper Finalist and Honorable Mention, The International Society of Service Innovation Professionals Human-Side of Service Engineering Conference, 2023
- Charles E. Ferris Faculty Award, University of Tennessee, 2023
- B. Ray Thompson Endowed Excellence in Research Award, University of Tennessee, 2023
- Official Nominator of the VinFuture Prize, 2023
- Global Catalyst Award, University of Tennessee, 2023
- Best Paper Award, The International Society of Service Innovation Professionals Human-Side of Service Engineering Conference, 2022
- Faculty Research Assistants Funding Award, University of Tennessee, 2022
- Faculty Fellow for Expanding Horizons, University of Tennessee, 2022
- Global Catalyst Award, University of Tennessee, 2022
- Healthy Longevity Global Competition Finalist, National Academy of Medicine, 2021
- Best Paper Finalist, International Conference on Social Robotics, 2021
- Game Changer Academies Panel Fellow, NSF CMMI, 2021
- Center for Transportation Research Fellow, University of Tennessee, 2020
- Healthy Longevity Global Competition Finalist, National Academy of Medicine, 2020

## Ozlem Kilic, D.Sc., Fellow ACES

Interim Vice Provost for Academic Affairs, and  
Dean, College of Emerging and Collaborative Studies

513 Andy Holt Tower  
Knoxville, TN 37996-0152  
University of Tennessee, Knoxville

### Professional Preparation

Bogazici University Istanbul, Turkey Electrical Engineering BS 1989  
The George Washington University Washington, DC Electrical Engineering MS 1991  
The George Washington University Washington, DC Electrical Engineering D.Sc. 1996

### Appointments

- 2023-Present Dean, University of Tennessee, Knoxville, College of Emerging and Collaborative Studies
- 2022-Present Interim Vice Provost for Academic Affairs, University of Tennessee, Knoxville
- 2019-2022 Associate Dean, University of Tennessee, Knoxville, Tickle College of Engineering
- 2018-2019 Associate Dean, Catholic University of America, Washington, DC, School of Engineering
- 2011-2018 Chair, Dept. EECS, The Catholic University of America
- 2017-2019 Professor, Dept. EECS, The Catholic University of America
- 2010-2017 Associate Professor, Dept. EECS, The Catholic University of America
- 2005-2010 Assistant Professor, Dept. EECS, The Catholic University of America
- 2002-2005 Electronics Engineer, U.S. Army Research Laboratory, Adelphi, MD
- 1996-2002 Program Manager and Senior Engineer, Lockheed Martin Global Telecommunications, Clarksburg, MD

### Research Interests

antennas, wave propagation, satellite communications systems, microwave remote sensing, computational electromagnetics, high performance computing for electromagnetics and large problems, hardware acceleration, human vital sign detection with rf, wave propagation, radiation and scattering in random media, detection and tracking, compressive sensing implementation of em problems.

### Selected Publications

- Fathy, A.E. and Kilic, O., 2022. Overview of Advanced Antennas Concepts for 5G. In Printed Antennas for 5G Networks (pp. 255-310). Cham: Springer International Publishing.
- T. K. V. Dai, Y. Yu, P. Theilmann, A. E. Fathy and O. Kilic, "Remote Vital Sign Monitoring With Reduced Random Body Swaying Motion Using Heartbeat Template and Wavelet Transform Based on Constellation Diagrams," in IEEE Journal of



Electromagnetics, RF and Microwaves in Medicine and Biology, vol. 6, no. 3, pp. 429-436, Sept. 2022, doi: 10.1109/JERM.2022.3140900.

- F. Tamjid, T. Kvelashvili, O. Kilic and A. E. Fathy, "A Novel Miniaturized 100:1 Broadband Balun with a 4:1 Impedance Ratio," 2022 IEEE Radio and Wireless Symposium (RWS), Las Vegas, NV, USA, 2022, pp. 19-22, doi: 10.1109/RWS53089.2022.9719934.
- F. Tamjid, T. Kvelashvili, O. Kilic and A. E. Fathy, "A Novel Miniaturized 100:1 Broadband Balun with a 4:1 Impedance Ratio," 2022 IEEE Radio and Wireless Symposium (RWS), Las Vegas, NV, USA, 2022, pp. 19-22, doi: 10.1109/RWS53089.2022.9719934.
- F. Tamjid, T. Kvelashvili, O. Kilic and A. E. Fathy, "A Novel Miniaturized 100:1 Broadband Balun with a 4:1 Impedance Ratio," 2022 IEEE Radio and Wireless Symposium (RWS), Las Vegas, NV, USA, 2022, pp. 19-22, doi: 10.1109/RWS53089.2022.9719934.
- T. Vo Dai, O. Kilic, H. Liu, "Improved Cell Search for mmWave Cellular Networks using Deterministic Scanning Algorithm with Directional Array Antenna," Electronics Journal Special
- Issue on "Smart Antennas and MIMO Communications," Electronics 2017, 6, 42,
- T. V. Dai, O. Kilic, "Compact Rotman Lens Structure Configurations to Support Millimeter Wave Devices," Progress in Electromagnetics Research (PIER-B), Vol. 71, page 91-106, 2016.
- T. V. Dai, T. Nguyen, and O. Kilic, "A Conformal Microstrip Rotman Lens Design," ACES Express, vol. 1, No. 7, pp. 205-208, 2016.
- A. Zaghoul and O. Kilic "Hybrid Beam Former for Distributed-Aperture Electronically Steered Antennas," IEEE Antennas and Wireless Propagation Letters (AWPL), V. 9, pp. 678-681, 2010.
- Q. Nguyen, V. Dang, O. Kilic, E. El-Araby, "Parallelizing Fast Multipole Method for Large-Scale Electromagnetic Problems using GPU Clusters," IEEE AWPL, vol. 12, June 2013.
- V. Dang and O. Kilic, "A Simple Method for Calculating the Output Voltage at Receive Antenna Terminals using the Complex Antenna Factor," IEEE Antennas and Wireless Propagation Letters (AWPL), DOI 10.1109/LAWP.2016.2601929, vol. PP, Issue 99, 2016.
- L. Ren, H. Wang, K. Naishadham, O. Kilic, A. E. Fathy, "Phase Based Methods for Heartbeat Detection using UWB Impulse Doppler Radar," IEEE Trans. on Microwave Theory and Techniques, Vol. PP, Issue: 99, pp. 1-13, DOI: 10.1109/TMTT.2016.2597824, 2016.
- Q. Nguyen, V. Dang and O. Kilic, "An Alternative Plane Wave Decomposition of
- Electromagnetic Fields using Spherical Wave Expansion Technique ", IEEE Antennas and Wireless Propagation Letters (AWPL), Vol. PP, Issue: 99, DOI: 10.1109/LAWP.2016.2562182, 2016
- A. Zaghoul and O. Kilic "Distributed Beam Former for Conformal and Distributed-Aperture Electronically Steered Antennas," IEEE Antennas and Wireless Prop. Letters, Vol. 9, pp. 678-681, June 2010.

## Selected Professional Activities

- Director of Engineering Center for Care of Earth (ECCE)
- Founding Editor-in-Chief, ACES Express Journal, January 2016 - present
- Associate Editor, IEEE Transactions on Antennas and Propagation, August 2016 - present
- Associate Editor, IEEE Antenna and Propagation Magazine, 2013 - 2015
- Technical Program Chair, IEEE Antennas and Propagation Society's (AP-S), 2005
- Internationally recognized, and elected for numerous leadership positions in professional organizations such as:
- International Union of Radio Scientists (URSI): Chair of United States National Commission A, Vice Chair of United States National Commission A, Member of Commissions A, B, C.
- The National Academies United States National Committee (USNC) for the International Union of Radio Science (URSI), elected Member-at-Large, and ex-Officio Member for USA.
- IEEE Antennas and Propagation Society: Administrative Committee member (by international elections), Constitutions and Bylaws Chair, Education Committee Member, Student Design Competition Founding Chair. (This is the largest international organization for Electrical Engineers, and AP-S is the largest society for Antennas and Propagation)
- Applied Computational Electromagnetic Society (ACES): Fellow, Founding Editor-in-Chief of ACES Express Journal, Member of Board of Directors (elected by international elections), Membership and Publicity Chair.
- Chair for URSI Commission A
- Member of IEEE Antennas and Propagation Society (AP-S) AdCOM
- Member of Board of Directors for Applied Computational Electromagnetics Society (ACES).
- Chair of the International Conference on Climate Change and Impacts, 2019, Washington, DC
- Board Member for Student Global Ambassadors Program Editor roles in multiple societies such as Editor-in-Chief for Applied Computational Electromagnetics Society, and Associate Editor: IEEE Transactions on Antennas and Propagation
- Service in numerous international professional societies such as IEEE Antennas and Propagation Society (AP-S) as an elected AdCom Member and Member of Education Committee, Chair of the Antenna Design Contest; Applied Computational Electromagnetics Society (ACES) elected member of Board of Directors (2009-2012); and US National Committee of the International

## Selected Awards and Recognitions

- Recipient of ACES Outstanding Service Award, Applied Computational
- Electromagnetic Society (ACES), 2017
- Elected as Fellow, Applied Computational Electromagnetic Society (ACES), 2016

**R. ALEXANDER BENTLEY**

Interim Associate Dean, College of Emerging and Collaborative Studies,  
University of Tennessee  
rabentley@utk.edu

**Professional Preparation**

Bowdoin College	Brunswick, ME	Physics	B.A.	1992
Cornell University	Ithaca, NY	Archaeology	M.A.	1996
Cornell University	Ithaca, NY	Geology	M.S.	1997
University of Wisconsin	Madison, WI	Anthropology	Ph.D.	2001

**Appointments (UTK: University of Tennessee, Knoxville)**

2023-present	Interim Associate Dean, College of Emerging and Collaborative Studies, UTK
2023-present	Student Success Advisory Council, Division of Student Success, UTK
2017-present	Professor, Dept. of Anthropology, UTK
2017-2020	Department Head, Dept. of Anthropology, UTK
2015-2017	Professor, Dept. of Comparative Cultural Studies, University of Houston
2016-2017	Research Associate, Hobby School of Public Affairs, University of Houston
2014-present	External faculty, Northwestern Institute on Complex Systems, Evanston, IL
2007-2016	Affiliate Graduate Faculty, Anthropology Department, University of Hawai'i
2011-2015	Full Professor, Dept. of Archaeology and Anthropology, Bristol University, U.K.
2012-2014	Chair of the Dept. of Archaeology and Anthropology, Bristol University, U.K.
2011	Deputy Director, Leverhulme 'Tipping Points' Project, Durham University, U.K.
2008-2011	Reader in Anthropology (full-time, tenured), Durham University, U.K.
2005-2008	Lecturer in Anthropology (full-time), Durham University, U.K.
2002-2005	Postdoctoral fellow, Institute of Archaeology, University College London, U.K.

**University of Tennessee undergraduate teaching**

- **Data Knowledge and Discovery** (DATA 201) Spring 2022, Fall 2023, Spring 2024.
- **Data Science Capstone** (DATA 499), Fall 2023.
- **Introduction to Archaeology** (ANTH 120 & ANTH 127) Spring 2021, Fall 2022
- **Big Data Social Sciences** (ANTH 449/603) Spring 2018, Spring 2019, Spring 2020.
- **Archaeology of Europe** (ANTH 469): Spring 2023
- **Archaeology of Asia** (ANTH 469): Spring 2022.
- **Statistics in Anthropology** (ANTH 504) Fall 2020.
- **Biology and Society** (ANTH 303) Fall 2020, Fall 2021.
- **Behavioral Neuroscience** (INPG 400) Fall 2018.

**Publications related to proposed program (e.g., data science, computational social science)**

- Horne, B.D., N.M. Rice, C.A. Luther, D.J. Ruck, J. Borycz, S.L. Allard, M. Fitzgerald, O. Manaev, B.C. Prins, M. Taylor, **R.A. Bentley** (2023) Generational effects of culture and digital media in former Soviet Republics. *Humanit Soc Sci Commun* 10: 172.
- **Bentley, R.A.**, J. Borycz, B.D. Horne (2023) Climate complacency reflects cultural values of nations. *Current Research in Ecological and Social Psychology* 5: 100137
- **Bentley R.A.**, B.D. Horne, J. Borycz, S. Carrignon, G. Shteynberg, B.Vidiella, S. Valverde, M.J. O'Brien (2023) Cultural evolution, disinformation, and social division. *Adaptive Behavior*, in press.
- Duran-Nebreda, S., M.J. O'Brien, **R.A. Bentley**, S. Valverde (2022) Dilution of expertise in the rise and fall of collective innovation. *Humanities and Social Science Communications* 9: 365.
- Vidiella B., S. Carrignon, **R.A. Bentley**, M.J. O'Brien and S. Valverde (2022). A cultural evolutionary theory that explains both gradual and punctuated change. *J. Roy. Soc. Interface* 19: 20220570.
- Borycz, J.D., B.D. Horne, R.A. Bentley (2022) Forking paths of cultural complexity: A case study of research paradigms. *Advances in Complex Systems*. DOI: 10.1142/S0219525922400045
- **Bentley R.A.**, J. Borycz, S. Carrignon, D.J. Ruck, M.J. O'Brien (2022). Machine learning for rediscovering revolutionary ideas of the past. *Adaptive Behavior* 30(3): 279–286.
- Houle, C., D.J. Ruck, R.A. Bentley, S. Gavrillets (2022). Inequality between identity groups and social unrest. *Journal of the Royal Society Interface* 19: 20210725.
- Pritchard, A., M. Silk, S. Carrignon, R.A. Bentley, N. Fefferman (2022). Balancing timeliness of reporting with increasing testing probability for epidemic data. *Infect. Dis. Model.* 7: 106-116.
- Rice, N.M., B.D. Horne, C.A. Luther, J.D. Borycz, S.L. Allard, D.J. Ruck, M. Fitzgerald, O. Manaev, B.C. Prins, M. Taylor, **R.A. Bentley** (2022). Monitoring event-driven dynamics on Twitter: a case study in Belarus. *Springer Nature Social Sciences* 2: Article 36.
- Carrignon, S., R.A. Bentley, M.J. Silk, N.H Fefferman (2022). How social learning shapes the efficacy of preventative health behaviors in an outbreak. *PLOS ONE* 17(1): e026505.
- **Bentley, R.A.**, S. Carrignon, D.J. Ruck, S. Valverde, M.J. O'Brien (2021). Neutral models are a tool, not a syndrome. *Nature Human Behaviour* 5(7): 807-808.
- Clark J., **R.A. Bentley**, V. Maroulas, N. Nagle (2022). Expectations and disciplinary blends. In (Short, P., et al., eds.). *Age of Inference: Cultivating a Scientific Mindset*. Information Age Pub.
- Ruck, D. J., **R.A. Bentley**, J. Borycz (2021). Early warning of vulnerable counties in a pandemic using socio-economic variables. *Economics & Human Biology* 41: 100988
- Ruck, D J., J. Borycz, **R.A. Bentley** (2021). Cultural values predict national COVID-19 death rates. *Springer Nature Social Sciences* 1(3), article 74.
- **Bentley, R.A.**, D.J. Ruck & H.N. Fouts (2020). U.S. obesity as delayed effect of excess sugar. *Economics and Human Biology* 36: article 100818.
- Ruck, D.J., **R.A. Bentley** and D.J. Lawson (2018). Religious change preceded economic change in the 20th century. *Science Advances* 4(7): eaar8680.
- Carrignon, S., **R.A. Bentley**, D.J. Ruck (2019). Modelling rapid online cultural transmission. *Palgrave Communications* 5, article 83.
- **Bentley, R.A.**, W.A. Brock, C.C.S. Caiado and M.J. O'Brien (2016). Evaluating reproductive decisions as discrete choices under social influence. *Phil. Transactions of the Royal Society B* 371: 20150154.
- **Bentley, R.A.**, Acerbi, A., V. Lampos, P. Ormerod (2014). Books average previous decade of economic misery. *PLoS ONE* 9(1): e83147.
- **Bentley, R.A.**, M.J. O'Brien, W.A. Brock (2014). Mapping collective behavior in the big-data era. *Behavioral & Brain Sciences* 37: 63-119.

**Books related to the proposed program**

1. **Bentley, R.A.** & M.J. O'Brien (2017). *The Acceleration of Cultural Change*. MIT Press.
2. O'Brien, M.J., **R.A. Bentley**, W.A. Brock (2019). *The Importance of Small Decisions*. MIT Press.
3. **Bentley, R.A.**, M.J. O'Brien, M. Earls (2011). *I'll Have What She's Having: Mapping Social Behavior*. M.I.T. Press

**Relevant awards and synergistic activities**

- Teaching award for "Big Data Anthropology" (2019) and College of Arts & Sciences Interdisciplinary research award (2019).
- Marketing science consultant in the UK (2008-2014) on projects for UK Department of Health, Unilever, Sony Europe, Gates Foundation, Sanofi Pasteur and other companies.
- Committee member for development of UTK's Data Science minor, and creator and instructor of record for its core course, "Data Science and Discovery" (DS 201).
- In 2010 was Deputy Director of the £1.75M Leverhulme 'Tipping Points' Project, Durham University, which brought together scientists, mathematicians, social scientists and humanities faculty to study a world of complexity and abrupt change.
- co-I on **\$1.6M** MINERVA (Department of Defense, 2019), "Russian disinformation campaigns in three former Soviet republics." (M. Taylor, P.I.).

**Grants – Externally funded**

- 2020 \$199K NSF (#2028710) "Modeling coupled social and epidemiological networks that determine the success of behavioral interventions on limiting COVID-19 spread" (co-P.I. w/ N. Fefferman).
- 2019 \$1.2M (MINERVA, Department of Defense), "Monitoring the Content and Measuring the Effectiveness of Russian Disinformation and Propaganda Campaigns in Selected Former Soviet Union States." (co-I, with M. Taylor, P.I., S., Allard, C. Luther, B. Prins co-Is)
- 2019 \$30,000 NSF "SUMMIT-P: Data Science" (co-I, with J. Clark, P.I., V. Maroulas, N. Nagle)
- 2018 \$335,000 NSF (# 1648630) "Acquisition of a TIMS for Expanding Applications at the University of Houston" (co-PI, with P.I. A. Brandon)
- 2014 £15,000 GW4 "Collective Human-Information Interaction" (w/ A Preece, P Johnson, R Maull)
- 2014 £34,965 – AHRC (REACT scheme): "Bristol Remembered Interactively So That Others Learn."
- 2013 £45,010 NERC LSMSF (w/ C. Jarman) "Untangling Viking Age identities through combined isotope analyses."
- 2012 £187,903 – Royal Society "Cultural evolution online: new models for a new era."
- 2012 €209,033 – (ERC FP7-PEOPLE-301460) "Movement and Migration in Irish Prehistory."
- 2009 £1,674,345 – Leverhulme Trust (Award # F/00128/BF; Co-PI with PI S. Lane.): "Tipping Points in economic and environmental systems."
- 2009 €10,000 ESF/COST conference grant: "Anthropology and physics: prospects & challenges." (with Paul Ormerod & Peter Richmond)
- 2008 £199,848 – AHRC Early Career Research Grant (PI, project reference AH/F009275/1): "Social diversity and the origins of complex society at Ban Non Wat, Thailand".
- 2008 £610,127 – AHRC (Co-I with PI A.W.R. Whittle, D.G. Pearson & R.E.M. Hedges, project reference AH/F018126/1) "The first farmers of Central Europe - diversity in LBK lifeways"
- 2006 £375,000 for three RCUK fellowships – (co-I with R. Barton, K. Dobney)
- 2005 £1,350,000 – AHRC Centre for the Evolution of Cultural Diversity (Co-I, AH/F111956/1)

**Vandana Singh Avasty**

Interim Program Director

College of Emerging and Collaborate Studies

Professor

School of Information Sciences

University of Tennessee Knoxville

Email: [vandana@utk.edu](mailto:vandana@utk.edu) Website: <https://sis.utk.edu/vandana>**EDUCATION**

B.Sc.	G.B. Pant University, Pantnagar, India	Economics,	1998
M.S.	Wageningen University, the Netherlands,	Knowledge Management Systems,	2001
M.S.	University of Chicago	Computer Science,	2006
Ph.D.	University of Illinois at Urbana Champaign,	Library and Information Science,	2008

**AREAS OF INTEREST**

Human Computer Interaction, Computer Supported Cooperative Work, Open Source Software, Online Communities, Integrated Library Systems, Library & Information Sciences Education, User Experience, Usability, Gender and Information Technology

**WORK EXPERIENCE****College of Emerging and Collaborate Studies**

Interim Program Director July 2023 – current

**College of Communication, University of Tennessee, Knoxville**

Director of Diversity, Equity, and Inclusion July 2022 – June 2023

**School of Information Sciences, University of Tennessee, Knoxville**

Professor	July 2022 – current
Associate Professor, 2022	August 2014 to July
SIS Director of Undergraduate Studies	May 2017 to April 2019
Assistant Professor,	Aug 2008 to July 2014
Acting Associate Director,	Jan 2013 to Aug 2013
Coordinator, Information Science and Technology Minor	Aug 2008 to July 2011

**School of Library and Information Science, University of North Texas**

Assistant Professor,	Aug 2007 to July 2008
Coordinator, Digital Imaging Track	Aug 2007 to July 2008

**University of Illinois at Urbana Champaign, iSchool**

Instructor, Undergraduate Minor	August 2003-July 2004
Research Assistant,	Academic years 2001-2002, 2002-2003, 2005-2006
Teaching Assistant, Graduate and Undergraduate	

**TEACHING EXPERIENCE****COURSES TAUGHT AT THE UNIVERSITY OF TENNESSEE**

INSC (567) 581: Information Networking Application Spring 2009, Fall 2009, Spring 2010, Fall 2010, Spring 2011, Summer 2011, Fall 2011, Spring 2012, Fall 2013, Spring 2013, Fall 2013, Fall 2014, Spring 2015, Fall 2015, Fall 2016, Spring 2017

INSC 598: Web Design, Spring 2012, Spring 2015, Fall 2016, Fall 2017, Fall 2018  
 INSC 585: Information Technologies Fall 2008, Spring 2009, Fall 2009  
 INSC 590: Web Development Using Content Management Systems Summer 2015  
 INSC 591: Independent Study, 31 since Fall 2008

#### **COURSES TAUGHT AT THE UNIVERSITY OF NORTH TEXAS**

SLIS Topics on Digital Imaging for Information Professional

#### **COURSES TAUGHT AT THE UNIVERSITY OF ILLINOIS AT URBANA CHAMPAIGN**

LIS 201 Information, Technology and Organizations  
 LIS 202 Social Aspects of Information Systems  
 LIS 210 Computing in the Humanities  
 LIS 290 Programming Web Mashups  
 LIS 310 Information, Organization and Access (on Campus and Online)  
 LIS 320 Libraries, Information and Society

#### **SELECTED PUBLICATION**

- Mehra, B., Black, K., Singh, V., Nolt, J., Williams, K.C., Simmons, S., and Renfro, N. (2014). The Social Justice Framework in the Information Technology Rural Librarian Master's Scholarship Program: Bridging the Rural Digital Divides. *Qualitative and Quantitative Methods in Libraries Journal*, Special Issue 2014: Social Justice, Social Inclusion (pp 5-11).
- Mehra, B., and Singh, V. (2014). Recruitment and Retention in the Information Technology Rural Librarian Master's Scholarship Program (Part I and Part II): Implications of Social Justice in the Southern and Central Appalachian Region. *Qualitative and Quantitative Methods in Libraries Journal*, Special Issue 2014: Social Justice, Social Inclusion (pp 13-22).
- Singh, V. (2017). "Long-Term Experiences of Open Source ILS Migration: Maintaining, Adapting, and Learning" *Journal of Librarianship and Information Science*
- Mehra, B., and Singh, V. (2017). Library Leadership-In-Training as Embedded Change Agents to Further Social Justice in Rural Communities: Teaching of Library Management Subjects in the ITRL and ITRL2. In Nicole A. Cooke and Miriam E. Sweeney (Eds.), *Teaching for Justice: Implementing Social Justice in the LIS Classroom*. Sacramento, CA: Library Juice Press.
- Mehra, B., Singh, V., Hollenbach, N. and Partee II, R.P. (2017). "A Community Informatics Model in ICT Use to Train Rural Librarians in the Southern and Central Appalachian Region as Change Agents in the 21 Century" Book Chapter proposal in *Rural and Small Public Libraries: Challenges and Opportunities* (Advances in Librarianship book series). Bingley, United Kingdom: Emerald Group Publishing.
- Mehra, B., Black, K., and Singh, V. (Editors). (under preparation). *Voices of Rural Librarians in the Appalachia: Current Realities and Future Possibilities of Information Technology in the 21st Century*. Manuscript in progress of development. Peer-reviewed Conference Proceedings (last 5 years)
- Singh, V., and Holt, L. (2013). Online Technical Support: How it Works and Why it Fails? *Proceedings of the Hawaii International Conference on System Science (HICSS – 46)*, IEEE, January 2013.
- Singh, V. (2013). A Case Study of Migration to an Open Source ILS: Partnership among State Libraries. *Proceedings of the Qualitative and Quantitative Methods in Libraries International Conference (QQML 2013)*, 3 - 6 June 2013, Rome, Italy.
- Singh, V. (2013) "Evaluating and Improving an Information Portal for Open Source Integrated Library Systems" *Proceedings of the 15th International Conference on Human Computer International 2013 (HCI 2013)*, 21-26 July 2013, Las Vegas, USA.
- Singh, V., (2013). "Challenges of Open Source ILS Adoption" Poster, *Proceedings of 76th Annual Meeting of the Association for Information Science and Technology, Beyond the Cloud: Rethinking Information Boundaries*, November 1-6, 2013, Centre Sheraton, Montreal, Quebec, Canada

- Mehra, B., and Singh, V. (2015). A Social Justice Framework to Further Community Engagement in Pakistan's Information Management and Library Professions, Proceedings of the International Conference on Information Management & Libraries, Department of Information Management, University of Punjab, Quaid-i-Azam Campus, Lahore-Pakistan, from 10-13 November, 2015.
- Singh, V. (2017) "Personas and Scenarios as a methodology for Information Sciences Research: Strengths, Weakness and Example" Proceedings of the Qualitative and Quantitative Methods in Libraries International Conference (QQML 2017), 3 - 6 June 2017, Limerick, Ireland
- Upadhyay, P., Reddy, J., Proctor, T., Sorel, O., Veereshlingam, H., Gandhi, M., Wang, X. and Singh, V., 2023. Expanded PCR Panel Testing for Identification of Respiratory Pathogens and Coinfections in Influenza-like Illness. *Diagnostics*, 13(12), p.2014.
- Malhotra, V., Javed, D., Bharshankar, R., Singh, V., Gautam, N., Mishra, S., Chundawat, D.S., Kushwah, A., Singh, G. and Deep, A., 2023. Prevalence and Predictors of Depression, Anxiety and Stress among Elderly during COVID-19: A Cross-sectional Study from Central India. *Mymensingh Med J*, 32(2), pp.556-566.

## HONORS

- Selected as a 3C Fellow at Duke University Computer Science Program on inclusive computing (2022-2024)
- Awarded College of Communication and Information Faculty Research Award 2021
- Keynote Speaker at ThriveWise Conference, June 30<sup>th</sup>, 2021
- Two Featured Articles relevant for practitioners – for informed Librarian Online July/August 2019 & July/August 2020 issues
- Awarded College of Communication and Information Service and Outreach Award for 2018-2019
- Paper nominated for the best paper award at the 15<sup>th</sup> International Conference of Open Source Systems, 2019
- Nominated by the Dean, College of Communication and Information, for Faculty Appreciation Week, February 2019
- Selected for the UTK Leadership Institute, 2017-2018
- Recognized by Office of Community Engagement & Outreach, University of Tennessee, recognizes 50 Partnerships that Make a Difference: Rural Library Professionals Program [Spring 2015].
- One of Top Five Papers at IFLA 2011, Mehra, B., Black, K., Singh, V., and Nolt, J. (2011). Mapping the Education of Rural Librarians' Technology Literacy and Management Training: Use of Mixed Data Collection Methods in the ITRL Program. Proceedings of the World Library and Information Congress: 77th International Federation of Library Associations and Institutions General Conference and Assembly, 13-18 August 2011, San Juan, Puerto Rico
- Best Conference Paper ALISE 2011, What is the Value of LIS Education? A Qualitative Analysis of the Perspectives of Tennessee's Rural Librarians. Bharat Mehra, Kimberly Black, Vandana Singh Junior Faculty Fellow to Provost, 2010 nominated and selected by School of Information Sciences and College of Communication and Information, July 2010
- Innovative Technology Award 2010, given by College of Communication and Information, University of Tennessee May 2010
- Outstanding Assistant Professor 2010 for the year given by School of Information Sciences, College of Communication and Information, University of Tennessee, May 2010
- Scholar of the Week, University of Tennessee, Week of 7/11/09.
- Best Note of CSCW 2008 - Singh, V. and Twidale, M., "The Confusion of Crowds: non-dyadic help interactions" Short Paper Computer Supported Cooperative Work Conference, 2008.



# Joshua D. Fagan, Ph.D.

## Home Address

8920 Colchester Ridge Road  
Knoxville, TN 37922  
(804) 627-2366  
jfagan2@utk.edu

## EDUCATION

2014 – 2022	<p>Doctor of Philosophy in Computer Science University of Tennessee, Knoxville, TN Graduate Research Advisor: Dr. Lynne Parker Committee Members: Dr. Lynne Parker, Dr. Hairong Qi, Dr. Daniel Rucker, Dr. Amir Sadovnik Dissertation: Constrained Collective Motion in Human-Robot Teams</p>
2014 – 2017	<p>Masters of Science in Computer Science University of Tennessee, Knoxville, TN Graduate Research Advisor: Dr. Lynne Parker Area of Study: Machine Learning</p>
2010 – 2014	<p>Bachelor of Science in Computer Science, Double Major in Mathematics University of Richmond, Richmond, VA Undergraduate Research Advisor: Dr. Arthur Charlesworth</p>

## RESEARCH EXPERIENCE

UNIVERSITY OF TENNESSEE, KNOXVILLE, DEPARTMENT OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

2017 – 2022	<p><b>Constrained Collective Motion of Human-Robot Teams</b> <i>Graduate Student</i> Advisor: Dr. Lynne Parker</p> <ul style="list-style-type: none"> <li>• Research focuses on enabling a robot to observe a team of human experts performing a task, infer the standard operating procedure influencing the team members, and adopt the inferred behaviors when placed on the team.</li> <li>• Research searches to accomplish a goal by merging capabilities of high-level, graph-based framework and low-level, end-to-end variational neural network, delivering rich, complex behaviors that are transparent and explainable to human team members.</li> <li>• Research extends the applications of serious games by utilizing the game development engine Unity for near photo-realistic simulation environments with accurate real-world physics.</li> </ul>
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## ARMY RESEARCH LABORATORY, ADELPHI, MD

Summer 2017 | **Human-Robot Formation Control via Deep Learning***Graduate Student*

Advisor: Dr. Christopher Reardon and Dr. Jonathan Fink

- Designed and participated in a project to incorporate robots into human team formation via deep learning.
- Designed a deep neural network with stacked CNN+LSTM architecture for robot end-to-end sensing and moving.
- Designed and performed experiments to collect data in ROS driven simulation and real world.

## NATIONAL TRANSPORTATION RESEARCH CENTER, OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TN

Summer 2015 | **Vehicle Security Analysis***Graduate Student*

Advisor: Dr. Jens Gregor

- Participated in developing a vehicle security analysis platform.
- Designed and developed a front-end vehicle user interface website and data analysis database.

**TEACHING EXPERIENCE**

## LECTURER AT THE UNIVERSITY OF TENNESSEE, KNOXVILLE

2022-2023	<b>Computer Solutions of Engineering Problems (EF 230)</b> Collaboratively taught an engineering-based programming course with Dr. Amy Biegalski. I designed lectures, projects, and assessments on course material that spans the fundamentals of programming for engineering students. I maintain a toolbox based on ROS for the students to program a fleet of 60 mobile robots.
2022-2023	<b>Data Management and Visualization (DATA 202)</b> Develop and teach class focusing on using programming tools in Python for managing data (including metadata), cleaning and processing data, and visualizing data.
2022-2023	<b>Introduction to the World of AI (AI 101)</b> Participated on interdisciplinary team to develop syllabus and content for class to introduce AI to the campus at large.
2023	<b>Introduction to Cybersecurity Concepts (CYBR 101)</b> Class to introduce Cybersecurity concepts to the campus at large.

**DEPARTMENTAL/UNIVERSITY SERVICE**

Spring 2023	<b>ChatGPT Taskforce</b> Participate on subcommittees dedicated to shaping UTK's response to ChatGPT with respect to policy, technology outreach, research practices, philosophy, and pedagogy.
Spring 2023	<b>AI Education Strategic Visioning Committee</b> Participate on committee to report on and shape advances of AI education at UTK.
2022 - 2023	<b>UTK Campus AI Curriculum</b> Participate on committee to design and develop a campus wide AI course.
Fall 2023	<b>AI in Higher Ed: Transforming the Teaching and Learning Experience</b> Participate on committee to design and develop AI symposium.

**PUBLICATIONS**

2022	<b>Joshua D. Fagan</b> , Amy Biegalski, "Work-in-Progress: Bridging the Gap Between MATLAB and Python via ROS to Build Skills in an Introductory Programming Course," in <i>2022 ASEE Annual Conference &amp; Exposition</i> .
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**PRESENTATIONS**

2021	Amy Biegalski, <b>Joshua D. Fagan</b> , <i>Using MATLAB's ROS Toolbox with Raspberry Pi Controlled Robots to Build Skills in an Introductory Programming Course</i> , Workshop Talk, Teaching Computation with MATLAB at the Science Education Resource Center at Carleton College, Virtual, October 17-19, 2021.
2012	Joshua Armstrong, <b>Joshua D. Fagan</b> , Kirstin Ladas, Gavin McGrew, and Rosa Romano, <i>Turing Patterns via Agent-Based Modeling</i> , Poster Session, Mathematical Association of America MathFest 2012, August 1-4, 2012.

**AWARDS, HONORS, AND LEADERSHIP ROLES**

Fall 2021	Engineering Fundamentals Outstanding Graduate Teaching Assistantship (GTA) Award
2015 – 2018	Funding from National Science Foundation for research in human-robot interactions.

**PROFESSIONAL SOCIETIES**

- American Society for Engineering Education (ASEE)
- IEEE Robotics and Automation Society

**MEHMET AYDENIZ, Ph.D.**

Department of Theory and Practice in Teacher Education  
 College of Education Health and Human Sciences  
 University of Tennessee, Knoxville  
 Tel: 865-242-9916  
 E-mail: [maydeniz@utk.edu](mailto:maydeniz@utk.edu), [bilge63@gmail.com](mailto:bilge63@gmail.com)

**EDUCATION HISTORY**

**2002- 2007 Ph.D. Florida State University, Science Education**  
 Department of Middle and Secondary Education  
 Tallahassee, FL

**1999- 2001 MS. Florida State University**  
 Science Education  
 Department of Curriculum and Instruction  
 Tallahassee, FL

**PROFESSIONAL EMPLOYMENT HISTORY**

**2019- Present Professor of STEM Education**  
 Program Coordinator, Science Education  
 University of Tennessee, Knoxville  
 Department of Theory and Practice in Teacher Education  
 Knoxville, TN.

**2013- 2019 Associate Professor of Science Education**  
 Program Coordinator, Science Education  
 University of Tennessee, Knoxville  
 Department of Theory and Practice in Teacher Education  
 Knoxville, TN,

**2007- 2013 Assistant Professor of Science Education**  
 Program Coordinator, Science Education  
 University of Tennessee, Knoxville  
 Department of Theory and Practice in Teacher Education  
 Knoxville, TN,

**PROJECTS, GRANTS, COMMISSIONS, AND CONTRACTS****Current:**

Quantum Networks Training and Research Alliance in the Southeast, \$3,000,000 07/01/2022 - 06/30/2027, Role **Co-PI**. Sponsor: **National Science Foundation(NSF)**

Collaborative Research ORCC: The role of bioenergetic budgets in defining elevation limits and modeling geographic range of species. 10/1/2022- 9/31/2025, \$614,280, Role: **SP. National Science Foundation (NSF)**.

### Completed

[One UT 1000 STEMS](#), the University of Tennessee System, \$50,000. Role: CoPI

CS for ALL, National Science Foundation, \$254,000, Role: Senior Personnel.

Basic Aerospace Education Workshop for Teachers, Tennessee Department of Transportation, \$50,000, 3/14/2018-313/2019. Role: PI

*A Meta-analysis of Teacher Belief Studies in Science Education*, \$3,600 **University of Tennessee**,

**Summer Research Funds**, Principal Investigator, 05/01/09-09/30/09

*Exploring the Impact of Kitbook on Elementary School Students' Conceptual Understanding of Electricity*, \$7,942, **Center for Industrial Services, State of Tennessee** Principal Investigator, 8/25/07-06/30/08

### RESEARCH AND/OR SCHOLARLY PUBLICATIONS

- Cuddington, K., Abbott, K., Adler, F., **Aydeniz, M** and others (2023). Challenges and opportunities to build quantitative self-confidence in biologists, *BioScience*, 73(5), 364–375, <https://doi.org/10.1093/biosci/biad015>
- **Aydeniz, M.** & Stone, M. (2023). Creativity and Innovation in Science and Technology Education. In B. Akpan, B. Zhang, B. Cavas, & T. Kennedy (Eds), *Contemporary Issues in Science and Technology Education (pp)*. ICASE.
- **Aydeniz, M.** (2021). Learning and teaching chemistry through argumentation. In S. Erduran (Ed) *Argumentation in Chemistry Education (pp. 11-25)*. Royal Society of Chemistry. London.
- **Aydeniz, M.**, Bilican, K. & Senler, B. (2021). Development of the Inquiry-Based Science Teaching Efficacy Scale for Primary Teachers. *Sci & Educ* 30, 103–120. <https://doi.org/10.1007/s11191-020-00168-w>
- Cakmakci, G., **Aydeniz, M.** Brown, A., & Makokha, J.M. (2020). Situated cognition and cognitive apprenticeship. B.Akpan, and T. Kennedy (Eds), *Science Education in Theory and Practice*. Springer (pp.293–310), The Netherlands.
- Huang, Y., Xueping Li, X., Wyatt, T., & **Aydeniz, M.** (2015). m-Learning Adoption: An Empirical investigation for engineering education. *International Journal of Engineering Education*, 31(4), 1081–1091.
- **Aydeniz, M.**, & Bilican, K. (2014). What do scientists know about the nature of science? A case study of novice scientists' views of NOS. *International Journal of Science and Mathematics Education*, 12 (5), 1083-1115. DOI 10.1007/s10763-013-9449-

### PAPERS PRESENTED AT TECHNICAL AND PROFESSIONAL MEETINGS

2

- **Aydeniz, M.**, Byrd, C., Churkina, O., &Eze-Echesi, O. (2023, May). The Impact of Team Diversity on Research Productivity. Paper presented at *The Atlanta Conferene on Science and Innovation Policy*.Atlanta, GA.
- **Aydeniz, M.** (2022). Scientific collaboration journey maps: A tool for forming, leading, and evaluating scientific collaborations. *Paper presented at the International Society for Science of Team Science Conference*. [Online].
- **Aydeniz, M.** (2021, **invited keynote**). Addressing the Leadership Gap in STEM Education Reforms. *Presented at the International Conference on Entrepreneurship, Science, Mathematics and Technology*. October, 2021.
- **Aydeniz, M. (2021)**. Navigating The Collaborative Space: Culture, Leadership and Identities. *Presented at the International Network for the Science of Team Science Conference., Blacksburg, VA.*

## UNIVERSITY TEACHING

### Courses Taught (Repeated):

Summer	SCE 550	Classroom Assessment and Evaluation Techniques (3)
Summer	SCE 565	Instructional Trends in Science Education (3)
Spring	SCE 572	Nature of Science and Mathematics (3)
Spring	SCE 696	Advanced Studies in Science Education (3)
		Development (3)

## LEADERSHIP & COMMITTEE EXPERIENCES

- **Program coordinator**, Science Education, Department of Theory and Practice in Teacher Education, The University of Tennessee, Knoxville.2008-current.
- **Chair**, [The Graduate Council](#), The University of Tennessee, Knoxville.- 2018-2019.
- **Chair**, Personnel Committee, Department of Theory and Practice in Teacher Education, The University of Tennessee, Knoxville. 2016-2021.
- **Chair**, Mentoring Faculty Committee, Department of Theory and Practice in Teacher Education, The University of Tennessee, Knoxville. 2019-current.
- **Chair**, Tenure and Promotion Committee, College of Education, Health and Human Sciences, The University of Tennessee, Knoxville. 2023-2024.
- **Program coordinator**, UT STEM Leadership Certificate-Distance Education, Graduate School of Education, The University of Tennessee, Knoxville.-current.
- **Member**, ToolKit Committee, International Network for Science of Team Science.
- **Member**, Education and Training Committee, International Network for Science of Team Science.

## Brianne R. Dosch

John C. Hodges Library, 1015 Volunteer Blvd. Knoxville, TN 37996  
bdosch@utk.edu

### EDUCATION

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Master of Science in Information Sciences, University of Tennessee, Knoxville, TN 2018  
Bachelor of Arts, English Literature, Brigham Young University – Hawaii, Laie, HI 2013

### EXPERIENCE

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#### **Head, Data and Digital Scholarship, Assistant Professor**

John C. Hodges Library, University of Tennessee, Knoxville, Aug 2023- Present

Provides vision and strategic direction for the University Libraries in support of a broad range of digital and data-intensive scholarly activities. Helps foster a responsive, user-oriented department that works collegially to build relationships with students, staff, faculty, organizations and people Knoxville and Tennessee, and the greater research community. The Data and Digital Scholarship department supports the research data life cycle and digital scholarship by convening research support in digital humanities, geographic information systems, computational social science support, data discovery, and data management across all disciplines.

#### **Social Sciences Data Librarian, Assistant Professor**

John C. Hodges Library, University of Tennessee, Knoxville, 2019-2023

Provided in-depth consultation, engagement and instruction to the Department of Psychology and developed specialized expertise in data support to serve interdisciplinary research needs in the social sciences. Proactively built relationships with faculty and students across the social sciences to understand and anticipate research needs. Worked closely with other social sciences librarians to provide in depth and discipline specific data services to students, staff, faculty, and Tennessee community members.

#### **Grant Program Manager, Research Associate**

Center for Information & Communication Studies, University of Tennessee, Knoxville 2018-2019

Directly supervised and managed the research work of MSIS graduate students sponsored by the UX-A IMLS grant. Planned and lead information meetings and instruction for MSIS graduate students. Compiled and communicated the final grant report to IMLS and other key grant program members. Worked directly with Dr. Carol Tenopir to update the bibliographic database associated with the ARL Lib-Value project in addition to work on the IMLS grant.

#### **Information Management Specialist**

Spallation Neutron Source, Oak Ridge National Laboratory, Oak Ridge, TN Jan-May 2019

Proactively developed relationships with laboratory staff to understand their user-experience and support their information and document management needs. Collaborated with laboratory programmers to develop and test interfaces which meet staff needs and improve the overall

usability and user-experience of laboratory interfaces. Developed protocols within the document management system ProjectWise to capture critical metadata and integrate processes to address unique staff member needs. Developed and delivered training and training resources for staff to use the electronic document management system ProjectWise.

## HONORS AND AWARDS

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2022, Library Society Service Endowment Award for Extraordinary Customer Service, UT Libraries' Spirit Awards

## PUBLICATIONS

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### ***Articles Published in Refereed Journals***

Dosch, B., & Martindale, T. (2021). Reading the fine print: A review and analysis of business journals' data sharing policies. *Journal of Business & Finance Librarianship*, 25(3–4), 261–280. <https://doi.org/10.1080/08963568.2020.1847549> (Primary author)

Kaufman, J., Dosch, B., & Clement, K.A. (2019) “No Failure, Just Feedback: A Reflection on Experiential Space Assessment in an Academic Library,” *Serials Review*, 44:3, 221-227, <https://doi.org/10.1080/00987913.2018.1513749> (Equal author)

Clement, K. A., Carr, S., Johnson, L., Carter, A., Dosch, B. R., Kaufman, J., ... Walker, T. (2018). Reading, writing, and ... running? Assessing active space in libraries. *Performance Measurement and Metrics*, 19(3), 166–175. <https://doi.org/10.1108/PMM-03-2018-0011> (Equal author)

### ***Contributions to Edited Volumes***

Dosch, B. (2024). Building a campus-wide lifelong learning book club: Supporting faculty ideas and centering the library in community building. In A. Dye-Reeves & E. Watson (Eds.), *How to Work with Academic Faculty: Partnerships, Collaborations, and Services in the Academic Library*. Association of College and Research Libraries. (Solo and primary author)

Ortiz-Baco, J. & Dosch, B. (2024). In W. Kramer, E. Muzzall, I. Burgos (Eds.), *Text and Data Mining Literacy for Librarians*. Association of College and Research Libraries. (Equal author)

### ***Papers Published in Refereed Conference Proceedings***

Dosch, B., Urquieta-Cortes, C. (2023). Building the Holistic E-resource Acquisition Transparency (HEAT) Communication Tool for Academic Librarians. *15th International Conference on Performance Measurement in Libraries*, 15(1). (Primary author)

Cannon, L., Dosch, B., & Gunderman, H. (2020). Preparing, Not Repairing. *Qualitative And Quantitative Methods In Libraries*, 9(1), 9-18. <http://www.qqml.net/index.php/qqml/article/view/546> (Equal author)

### ***Articles published in non-refereed journals***



Dosch, B. (2022). How academic liaison librarians can self-assess – and why they should. *Elsevier's Library Connect*. <https://www.elsevier.com/connect/library-connect/how-academic-liaison-librarians-can-self-assess-and-why-they-should> (Primary author)

### ***Invited Workshops/Seminars/Presentations***

Dosch, B. “Data sources and services for academic librarians.” Presentation LS 502 Research Methods Course, School of Library and Information Studies, University of Alabama, virtual, January 26, 2023.

Dosch, B. (2021, October) “Finding Available Data Related to Sensitive Topics.” Invited webinar for the University of Michigan’s Inter-university Consortium for Political and Social Research (ICPSR), Virtual, October 27, 2021.

### GRANTS, FELLOWSHIPS, AND SCHOLARSHIPS

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2021 ICPSR Visiting Representative Fellow, Inter-university Consortium for Political and Social Research at the University of Michigan, \$2800

2019, Conference Travel Grant, Institute of Museum and Library Services, User Experience and Assessment, Center of Information and Communication Studies, University of Tennessee, \$4,000  
2016-present, Conference Travel Grant, Institute of Museum and Library Services via University of Tennessee, \$2,000

2016-present, Institute of Museum and Library Services funded Master’s degree, User Experience and Assessment, School of Information Science University of Tennessee, \$9,000

### SERVICE

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#### *Committees and Task Forces*

Data Science Curriculum Committee, member, 2023-Present  
AI Curriculum Committee, member, 2023-Present  
UT Promise Mentoring Program, mentor, 2020-Present  
Data Science Librarian Search Committee, member, December 2022-February 2023  
Strategic Visioning Committee, co-chair, March 2022 – January 2023  
ACRL Academic Library Trends & Statistics Survey Editorial Board, member, 2022 - Present

#### *Service and Leadership Roles*

Lifelong Learning Book Club, University of Tennessee, organizer and leader, 2020-Present  
Inter-university Consortium for Political and Social Research (ICPSR), Official Representative for University of Tennessee, July 2019-present  
Tennessee State Data Center, Affiliate Representative for UT Libraries, July 2019-Present

Updated 10/13/2023

**Brendan P. McConville**

1741 Volunteer Blvd, Knoxville, TN 37916

(865) 974-7546 • [bmconvi@utk.edu](mailto:bmconvi@utk.edu)[www.mcconvillemusic.com](http://www.mcconvillemusic.com)<https://music.utk.edu/people/mcconville/>**EDUCATION**

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Rutgers University, Mason Gross School of the Arts, New Brunswick, NJ

Ph.D., Music Theory and Composition, May 2007

M.A., Music Theory and Composition, January 2005

Johns Hopkins University, musical training at Peabody Conservatory of Music, Baltimore, MD

Honors Bachelors of Arts Degree, May 2000

Honors: Phi Beta Kappa, Omicron Delta Kappa, Golden Key International Honor Society

**TEACHING AND WORK EXPERIENCE**

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The University of Tennessee, College of Arts &amp; Sciences, Knoxville, TN

*Interim Associate Dean for Academic & Faculty Affairs*

June 2023 – Present

- Selected Responsibilities: Oversight of all matters of academic (curriculum, advising, student wellness and success, etc.) and faculty (annual evaluation, promotion & tenure, searches, etc.) affairs for the College of Music.
- Selected University Committees: Chancellor's Leadership Academy, College of Emerging and Collaborative Studies (CECS) Advisory Board, CECS Curriculum Program, UTK Provost's Artificial Intelligence Task Force, Undergraduate Curriculum Committee, Undergraduate Council, Undergraduate Academic Policies Committee, Graduate Curriculum Committee, Graduate Council, College Teaching Council

The University of Tennessee, College of Arts &amp; Sciences, Knoxville, TN

*Associate Dean for Academic Programs*

September 2022 – June 2023

- Selected Responsibilities: Provide leadership and direction for students and their concerns, including information and guidance regarding the college's undergraduate and graduate degree programs and activities. In addition, leadership collaborates with students and campus administration to address issues related to orientation and student activities, as well as curriculum development and implementation.
  - Leadership of:
    - undergraduate programs in the College (nearly 10,000 students in over 150 majors, minors, certificates, concentrations, and pre-professional programs)
    - graduate programs in the College (nearly 1,500 students in approximately 50 graduate programs and certificates)
    - fully online degree programs in the College
  - College of Arts & Sciences oversight and coordination of:
    - all curriculum changes

- strategic vision for academic and online programming
  - student enrollments and planning
  - student success (e.g. identifying high DFW, coaching/tutoring, mentoring, etc.)
  - College Teaching Council (e.g. general education, best practices in online instruction, inclusive teaching initiatives, etc.)
  - teaching issues, awards and recognition, strategic teaching hires
  - student issues, grade appeals, awards and graduate funding, etc.
- Selected Dean's cabinet high-priority topics:
    - annual College budget
    - promotion and tenure
    - diversity and inclusion initiatives
    - faculty and staff issues
    - retention offers
    - University spacing issues
- University Committees: UTK Fall 2023 Provost Task Force, UTK Provost's Artificial Intelligence Task Force, Undergraduate Curriculum Committee, Undergraduate Council, Undergraduate Academic Policies Committee, Graduate Curriculum Committee, Graduate Council, College Teaching Council, Executive Associates Deans' Committee (Office of Vice Provost for Academic Affairs), Noodle Online Programs Planning Committee, Nursing/College of Arts & Sciences Timetable Committee, Curriculum Pilot Committee
  - Strategic Initiatives: (projects in development)
    - Nursing and foreign language minor
    - Arts administration (School of Art, College of Business)
    - Sustainability Chain concentrations (Dept of Geography and Sustainability, College of Agriculture, College of Business)
    - Jumpstart: College and Provost-funded program to develop fully online courses
    - Leading group of A&S faculty to study AI & online learning at Arizona State U.

The University of Tennessee, School of Music, Knoxville, TN

*Director for Undergraduate Studies*

January 2018 – 2022

*Coordinator, Music Theory and Composition*

January 2017 – 2022

*Manager, School of Music Timetable of Classes*

August 2013 – 2022

*Professor*

August 2020 – Present

*Associate Professor*

August 2014 – July 2020

*Assistant Professor*

August 2008 – July 2014

*Lecturer*

August 2007 – July 2008

Conservatorio Luisa D'Annunzio, Pescara, Italy

*Guest Instructor*

Spring 2016

- Taught compositional techniques, theoretical concepts and technology to conservatory students (taught in Italian)

Chief Academic Officer

Spring 2011 – Summer 2013

Appademia, LLC

Sony Music Entertainment, Inc., New York, NY

*Production Assistant, New Technology and Business Development* August 2000 – August 2002

## SELECTED PUBLICATIONS

### *Book*

- McConville, Brendan and Barbara Murphy. 2020. *Foundations of Music Theory: an Interactive eBook, Second Edition*. Dubuque: Kendall-Hunt.
  - Online textbook includes interactive drills and presentations, flashcards, and assessments that pull from banks of nearly 4,000 questions.

### *Scholarly Peer Reviewed Articles*

- McConville, Brendan. 2021. “Constructivist Peer Review in Music Theory and Composition Courses: Technologies and Practice,” *Journal of the Association for Technology in Music Instruction*, 2 (1).
- McConville, Brendan and Barbara Murphy. 2017. “What is Online? A Survey and Study of Online Music Courses.” *College Music Symposium* 57: 1 – 18 (JSTOR and online).
  - Citations:
- McConville, Brendan. 2012 “Noteflight as a Web 2.0 Tool for Music Theory Pedagogy.” *Journal of Music Theory Pedagogy* 26: 265 – 289.

### *Commercial Recordings*

- *Fantasia e Romanze*. 2020. DaVinci Classics (Japan).
- *Un D’Annunzio Nuovo*. 2018. Wide Classique (Italy).
- *Punto de Encuentro*. 2017. Centro par la Música y Tecnología (National University of Rosario, Argentina) and the University of Tennessee (USA).
- *Rapport: Vocal Chamber Music*. 2010. Navona Records (USA), distributed by Naxos.
- *Masterworks of the New Era, Volume 11*. 2007. ERM Media (USA).

## SELECTED HONORS/AWARDS

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- 2022. Affiliated Fellow, American Academy of Rome.
- 2019. The American Prize in Music Composition (vocal chamber) for *Quattro Canzoni da ‘La Pioggia nel Pineto’* [National Finalist]
- 2019. Winner, Global Music Award Silver Medal – Outstanding Achievement, *Un D’Annunzio Nuovo*, album category.
- 2019. Winner, Global Music Award Silver Medal – Outstanding Achievement, Brendan McConville, composer category for *Un D’Annunzio Nuovo*.
- 2019. Winner, Global Music Award Silver Medal – Outstanding Achievement, *Un D’Annunzio Nuovo*, modern classical category.
- 2015 – 2016. Fulbright Core Scholar Award to Italy

**GREGORY D. PETERSON**

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The University of Tennessee  
303 Min Kao Hall  
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**Professional Preparation**

D.Sc. in Electrical Engineering, Washington University, St. Louis, Missouri, December 1994.  
M.S. in Electrical Engineering, Washington University, St. Louis, Missouri, May 1992.  
M.S. in Computer Science, Washington University, St. Louis, Missouri, May 1992.  
B.S. in Electrical Engineering, Washington University, St. Louis, Missouri, May 1990.  
B.S. in Computer Science, Washington University, St. Louis, Missouri, May 1990.

**Appointments**

- August 2012 – present, *Professor*, The University of Tennessee, Electrical Engineering & Computer Science, Knoxville, TN.
- August 2012 – present, *Director*, National Institute for Computational Sciences, The University of Tennessee, Knoxville, TN.
- July 2022 – present, *Program Committee Chair*, Interdisciplinary Graduate Minor for Computational Sciences, The University of Tennessee, Knoxville, TN.
- August 2018 – May 2023, *Head*, The University of Tennessee, Electrical Engineering & Computer Science, Knoxville, TN.
- January 2013 – September 2022, *Director of Operations*, XSEDE.
- August 2012 – July 2018, *Deputy Director*, Joint Institute for Computational Sciences, The University of Tennessee, Knoxville, TN, and Oak Ridge National Laboratory, Oak Ridge, TN.
- August 2006 – July 2012, *Associate Professor*, The University of Tennessee, Electrical Engineering & Computer Science, Knoxville, TN.
- August 2000 – July 2006, *Assistant Professor*, The University of Tennessee, Electrical & Computer Engineering, Knoxville, TN.
- January 1999 – July 2000, *Chief Technical Officer*, FTL Systems, Inc., Rochester, MN.  
January 1999 – June 2006, *Captain*, United States Air Force Reserve (inactive).
- March 1996 – January 1999, *Captain/Computer Systems Research Engineer*, United States Air Force, Air Force Research Laboratory, Wright-Patterson Air Force Base, Dayton, OH.
- January 1995 – March 1996, *1 Lt/Avionics Systems Research Engineer*, United States Air Force, Wright Laboratory, Wright-Patterson Air Force Base, Dayton, OH.

**Honors and Awards**

- Member, Sigma Xi (Scientific Research Honor Society), August 2019.
- Deployed #1 Computer on Green 500 list, National Institute for Computational Sciences, November 2012.
- Best paper award, *Symposium on Application Accelerators in High Performance Computing*, Argonne National Lab, July 2012.

- Best student paper award, *International Emerging Computational Methods for the Life Sciences Workshop*, Delft, Netherlands, June 2012.
- Advisor to Akila Gothandarman – 1<sup>st</sup> place *ACM Supercomputing Student Research Competition* (2008)
- Advisor to Junqing Sun – 3rd place *ACM Student Research Competition Grand Finals* (2008, competition among winners from all major ACM conferences)
- Advisor to Junqing Sun – 1<sup>st</sup> place *ACM Supercomputing Student Research Competition* (2007)
- Min Kao Fellowship, Electrical and Computer Engineering, University of Tennessee, October 2006.
- John W. Fisher Professorship, College of Engineering, University of Tennessee, August 2001.
- Best Paper Award, IEEE/Acellera VHDL International Users' Forum, October 2000.
- Air Force Commendation Medal (1999).
- US Air Force Research and Development Award, recognized as the best research and development engineer in US Air Force for 1998.
- Wright Laboratory Company Grade Officer of the Quarter, Q2, 1997 (out of 250 CGOs).
- Recipient of Air Force Association's Theodore von Karman Graduate Fellowship, May 1990.
- Eta Kappa Nu (Electrical Engineering honor society), 1989.
- Tau Beta Pi (Engineering honor society), 1989.
- U.S. Air Force Reserve Office Training Corps (ROTC) scholarship, April 1986.
- National Merit Scholarship, April 1986.

### Professional Service

Dr. Peterson has made extensive service contributions through leadership roles in professional societies, editorial work, standards development, conference/workshop organization, university service, student mentoring, and more. His service record reflects sustained impact across his fields of expertise.

#### Professional Memberships

- Senior Member of IEEE (2000-present)
- Member of ACM, SIAM, AAAS, ASEE, and other professional organizations

#### Professional Service Highlights

- Chair of IEEE East Tennessee Section (2002-2005)
- Chair of IEEE VHDL International Users' Forum (1999-2001)
- Board Member of Accellera/VHDL International (1999-2001)
- Chair of IEEE Design Automation Standards Committee VHDL Group (1997-2000)

#### Service Activities

- Extensive service for standards development and technical committees related to VHDL, electronic systems design, and other areas
- Leadership roles in organizing major conferences and workshops including general chair and program chair positions
- Contributions to professional societies through committee memberships, conference planning, and more

#### Editorial Activities

- Editor and reviewer for major journals and conferences spanning VLSI design, high performance computing, parallel computing, and other areas
- Specialty editor for journals such as Computer Physics Communications

### **Publications**

Dr. Peterson has an extensive publication record spanning over 100 refereed papers in major journals and conference proceedings. His research has been published in leading venues. Dr. Peterson has co-authored over 50 conference papers and 40 journal articles during his career. He has also contributed to numerous books, standards publications, and technical reports. His publication record reflects sustained productivity and impact across the fields of computer engineering and high performance computing.

### **Research Funding**

Dr. Peterson has been continuously funded as PI or co-PI on major projects providing crucial infrastructure for the science and engineering community and advancing the state-of-the-art in areas including high performance computing, computational science, reconfigurable computing, and others. Some of his major grants include:

- \$14M as co-PI on NSF grant for eXtreme Science and Engineering Discovery Environment (XSEDE)
- \$85M as PI on NSF grant for petascale computing environment
- \$500K as co-PI on AFOSR grant for software/hardware co-design
- \$340K as co-PI on DOE grant for computational chemistry
- \$335K as PI on NSF grant for undergraduate research experiences
- \$225K as co-PI on NSF grant for wireless biosensors research

### **Teaching Summary**

Dr. Peterson has extensive teaching experience at the University of Tennessee spanning over 20 years. He has taught a wide range of undergraduate and graduate courses including:

- Computer Architecture
- High Performance Computing
- Embedded Systems
- Digital Logic Design
- Advanced Computer Architecture
- Hardware Description Languages
- Computer Systems Architecture
- Parallel Programming

Some highlights of his teaching activities:

- Instructor for core computer engineering courses taken by all students in the major
- Developed and taught new graduate courses in emerging topics like reconfigurable computing
- Taught interdisciplinary courses in areas like programming for scientists/engineers
- Supervised dozens of MS and PhD students as primary advisor
- Mentored undergraduate researchers participating in projects in his lab
- Secured funding to upgrade lab infrastructure and enhance educational programs
- Participated in teaching conferences and workshops to improve his instructional practices

**Dr. Vasileios Maroulas**  
**Assistant Vice Chancellor/ Deputy Director AI TENNessee Initiative/ Professor**  
**University of Tennessee**

**Office address:** 202 Ayres Hall, 1403 Circle Drive, Knoxville, TN 37996  
**Office phone #:** 865-974-4302; **Email address:** [vasileios.maroulas@utk.edu](mailto:vasileios.maroulas@utk.edu)

**Research Interests**

- AI and Dynamic Data Learning
- Mathematical Foundations of Data Science
- Bayesian Computational Statistics
- Quantum Machine Learning/Deep Learning
- Applications to Health, Biology, Neuroscience Chemistry, Materials Science

**Professional Appointments**

- Assistant Vice Chancellor and Deputy Director of AI TENNessee Initiative, October 2023 -
- Professor (with tenure), Department of Mathematics, Department of Business Analytics & Statistics, Bredesen Center Data Science and Engineering, University of Tennessee, August 2019-
- Senior Research Fellow, Army Research Lab, September 2019-September 2021.
- Associate Professor (with tenure), Department of Mathematics, Department of Business Analytics & Statistics, and Bredesen Center in Data Science & Engineering, University of Tennessee, August 2016-July 2019.
- Assistant Professor, Department of Mathematics, University of Tennessee, August 2010-July 2016.
- Assistant Professor, Department of Business Analytics and Statistics, University of Tennessee, February 2015-July 2016.
- Leverhulme Trust Visiting Fellow, Mathematical Sciences Dept., University of Bath, UK, 10/2013-7/2014.
- Industrial Postdoctoral Fellow, joint appointment with the Institute for Mathematics and its Applications (IMA), University of Minnesota and Lockheed Martin. September, 2008-July, 2010.

**Education**

- PhD (2008), Department of Statistics and Operations Research, University of North Carolina at Chapel Hill, NC.
- BSc (2003), Department of Mathematics, University of Athens, Greece. Major in Applied Mathematics.

**Selected Awards and Honors**

- Chancellor's Award for Research and Creative Achievement, UTK, 2023
- Graduate Research Mentor of the Year, UTK, 2020.
- Senior Research Fellowship, Army Research Lab
- Elected Member of the International Statistical Institute, 2018.
- Interdepartmental Collaborative Research and Scholarship Award, College of Arts & Sciences, University of Tennessee, 2018.
- Leverhulme Trust Fellow, University of Bath, UK, 2012.

**Selected Recent Publications (Total: 71)**

1. **V. Maroulas**, J. Mike and C. Oballe. Nonparametric Estimation of Probability Density Functions of Random Persistence Diagrams. *Journal of Machine Learning Research*, 20 (151), pp.1-49, 2019.
2. **V. Maroulas**, F. Nasrin, and C. Oballe. A Bayesian framework for persistence homology. *SIAM Journal on Mathematics of Data Science*, 2(1), pp. 48-74, 2020.
3. J. Townsend, C. Micucci, J. H. Hymel, **V. Maroulas**, and K. Vogiatzis. Representation of Molecular Structures with Persistent Homology Leads to the Discovery of Molecular Groups with Enhanced CO<sub>2</sub> Binding. *Nature Communications*, 11(1), pp. 1-11, 2020.
4. **V. Maroulas**, C. Micucci, and F. Nasrin. Bayesian Topological Learning for Determining the



- Structure of Biological Networks. *Bayesian Analysis*, 17(3), 711-736, 2022
5. T. Papamarkou, F. Nasrin, A. Lawson, N. Gong, O. Rios, and **V. Maroulas**. A Random Persistence Diagram Generation. *Statistics and Computing*, 32 (88), 2022.
  6. A. Aristotelous, E. Mitchell, **V. Maroulas**. ADLGM: An Efficient Adaptive Sampling Deep Learning Galerkin Method. *Journal of Computational Physics*, 477, 2023.
  7. E. Love, B. Fillipenko, **V. Maroulas** and G. Carlsson. Topological Convolutional Layers for Deep Learning. *Journal of Machine Learning Research*, 24: 1-35, 2023.
  8. O. Queen, G. McCarver, S. Thatigotla, B. Abolins, C. Brown, **V. Maroulas**, and K. Vogiatzis. Polymer Graph Neural Networks for Multitask Property Learning. *npj Computational Materials*. 9 (90), 2023.

#### **Funding Awards (Total: \$6,560,000; Current: \$4,911,342)\***

- **ARL – STRONG (\$1,200,000)**: Towards Robust Human-Agent Teaming via a Neuro-mimetic Architecture. (**Role: PI**; co-PI: Katia Sycara (CMU), Sam Neymotin (NKI)): 09/15/23 – 09/14/26
- **NSF (\$240,000)**: Center of Advanced Materials and Manufacturing (CAMP) (Role: Senior Personnel; PI: A. Tennant; Total: \$18,000,000): 09/01/2023 – 08/31/2029
- **Tennessee Higher Education (\$19,386)**: VA Reconnect (Role: co-PI; PI: B. LaMattina; Total: 27,711): 01/01/2023 – 10/15/2024
- **ORNL/ Veteran Affairs (\$193,506)**: Opioid Modeling Plan (Role: co-PI; PI: C. Strickland; Total: \$458,453): 1/11/23 – 6/30/24
- **ARL (\$100,000)**: Multi Modal Anomaly Detection Using Bio-Driven Artificial Attention Networks (INCUBATOR); (**Role: PI**): 7/1/22-6/30/23
- **ARL (\$2,424,735)**: Spatiotemporal Awareness via Topological Artificial Intelligence (SPARTAN) (**Role: PI**); 9/1/21-8/31/26
- **ARO (\$433,715)**: Computational Bayesian Learning via Topology (CoBILT) (**Role: PI**); 2/1/21-1/31/24.
- **Eastman (\$40,000)**: Molecular Encoding for Machine Learning (**Role: co-PI**; PI: K. Vogiatzis; Total \$110,000); 1/1/2021-12/31/2021.
- **NSF (\$300,000)**: Quantum Topological Signal Classification (QuATOMIC) (**Role: PI**; coPI: G. Siopsis); 8/1/2020-7/31/2024.
- **Summit-P/NSF (\$30,000)**: Data Science-toward understanding Earth and its Humans. (Education Grant to develop a Data Science Course; **Role: co-PI**; PI: Jeneva Clark); 1/1/2020-8/31/2021.
- **Army Research Lab (\$150,000)**: Stochastic Topological Analysis of EEG data. (**Role: PI**); 9/16/2019-9/15/2021.
- **UTK Office of Research (\$50,000)**: Force-energy Atomic Landscapes through Computationally Optimized Numerics (FALCON) (**Role: co-PI**; TOTAL: \$100K); 5/1/2019-4/30/2021.
- **NSF (\$100,000)**: Online spatiotemporal filtering and Bayesian topology for Tracking in dynamically designed sensor networks, (**Role: PI**); 8/15/2018-8/14/2021.
- **NSF (\$267,131)**: Mechanisms of Cytoplasmic Streaming, (**Role: co-PI**; PI: A. Nebenfuhr (UTK), co-PI: S. Abel (UTK); TOTAL: \$857,914); 8/1/2017-7/31/2021.
- **Army Research Office (\$457,465)**: Construction of distributions on complex topological spaces of signals and their application to machine learning and state estimation, (**Role: PI**); 7/1/2017-3/30/2021.
- **Army Research Lab/Thor Industries (\$200,000)**: Statistical Topological Learning of EEG data (**Role: PI**); 10/1/2017-8/31/2019.
- **IMA (\$5,000)**: 2017 John H. Barrett Memorial Lectures, Mathematical Foundations of Data Science, (**Role: PI**; co-PI: J. Rosinski, C. Webster, and S. Wise); 4/1/2017-3/31/2018.
- **NSF (\$16,000)**: 2017 John H. Barrett Memorial Lectures, Mathematical Foundations of Data Science, (**Role: PI**; co-PI: J. Rosinski, C. Webster, and S. Wise); 4/1/2017-3/31/2018.
- **Air Force Office of Scientific Research (\$100,637)**: A distributed dynamic data driven framework for multi-threat tracking. (**Role: co-PI**; PI: I. D. Schizas of UT, Arlington; TOTAL: \$225K); 2/15/2015-4/15/2018.

- **Simons Foundation (\$35,000)**: Collaboration grants for mathematicians-Large deviations for stochastic systems and applications, 9/2013-8/2018 (**Role: PI**).
- **ORNL/Department of Energy (\$159,676)**: Analyzing Data-Specific Model-Selection Criteria, 1/8/2015-5/31/2017 (**Role: PI**).
- **ORNL/Department of Energy (\$120,300)**: Bioenergy sustainability assessment, 8/1/2014-7/31/2016 (**Role: PI**).
- **NSF (\$10,000)**: John H. Barrett Memorial Lectures, Stochastic Filtering, Computations and their Applications, (**Role: PI**; co-PI: J. Rosinski and J. Xiong); 3/1/2015-2/28/2016
- **IMA (\$5,000)**: John H. Barrett Memorial Lectures, Stochastic Filtering, Computations and their Applications (**Role: PI**; co-PI: J. Xiong); 3/1/2015-2/28/2016.
- **Leverhulme Trust Visiting Grant (£29,190)**: Collaborative Work in Statistics at the University of Bath, 10/1/2013-7/31/2014 (**Role: PI**).
- **Summer Teaching Institute Award (\$2,000)**: Transforming Online the Probability and Statistics for Teachers Course, Math 507, Summer 2013 (**Role: PI**).
- **UTK Professional Development Award (\$4,000)**: Mathematical Modeling of Intracellular Movements, 5/2010-6/2010 (**Role: PI**).

\* **Bold numbers in parentheses indicate total funding to Vasileios Maroulas.**

### Teaching Experience

- Taught multiple courses in mathematics of AI, machine learning, and computational statistics
- Developed two brand new courses i) Linear Algebra for Data Science, ii) Mathematical Foundations of Data Science (this is a very popular grad course)
- Mentored (so far) 10 postdocs, 16 PhD Students, 4 Masters, 15 undergraduates, and 3 high school researchers. All were funded by various grants.

### Professional Service

#### *University of Tennessee*

- Chair of two Hiring Committees for two senior hires in AI in Math, 2023-2024
- Elected Member of the Advisory Committee, August 2022- May 2024
- Lead of the Science informed AI Cluster Hire, 2022-
- Member of the Board of Visitors Committee, 2023-2024
- Chair of Hiring Committee for a TT Assistant Prof. in Statistics, August 2019-May 2020.
- Faculty Senator, Fall 2020-2023
- Executive Committee representing the College of Arts and Sciences of the UTK Data Science Initiative, Spring 2020- Fall 2021
- Dean's Advisory Council, Member, Fall 2017-2019.

#### *Profession At Large*

- Member of the Strategic Planning in Mathematical Sciences in the US Army, 2021
- Letter writer for various promotions in the ranks of other R1 Universities, 2020, 2021, 2023.
- AFOSR Proposals Reviewer, 2015, 2016, 2017.
- ARO Proposals Reviewer 2020, 2021, 2022, 2023
- NSF Panel 2018, 2019, 2020, 2021, 2022, 2023.
- NIH Panel 2021.

#### *Editorial Roles*

- Editor-In-Chief, Foundations of Data Science, January 2019-.
- Editor, Statistics and Computing, Springer Nature, January 2022-.
- Senior Advisory Editor, Probabilistic Machine Learning, ACM, January 2023-
- Editor, Scientific Reports, May 2023-
- Associate Editor of Mathematical Biosciences and Engineering, 9/2018-.

## Harry F. Dahms

*Professor, Department of Sociology*  
*Co-Director, Center for the Study of Social Justice*  
*Co-Chair, Committee on Social Theory*  
*Editor, Current Perspectives in Social Theory*  
*Director, International Social Theory Consortium*  
 ph: (865) 974-7028 | email: [hdahms@utk.edu](mailto:hdahms@utk.edu)

### EDUCATION

- 9/1987-5/1993 PH.D. IN SOCIOLOGY. Graduate Faculty of Political and Social Science (GF) NEW SCHOOL FOR SOCIAL RESEARCH, New York. Dissertation: "The Entrepreneur in Western Capitalism: Schumpeter's Theory of Economic Development" (Honor: *Albert Salomon Memorial Award*). Dissertation Supervisor: Arthur J. Vidich (members: Andrew Arato, José Casanova).
- 10/1981-8/1987 M.A. IN SOCIOLOGY. Faculty of Social Sciences. UNIVERSITY OF KONSTANZ, Germany. Thesis: "Can a Democratic Society Experience a Legitimacy Crisis?" Thesis Supervisor: Prof. Ralf Dahrendorf (secondary reviewer: Wolfgang Fach, Political Science).

### PROFESSIONAL EXPERIENCE

- 8/2016- PROFESSOR OF SOCIOLOGY, University of Tennessee, Knoxville. Co-Director, Center for the Study of Social Justice. Co-Chair, Committee on Social Theory. Spring 2019: Leave semester for research on planetary sociology.
- 8/2004-7/2016 ASSOCIATE PROFESSOR OF SOCIOLOGY, University of Tennessee, Knoxville. Tenured in 2005. Co-Director (2014-), Acting Director (Fall 2013), Associate Director (8/09 7/13), Center for the Study of Social Justice. Co-Chair, Committee on Social Theory (August 2013-). Director of Graduate Studies (8/2006-7/2010; 1/2011-7/2011). Associate Head (8/2006-7/2010); Acting Head (8/2006-7/2010–intermittently). Director of Undergraduate Studies (interim: spring 2020; 8/2005-7/2006).
- 5-6/2011, 2012 VISITING PROFESSOR OF SOCIOLOGY, L. F. University Innsbruck, Austria.
- 2010- AFFILIATED FACULTY, Institute of Sociology, Leopold Franzens University Innsbruck, Austria (5/2010, 6/2013, 12/2015, 5/2017, 6/2018, 6/2019).
- 8/1999-6/2004 ASSOCIATE PROFESSOR OF SOCIOLOGY, Florida State University (tenured in 1999). Director of Graduate Studies (1/2002-7/2004).
- 10/1999-7/2000 VISITING PROFESSOR OF SOCIOLOGY, Center for European and North American Studies, Georgia Augusta University Göttingen, Germany.

8/1993-7/1999 ASSISTANT PROFESSOR OF SOCIOLOGY, Florida State University.

8/1992-6/1993 INSTRUCTOR, Gallatin Division, New York University.

### ***PUBLICATIONS:***

Dr. Dahms has an extensive publication record spanning book, edited volumes, journal articles, book chapters, encyclopedia articles, and book reviews. His scholarship focuses heavily on social and critical theory, political economy, globalization, and modern society. The following is a list of selected publications.

#### **Books**

- Modern Society as Artifice: Critical Theory and the Logic of Capital (Routledge, forthcoming 2021)
- The Vitality of Critical Theory (Emerald, 2011)

#### **Edited Volumes**

- Over 15 edited volumes, including The Centrality of Sociality (Emerald, forthcoming 2021), Planetary Sociology (Emerald, forthcoming 2020), The Challenge of Progress (Emerald, 2019), Ecologically Unequal Exchange (Palgrave, 2018), and others on topics like social theory, political economy, and globalization.

#### **Articles**

- Over 30 refereed journal articles published in venues like Critical Sociology, Basic Income Studies, Theory and Society, International Journal of Politics, Culture and Society, and others. Topics cover critical theory, political economy, philosophy, globalization, basic income, and more.

#### **Book Chapters**

- Around 20 chapters in edited volumes on social theory, critical theory, philosophy, globalization, basic income, science fiction films, and related topics.

#### **Book Reviews**

- Book reviews published in Contemporary Sociology, Journal of Evolutionary Economics, Sociological Inquiry, and other journals.

#### **Encyclopedia Articles**

- Entries on topics like alienation, modernity, and ideology in Wiley Blackwell Encyclopedia of Sociology, Encyclopedia of Globalization, and other major reference works.

### ***LECTURES AND PRESENTATIONS***

Dr. Dahms is an invited speaker at major conferences worldwide, actively engages in conference organization, and frequently presents his research at national and international meetings. His lecturing reflects his reputation as a scholar in social theory, critical theory, and related areas.

- Has given over numerous keynote addresses at major national and international conferences, including meetings of the International Social Theory Consortium, which he

founded and organizes.

- Numerous invited presentations at conferences and universities in the US, Canada, UK, Austria, Germany, and other countries. Topics cover his research interests like social theory, critical theory, political economy, globalization, ideology, science fiction, and modern society.
- Has organized over 50 conference paper sessions, roundtables, and other events for associations like American Sociological Association, Southern Sociological Society, and Midwest Sociological Society.
- Presented over 60 papers at national conferences like ASA, SSS, and MSS.
- Presented dozens of papers at international conferences in US and Europe.
- Given invited lectures at universities across the US and Europe, including UT Knoxville, Florida State, University of Innsbruck (Austria), University of Magdeburg (Germany), and others.

### ***PROFESSIONAL SERVICE***

- Director of the International Social Theory Consortium (2016-present)
- Editor of the journal *Current Perspectives in Social Theory* (2008-present)
- Associate Editor for *Basic Income Studies* journal (2005-present)

#### Editorial Activities

- Editorial board member for several journals including *The Sociological Quarterly*, *Soundings*, *The New York Sociologist*.
- Manuscript reviewer for over 15 academic journals.
- Book proposal reviewer for publishers like Cambridge Univ Press, Palgrave, Routledge.

#### Academic Associations

- Active in American Sociological Association, Southern Sociological Society, Midwest Sociological Society, and other major professional organizations.
- Served on committees, conference program committees, and in other service roles.

#### Standards Development

- No activities listed related to standards development.

### ***TEACHING EXPERIENCE***

Dr. Dahms has extensive graduate and undergraduate teaching experience spanning over two decades and multiple institutions. His teaching covers his broad scholarly expertise in social theory, political economy, globalization, and various other domains within sociology.

- Over 25 years of teaching experience at University of Tennessee, Florida State University, University of Innsbruck (Austria), and other institutions.
- Has taught a wide variety of graduate and undergraduate courses in his areas of expertise like sociological theory, political economy, globalization, social justice, science fiction, and more.
- Regularly teaches core graduate theory seminars at UT Knoxville and previously at Florida State.
- Taught specialized graduate seminars on thinkers like Adorno and topics like American critical theory.
- Developed and taught new graduate and undergraduate courses throughout his career.
- Taught undergraduate courses in sociological theory, social class, globalization, science fiction films, sociology of business/government, and other topics.
- Directed dozens of independent studies and graduate research projects.
- Served as graduate director and on graduate committees for much of his time at UT and Florida State.

**Dr. Dania Bilal, Professor**  
 University of Tennessee  
 School of Information Sciences  
 1345 Circle Park Dr., Suite 451  
 Knoxville, TN 37996-0341 USA  
[danial@utk.edu](mailto:danial@utk.edu)

### Education

**PhD**, Florida State University  
**MSLS**, Florida State University  
**BS**, Lebanese University

### Professional Experience (most recent)

**University of Tennessee, School of Information Sciences, Knoxville, TN**

- Professor, August 2007-present
- Interim Director, July 1, 2015-August 7, 2016
- Associate Professor, August 2002-July 2007
- Assistant Professor, August 1997-May 2002

### Teaching (current)

- Information Science Theory
- Human-Computer Interaction
- Foundations of User Experience
- Usability Methods and Tools
- Seminar in Youth Informatics

### Work Experience

**University of Tennessee, Knoxville, TN (most recent)**

*School of Information Sciences, College of Communication, and Information*

- Interim Director, July 1, 2015-August 7, 2016
- Professor, August 2007-present
- Associate Professor, August 2002-July 2007
- Assistant Professor, August 1997-May 2002

### Research and Scholarly Publications

#### Books

- Bilal, D., & Beheshti, J. (Eds.). (2014). *New directions in children's and adolescents' information behavior research*. Badfork, U.K.: Emerald Group Publishing, Inc.
- Bilal, D. (2014). *Library automation: Core concepts and practical systems analysis*. Westport, CT: Libraries Unlimited, ABC-CLIO.
- Nahl, D., & Bilal, D. (Eds.). (2007). *Information and emotion: The emergent affective paradigm in information behavior research and theory*. Medford, NJ: Information Today.  
<http://books.infotoday.com/asist/InformationAndEmotion.shtml>
- Bilal, D. (2002). *Automating media centers and small libraries: A microcomputer-based approach* (2<sup>nd</sup> ed.). Westport, CT: Libraries Unlimited.

#### Peer-Reviewed Publications

- Bilal, D. (202). Theoretical applications in children and youth information behavior research: 1999-2019. *Proceedings of the 85th Annual Meeting of the Association for Information Science & Technology*, Oct 29-Nov 1, Pittsburgh, PA (forthcoming; long paper).
- Yuan, F., Boltz, M., Bilal, D., Duzan J., Bahour, A., Crane, M., & Zhao, X. (2022). Cognitive exercise for persons with Alzheimer's Disease and related Dementia using a social robot. *IEEE Transactions on Robotics Journal*.
- Bilal, D., Chu, C.M., & Rieh, S.Y. (2022). AI education in iSchools: Reshaping the curricula for an equitable and inclusive information landscape. *Proceedings of the 17th International Conference, iConference*, February 28-March 4. Abstract.

- Rieh, S.Y., Chu, C.M., & Bilal, D. (2022). AI in the real world: Strengthening connections between LIS research and practice. *Proceedings of the 85th Annual Meeting of the Association for Information Science & Technology, Oct 20-Nov 1, Pittsburgh, PA. (Forthcoming). Extended abstract.*
- Yuan, F., Boltz, M., Bilal, D., Duzan, J., Crane, M., & Zhao, X. (2022). Cognitive rehab for people with dementia based on human-robot communication modeling. *MECC: 2022 Modeling, Estimation and Control Conference*, October 2-5, New Jersey City, NJ. (Abstract).
- Bilal, D., & Barfield, J. (2021). Voice switching in voice-enabled digital Assistants (VDAs). *Proceedings of the 2021 Human-Computer Interaction International Conference*, July 24-29 (pp. 507-520).
- Bilal, D., & Barfield, J. K. (2021). Hey there! What do you look like? User voice switching and Interface mirroring in voice-enabled digital assistants (VDAs). *Proceedings of the 84th Annual Meeting of the Association for Information Science & Technology*, Oct. 29 – Nov. 3, 2021, Salt Lake City, UT (pp. 1-12).
- Yuan, F., Zhang, R., Bilal, D., & Zhao, X. (2021). Learning-based strategy design for robot-assisted reminiscence therapy based on a developed model for people with Dementia. *Social Robotics: Proceedings of the 13th International Conference on Social Robotics (ICSR 2021)*, November 10-13, Singapore (pp. 432-442).
- Barfield, J., & Bilal, D. (2021). The Effect of race, ethnicity, gender, religion, and cultural competence on user perception of embodied voice interfaces in digital assistants. *Proceedings of the 84th Annual Meeting of the Association for Information Science & Technology, Social Informatics Workshop*, Oct. 29 – Nov. 3, 2021, Salt Lake City, UT. Extended abstract.
- Bilal, D., & Chu, C.M. (2021). Educating the next generation of AI leaders in libraries: IDEA Institute on AI. *Lebanese Library Association/IFLA Oceania Section Conference, Libraries as Power of Change*. May 19, 2021, Beirut, Lebanon. Extended abstract. (Virtual). Invited. <https://lebaneselibRARYassociation.org/presentations>
- Rieh, S. Y, Chu, C. M., & Bilal, D. (2021). Artificial Intelligence in information research and practice: Fostering interconnected communities. *Proceedings of the 84th Annual Meeting of the Association for Information Science & Technology*, Oct. 29 – Nov. 3, 2021, Salt Lake City, UT. Extended abstract.
- Allard, S., Bilal, D., Fleming-May, R., Forrester, A., Frame, A., Mayes, R., & Tenopir, C. (2018). Merging coursework with real world experience: Testing user experience in a science agency. *Proceedings of the iConference 2018, Special Program: iSchools and Industry Partnerships*, March 25-18, Sheffield, UK (pp. 1-7). Springer Lecture Note Series. <https://ischools.org/resources/Documents/iconf%202018/iSchool-industry.partnerships-UXA.pdf>
- Fleming-May, R., Mays, R., Forrester, A., Walker, T., Tenopir, C., Bilal, D., & Allard, S. (2017). Experience assessment: Designing an innovative curriculum for assessment and UX professionals. *Performance Measurement and Metrics*, 19(1), 30-39. <https://doi.org/10.1108/PMM-09-2017-0036>
- Bilal, D. (2012). Ranking, relevance judgment, and precision of information retrieval on children's queries: Evaluation of Google, Yahoo!, Bing, Yahoo! Kids, and Ask Kids. *Journal of the American Society for Information Science and Technology*, 63(9), 1879-1896. <http://onlinelibrary.wiley.com/doi/10.1002/asi.22675/full>
- Bilal, D., Sarangthem, S., & Bachir, I. (2008). Toward a model of children's information seeking behavior in using digital libraries. *ACM International Conference Proceeding Series*, 348. *Proceedings of the Second International Symposium on Information Interaction in Context (IliX)*. October 14-17, London, UK (pp. 145-151). <http://dl.acm.org/citation.cfm?doid=1414694.1414727>
- Bilal, D. (2006). Measuring the usability of an international user interface: Culture and design representations. In *Human-Computer Interaction Symposium, The American Society for Information Science & Technology*. <http://web.utk.edu/~dania/HCI%20Symposium.doc>
- Bilal, D. (2003). Draw and tell: Children as designers of web interfaces. *Proceedings of the 66th Annual Meeting of the American Society for Information Science & Technology*. October 18-22, Long Beach, CA (pp. 135-141). <http://onlinelibrary.wiley.com/doi/10.1002/meet.1450400117/abstract?deniedAccessCustomisedMessage=&userIsAuthenticated=false>

- Bilal, D., & Kirby, J. (2002). Differences and similarities in information seeking: Children and adults as web users. *Information Processing & Management*, 38(5), 649-670. <http://www.sciencedirect.com/science/article/pii/S0306457301000577>
- Bilal, D. (2002). Children's use of the Yahoo!igans! web search engine. III. Cognitive and physical behaviors on fully self-generated tasks. *Journal of the American Society for Information Science & Technology*, 53(13), 1170-1183. <https://doi.org/10.1002/asi.10145>
- Bilal, D. (2001). Children's use of the Yahoo!igans! web search engine. II. Cognitive and physical behaviors on research tasks. *Journal of the American Society for Information Science & Technology*, 52(2), 118-137. [http://twiki.cite.hku.hk/pub/MITE6025/GroupD/Childrens\\_use\\_of\\_the\\_Yahoo!igans!\\_Web\\_search\\_engine.pdf](http://twiki.cite.hku.hk/pub/MITE6025/GroupD/Childrens_use_of_the_Yahoo!igans!_Web_search_engine.pdf)
- Bilal, D. (2000). Children's use of the Yahoo!igans! web search engine. I. Cognitive, physical, and affective behaviors on fact-based tasks. *Journal of the American Society for Information Science*, 51(7), 646-665. <http://ithreads.pbworks.com/f/yhoo1.pdf>
- Bilal, D., Barry, J., & Penniman, D. W. (1999). Automated system marketplace 1999: A balancing act. *Library Journal*, April 1, 45-54.
- Bilal, D. (1994). Automating library media centers in Georgia: A survey of practices, knowledge, issues, and trends. *School Library Media Quarterly*, 22(4), (pp. 221-230).

### Grants & Research Proposals

- Bilal, D. (PI), Chu, C. (Co-PI), & Rieh, S.Y. (Co-PI). (2020-2023). IDEA (Innovation, Disruption, Enquiry, Access) Institute on Artificial Intelligence (AI). IMLS Laura Bush 21<sup>st</sup> Century Librarian Program. Funded (\$208,142), September 1, 2020, August 31, 2022; Extended until August 31, 2023).
- Bilal, D. (Co-PI), Tenopir, C. (PI), Fleming-May, R. (Co-PI), & Mays, R. (Co-PI). Experience Assessment: Building User Experience and Assessment Capabilities in Libraries and Information Centers. IMLS Laura Bush 21<sup>st</sup> Century Librarian Program. Funded: \$811,500.00. June 1, 2016-May 31, 2018.
- Bilal, D. (PI), & Gwizdzka, J (Co-PI). Child-friendly SERPs: Towards a better understanding of Google search results readability by children. August 2014. Google, Inc. \$41,363.

### Awards

#### Association of Information Science and Technology (ASIST)

- SIG USE Outstanding Contributions to Information Behavior Research Award, 2017.
- SIG Publication-of-The-Year Award 2008 for the book, *Information and Emotion: The Emergent Affective Paradigm in Information Behavior Research and Theory*. Medford, New Jersey: Information Today.

#### Association of Library and Information Science Education (ALISE)

- Teaching Excellence Award, 2007

#### University of Tennessee, College of Communication and Information

- The Carol Tenopir Faculty Award for Outstanding Contributions. 2022. A special award given in celebration of the School of Information Sciences celebration of its 50th Anniversary of ALA accreditation
- Distinguished Administrative Service Award, 2015-2016

### Service (School of Information Sciences-SIS)

#### Committees (Current)

- Strategic Plan Committee, Chair, Fall 2022
- Tenure and Promotion Committee, Chair, Fall 2018-2020
- Director's Research Advisory Committee, Fall 2019



## Deborah Penchoff

Associate Director of Innovative Computing Laboratory and Research Assistant Professor  
 December 2020–present, Associate Director, [UT Innovative Computing Laboratory](#)  
 Provides leadership in creating, developing, carrying out and communicating the  
 research program directives, including support for the Director in coordinating with  
 university, national and international organizations with whom the center collaborates.  
 Her role includes leadership, staff management, proposals development, strategic  
 planning, and project development, including directing synergistic projects involving  
 internal and external partners with research focus on scientific computing

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## Education

PhD, Physical Chemistry with IGMCS (UT Interdisciplinary Graduate Minor in  
 Computational Science), University of Tennessee, Knoxville, 2014  
 Dissertation: Computational Studies for Optimization and Design of Extracting Agents  
 for Separations of Lanthanides and Actinides.  
 Advisor: Robert J. Harrison; co-advisor: George K. Schweitzer  
 BS, Chemistry and Mathematics, Lee University, 2007

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## Professional Service

2022 - present, Member, DOE Exascale Workforce Development and Retention Action  
 Group (HPC-WDR)  
 2021–2024, Elected Officer, Member-at-large, Executive Committee, Nuclear Chemistry  
 & Technology Division, American Chemical Society (ACS-NUCL)  
 2021, Chief Editor, ACS Book Series, [Rare Earth Elements and Actinides: Progress in  
 Computational Science Applications](#)  
 2020 –present, Energy and Environment Baker Fellow, Howard H. Baker Jr. Center for  
 Public Policy  
 2021-present, Chair, Data Science & Artificial Intelligence Applications in Nuclear and  
 Radiochemistry, ACS-NUCL  
 2018–present, Chair, Computational Science for Rare Earth Elements/Lanthanides &  
 Actinides, ACS-NUCL  
 2021 - present, member, UTK Institutional Review Board  
 2022 - present, Officer, Ad-Hoc Asian American and Pacific Islander (AAPI) Commission,  
 UTK Office of the Chancellor  
 2020-present, Officer, Commission for Blacks, UT Office of the Chancellor  
 2020–present, Strategic Planning Committee, ACS-NUCL  
 2020-present, Member, UT Coronavirus-19 Outbreak Response Experts (CORE-19)  
 2020–present, Member, Retention Committee in Student Success Advisory Board, UT  
 Tickle College of Engineering  
 2020–present, Co-chair, Diversity, Equity, and Inclusion Action Committee (DEIAC), UT  
 Nuclear Engineering

2020, Member, Outreach and Engagement Subcommittee, UT COVID-19 Taskforce  
 2021-2022, Chair, Technical Panels, Practice & Experience in Advanced Research Computing (PEARC21, PEARC22)  
 2020–2021, Mentor in University of Tennessee Promise Program  
 2020–2021, Mentor, NSF XSEDE EMPOWER (Expert Mentoring Producing Opportunities for Work, Education, and Research) program  
 2020–present, XSEDE Campus Champion, NSF Extreme Science and Engineering Discovery Environment  
 2020–2021, Chair, Young Investigators in Nuclear & Radiochemistry, ACS-NUCL  
 2017, 2019, Co-Organizer, Radiobioassay and Radiochemical Measurements Conference  
 2014, Chair, Gordon Research Seminar on Computational Chemistry

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### Awards and Recognitions

2021, Faculty Service Award – UT Department of Nuclear Engineering  
 2020, Early Career Program Awardee – International Conference for High Performance Computing, Networking, Storage, and Analysis (SC20)  
 2015, Research Highlight – Joint Institute for Computational Sciences – Technology Researcher Q&A: “Deborah Penchoff discusses the importance of rare earth elements to society”  
 2010, Outstanding Teaching Award (American Chemical Society Student Affiliates)  
 2008, Outstanding Teaching Award (University of Tennessee, Chemistry)

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### Publications

Select list of publications. For the full list, view their [Google Scholar page](#).

- Joseph F. DeJesus, Ryan W. F. Kerr, Deborah A. Penchoff, Xian B. Carroll, Charles C. Peterson, Polly L. Arnold,\* David M. Jenkins. Actinide Tetra-N-heterocyclic Carbene ‘Sandwiches’. *Chemical Science.*, 2021, 12, 7882-7887. [doi.org/10.1039/D1SC01007G](https://doi.org/10.1039/D1SC01007G)
- Deborah A. Penchoff, Eduard Valeev, Heike Jagode, Piotr Luszczek, Anthony Danalis, George Bosilca, Robert J. Harrison, Jack Dongarra, Theresa L. Windus. An Introduction to High Performance Computing and its Intersection with Advances in Modeling Rare Earth Elements and Actinides. *Rare Earth Elements and Actinides: Progress in Computational Science Applications*. Vol. 1388, Chapter 1, 2021. <https://pubs.acs.org/doi/10.1021/bk-2021-1388.ch001>
- Deborah A. Penchoff, Charles B. Sims, Theresa L. Windus. Rare Earth Elements & Critical Materials: Uses and Availability. *Rare Earth Elements and Actinides: Progress in Computational Science Applications*, Vol. 1388, Chapter 3, 2021. <https://pubs.acs.org/doi/10.1021/bk-2021-1388.ch003>
- Huei Meznarich, Deborah A. Penchoff. A Brief on Nuclear Waste at Hanford Site and a Computational Analysis of Uranyl Nitrate with and without Tributyl Phosphate. *Rare Earth Elements and Actinides: Progress in Computational*

Science Applications, Vol. 1388, Chapter 5,

2021. <https://pubs.acs.org/doi/10.1021/bk-2021-1388.ch005>

- Joseph F. DeJesus, Ryan W. F. Kerr, Deborah A. Penchoff, Xian B. Carroll, Charles C. Peterson, Polly L. Arnold, David M. Jenkins. Macrocyclic Tetra-carbene Actinide Sandwiches. *Chemical Science.*, 2021, 12, 7882-7887. <https://pubs.rsc.org/en/content/articlehtml/2021/sc/d1sc01007g>
- Deborah A. Penchoff, Katie Cahill. “How do Stay-at-Home measures affect Knox County?”. Howard H. Baker Jr. Center for Public Policy, Baker Policy Briefs, April 2020, 04.13/1-10. <https://t.e2ma.net/webview/7tqlfc/050ecd4e0cd82d2a9a57581f90a3803f>
- Charles C. Peterson, Deborah A. Penchoff, John D. Auxier II, Howard L. Hall. “Establishing Cost-Effective Computational Models for the Prediction of Lanthanide Binding in  $[\text{Ln}(\text{NO}_3)]_2^+$  (with Ln = La to Lu)”, *ACS Omega*, 2019, 4, 1, 1375-1385. <https://pubs.acs.org/doi/10.1021/acsomega.8b02403>
- Deborah A. Penchoff, Charles Peterson, Jon P. Camden, James Bradshaw, John D. Auxier, George K. Schweitzer, David M. Jenkins, Robert J. Harrison, Howard L. Hall. “Structural Analysis of the Complexation of Uranyl, Neptunyl, Plutonyl, and Americyl with Cyclic Imide Dioximes”, *ACS Omega*, 2018, 3, 10, 13984-13993. <https://pubs.acs.org/doi/10.1021/acsomega.8b02068>
- Deborah A. Penchoff, Charles C. Peterson, Mark S. Quint, John D. Auxier II, George K. Schweitzer, David M. Jenkins, Robert J. Harrison\*, Howard L. Hall. “Structural Characteristics, Population Analysis, and Binding Energies of  $[\text{An}(\text{NO}_3)]_2^+$ , [with An = Ac - Lr]”, *ACS Omega*, 2018, 3, 10, 14127-14143. <https://pubs.acs.org/doi/10.1021/acsomega.8b01800>

**Agustin Rius**

Associate Professor, Animal Science at University of Tennessee Institute of Agriculture  
University of Tennessee Institute of Agriculture

**Education**

2005 - 2009 Virginia Tech

PhD, Department of Dairy Science, Nutrition  
PhD, Department of Dairy Science,  
Nutrition

2002 - 2004 University of Illinois Urbana-Champaign

Master of Science, Animal Science  
Master of Science, Animal Science

**Professional Experience**

Jun 2019 - Present · Associate Professor, Animal Science  
University of Tennessee Institute of Agriculture  
Knoxville, Tennessee Area  
Knoxville, Tennessee Area

Sep 2013 - Jun 2019 · Assistant Professor, Animal Science  
University of Tennessee Institute of Agriculture  
Knoxville, Tennessee Area  
Knoxville, Tennessee Area

Jul 2009 - Aug 2013 · Research Scientist  
DairyNZ, Hamilton, New Zealand

**Selected Publications**

## JOURNAL ARTICLE

Heat stress-associated changes in the intestinal barrier, inflammatory signals, and microbiome communities in dairy calves. 18 Sep 2023  
J Dairy Sci Co-authors Yu Z, Cantet JM, Paz HA...4 more

## JOURNAL ARTICLE

A cinnamaldehyde feed additive improved feed use-efficiency in lactating dairy cows  
1 Jun 2023  
Livestock Science 272  
Co-authors Cantet JM, Yu Z, Tucker HA...1 more

## JOURNAL ARTICLE

Physiological responses of Holstein calves to heat stress and dietary supplementation with a postbiotic from *Aspergillus oryzae*  
1 Dec 2022  
Scientific Reports 12(1)  
Co-authors Rius AG, Kaufman JD, Li MM...2 more

## CONFERENCE

Dexamethasone improved productivity of heat-stressed dairy calves.

2022Annual Meeting of the American-Dairy-Science-AssociationJOURNAL OF DAIRY SCIENCE105:234 (1 page)ELSEVIER SCIENCE INC  
Co-authors Cantet JM, Yu Z, Nair MRR...1 more

#### CONFERENCE

Effects of heat stress on inflammation and intestinal integrity in dairy calves  
2022Annual Meeting of the American-Dairy-Science-AssociationJOURNAL OF DAIRY SCIENCE105:185 (1 page)ELSEVIER SCIENCE INC  
Co-authors Yu Z, Cantet JM, Rius AG

#### CONFERENCE

Effects of heat stress on inflammation and intestinal integrity in dairy calves.  
2022Annual Meeting of the American-Dairy-Science-AssociationJOURNAL OF DAIRY SCIENCE105:173 (1 page)ELSEVIER SCIENCE INC  
Co-authors Yu Z, Cantet JM, Rius AG

#### JOURNAL ARTICLE

A postbiotic from *Aspergillus oryzae* attenuates the impact of heat stress in ectothermic and endothermic organisms  
1 Dec 2021Scientific Reports11(1)  
Co-authors Kaufman JD, Seidler Y, Bailey HR...7 more

#### JOURNAL ARTICLE

Heat stress-mediated activation of immune–inflammatory pathways  
1 Nov 2021Antibiotics10(11)  
Co-authors Cantet JM, Yu Z, Rius AG

#### JOURNAL ARTICLE

Prevalence of mastitis and antibiotic resistance of bacterial isolates from cmt positive milk samples obtained from dairy cows, camels, and goats in two pastoral districts in southern ethiopia  
1 Jun 2021Animals11(6)  
Co-authors Balemi A, Gumi B, Amenu K...7 more

#### JOURNAL ARTICLE

Cooling and dietary crude protein affected milk production on heat-stressed dairy cows  
1 Oct 2020Livestock Science240  
Co-authors Kaufman JD, Bailey HR, Kennedy AM...2 more

#### JOURNAL ARTICLE

Rumen-protected lysine supplementation increased milk production in dairy cows fed a lysine-deficient diet  
1 Oct 2019Applied Animal Science35(5):482-490  
Co-authors Bailey HR, Kaufman JD, Estes KA...3 more

#### JOURNAL ARTICLE

A redefinition of the modeled responses of mammary glands to once-daily milking  
 1 Jul 2019 *Journal of Dairy Science* 102(7):6595-6602  
 Co-authors Rius AG, Levy G, Turner SA...3 more

#### JOURNAL ARTICLE

INVITED REVIEW: Adaptations of protein and amino acid metabolism to heat stress in dairy cows and other livestock species \* †  
 1 Feb 2019 *Applied Animal Science* 35(1):39-48  
 Co-authors Rius AG

#### CONFERENCE

Amino acid utilization by mammary glands in response to dietary protein and insulin.  
 2019 *JOURNAL OF DAIRY SCIENCE* 102:118 (1 page) ELSEVIER SCIENCE INC  
 Co-authors Campos LM, Rius AG, Appuhamy JADRN...3 more

#### JOURNAL ARTICLE

Mammary Gland Amino Acid Flux For Lactating Dairy Cows In Response To Hyperinsulinemia And Dietary Protein  
 1 Jan 2019 *EAAP Scientific Series* 138:397-398  
 Co-authors Bompadre TFV, Campos LM, Rius AG...3 more

#### JOURNAL ARTICLE

Mammary gland amino acid affinity in response to different levels of dietary protein and insulin  
 1 Jan 2019 *EAAP Scientific Series* 138:395-396  
 Co-authors Campos LM, Rius AG, Kirovski D...3 more

#### CONFERENCE

The probability of subclinical mastitis and isolated organisms in organic dairy herds varies between years.  
 2019 *JOURNAL OF DAIRY SCIENCE* 102:26-27 (2 pages) ELSEVIER SCIENCE INC  
 Co-authors Luc EK, Schneider G, Couture VL...5 more

#### JOURNAL ARTICLE

Short communication: High incubation temperature in bovine mammary epithelial cells reduced the activity of the mTOR signaling pathway  
 1 Aug 2018 *Journal of Dairy Science* 101(8):7480-7486  
 Co-authors Kaufman JD, Kassube KR, Almeida RA...1 more

#### JOURNAL ARTICLE

Short communication: Relationships among temperature-humidity index with rectal, udder surface, and vaginal temperatures in lactating dairy cows experiencing heat stress  
 1 Jul 2018 *Journal of Dairy Science* 101(7):6424-6429  
 Co-authors Kaufman JD, Saxton AM, Rius AG

**Thomas Berg**

Associate Professor  
College of Nursing  
University of Tennessee, Knoxville,

**Education**

1975 - 1981 BS/MBABS/MBA  
University of Wisconsin-Madison

Master of Business Administration  
University of Wisconsin–Whitewater, Whitewater, United States

2019 PhD, Industrial and Systems Engineering  
University of Tennessee at Knoxville, Knoxville, United States

**Professional Experience**

2023-present  
Associate Professor at University of Tennessee, Knoxville, College of Nursing

2019-2023  
Assistant Professor at University of Tennessee, Knoxville, College of Nursing

Oct 2008 - Jul 2019  
Director Technology Development , Technology Transfer and University Partnerships

**Selected Publications**

Development of a Proof-of-Concept Multi-Method Computer Simulation to Support Rural Healthcare Disaster Preparedness Planning  
31 Dec 2023. International Journal of Disaster Risk Science  
Co-authors Berg T, Kitzinger K, Crumly J...3 more

Public Health Computer Simulation Tool to Support Disaster Preparedness in Rural Communities  
16 Aug 2023 Extending Public Health Disaster Research and Community Engagement in the U.S. Territories: Special Call 3  
Co-authors Kitsinger K, Berg T, Stansberry T...3 more

The Application of Model-Based Systems Engineering to Rural Healthcare System Disaster Planning: A Scoping Review  
1 Jun 2023 International Journal of Disaster Risk Science 14(3):357-368  
Co-authors Berg TA, Marino KN, Kintziger KW

Improving Rural Healthcare Disaster Preparedness: Development of a Multimethod Computer Simulation to Support Disaster Planning (in review)

31 Jan 2023 Health and Emergency Preparedness in Rural Communities, Disaster  
Medicine and Public Health Preparedness  
Co-authors Berg T, Kintzinger K, Lawson S...2 more

Use of Discrete Event Simulation and Monte Carlo Methods to Prioritize Selection of  
Critical Programs, Final Report. United States Department of Energy Y12 National  
Nuclear Security Complex  
30 Sep 2022  
Co-authors Berg T, Lawson, S, Allard G

Improving Rural Healthcare Disaster Preparedness: Development of a Multimethod  
Computer Simulation to Support Disaster Planning  
1 Sep 2022  
Co-authors Berg T, Kintzinger K, Lawson S...2 more

Simulation as a Soft Digital Twin for Maintenance Reliability Operations  
1 Jan 2022 Proceedings - Winter Simulation Conference 2022-December:2499-2510  
Co-authors Li X, Berg T, Jones G...5 more

Simulation as a Soft Digital Twin for Maintenance Reliability Operations  
2022  
Co-authors Berg T, Li X, Jones G

Use of Discrete Event Simulation and Monte Carlo Methods to Prioritize Selection of  
Critical Programs, Final Report.  
2022 United States Department of Energy Y12 National Nuclear Security Complex  
Co-authors Berg T, Allard G, Lawson S

Use of Simulation to Measure the Effects of Just-in-Time Information to Prevent Nursing  
Medication Errors: A Randomized Controlled Study  
1 Dec 2021 Simulation in Healthcare 16(6):E136-E141  
Co-authors Berg TA, Hebert SH, Chyka D...2 more

Application of Advanced Systems Modeling to Improve High Consequence Decision  
Making  
30 Sep 2021  
Co-authors Berg T, Allard G, Stowe A...2 more

Agent-Based Modeling Simulation of Nurse Medication Administration Errors  
1 Apr 2021 CIN - Computers Informatics Nursing 39(4):187-197  
Co-authors Berg TA, Li X, Sawhney R...1 more

Disaster Preparedness Summit  
2 Feb 2021 Disaster Preparedness Summit <https://www.naccho.org/blog/articles/recap-2021-preparedness-summit>  
Co-authors Berg T, Crumly J, Gray F...1 more



Application of Advanced Systems Modeling to Improve High Consequence Decision Making.

2021 United States Department of Energy Y12 National Nuclear Security Complex  
Co-authors Berg T, Baucum M, Frederick J...2 more

A Randomized Control Trial Measuring Effects of a Just-In-Time App to Prevent Nursing Medication Errors

30 Nov 2020 Simulation in Healthcare: Journal of the society for simulation in healthcare  
Wolters Kluwer Health  
Co-authors Berg T, Hebert S, Chyka D...2 more

Simulation of Nurse Medication Administration Errors

19 Oct 2020 Computers, and Nursing Informatics  
Co-authors Berg T, Li X, Wyatt T...1 more

The application of random forest to predictive maintenance

1 Jan 2018 IIE Annual Conference and Expo 2018 354-359  
Co-authors Kizito R, Scruggs P, Li X...3 more

The application of random forest to predictive maintenance.  
2018

Co-authors Berg T, Devinney M, Kress R...3 more

Modeling the clinic patient scheduling as a flexible job-shop problem: A case study

1 Jan 2013 IIE Annual Conference and Expo 2013 2952-2960  
Co-authors Zhao Z, Li X, Zhu X...2 more

Modeling the clinic patient scheduling as a flexible job-shop problem: A case study  
2013

Co-authors Zhao Z, Wilck J, Zhu X...2 more

Optimizing a healthcare clinic using real-time location system and simulation

1 Jan 2013 IIE Annual Conference and Expo 2013 1409-1417  
Co-authors Li X, Guo C, Mattie C...2 more

Optimizing a healthcare clinic using real-time location system and simulation.  
2013

Co-authors Berg T, Wilck J, Mattie C...2 more

Cost reduction in healthcare via Lean Six Sigma

1 Jan 2012 2nd IIE Annual Conference and Expo 2012 1263-1270  
Co-authors Huang Y, Li X, Wilck J...1 more

Cost reduction in healthcare via Lean Six Sigma  
2012

Co-authors Berg T, Wilck J, Li X...

**Stanimire Tomov****Research Director and Research Associate Professor**Innovative Computing Laboratory

Electrical Engineering and Computer Science Department

University of Tennessee, Knoxville

**Contact Information**

- **Office Address:** Claxton Building, Room 317
- **Phone:** 865-974-6317
- **Fax:** 865-974-8296
- **E-mail:** [tomov@icl.utk.edu](mailto:tomov@icl.utk.edu)

**Education**

- PhD in Mathematics, Texas A&M University, TX, 2002
- MS in Mathematics, Texas A&M University, TX, 1999
- BS and MS in Computer Science, Sofia University St. Kliment Ohridski, Bulgaria, 1994

**Research Statement**

Tomov's research interests are in parallel algorithms, numerical analysis, and high-performance scientific computing (HPC). He has been involved in the development of numerical algorithms and software tools in a variety of fields ranging from scientific visualization and data mining to accurate and efficient numerical solution of PDEs. Currently, his work is concentrated on the development of numerical linear algebra libraries for emerging architectures for HPC, such as heterogeneous multicore processors, graphics processing units (GPUs), and Many Integrated Core (MIC) architectures. In particular, he is leading the development of the Matrix Algebra on GPU and Multicore Architectures (MAGMA) libraries, targeting to provide LAPACK/ScaLAPACK functionality on the next-generation of architectures. Tomov is also a Principal Investigator of the CUDA Center of Excellence (CCOE) at UT, and Co-PI of the Intel Parallel Computing Center (IPCC) at ICL.

**Selected Publications**PAQR: Pivoting Avoiding QR factorizationW Sid-Lakhdar, S Cayrols, D Bielich, A Abdelfattah, P Luszczek, M Gates, ...  
2023 IEEE International Parallel and Distributed Processing SymposiumAddressing irregular patterns of matrix computations on GPUs and their impact on applications powered by sparse direct solversA Abdelfattah, P Ghysels, W Boukaram, S Tomov, XS Li, J Dongarra  
SC22: International Conference for High Performance Computing, Networking ...2022Extending MAGMA Portability with OneAPIA Fortenberry, S Tomov  
The International Conference for High Performance Computing, Networking ...2022

A Python Library for Matrix Algebra on GPU and Multicore Architectures

D Nance, S Tomov, K Wong

2022 IEEE 19th International Conference on Mobile Ad Hoc and Smart Systems ...2022

Lossy all-to-all exchange for accelerating parallel 3-D FFTs on hybrid architectures with GPUs

S Cayrols, J Li, G Bosilca, S Tomov, A Ayala, J Dongarra

2022 IEEE International Conference on Cluster Computing (CLUSTER), 152-160 2022

Analysis of the Communication and Computation Cost of FFT Libraries towards Exascale

A Ayala, S Tomov, P Luszczek, S Cayrols, G Ragghianti, J Dongarra 2022

Parallel Path Tracking for Homotopy Continuation using GPU

CH Chien, H Fan, A Abdelfattah, E Tsigaridas, S Tomov, B Kimia

Proceedings of the International Symposium on Symbolic and Algebraic Computation 2022

Batch QR factorization on GPUs: Design, optimization, and tuning

A Abdelfattah, S Tomov, J Dongarra

International Conference on Computational Science, 60-74 2022

Mixed precision and approximate 3D FFTs: Speed for accuracy trade-off with GPU-aware MPI and run-time data compression

S Cayrols, J Li, G Bosilca, S Tomov, A Ayala, J Dongarra

Innovative Computing Laboratory Technical Report 2022

ECP Milestone Report High-order algorithmic developments and optimizations for more robust exascale applications WBS 2.2. 6.06, Milestone CEED-MS38

T Kolev, P Fischer, A Abdelfattah, N Beams, J Brown, JS Camier 2022

FFT Benchmark Performance Experiments on Systems Targeting Exascale

A Ayala, S Tomov, P Luszczek, S Cayrols, G Ragghianti, J Dongarra

Innovative Computing Laboratory Technical Report 2022

GPU-based homotopy continuation for minimal problems in computer vision

CH Chien, H Fan, A Abdelfattah, E Tsigaridas, S Tomov, B Kimia

Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern 2022

GPU algorithms for efficient exascale discretizations

A Abdelfattah, V Barra, N Beams, R Bleile, J Brown, JS Camier, R Carson, ...

Parallel Computing 108, 102841 2021

Accelerating Multi-Process Communication for Parallel 3-D FFT

A Ayala, S Tomov, M Stoyanov, A Haidar, J Dongarra

2021 Workshop on Exascale MPI (ExaMPI), 46-53 2021

Efficient exascale discretizations: High-order finite element methods

T Kolev, P Fischer, M Min, J Dongarra, J Brown, V Dobrev, T Warburton, ...  
The International Journal of High Performance Computing Applications 35 2021

Port and optimize the CEED software stack to Aurora/Frontier EA (ECP Milestone Report)

T Kolev, P Fischer, N Beams, J Brown, JS Camier, N Chalmers, V Dobrev, ...  
Lawrence Livermore National Lab.(LLNL), Livermore, CA (United States ...2021

A more portable HeFFTe: implementing a fallback algorithm for scalable Fourier transforms

D Sharp, M Stoyanov, S Tomov, J Dongarra  
2021 IEEE High Performance Extreme Computing Conference (HPEC), 1-5 2021

Exploiting Block Structures of KKT Matrices for Efficient Solution of Convex Optimization Problems

Z Iqbal, S Nooshabadi, I Yamazaki, S Tomov, J Dongarra  
IEEE Access 9, 116604-1166112021

Advances in Mixed Precision Algorithms: 2021 Edition

A Abdelfattah, H Anzt, A Ayala, E Boman, E Carson, S Cayrols, T Cojean, ...  
Lawrence Livermore National Lab.(LLNL), Livermore, CA (United States) 2021

libCEED: Fast algebra for high-order element-based discretizations

J Brown, A Abdelfattah, V Barra, N Beams, JS Camier, V Dobrev, ...  
Journal of Open Source Software 6 (63), 2945 2021

Interim Report on Benchmarking FFT Libraries on High Performance Systems

A Ayala, S Tomov, P Luszczek, S Cayrols, G Raghianti, J Dongarra  
2021

A survey of numerical linear algebra methods utilizing mixed-precision arithmetic

A Abdelfattah, H Anzt, EG Boman, E Carson, T Cojean, J Dongarra, A Fox, ...  
The International Journal of High Performance Computing Applications 35 2021

A set of batched basic linear algebra subprograms and LAPACK routines

A Abdelfattah, T Costa, J Dongarra, M Gates, A Haidar, S Hammarling, ...  
ACM Transactions on Mathematical Software (TOMS) 47 (3), 1-23 2021

Translational process: Mathematical software perspective

J Dongarra, M Gates, P Luszczek, S Tomov  
Journal of Computational Science 52, 101216 2021

# Curriculum Vitae

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## Dr. Kwai L. Wong

Research Assistant Professor

Department of Mechanical, Aerospace, and Biomedical Engineering

University of Tennessee, Knoxville

## Contact Information

Address: [Insert Address]

Phone: [Insert Phone]

Email: [Insert Email]

## Biography

2014-present: Research Assistant Professor, University of Tennessee, Knoxville

2014-present: Director of CFD Laboratory, MABE, UTK

2003-2013: Adjunct Faculty, MABE, UTK

1997-present: Research Scientist, Joint Institute for Computational Sciences, University of Tennessee/Oak Ridge National Laboratory

1996-1997: Postdoctoral Research Associate, JICS, UTK

1995-1996: Postdoctoral Fellows, Department of Mathematics, Chinese University of Hong Kong, Hong Kong

## Education

Ph.D., 1995, University of Tennessee, Knoxville

M.S., 1986, University of Tennessee, Knoxville

B.S., 1982, University of Tennessee, Knoxville

## Professional Experience

SIAM, member

Research Scientist, Joint Institute for Computational Sciences, 1997-Present

### Research Interests

Multiphysics simulations on large scale parallel computers

Finite element formulations for computational fluid dynamics

Parallel direct and sparse solvers for systems of linear equations

Numerical linear algebra implementation on GPUs

Scalable software framework for multi-disciplinary biomedical simulations

### Selected Publications

Freeman, A.J. Baker, J. Orzechowski, K. Wong, and J. Sanders, "Validation of a Time-Accurate Node-based Weak Form Algorithm for Convection – Grey Body Radiation Dominated Unsteady Heat Transfer," *J. Heat & Mass Transfer*, V.134, March 2014.

Kail, K. Wong, H. Xia, and X. Zhao, "Interoperable Executive Library for the Simulation of Biomedical Processes," *JCAM*, 10.1016/j.cam.2014.01.011, 2014.

D'Azevedo, Z. Hu, S. Su, and K. Wong, "Solving a Large Scale Radiosity Problem on GPU-based Parallel Computers," *JCAM*, 10.1016/j.cam.2014.02.011, 2014.

J. L. Kinter III, B. Cash, D. Achuthavarier, J. Adams, E. Altshuler, P. Dirmeyer, B. Doty, B. Huang, L. Marx, J. Manganello, C. Stan, T. Wakefield, E. Jin, T. Palmer, M. Hamrud, T. Jung, M. Miller, P. Towers, N. Wedi, M. Satoh, H. Tomita, C. Kodama, T. Nasuno, K. Oouchi, Y. Yamada, H. Taniguchi, P. Andrews, T. Baer, M. Ezell, C. Halloy, D. John, B. Loftis, R. Mohr, and K. Wong, "Revolutionizing Climate Modeling – Project Athena: A Multi-Institutional, International Collaboration," *BAMS*, V. 94, Issue 2 – Feb. 2013.

H. Xia, K. Wong, and X. Zhao, "A Fully Coupled Model for Electromechanics of the Heart," *Computational and Mathematical Methods in Medicines*, Article ID 927279. 2012.

R. F. Barrett, T. H. F. Chan, E. F. D'Azevedo, E. F. Jaeger, K. Wong, and R. Y. Wong, "Complex version of high performance computing LINPACK benchmark (HPL)," *Concurrency and Computation: Practice and Experience*, V. 22, Issue 5, p.573-587, April 2010.

Y. H. Kuo, K. L. Wong and C. F. Wong, "Investigation of Taylor-Gortler-like Vortices Using the Parallel Consistent Splitting Scheme," *Advances in Applied Mathematics and Mechanics*, Dec. 2009.

A. J. Baker, S.C. Ericson, J.A. Orzechowski, K.L. Wong and R.P. Garner, "Aircraft Passenger Cabin ECS-Generated Ventilation Velocity and Mass Transport CFD Simulation, II, Mass

Transport Validation,” Journal Inst. Environmental Sciences & Technology, V. 51, No 1, p. 90-113, 2008.

A.,J. Baker, S.C. Ericson, J.A. Orzechowski, K.L. Wong and R.P. Garner, “Aircraft Passenger Cabin ECS-Generated Ventilation Velocity and Mass Transport CFD Simulation, I. Velocity Field Validation,” Journal Inst. Environmental Sciences & Technology, V. 49, No. 2, p. 51-83, 2006.

A. J. Baker, K. L. Wong and N. S. Winowich, “Design and Assessment of a Very Large Scale CFD Industrial Ventilation Flowfield Simulation,” ASHARE Transactions, V. 108, Pt. 1, p. 999-1004, 2002.

K. L. Wong and A. J. Baker, “A 3-D INS Velocity-Vorticity Weak Form FE CFD Algorithm,” Int. Journal Num. Mtd. Fluids, V. 38, p. 99-123, 2002.

K. L. Wong and A. J. Baker, “A Modular Collaborative Parallel CFD Workbench,” Journal of Supercomputing, V. 22, p. 45-53, 2002.

## Cyber Training

Dr. Wong leads the NSF-funded LAPENNA program, an initiative under the NSF CyberTraining framework that aims to bolster AI literacy within the data-driven science sector. LAPENNA, standing for Linear Algebra Preparation for Emergent Neural Network Architectures, equips faculty, students, and researchers with expertise in numerical mathematics, linear algebra software, and machine learning tools.

LAPENNA's comprehensive curriculum encompasses:

1. **Introduction:** Webinar lectures and exercises on workstation operations, programming, parallel computing, and GPU-based data-driven science.
2. **In-depth Training:** Detailed sessions on data-driven sciences' mathematics, machine learning, numerical linear algebra, and practical project examples like image processing.
3. **Hands-on Implementation:** Practical work on implementing Deep Neural Networks (DNN) on GPU systems and evaluating their performance on high-end platforms.
4. **Integration:** Incorporating the learned materials into undergraduate curriculums.

The program conducts two annual training sessions, each culminating in a week-long workshop. In addition, LAPENNA provides ten webinars and lectures, paired with online tutorials for the broader community.

**Gary Pulsinelli**

Professor of Law at University of Tennessee

**Education**

J.D., 1997, University of California-Berkeley

Ph.D, 1994, University of Wisconsin-Madison

A.B., 1985, Harvard University

**Professional Experience**

2001 – present            Professor of Law  
University of Tennessee

1999 – 2001            Clerk to Judge Plager  
U.S. Court of Appeals for the Federal Circuit

1997 – 1999            Associate Attorney  
Pennie & Edmonds LLP

**Selected Publications**

Commentary on Trading in the Clouds

2023 Transactions: The Tennessee Journal of Business Law 24(2):379-384

Co-authors Pulsinelli G

Commentary on Trading in the Clouds

30 Sep 2022

Co-authors Pulsinelli G

Marching Backward to Move Forward: Speeding Emergency Access to Drugs under the  
Bayh-Dole Act

12 Aug 2022

Co-authors Pulsinelli G

Antitrust Implications of Protecting Software Interfaces

7 Oct 2020 VIT University Law Review 2(2):29-55

Co-authors Pulsinelli G

Commentary to Professor Baker's Presentation

5 May 2020 Transactions: The Tennessee Journal of Business Law 21:403-407

Co-authors Pulsinelli G

Oracle v. Google: Antitrust vs. Copyright

7 Feb 2020

Co-authors Pulsinelli G

Commentary on Professor Colleen Baker's Presentation, Banking on the Cloud

27 Sep 2019



Co-authors Pulsinelli G

Marching Backward to Move Forward: Speeding Emergency Access to Drugs under the Bayh-Dole Act

20 Feb 2019

Co-authors Pulsinelli G

Legal Issues Surrounding Blockchain, Cryptocurrency, & Bitcoin

7 Jan 2019 Transactions: The Tennessee Journal of Business Law 20:1135-1168

Co-authors Ehrenfeld J, Gallagher R, Lyon M...3 more

A 'Case' Study in Legal Writing Pedagogy: Connecting Doctrine and Skills to Authentic Client Voices

2019 University of Toledo Law Review 51

Co-authors Jacobs BL, Pulsinelli G

High rate of mismatch extension during reverse transcription in a single round of retrovirus replication

27 Sep 1994 Proceedings of the National Academy of Sciences of the United States of America 91(20):9490-9494

Co-authors Pulsinelli GA, Temin HM

Characterization of large deletions occurring during a single round of retrovirus vector replication: Novel deletion mechanism involving errors in strand transfer

1 Jan 1991 Journal of Virology 65(9):4786-4797

Co-authors Pulsinelli GA, Temin HM

## Teaching Experience

Dr. Pulsinelli has an extensive teaching experience spanning over two decades, primarily focused on law subjects, particularly in Intellectual Property Law, Copyright Law, and Patent Law, among others. He has taught a wide range of law courses including LAW 959 - Intellectual Property, LAW 955 - Patent Law, and LAW 954 - Copyright Law, in various semesters from 2013 through 2023. These courses delve into various facets of intellectual property law, providing students with comprehensive knowledge and practical skills. In addition to the regular courses, Dr. Pulsinelli has also been active in delivering guest lectures in different courses such as Introduction to Law and Professional Topics in Engineering. These guest lectures provide a glimpse of Dr. Pulsinelli's interdisciplinary approach to teaching, bridging the gap between law and other professional fields like engineering. Furthermore, Dr. Pulsinelli has been actively involved in curriculum development and student engagement activities. He has participated in Teaching/Learning Development Activities like Online Course Jumpstart and Virtual Vol Bootcamp, indicating their commitment to adapting to modern teaching methodologies and improving the learning experience for students. Dr. Pulsinelli also played a vital role as an academic advisor from 2001 to 2020, advising students interested

in Intellectual Property on course selection and assisting with job searching. He served as an advisor to incoming 2L transfer students and College of Law Transfer Students, showcasing their dedication to student success and academic progression.

### **Professional Services**

Dr. Pulsinelli has exhibited a notable commitment to both university and college service over multiple years, covering a broad spectrum of activities and responsibilities. At the university level, Dr. Pulsinelli has served on various committees including the University of Tennessee Faculty ChatGPT Policy Committee, Greg March Periodic Post-Tenure Performance Review (PPPR) Committee, and the Student Conduct Board. These roles have positioned Dr. Pulsinelli in key decision-making forums, reflecting trust in their judgement and expertise within the university community. At the college level, Dr. Pulsinelli has been particularly active in moot court competitions, serving as a coach for the Saul Lefkowitz Trademark Moot Court Competition and the Giles Rich Patent Moot Court Competition, among others. Their involvement as a guest judge in moot court activities demonstrates a strong commitment to practical legal education and the development of advocacy skills among students. In the realm of academic development and faculty recruitment, Dr. Pulsinelli has served on hiring committees for positions like the Academic Success Program Assistant Director and the Educational Technology Specialist, playing a critical role in shaping the academic support structure within the college. Their involvement in recruitment events as a presenter also indicates a dedication to attracting quality students to the institution. Further, Dr. Pulsinelli has contributed to the broader academic and professional community by serving as a moderator and panelist in conferences such as the Changing Regulation of Pharmaceuticals Conference and the Law and Business Technology CLE Conference. They have also served on the Website, Technology, and Communications Committee, showcasing a broader service to the discipline. Dr. Pulsinelli's service extends to advising and mentoring, as evidenced by their long-term roles as a Transfer Student Advisor and the Chair of the Adjunct and Visiting Faculty Committee, indicating a deep commitment to both student and faculty support. Through these varied service roles, Dr. Pulsinelli has evidently made substantial contributions to the enriching of the academic environment and the enhancement of student and faculty experiences.

# AMIR SADOVNIK

OAK RIDGE NATIONAL LAB, OAK RIDGE, TN  
 PHONE: (347) 645-7690 · EMAIL: [SADOVNIKA@ORNL.GOV](mailto:SADOVNIKA@ORNL.GOV)  
 WEB: [HTTP://UVU.EECS.UTK.EDU/](http://UVU.EECS.UTK.EDU/)

## Positions Held

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**Research Scientist** October 2022–present  
 Oak Ridge National Lab, Oak Ridge, TN  
 National Security Sciences Directorate  
 Research lead for the Center for Artificial Intelligence Security Research (CAISER)  
 Performing research at the intersection of cybersecurity and machine learning.

**Tenure Track Assistant Professor** July 2018–October 2022  
 University of Tennessee, Knoxville, TN  
 Department of Electrical Engineering and Computer Science  
 Director of the Understanding Visual Understanding Lab (UVU Lab).  
 Supervising 4 PhD students, 2 Masters students, and 2 undergraduate students in research.  
 Teaching a variety of machine learning classes in both the undergraduate and graduate level.  
 Helping in the design of the machine learning curriculum.  
 Developing a digital humanities curriculum to introduce CS to students in other majors.  
 Working with elementary school teachers to introduce CS into their curriculum.  
 Faculty advisor for the University’s machine learning group (UTKML)

**Tenure Track Assistant Professor** July 2014–June 2018  
 Laffayette College, Easton, PA  
 Department of Computer Science  
 Taught basic computer science courses to undergraduate students.  
 Resigned the intro CS course to increase retention and interest.  
 Led 4 undergraduate students research projects with several publications.  
 Faculty advisor to the Future Interactions Lab student group

## Education

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**Ph. D., Electrical and Computer Engineering** Sep 2009–May 2014  
 Cornell University, Ithaca, NY.

Advisor: Prof. Tsuhan Chen (IEEE Fellow, Director of the School of Electrical and Computer Engineering).

GPA: 4.092 on a 4.3 scale

**B. S., Electrical and Computer Engineering** Sep 2006– May 2009  
 Cooper Union, New York, NY.

GPA: 3.9 on a 4.0 scale

**Physics** Sep 2004– May 2006  
 Brooklyn College, Brooklyn, NY.

GPA: 3.98 on a 4.0 scale

## Publications

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- [1] F. Yuan, A. Sadovnik, R. Zhang, D. Casenhiser, E. J. Paek, and X. Zhao. A simulated experiment to explore robotic dialogue strategies for people with dementia. *Journal of Rehabilitation and Assistive Technologies Engineering*, 9, 2022.
- [2] R. J. Nowling, F. Fallas-Moya, A. Sadovnik, S. Emrich, M. Aleck, D. Leskiewicz, and J. G. Peters. Fast, low-memory detection and localization of large, polymorphic inversions from snps. *PeerJ*, 10:e12831, 2022.
- [3] T. Ahmed, A. Sadovnik, and D. Wilson. Data-driven inference of low-order isostable-coordinate-based dynamical models using neural networks. *Nonlinear Dynamics*, pages 1–19, 2022.
- [4] X. Xiao, F. Yang, and A. Sadovnik. Msdu-net: A multi-scale dilated u-net for blur detection. *Sensors*, 21(5), 2021.
- [5] T. Naderi, A. Sadovnik, and H. Qi. Monocular depth estimation with adaptive geometric attention. In *IEEE Winter Conference on Applications of Computer Vision*, 2021.
- [6] F. Fallas-Moya, R. J. Nowling, S. Emrich, and A. Sadovnik. Automated detection and localization of genome inversions using principal component analysis. In *IEEE International Conference on BioInspired Processing*, 2021.
- [7] F. Fallas-Moya, M. Gonzalez-Hernandez, and A. Sadovnik. Size does matter: Overcoming limitations during training when using a feature pyramid network. In *IEEE 2021 ICMLA Workshop on Machine Learning for Predictive Models in Engineering Applications*, 2021.
- [8] F. Fallas-Moya, J. Duncan, T. Samuel, and A. Sadovnik. Measuring the impact of memory replay in training pacman agents using reinforcement learning. In *IEEE Confererencia Latinoamericana en Informatica (CLEI 2021)*, 2021.
- [9] H. Eigen and A. Sadovnik. Topkconv: Increased adversarial robustness through deeper interpretability. In *IEEE 2021 International Conference on Machine Learning and Applications*, 2021.
- [10] J. Duncan and A. Sadovnik. One size does not fit all: Transferring adversarial attacks across sizes. In *CVPR 2021 Workshop on Adversarial Machine Learning in Real-World Computer Vision Systems and Online Challenges (AML-CV)*, 2021.
- [11] J. K. Senter, D. Wilson, and A. Sadovnik. Reinforcement learning for elimination of reentrant spiral waves in excitable media. In *2020 American Control Conference (ACC)*, pages 4034–4039, 2020.
- [12] J. K. Senter, T. M. Royalty, A. D. Steen, and A. Sadovnik. Unaligned sequence similarity search using deep learning. In *2019 IEEE International Conference on Bioinformatics and Biomedicine (BIBM)*, pages 1892–1899, 2019.
- [13] A. Sadovnik, W. Gharbi, T. Vu, and A. Gallagher. Finding your lookalike: Measuring face similarity rather than face identity. In *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition Workshops*, pages 2345–2353, 2018.
- [14] T. Fuller and A. Sadovnik. Image level color classification for colorblind assistance. In *IEEE International Conference on Image Processing (ICIP)*, 2017.
- [15] T. Vu, D. Piros, and A. Sadovnik. How your phone recognizes your home: An investigation of mobile object recognition. In *Proceedings of The National Conference On Undergraduate Research (NCUR)*, 2016.
- [16] K.-C. Peng, T. Chen, A. Sadovnik, and A. Gallagher. Where do emotions come from? predicting the emotion stimuli map. In *20th IEEE International Conference on Image Processing (ICIP)*, 2016.
- [17] K.-C. Peng, T. Chen, A. Sadovnik, and A. Gallagher. A mixed bag of emotions: Model, predict, and transfer emotion distributions. In *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2015.
- [18] A. Sadovnik, A. Gallagher, D. Parikh, and T. Chen. Spoken attributes: Mixing binary and relative attributes to say the right thing. In *International Conference on Computer Vision (ICCV)*, 2013.
- [19] A. Sadovnik, A. Gallagher, and T. Chen. Not everybody’s special: Using neighbors in referring expressions with uncertain attributes. In *The V&L Net Workshop on Language for Vision, IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2013.
- [20] A. Sadovnik, A. Gallagher, and T. Chen. It’s not polite to point: Describing people with uncertain attributes. In *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2013.
- [21] A. Sadovnik and T. Chen. A visual dictionary attack on picture passwords. In *20th IEEE International Conference on Image Processing (ICIP)*, page (Recognized as top 10% paper), 2013.

- [22] A. Sadovnik, Y.-I. Chiu, N. Snavey, S. Edelman, and T. Chen. Image description with a goal: Building efficient discriminating expressions for images. In *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2012.
- [23] A. Sadovnik and T. Chen. Hierarchical object groups for scene classification. In *19th IEEE International Conference on Image Processing (ICIP)*, pages 1881–1884, 2012.
- [24] A. Sadovnik and T. Chen. Pictorial structures for object recognition and part labeling in drawings. In *18th IEEE International Conference on Image Processing (ICIP)*, 2011.

## Funded Grants

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Co-PI, “**CS for Appalachia: Expanding a Research-Practice Partnership to Integrate Computer Science and Literacy in Rural East Tennessee Schools**,” NSF, \$999,980, 10/01/2022 - 9/30/2025

Co Project Director, “**Planning a humanistic computing curriculum integrating the humanities and computer science**,” NEH, \$35,000, 6/1/2021-5/31/2022

Co-PI, “**CS for Appalachia: A Research-Practice Partnership for Integrating Computer Science into East Tennessee Schools**,” NSF, \$215,314, 10/01/2019-09/30/2021

Senior Personnel, “**Culturally Relevant Robotics: A Family and Teacher Partnership (CRAFT Partnership) for Computational Thinking in Early Childhood**,” NSF, \$1,000,000, 1/01/2021 - 12/31/2023.

Co-PI, “**Engineering Bifurcations in High-Dimensional Dynamical Systems Using Isostable Reduction Methods**,” NSF, \$64,096.00, 8/01/2020 - 7/31/2021

## Professional Service Activities

---

Reviewer for:

Signal, Image and Video Processing (SIVP) journal, IEEE International Conference on Image Processing (ICIP), IEEE Transactions on Multimedia (TIM), Association for the Advancement of Artificial Intelligence Conference (AAAI), IEEE Transactions on Image Processing, IEEE Transactions on Pattern Analysis and Machine Intelligence, IEEE Open Journal of Engineering in Medicine and Biology, IEEE Multimedia Journal, Winter Conference on Applications of Computer Vision.

NSF Panel reviewer

## Courses Taught

---

**Undergraduate Courses:**

**CS 105: Digital Media Computing.** Fall 2014, Fall 2015, Fall 2016.

**CS 105L: Digital Media Computing Lab.** Fall 2014, Fall 2015, Fall 2016.

**CS 104L: Computer Gaming Lab.** Spring 2016.

**CS 106L: Personal Robotics Lab.** Spring 2015.

**CS 150L: Data Structures and Algorithms Lab.** Spring 2017, Spring 2018.

**CS 203: Computer Organization.** Fall 2014, Fall 2015.

**CS 305: Computer Networks.** Spring 2015, Spring 2017, Spring 2018.

**CS 406: Operating Systems.** Spring 2016.

**CS 200: Computers and Society.** Spring 2018.

**ECE 414: Reinforcement Learning.** Fall 2021, Fall 2022

**Graduate Courses:**

**ECE 517: Reinforcement Learning in Artificial Intelligence.** Fall 2018, Fall 2019, Fall 2020, Fall 2021, Fall 2022.

**ECE 574: Computer Vision.** Spring 2019.

**COSC 525: Deep Learning.** Spring 2020, Spring 2021, Spring 2022.

## Sergei V. Kalinin

**Sergei V. Kalinin**  
**Weston Fulton Professor**  
**Department of Materials Science**  
**University of Tennessee, Knoxville**

### PROFESSIONAL EXPERIENCE

**2023 – present** Weston Fulton Professor, Department of Materials Science, University of Tennessee, Knoxville

**2022 – 2023** Principal Research Scientist, special projects - Amazon

**June 2014 – 2022** Director, Institute for Functional Imaging of Materials, ORNL

**Oct. 2007 – Oct. 2016** co-theme leader for Electronic and Ionic Functionality (previously Functional Imaging on the Nanoscale), Center for Nanophase Materials Sciences, ORNL

**Jan 2013 – Dec. 2017** adjunct professor, Sung Kyun Kwan University, South Korea

**Dec 2010 – present** joint faculty, Center for Interdisciplinary Research and Graduate Education, University of Tennessee, Knoxville

**Dec 2009 – present** adjunct faculty, Department of Materials Science and Engineering, Pennsylvania State University

**Fall 06 – present** Adjunct Associate Professor, Department of Materials Science and Engineering, University of Tennessee, Knoxville

**Fall 05 – present** Adjunct Assistant Professor, Department of Materials Science and Engineering, North Carolina State University

**Oct. 04 – present** Research Staff Member, Oak Ridge National Laboratory

**Oct. 02 – Oct. 2004** Eugene P. Wigner Fellow, Oak Ridge National Laboratory

**Sept. 02** Ph.D., Department of Materials Science and Engineering, University of Pennsylvania, Thesis: *Nanoscale Electric Phenomena in Oxide Materials by Scanning Probe Microscopy*, Advisor: Prof. Dawn A. Bonnell, **GPA** 4.0/4.0

**Jan. 1998** M.S. summa cum laude, Department of Materials Science, Moscow State University, RUSSIA, Thesis: *Cryosol synthesis of nanocomposite materials*, Advisor: Prof. Alexey A. Vertegel, **GPA** 5.0/5.0, ranked first in class for the whole period of education

### RESEARCH INTERESTS

Atom by atom fabrication via electron beams. Applications of machine learning and artificial intelligence for physics extraction from the atomically-resolved and mesoscopic imaging data. Coupling between electromechanical, electrical, and transport phenomena on the nanoscale.

Developing novel SPM techniques, mathematical analysis of SPM data, quantitative measurements of local properties by SPM.

### **HONORS AND AWARDS**

- Pollak lecture, Technion, **2019**
- MRS Symposium X Lecture, Fall **2018**
- RD100 Award for “Atomic Forge”, **2018**
- ORNL Significant Event award, **2018**
- Highly cited researcher, Clarivate Analytics, **2018**
- Laureate of Blavatnik National Award for Young Scientists in Physics, **2018**
- CNMS Distinguished patent award, **2018**
- Fellow, Foresight Institute, **2018**
- Zernicke lecture, U. Groeningen, **2018**
- Fellow, IoP, **2017**
- Fellow, IEEE, **2017**
- Fellow, Materials Research Society, **2017**
- One of the top 100 most cited Russian physicists, **2017**
- RD100 Award for “G-Mode Scanning Probe Microscopy and Spectroscopy”, **2016**
- Finalist, Blavatnik National Award for Young Scientists, Physics, **2016, 2017, 2018**
- Microscopy Today Innovation Award for “General Mode (G-mode) Microscopy & Spectroscopy”, **2016**
- Fellow, American Physical Society, **2015**
- Fellow, AVS, **2015**
- IEEE Senior member, **2015**
- Medal for Scanning Probe Microscopy, Royal Microscopical Society, **2015**
- ORNL Distinguished Scientist Award, **2013**
- ORNL Team Award in Science and Technology (led the team), **2011**
- Microscopy Today Innovation Award for “Electrochemical Strain Microscopy”, **2011**
- Roland B. Snow Award, American Ceramics Society, **2010**
- Presidential Early Career Award for Scientists and Engineers (PECASE), **2009**
- R&D 100 Award for “Ztherm Modulated Thermal Analysis” (with M. Nikiforov and S. Jesse, ORNL, and A. Gannepali and R. Proksch, Asylum Research), **2010**
- Microscopy Today Innovation Award for “Adaptive Band Excitation Method in Scanning Probe Microscopy”, **2010**
- Significant Event Award, ORNL **2010**
- 2010 IEEE-UFFC Ferroelectrics Young Investigator Award, **2010**
- Burton medal for Young Investigator, Microscopy Society of America, **2010**
- ISIF Young Investigator Award, **2009**
- Robert L. Coble Award for Young Scholars, American Ceramic Society, **2009**

- Southeast FLC Excellence in Technology Transfer Award for “Adaptive Band Excitation Method and Controller in Scanning Probe Microscopy”, **2008**
- R&D 100 Award for “Adaptive Band Excitation Method and Controller in Scanning Probe Microscopy” (with S. Jesse, ORNL, and R. Proksch, Asylum Research), **2008**
- Peter Mark Memorial Award for Young Scientists, AVS: Science and Technology Society, 2008
- Cosslett Award for Best Invited Paper of Microbeam Analysis Society (principal S. Jesse) 2008
- CNMS Division Director Award, **2007** and **2009**
- ORNL Director Award for Outstanding Team Accomplishment in Science and Technology (led the team), **2006**
- Team Scientific Research Award from ORNL (led the team), **2006**
- ORNL Early Career Accomplishment Award for Science and Technology, **2005**
- Ross Coffin Purdy Award of American Ceramic Society, **2003**
- Wigner Fellowship of Oak Ridge National Laboratory, **2002**
- MRS best poster award (**Fall 2009**, **Spring 2005**, **Fall 2003**)
- AVS Graduate Student Award, **2002**
- MRS Gold Graduate Student Award - **Fall 2001** Meeting
- MRS Silver Graduate Student Award - **Fall 1999** Meeting, **Fall 2000** Meeting
- Ceramographics Contest at 2000 ACerS meeting (2nd and 3d award in Problem Solving and 3d award in Scanning Probe Microscopy sections)
- Bochvar Prize for excellence in studies (Moscow State University) **1998**
- Novoselova prize for best student research work in Inorganic Chemistry, MSU, **1997**
- Soros undergraduate student fellowship **1994/1995**, **1995/1996** and **1996/1997**
- Moscow State University Lomonosov Scholarship for Excellency in Studies, **1996/1997**
- State Scholarship for Young Scientists from Russian Academy of Sciences, **1994-1996**

## PUBLICATIONS

In total, >560 peer-reviewed papers (4 *Science*, 1 *Science Advances*, 2 *Nature*, 9 *Nature Mat.*, 4 *Nature Nanotech.*, 1 *Nature Chem.*, 4 *Nature Phys.*, 24 *Nature Comm.*, 13 *Sci. Rep.*, 17 *Phys. Rev. Lett.*, 42 *Adv. (Func., Electronic, Energy) Mat.*, 2 *PNAS*, 27 *Nano Lett*, 45 *ACS Nano*, 2 *Small*), 20 reviewed papers in conference proceedings, 11 book chapters, 2 books [+2 in Russian], citations >14500,  $h = 60$  by ISI (75 by *Google Scholar*), 15 patents, 7 disclosures, ~200 invited and plenary talks and workshops

## SELECTED PROFESSIONAL SERVICES

Co-founder, APS topical group on data science

MRS Board of directors, 2018

Conference organizer, IMRS Cancun, Mexico, 2017

Chair-elect, Nanoscale Science and Technology Division, AVS, 2016

Editor, *NPJ Computational Materials*, since 2015

Member, Program Development Subcommittee MRS, since **2014**, Award Diversity Subcommittee, since **2017**

Editorial board, *Advances in Chemical and Structural Imaging*, since 2014

Editorial advisory board, *ACS Nano*, since 2014



## New Academic Program Proposal

# Bachelor of Science in Innovative Transdisciplinary Studies (BS-ITS)



THE UNIVERSITY OF  
TENNESSEE  
KNOXVILLE

Updated January 17, 2024

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## Section I: Overview

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### *Program Information*

<b>Institution:</b>	University of Tennessee Knoxville
<b>College:</b>	College of Emerging and Collaborative Studies (CECS)
<b>Title of Degree:</b>	Bachelor of Science in Innovative Transdisciplinary Studies
<b>Degree Designation:</b>	Bachelor of Science
<b>Formal Degree Abbreviation:</b>	BS-ITS
<b>CIP Code:</b>	30.0601
<b>CIP Code Title and Definition:</b>	<p>Systems Science and Theory</p> <p>A program with a multidisciplinary approach to analyzing and solving complex problems requires a combined approach using data and models from the natural, social, technological, behavioral, life sciences, and other specialized fields.</p>
<b>Proposed UT BOT Approval:</b>	February 2024
<b>Proposed THEC Approval:</b>	May 2024
<b>Proposed Implementation Date:</b>	August 2024
<b>Academic Program Liaisons:</b>	<p>Karen Galicia, Director of Academic Affairs            505 Summer Place / 1268B UT Tower            University of Tennessee System            Phone number: 865-974-2140            Email: <a href="mailto:galicia@tennessee.edu">galicia@tennessee.edu</a></p> <p>Dr. Vandana Singh Avasty            Professor and Program Director,            College of Emerging and Collaborative Studies            University of Tennessee, Knoxville            Phone: 865-974-2757            Email: <a href="mailto:vandana@utk.edu">vandana@utk.edu</a></p>

*System Letter of Support*



August 4, 2023

Dr. Bob Smith, Interim Executive Director  
Tennessee Higher Education Commission  
312 Rosa L Parks Ave. 9<sup>th</sup> Floor  
Nashville, TN 37243

Dr. Smith:

On behalf of the University of Tennessee, Knoxville (UTK), please accept this Letter of Notification (LON) for a proposed Bachelor of Science in Innovative Transdisciplinary Studies (BS-ITS), which will be housed in UTK's new College of Emerging and Collaborative Studies (CECS). The program will be designed as a customizable degree that prepares students for employment opportunities in multiple emerging areas across the natural, social, and health sciences in a humanities context. The program will feature an innovative curriculum designed to be modular with stackable certificates. Currently, CECS plans to launch ten certificates in Fall 2024. These planned programs will focus on Cybersecurity, Data Science, Applied Artificial Intelligence, Human-Computer Interaction, Emerging Design Studies, User Experience and Game Design, Law Tech, Connected World, One Health, and Sustainability. We are excited about the work currently happening in CECS and look forward to receiving an evaluation this proposed program by THEC staff.

Sincerely,

Bernie Savarese, Ed.D.  
Acting Vice President of Academic Affairs and Student Success  
University of Tennessee System

CC: Donde Plowman  
John Zomchick  
Ozlem Kilic  
Vandana Singh  
Heather Hartman  
Karen Etzkorn

400 W. Summit Hill Drive (physical) • 505 Summer Place (postal) • UT Tower 1258 • Knoxville, TN 37902 • (865) 924-3843  
aass.tennessee.edu

*Campus Letter of Support*

July 29, 2023

President Randy Boyd  
505 Summer Place / UT Tower  
Knoxville, TN 37902

President Boyd:

As Provost of the University of Tennessee-Knoxville (UTK), I am writing in support of the Customizable B.S. degree to be offered by the College of Emerging and Collaborative Studies (CECS) at UTK.

As approved by the U.T. Board of Trustees in February 2023, CECS is a new interdisciplinary college created specifically to host emerging, future-oriented interdisciplinary programs at UTK. Essentially CECS will offer programs in topics that are not only rapidly emerging in a fast-changing world but are also too multi-disciplinary to fit into any one academic department or even academic college. In Fall 2024, CECS will also launch new B.S. degrees in Data Science and Artificial Intelligence and a minor in Cybersecurity.

CECS is resourced sufficiently to deliver these courses for the B.S. in Data Science. CECS instructors will deliver the core courses. Upper-level level electives will be selected from existing offerings from multiple colleges on campus. The staffing of CECS means that the Customizable Degree, which will draw substantially on CECS degree programs and certificates offered in collaboration with other colleges, will be sustainable but also able to keep pace with emerging new topics. For co-creation on 9-credit certificate offerings, CECS has already engaged with colleges on campus such as UT Institute of Agriculture, Haslam College of Business, College of Arts and Sciences, Tickle College of Engineering and College of Law.

Facilitated by CECS, the degree will leverage interdisciplinary resources in a new degree that addresses the future workforce skills. The possibilities for the Customizable degree are all but endless. Students interested in the legal/ethical ramifications of A.I., for example, can combine the CECS certificate in A.I. with a certificate co-created with the Law School and with Arts and Sciences.

As a result of its internship requirement (see letters from our business partners), the CECS Customizable Degree will position students to enter rapidly-growing employment sectors. This aligns with the "Drive to 55" objective of the THEC Master Plan for postsecondary education, the goal of which is for 55% of Tennessee's working-age population (ages 25-64) to attain a postsecondary credential by 2025. The skills offered by CECS are all in high demand across most sectors of the present and future economy. According to the U.S. Bureau of Labor and Statistics (USBLS), jobs in computer and information technology will grow 13% in this decade, and jobs in data science are expected to increase 5% annually into the next decade. Jobs requiring knowledge of AI are expected to increase substantially over the next 5 years, as most companies today are either using A.I. already or are planning to use it in the near future to automate IT, business or network processes, address their sustainability goals, and interact with customers.

Office of the Provost and Senior Vice Chancellor  
327 Andy Holt Tower, Knoxville, TN 37996-0132  
865-974-2443 865-974-4811 fax provost.utk.edu

Flagship Campus of the University of Tennessee System

2 BS\_Customizable\_degree\_proposal request

The CECS Customizable Degree will contribute to UT's mission and the goals of UTK by (i) enhancing educational excellence, (ii) creating value through economic, social, and technological development, and (iii) fostering outreach and engagement. In terms of *educational excellence*, each Custom Degree will apply intelligence-related skills to real-world problems in other disciplines, including those that are the focus of new UTK cluster hires in artificial intelligence, food security, future mobility, sustainability and precision agriculture. The Customizable Degree will *create value* and foster *engagement* by requiring service courses and off-campus internship experiences as part of the customizable degree. CECS has administrators dedicated to industry engagement to secure workforce internships for upper-level students. The capstone project will further instill teamwork skills and creativity in students working on real-world research and outreach projects.

Overall, this intercollegiate, customizable degree helps fulfill UT's land-grant prerogatives, as articulated by UTK Chancellor Plowman (*The Tennessean* 2/2/23), in "making our curriculum more flexible and designing new degree programs that allow students to master competencies essential to success in the innovation economy."

For these reasons, I strongly support the CECS custom degree.

No additional resources will be required in order to implement this change. At this time, we request transmission to Tennessee Higher Education Commission for approval. Please contact me if you have any questions or need additional documentation. Thank you in advance for your attention to this matter.

Sincerely,



John Zomchick  
Provost and Senior Vice Chancellor

CC: Bernie Savarese  
Karen Etzkorn  
Donde Plowman  
Ozlem Kilic  
Heather Hartman

## Section II: Background

---

### *Background Concerning Academic Program Development*

The Bachelor of Science in Innovative Transdisciplinary Studies (BS-ITS) is designed to be a customizable degree to prepare students for future employment opportunities based on the need for a workforce skilled in multiple emerging areas of expertise. The future of the workforce will heavily rely on transdisciplinarity, meaning it will integrate the natural, social, and health sciences in a humanities context and transcend traditional disciplinary boundaries, this program caters to that future. Student interests across disciplines will be facilitated by an innovative curriculum designed to be modular with stackable certificates. Each certificate will consist of 12 student credit hours, and students can earn (stack) multiple certificates to develop a customized skill set, e.g., a certificate in human-computer interaction can be stacked with a certificate in game design to create specific expertise for a student. All the certificates developed and facilitated by CECS will be stackable as part of the proposed degree. The BS-ITS will be a flagship bachelor's program of the College of Emerging and Collaborative Studies (CECS) at U.T.-Knoxville. Mandated by the Board of Trustees in the spring of 2023, CECS is a new interdisciplinary college created to host emerging, future-oriented interdisciplinary programs at UTK. With specific new degree programs planned for CECS, including Data Science, Artificial Intelligence, and Cybersecurity, this BS-ITS will be a customizable degree that will allow students to apply these emerging capacities toward subjects taught across the diverse colleges across the Knoxville Campus, such as colleges of Architecture and Design, Business, Agriculture, Engineering and more (see below).

The purpose of CECS is to engage students in emerging new fields of study, which are typically highly interdisciplinary and therefore, do not fit in conventional colleges or departments on campus. By integrating offerings across campus (there are 900 different degree topics currently taught at UT), CECS aims to reduce the redundancy of delivery of topics such as data science and artificial intelligence. These topics are relevant to engineering, natural and social sciences, business, agriculture, and more. For instance, students from all colleges on campus have been taking the Introduction to Data Science course offered every semester since Spring 2022 under the intercollegiate Data Science minor. Inspired by this success, the BS-ITS will mirror this approach by facilitating students across the university to take topics that interest them for a future career in a classroom setting that includes a variety of student backgrounds and interests.

### *Purpose and Nature of Academic Program*

#### **Description of the Academic Program**

The CECS Customizable degree BS-ITS will allow students to design their transdisciplinary undergraduate degree, with guidance from advising and faculty, including internship and service experiences that prepare each student for the workforce in their chosen certificates. The customizable option allows CECS to keep pace with the fast-evolving interests of new students



along with recent technologies, especially in digital intelligence. This novel approach to transdisciplinary studies is distinct from the Interdisciplinary program (IDP) at the University of Tennessee and other universities across the state. The existing IDPs do not have a coherent theme but are instead a selection of several courses that can count towards the completion of a degree, the courses can be from any of the existing disciplines. On the contrary, the ITS program is identifying emerging fields of studies, and developing original content through new courses with collaboration from the faculty expertise on campus. These topics are not already developed and/or taught, but many courses in the certificate programs are being developed specifically for the certificate in the merging field. Faculty members from different colleges conceptualize a course together to make it transdisciplinary. The other innovative aspect of the emerging fields is that CECS will serve as a sandbox to try out new fields through these certificates, if a certificate is successful in student enrolment and job placements, then the certificate will be developed into a minor and/or a major. If a certificate does not succeed, CECS will re-visit the certificate to decide if it should continue or evolve into an area of industry demand. These will allow the University of Tennessee to offer emerging collaborative, successful programs that meet student needs as well as employer demands.

CECS has a dedicated Director of Partnerships and Engagement position shared with the Office of Research and Engagement Development at UTK. This position is critical in developing and maintaining industry relationships and liaising with campus expertise. All CECS programs have a required internship component that all students will utilize to develop industry relationships and specific skill sets for employability in the chosen domain. This is another key differentiating element of the CECS BS-ITS program from the other IDP programs. CECS is currently in conversation with Roane Community College, the Tennessee Board of Regents, and other community colleges in Tennessee to solidify pathways for transfer students to achieve these skill sets through certificates and utilize UTK's partnerships for future employability.

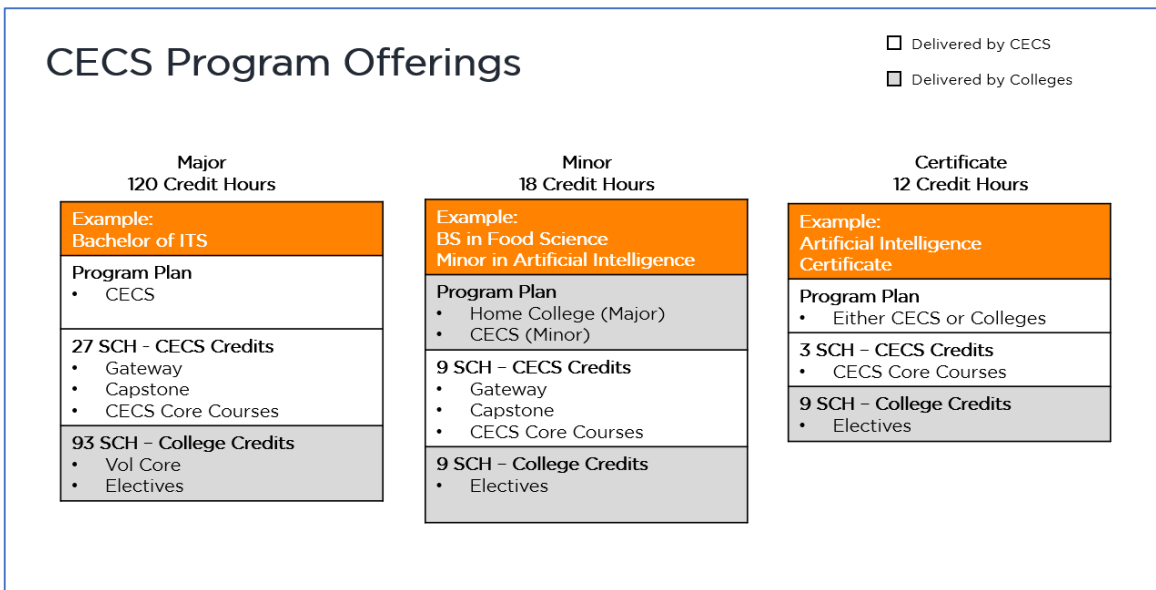
The certificates being developed at CECS for the BS-ITS degree will be stand-alone and open to anyone who wants to attain skills in the certificate field. However, a vital component of this experience will be a cohort experience. All the students who take these certificates, either as stand-alone certificates, as the BS-ITS degree, or as a minor will start with a cohort and take at least one course together. Through extracurricular activities, CECS will continue to maintain their cohort experiences and engage them in activities together.

### **Total Credit Hours**

The degree program will be completed by earning 120 credit hours, as required for any bachelor's degree at the University of Tennessee, Knoxville. Out of the 120 credit hours, 27 will be CECS core courses taught by CECS full-time faculty and CECS Faculty Fellows appointed from across disciplines at UTK. Additionally, students will complete 6 to 12 credit hours in research, service, and internships to further strengthen their employable skills, expertise, and network. These courses will be taught by CECS faculty and supported by the CECS Director for Partnerships and Engagement and the UTK Center for Career Development to connect CECS students with future employers.

Students at UT-Knoxville must fulfill their mandatory VolCore requirement, typically between 50 and 60 credit hours in multiple themes.

The remainder of the credits in this degree will be earned from stackable certificates and minors or approved campus electives facilitated by CECS. Each certificate consists of a gateway 101 course taught by CECS plus nine credit hours (three courses) of courses on the topic. For example, students from any major can choose a certificate in Artificial Intelligence offered by CECS. To take this certificate, they will build on the CECS core courses (ITS 101 -3 credit hours) and take nine credit hours of non-CECS UTK courses approved by CECS faculty. Additionally, if they want, they can strengthen their expertise with a certificate in Data Science. They will build on three credit hours from the CECS core and nine credit hours of CECS-approved courses. Figure 1 demonstrates how this collaboration between CECS and the other colleges will work to establish minors, majors, and stackable certificates.



**Figure 1: Customizable CECS Offerings**

Each CECS BS-ITS student will take an introductory design course, “ITS-101 Design Your Degree Design Your Career,” at the start of their degree. In this course, students will receive one-on-one guidance from instructors to understand the design process to apply to their customized degree program plan, using the available stackable certificates and campus resources.

This BS-ITS degree allows for multiple combinations of stackable certificates. Courses in this customizable degree will teach students basic design skills, which CECS believes are essential for success in the new workforce. The critical component is the variety of certificates that CECS has created and will continue to create in pace with changing workforce needs. CECS will collaborate with UTK faculty, students, and industry to develop these certificates and minors by leveraging

existing UTK courses and developing new interdisciplinary courses. Currently, CECS plans to launch ten certificates in Fall 2024. These planned programs will focus on Cybersecurity, Data Science, Applied Artificial Intelligence, Human-Computer Interaction, Emerging Design Studies, User Experience and Game Design, Law Tech, Connected World, One Health, and Sustainability. Developing and delivering such interdisciplinary, innovative programs is the growth model of CECS. This is a credential-based program and multiple examples for the potential program of study are presented in Table 11.1 to Table 11.6.

### **Target Audience**

The target audience is multifaceted. One demographic is the highly focused and motivated students who want to apply emerging fields to a specific career to work in that sector of the workforce after graduation. Another is the students uncertain about their ideal career, who need to explore options while building employable skills. Currently, over one thousand students at UTK start as undecided, and this degree will be a potential pathway for them. Working closely with our Center for Career Development advising team and industry partners, students can maximize their credit hours towards gainful employment. The third category includes those who have finished community college or have relevant work experience and would like to pursue a 4-year degree in an emerging field. As such, we envision our custom degree will cater to a diverse group of students, including UTK honors students, students entering UT with relevant AAS skills via Tennessee Transfer Pathway (TTP), or students who have been in the workforce and would like to fine-tune their skillsets with a degree that fulfills their career plans. All high school students graduating in Tennessee and elsewhere can apply for this customizable bachelor's degree at CECS.

### **Purpose**

The highly flexible curriculum is one aspect, but so is the interdisciplinary instruction and collaboration with the cohort of CECS students. With the custom degree launching alongside proposed CECS majors in Data Science, Applied Artificial Intelligence, and Cybersecurity, CECS provides the collaborative intellectual environment that will be foundational to the custom degree. With other CECS students majoring in data science and Applied Artificial Intelligence, for instance, CECS instructors could help students in the customizable degree think about applications of these new intelligence technologies towards design, music, social sciences, natural sciences, business, or communications. The customizable degree will be unique to each student, catering to their diverse goals and needs in an interdisciplinary classroom setting. Through ITS-101 (Design Your Degree, Design Your Career), they will explore the process of designing an undergraduate degree as strategic preparation for a career of collaborative, interdisciplinary work in a fast-evolving workforce. They will develop the program plan as a final deliverable of the course. Additionally, to support the students throughout the degree, CECS will maintain a drop-by advising office for students planning their courses, degree timetable, internships, and placements. Class planning can be combined with bespoke career advice and internship placements for CECS students. Students graduating from this program will use transdisciplinary skills as tools as they enter the workforce.

### **Program Outcomes**

The BS-ITS degree program aims to equip students with the versatility and skills needed to meet the multifaceted challenges of today's workplace. The degree will emphasize holistic problem-solving by integrating knowledge and methodologies from multiple disciplines. Students will gain the capacity to address complex problems that cannot be adequately solved via a single discipline.

Upon successful completion of this program, students will be able to:

- 1- Demonstrate a deep understanding of concepts, theories, and methods from multiple disciplines relevant to the chosen transdisciplinary field.
- 2- Identify connections, patterns, and interdependencies between different disciplines and integrate this knowledge to address complex problems.
- 3- Apply systems thinking principles to comprehend the complexity and interconnectedness of social, environmental, and technological systems.
- 4- Consider the societal and environmental implications of transdisciplinary solutions and propose responsible courses of action.
- 5- Plan and conduct transdisciplinary research projects, employing appropriate methodologies from different disciplines.
- 6- Synthesize and interpret data from diverse sources to support evidence-based conclusions.
- 7- Design and execute a comprehensive transdisciplinary project integrating insights from different disciplines to address a complex issue.
- 8- Collaborate effectively with individuals from different disciplines to collectively address transdisciplinary problems.
- 9- Communicate ideas and findings clearly and coherently to diverse audiences, including those without specialized knowledge in particular disciplines.

**Delivery method** – Hybrid (in-person and online)

### *Alignment with State Master Plan and Institutional Mission*

This program is well aligned with The University of Tennessee, Knoxville mission which states:

“We are a diverse community with a shared commitment to discovery, creativity, learning, and engagement. At UT Knoxville, we: Empower learners of all ages and backgrounds to achieve their dreams through accessible and affordable education and state-of-the-art research training opportunities. Advance the prosperity, well-being, and vitality of communities across Tennessee and around the world through our research, teaching, service, and engagement. Commit to excellence, equity, and inclusion within the university, across the state, and in all our global activities.”

By enabling students from diverse backgrounds to customize their own bachelor’s degree, the BT-ITS degree aligns with the “Drive to 55” objective of the [THEC Master Plan](#) for postsecondary education, by which 55% of Tennessee’s working-age population (ages 25-64) would attain a postsecondary credential by 2025. CECS aims to capture a significant fraction of the Tennessee Transfer Partnership (TTP) students annually to position them to enter the workforce with highly advanced skills at the forefront of the innovation economy. This aim and vision of CECS is supported by the Chancellor of Tennessee Board of Regents, Dr. Tydings, as evidenced in her letter of support attached in Appendix A. Roane State Community College has also expressed their excitement and collaboration plans in their letter of support attached in Appendix A. In their 2021 Report, the Tennessee Higher Education Commission reported that students (in the 2014 cohort) who complete a vertical transfer (from a two-year institution to a four-year institution) earned a wide variety of degrees, with almost three-quarters earning a degree in six years, including over 25% of students earning both an associate and a bachelor’s degree.

UT Knoxville has the highest graduation and first-to-second-year retention rates among the state’s public institutions and has developed innovative programs and support structures to help students thrive in and out of the classroom. As a doctoral university holding the highest Carnegie classification for research activity and designated as a Carnegie Community Engaged Institution, UT-Knoxville allows students to learn from faculty at the forefront of their fields.

The BT-ITS program is expanding the innovation, customization, and quality education mission of the University of Tennessee Knoxville. Through internship placements, research courses, and capstone projects, BT-ITS students can conduct real-world research that affects their communities and allow them to work alongside faculty in campus laboratories and the field.

### *Institutional Capacity to Deliver the Proposed Program*

The CECS BS-ITS will increase the overall impact of UT-Knoxville by catalyzing innovative, intercollegiate undergraduate courses, stackable certificates, minors, and bachelor's programs. CECS has developed a straightforward rubric for revenue sharing via student credit hour (SCH) allocation, given that UTK now uses a budget allocation model (BAM) under which colleges manage their revenues and expenditures. The basic model is that 80% of the SCH goes to the college teaching the course, with 20% going to the student's home college. Students majoring in the Custom degree would be CECS students, so when they take a gateway course such as AI 101, CECS keeps 100% of the SCH. When students from other colleges take AI 101, CECS retains 80% of the SCH; when CECS students take electives in other colleges, those colleges retain 80% of the SCH. It is a simple and effective resource allocation model.

For sustainability, this program is supported by CECS at multiple levels. The Program Directors and Program Coordinators, both appointed by CECS, oversee the curriculum and enrollment, course scheduling, assessment, accreditation, capstone, and research course contents. The Program Directors collaborate with the faculty across UTK to develop and approve new certificates and minors. The CECS Director of Marketing oversees advertising, outreach, and prospective student recruitment. The CECS Director of Advising oversees the advising of all CECS majors in their degree program operations. The Director of Partnerships and Economic Development will also engage campus, community, and industry partners to support experiential learning in the program, fostering pathways to student employment.

### *Existing Programs Offered at TN Institutions*

No other programs are offered at public or private Tennessee institutions with the innovative transdisciplinary focus of this degree. The only other program in Tennessee under this CIP code (30.0601) is a doctoral program in Data Science and Engineering at the Bredesen Center at UTK. Therefore, this collaboration between CECS administrators and faculty fellows at the Bredesen Center is synergistic. Dr. Xiaopeng Zhao, a program director at CECS is also a Faculty Fellow at the Bredesen center. One potential collaboration on this program is through faculty teaching at both places. Other possible collaboration is CECS developing pipeline of graduates to enter the interdisciplinary doctoral program. Collaborative research projects are a potential collaboration option as well.

Some comparable programs are offered under the Interdisciplinary approach across the State; below we present a comparison of these programs with the BS-ITS at UTK. The differences discussed in Section II subsection Description of the Academic Program are based on the study of the following descriptions of interdisciplinary programs across Tennessee. The differentiating characteristics of the BS-ITS program are that the focus is transdisciplinary emerging fields of study that do not exist in the traditional discipline-specific silo courses, the stackable certificates are a credential-based set of skills for the employability in the future workforce, the sandbox approach to

identify future topics, strategic mandatory industry partnerships, pathways for community college students and stand-alone certificates for skill development.

#### **East Tennessee State University:**

ETSU offers two different degrees through its Division of Cross-Disciplinary Studies. They offer a **BS in Interdisciplinary Studies (BSIS** - the [Bachelor of Science in Interdisciplinary Studies](#)) and a **Bachelor of Applied Science (BAS)**. The **BSIS** comprises 41-42 hours of Gen Ed credits, 43 hours in the Major total, and 35-36 hours of electives. The flexibility is found within the Major component of the program. Three different concentrations are available (Individualized, Integrative, or Professional Studies). While every student in this degree program takes the same **5 Major Core courses** (see below), they have flexibility within their concentration. They will take three credit hours in each of the offered categories but then select one category to take an additional amount of credit hours. The closest program to CECS would be for a student who enrolled in the BSIS, Integrative Concentration, and then selected Science & Technology as their Focal Area, giving them 12 credit hours in science/tech-specific courses. The **BAS** is designed only for students who have already earned an Associate of Applied Science degree in a technical field. It also offers three concentrations (Culinary Leadership, Industrial Leadership, and Professional Development). The Professional Development concentration provides the most opportunity for specialization by allowing students to complete 18 hours of complementary courses that can also be used towards a minor.

#### **Middle Tennessee State University:**

MTSU offers a [Bachelor of Science in Integrated Studies](#) through MTSU's University College. This degree allows students to select two areas of emphasis and combine coursework in those areas with core Professional Studies courses to create a customized major. Core courses consist of Professional Studies courses including Interdisciplinary Research and Problem Solving (PRST 3995) and either PRST 310 (Prior Learning Assessment) or PRST 3500 (Integrated Studies Career Development Seminar). They offer pre-planned areas of emphasis in the following areas: Communication, Agriculture/Agriscience, Dance, Health & Human Performance, Leadership, and Tourism & Hospitality Management; however, students can work with an advisor to develop customized areas of emphasis to match their interests. In addition to the areas of emphasis included in the **Major Requirements**, students also complete general education and elective coursework as well as additional coursework in an "area of support/minor."

#### **Tennessee State University:**

Tennessee State University offers a Bachelor of Science in Arts and Sciences through their Interdisciplinary Studies Program. This degree has two different tracks.

- 1) The [B.S. in Arts and Sciences](#) track offers three concentrations to students: humanities, social sciences, or natural sciences. Students design their degree by selecting two disciplines to study within their selected concentration.

The concentrations and their related disciplines are listed below:

- Humanities: Art, English, French, Philosophy, Religious Studies, Spanish, Theater, Fashion, Design
- Social Sciences: Africana Studies, Communications, Criminal Justice, Economics, Geography, History, Political Science, Psychology, Sociology
- Natural Sciences: Biology, Chemistry, Computer Sciences, Mathematics, Physics.

**Degree Requirements:**

- accumulation of 120 credit hours and a minimum 2.00 GPA
- Gen Ed core courses
- 15 upper-division hours in the first discipline (disciplines discussed above)
- 8-9 upper-division hours in the second discipline
- 9 upper-division hours from any of the disciplines listed above (plus Music and Social Work)
- 9-10 upper-division hours from any discipline
- completion of the Senior Exit Exam

- 2) The [B.S. in Arts and Sciences with a Multidisciplinary](#) concentration offers more flexibility by allowing students to select any two disciplines that the university offers.

**Degree Requirements:**

- accumulation of 120 credit hours and a minimum 2.00 GPA
- the general education core
- 12 upper-division hours in the first discipline
- 12 upper-division hours in the second discipline
- 15 upper-division hours from any discipline
- a three-hour upper-division Senior Project, usually INDS 4000
- completion of the Senior Exit Exam

\*\* The Interdisciplinary Studies program also offers an Elementary Education Track but it is advised through the College of Education and offers customization based on the type of teaching certification a student is seeking.

**Tennessee Technological University:**

Tennessee Tech offers a [Bachelor of Science degree in Interdisciplinary Studies](#). It allows students to customize their study by developing their major around a theme or topic.

Degree Requirements:



- 120 credit hours (\*\*\*) the courses listed on the course outline do not add up to 120)
  - Gen Ed
  - Concentration/ Area of Emphasis –24 hours
  - Electives—63 hours
    - 6 hours in social or behavioral sciences
    - 6 hours in humanities or fine arts
    - 17 hours upper-level courses

### **University of Tennessee, Martin**

UT Martin offers a [Bachelor of Interdisciplinary Studies \(BIS\)](#). This degree is primarily designed to meet the needs of working adults or others whose goals are not met by traditional programs. Students must take 38 hours of gen ed/core courses and can receive up to 12 hours of academic credit for “previous non-college learning experiences.”

The University of Memphis offers a [Bachelor of Liberal Studies and a Bachelor of Professional Studies](#). They also offer an Interdisciplinary Studies major through the TN eCampus online degree program. These degree programs both consist of 120 total credit hours. The flexibility comes in the Coordinated Study piece of the program where students select two or more areas of emphasis. Students must take between 12-21 upper-division credit hours in each area of emphasis.

### ***Accreditation***

Like all academic programs at the University of Tennessee-Knoxville, the undergraduate major will be regionally accredited by SACSCOC (<https://sacs.utk.edu/>). There is no accrediting body for undergraduate transdisciplinary programs. Therefore, no professional disciplinary accreditation organizations are identified. Heather Hartman is the SACSCOC liaison at UTK and is responsible for keeping the accreditation updated for all undergraduate programs at UTK.

### ***Administrative Structure***

The administrative structure replicates the administrative structure of colleges at the University of Tennessee. The Chancellor and the Provost support the Dean of CECS. Dr. Ozlem Kilic is the Dean for CECS and the Interim Vice-Provost for Academic Affairs. The dean of the college is supported in creating a vision by a campus leadership advisory executive board and a board of visitors. The Dean oversees the daily operations of the college. In collaboration with the Dean, the Associate Dean of the college oversees academic and student matters and oversees the directors and lecturers. Please review Figure 2 for a detailed College of Emerging and Collaborative Studies organizational chart.

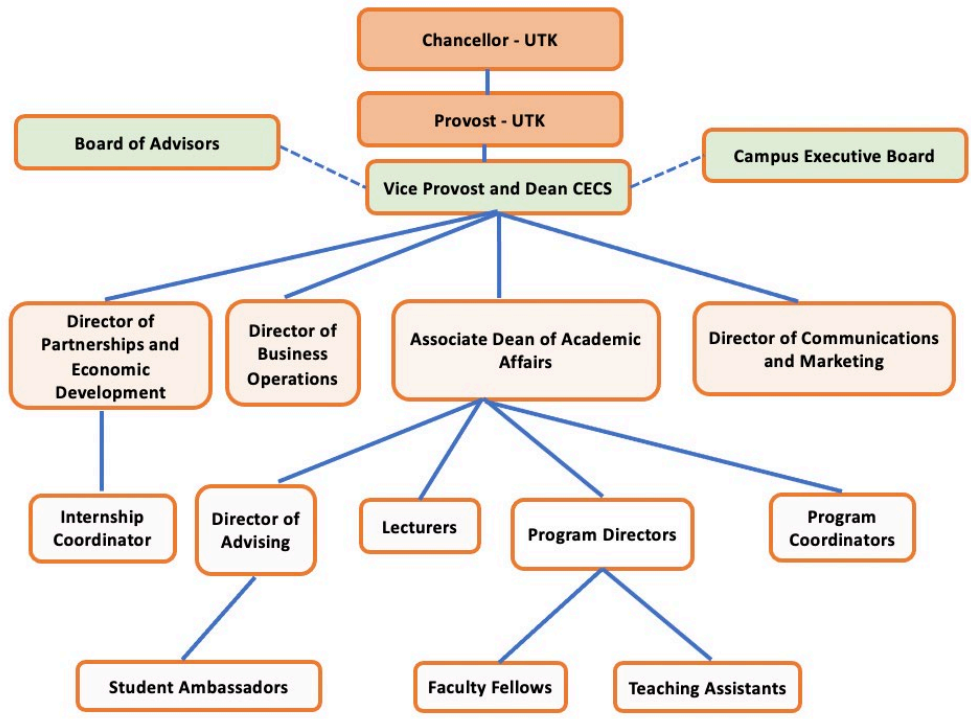


Figure 2: College of Emerging and Collaborative Studies (CECS) Organizational Chart and Program Management Chart

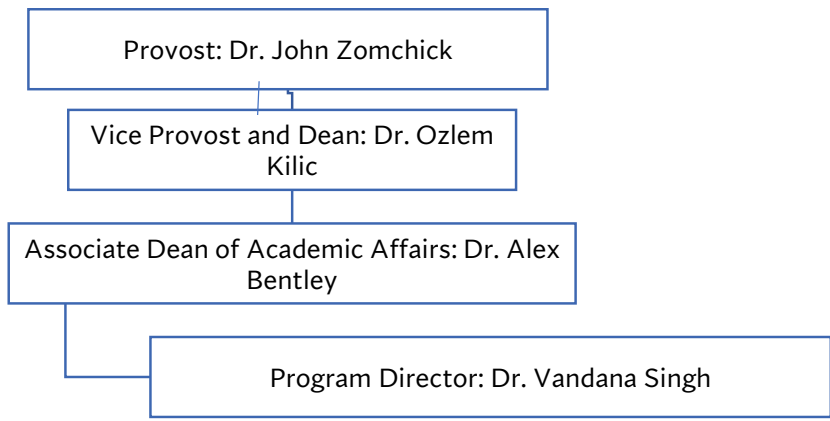


Figure 3: Reporting Structure for BS-ITS Program

## Section III: Feasibility Study

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### *Student Interest*

A survey of current undergraduate students at the University of Tennessee Knoxville indicated a strong interest in the undergraduate major in Innovative Technology Studies. This survey was distributed to two undergraduate listservs to ensure a diversity of disciplines in the responses. The survey was distributed to undergraduate students in the Tickle College of Engineering (3716 students) and the School of Information Sciences (199 students) at UTK. The survey was distributed in July 2023 for one week. As of August 1st, 2023, 281 responses were received, making it a response rate of a little above 7%. The response rate is impacted by the fact that this is a summer semester, and not all the students register for summer classes – essentially reducing the total number of students available for responding. We plan to keep the survey open and will update the results when we submit an updated New Academic Program Proposal in response to the external reviewer’s report.

Below are results from a few questions from the survey conducted to document student interest in an undergraduate major in Information Science.

Question 1 - If a BS in "Emerging and Collaborative Studies" with opportunities for multidisciplinary education (*with potential certificates in cybersecurity, Data Science, AI, Human-Computer Interaction, Design Studies, Graphic Design Studies, User Experience Design, Law Tech, Game Design, Sustainability, and Earth Sciences, etc.*) had been available when you were choosing your major at UT, how interested would you have been in this major?

**Table 1: Interest in Interdisciplinary Customizable Degree**

#	Response	Number (%)
1	Extremely Likely	96 (34)
2	Neither Likely nor Unlikely	114 (41)
3	Extremely Unlikely	57 (20)
	Total	281

Question 2 - If a multidisciplinary BS in Emerging and Collaborative Studies had been available to you and offered a choice of different areas of study, how interested would you have been in pursuing each area of study or major:

**Table 2: Interest in Different Certificates Planned by CECS**

#	Question	Extremely interesting Number (%)	Moderately interesting Number (%)	Not interesting at all Number (%)
1	Cybersecurity	58 (21)	127 (45)	81 (29)
2	Artificial Intelligence	99 (35)	124 (44)	43 (15)
3	Data Science	70 (25)	115 (41)	81 (29)
4	Human-Computer Interaction	74 (26)	110 (39)	83 (30)
5	Design Studies	61 (22)	99 (35)	107 (38)
6	Graphic Design Studies	47 (17)	92 (33)	127 (45)
7	User Experience Design	48 (17)	94 (33)	125 (44)
8	Law Tech	32 (11)	88 (31)	147 (52)
9	Game Design	97 (35)	93 (33)	97 (35)
10	Sustainability	73 (26)	113 (40)	81 (29)

Question 3 - If a multidisciplinary BS in Emerging and Collaborative Studies had been available to you and offered a choice of different certificates, how likely is it that you would have selected this certificate or major:

**Table 3: Interest in the Selection of a Certificate from CECS**

#	Question	Extremely interesting Number (%)	Moderately interesting Number (%)	Not interesting at all Number (%)
1	Cybersecurity	55 (20)	102 (36)	111 (40)
2	Artificial Intelligence	73 (26)	118 (42)	74 (26)
3	Data Science	62 (22)	97 (35)	105 (37)
4	Human-Computer Interaction	42 (15)	101 (36)	124 (44)
5	Design Studies	41 (15)	89 (32)	137 (49)
6	Graphic Design Studies	38 (14)	82 (29)	146 (52)
7	User Experience Design	31 (11)	84 (30)	151 (54)
8	Law Tech	24 (9)	81 (29)	162 (58)
9	Game Design	50 (18)	103 (37)	114 (41)
10	Sustainability	45 (16)	106 (38)	116 (41)

### *Local and Regional Need/Demand*

We conducted our analysis for assessing the local, regional, and employer demand through Lightcast (a labor market analytics firm that combines data from government sources from agencies like the Bureau of Economic Analysis, U.S. Census Bureau, and Bureau of Labor Statistics into one dataset that details industries, occupations, demographics, academic programs, and more.). Our analysis shows no programs in the entire region (Alabama, Arkansas, Georgia, Kentucky, Mississippi, Missouri, North Carolina, and Tennessee) graduate students in this category. Conversely, the regional trends for target occupations from this degree are projected to increase by 14% in the region from 2022-2027. We focused our analysis on the areas where CECS certificates are offered. There is no way to cross-list the different skills in this research, but the individual areas and their local/regional demand and employer demand are provided below. Table 4 shows results of search on the CIP Code, 30.0601.

**Table 4: Regional Trends for Target Populations (Source: Lightcast)**

Occupation	2022 Jobs	Annual Openings	Median Earnings	Growth (2022 - 2027)
Software Developers	179,969	20,148	\$53.62/hr	+19.79%
Computer Systems Analysts	74,663	7,034	\$43.76/hr	+10.03%
Computer and Information Systems Managers	62,120	6,719	\$65.95/hr	+14.85%
Computer Occupations, All Other	55,671	5,446	\$36.42/hr	+11.22%
Network and Computer Systems Administrators	44,445	3,783	\$37.86/hr	+7.07%
Engineers, All Other	24,847	2,065	\$47.01/hr	+7.72%
Architectural and Engineering Managers	21,054	1,981	\$63.18/hr	+9.75%

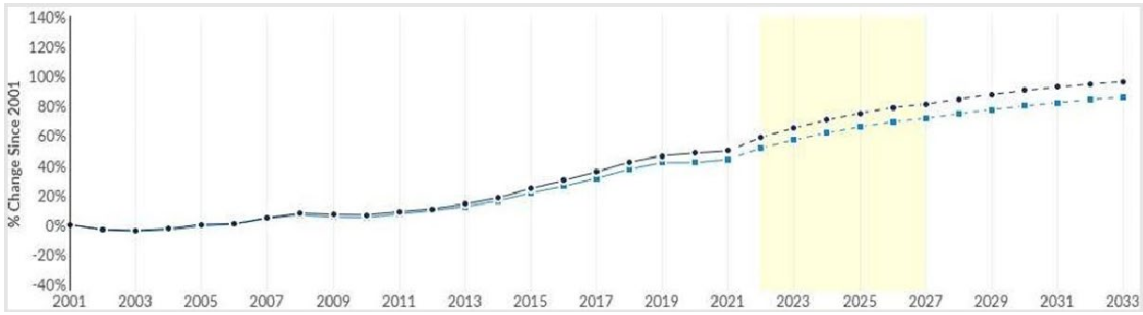


Figure 4: % Change in regional trends of occupation growth for the proposed field (Source: Lightcast)

Table 5: Regional Trends of Occupation Growth – 5-year projection (Source: Lightcast)

Region	2022 Jobs	2027 Jobs	Change	% Change
Region	462,769	528,461	65,692	14.2%
Nation	3,844,166	4,350,008	505,842	13.2%

For Cybersecurity Defense Strategy/Policy, there is a 44.66% increase in the first-line supervisors of police and detectives and a 56.62% increase in the first-line supervisors of security workers in our region. (Figure 5)

### Target Occupations

<p><b>740,935</b> Jobs (2012) 14% above National average</p>	<p><b>+8.4%</b> % Change (2012-2022) Nation: +8.1%</p>	<p>\$28.75/hr <b>\$59.8K/yr</b> Median Earnings Nation: \$33.90/hr; <b>\$70.5K/yr</b></p>	<p><b>102,948</b> Annual Openings</p>		
Occupation	2012 Jobs	Annual Openings	Median Earnings	Growth (2012 - 2022)	Employment Concentration (2012)
Military-only occupations	310,822	37,620	\$17.07/hr	-12.30%	1.63
Postsecondary Teachers	289,903	37,998	\$33.11/hr	-0.34%	0.92
Managers, All Other	110,863	22,390	\$40.12/hr	+78.71%	0.94
First-Line Supervisors of Police and Detectives	22,847	3,422	\$32.64/hr	+44.66%	1.20
First-Line Supervisors of Security Workers	6,501	1,519	\$22.22/hr	+56.62%	0.85

Figure 5: % Change in regional trends of occupation growth for the proposed field (Source: Lightcast)

Occupation	2012 Jobs	Annual Openings	Median Earnings	Growth (2012 - 2022)	Employment Concentration (2012)
Environmental Science and Protection Technicians, Including Health	4,649	1,042	\$22.22/hr	+26.18%	0.82
Conservation Scientists	3,469	743	\$28.39/hr	+31.36%	0.93
Forest and Conservation Workers	3,430	1,259	\$13.90/hr	+16.71%	1.21
Economists	2,208	507	\$45.38/hr	+37.32%	0.73
Solar Photovoltaic Installers	1,524	577	\$20.93/hr	+93.57%	1.03

Figure 6: % Change in regional trends of occupation growth for the proposed field (Source: Lightcast)

For Sustainability, there is no job with sustainability in the title, but there is 26.18% growth in environmental science and protection technicians, a 32.36% increase in the growth of conservation scientists job posting in our region. (Figure 6)

For Digital Forensics, there is an 83% grown in the target occupations in the national, and specifically in the information security analysts there is 119.25% growth, a 28.46% growth in forensic science technicians, and a 112.22% growth in the business operations specialists for digital forensics. (Figure 7).

**Target Occupations**

<p>381,989</p> <p>Jobs (2012)</p> <p>3% below National average</p>	<p>+83.0%</p> <p>% Change (2012-2022)</p> <p>Nation: +75.9%</p>	<p>\$39.07/hr</p> <p>\$81.3K/yr</p> <p>Median Earnings</p> <p>Nation: \$42.18/hr;</p> <p>\$87.7K/yr</p>	<p>79,352</p> <p>Annual Openings</p>		
Occupation	2012 Jobs	Annual Openings	Median Earnings	Growth (2012 - 2022)	Employment Concentration (2012)
Managers, All Other	110,863	22,390	\$40.12/hr	+78.71%	0.94
Business Operations Specialists, All Other	101,816	24,605	\$33.69/hr	+112.22%	0.97
Project Management Specialists	67,559	14,149	\$43.73/hr	+93.86%	0.91
Computer Occupations, All Other	51,983	8,941	\$42.32/hr	+49.64%	1.01
Information Security Analysts	20,004	4,754	\$55.39/hr	+119.25%	1.52
Detectives and Criminal Investigators	18,110	2,079	\$29.64/hr	+5.64%	0.90
Private Detectives and Investigators	5,873	1,216	\$25.09/hr	+9.26%	1.06
Emergency Management Directors	3,154	510	\$30.92/hr	-0.41%	1.30
Forensic Science Technicians	2,625	709	\$25.36/hr	+28.46%	1.09

**Figure 7 Change in the regional and national target occupations (Source Lighcast)**

For Game Design, there is 68.6% overall growth in the target occupations in the region with a 67.52% increase in the art directors job openings and a 12.34% increase in the job opening for graphic designers. (Figure 8).



### Target Occupations

<p>245,347</p> <p>Jobs (2012)</p> <p>10% below National average</p>	<p>+68.6%</p> <p>% Change (2012-2022)</p> <p>Nation: +59.5%</p>	<p>\$51.02/hr</p> <p>\$106.1K/yr</p> <p>Median Earnings</p> <p>Nation: \$53.80/hr;</p> <p>\$111.9K/yr</p>	<p>44,026</p> <p>Annual Openings</p>		
Occupation	2012 Jobs	Annual Openings	Median Earnings	Growth (2012 - 2022)	Employment Concentration (2012)
Software Developers	144,539	27,396	\$57.65/hr	+93.10%	0.92
Computer Occupations, All Other	51,983	8,941	\$42.32/hr	+49.64%	1.01
Graphic Designers	35,409	5,120	\$24.02/hr	+12.34%	0.82
Art Directors	6,965	1,664	\$31.16/hr	+67.52%	0.66
Special Effects Artists and Animators	6,451	906	\$25.85/hr	-17.14%	0.68

Figure 8: Change in the regional and national target occupations (Source: Lightcast)

### *Employer Demand*

This program by UTK can fill a gap in the region, where the unique job postings in the information technology fields are regularly increasing. Tennessee needs students from similar programs, and the neighboring states are experiencing a growth in the demand for such employees. This program will support the region by graduating students with in-demand skills in the region. In the region surrounding Tennessee, there were 629,733 total job postings from July 2022 to June 2023, of which 307,329 were unique, clearly demonstrating the demand from employers.

**Table 6: Unique Job Title regional breakdown for last 12 months (Source: Lightcast)**

Job Title	Total/Unique (Jul 2022 - Jun 2023)
Software Engineers	30,460 / 12,312
Systems Engineers	10,443 / 4,813
Java Developers	6,367 / 4,046
Software Developers	7,182 / 3,438
DevOps Engineers	5,529 / 3,262
Systems Administrators	6,760 / 3,167
.NET Developers	5,078 / 3,057
Business Systems Analysts	5,526 / 3,018
IT Project Managers	4,916 / 2,675
Scrum Masters	5,743 / 2,662

**Table 7: Job postings regional breakdown for last 12 months (Source: Lightcast)**

State	Unique Postings (July 2022 - June 2023)
North Carolina	84,620
Georgia	81,866
Missouri	41,055
Alabama	29,801
Tennessee	29,473

In addition to the local, regional, and employer demand for a bachelor's degree in systems, science, and theory (CIP code for this degree), we analyzed local, regional, and employer demand for the specific areas that are available to the students in the form of stackable certificates. The innovative

approach to this degree program is the ability for all undergraduate students to earn qualifications in these high-demand areas of expertise through CECS and this degree.

Certificates market analysis on Artificial Intelligence (AI): Along with the BS-ITS, CECS is developing an undergraduate degree in Applied Artificial Intelligence (AAI). The CECS AAI program will provide the courses and resources for this certificate in BS-ITS. The market analysis for AI shows 255,484 total job postings from July 2022 to June 2023 in our region. Out of these postings, there were 11,954 in the state of Tennessee. For Game Design – there was a 16.9% increase expected in the target occupations in our region for the target occupations for students with this specialization. For Human Centered Design or User-Centered Design, as mentioned in the letter of support by Dr. Tahamtan, there is a gap in talent supply and demand. The need for graduates with human-centered design skills is increasing at a much higher rate – project at + 20.2% for this region and + 17.6% for the nation.

### *Community and Industry Partnerships*

CECS is engaged in discussions with TTP arrangements with community colleges, including Roane State, which has provided a letter of support (below). Given the highly compatible programs at Roane State (including their Cyber Defense and GIS certificates), there could be a natural TN pathway into our customizable degree. Roane State is also engaged in CECS and Oak Ridge Enhanced Technology and Training Center (see support letter from ORETTTC Director Ashley Stowe below) plans about a shared customizable degree pathway in BS-ITS that would focus on game design for enterprise visualization and other possibilities that would combine certificates in AI, Data Science, Cybersecurity with additional electives. CECS is in conversation with the Tennessee Board of Regents to create a pathway for students from community colleges across the state.

CECS has received tremendous support from the University of Tennessee, Knoxville, industry, community, and regional higher education institutions, as is documented by the following letters of support for the BS-ITS degree. The letters of support are from diverse industries with equal enthusiasm for the innovative transdisciplinary approach of BS-ITS and include sectors such as clean energy, innovative technology, bio-medical, quantum computing, and banking. This demonstrates the employer demand for future graduates of BS-ITS, an innovative new program in Tennessee.

The following letters are attached in Appendix A.

- |   |  |
|---|--|
| <p>1) Dr. Flora W.<br/>Tydings<br/>Chancellor<br/>Tennessee Board of<br/>Regents Nashville, TN</p> <p>2) Edward Chang,<br/>Co-founder &amp; CEO<br/>Moment Energy<br/><a href="mailto:Edward@momentenergy.com">Edward@momentenergy.com</a></p> <p>3) Dr. Iman Tahamtan,<br/>Senior UX<br/>Researcher<br/>JPMorgan Chase<br/>1111 Polaris Pkwy<br/>Columbus, OH 43240<br/>Lecturer<br/>University of Tennessee, Knoxville</p> <p>4) Patrick M. Hanley, Jr., Esq.<br/>Head of Government<br/>Affairs Viridi Parente<br/>1001 E Delavan Ave, Buffalo, NY 14215<br/><a href="https://viridiparente.com/">https://viridiparente.com/</a></p> <p>5) Ryan Herring<br/>Sales Director, Partnerships &amp; Alliances<br/>Quantum Computing, Services and<br/>Solutions, IonQ<br/><a href="https://ionq.com/">https://ionq.com/</a></p> | <p>6) Britton Garrett<br/>CEO, iO<br/>Urology<br/><a href="https://i-ourology.com/">https://i-ourology.com/</a><br/>Carbon Rivers</p> <p>7) David Morgan<br/>Chief Strategy Officer<br/>Carbon Rivers<br/><a href="https://www.carbonrivers.com/">https://www.carbonrivers.com/</a></p> <p>8) Dr. David G.<br/>White Interim<br/>Dean<br/>Herbert College of Agriculture<br/>University of Tennessee Knoxville<br/><a href="mailto:herbert@utk.edu">herbert@utk.edu</a></p> <p>9) Matthew M. Mench, PhD, MBA<br/>Dean and Wayne T. Davis Dean's<br/>Chair Chancellor's Professor<br/>456 Zeenah Engineering<br/>Complex Knoxville, TN 37996<br/><a href="http://www.tickle.edu">www.tickle.edu</a></p> <p>10) Diane Ward<br/>Vice President of Student Learning<br/>Chief Academic Officer<br/>Roane State Community<br/>College Harriman, TN<br/>37748-5011</p> |
|---|--|
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## Section IV: Enrollment and Graduation Projections

The five-year projected enrollment and productivity listed in Table 3 for the Customizable B.S. is based on an estimate of enrollment growth of about 20% additional new students per year students in the first several academic years before leveling off, with about 10% possible attrition rate (based on UTK-wide retention rate of approximately 90%).

Trends are projected to be modest in the first year and increase with increased marketing and recruitment. Projected graduation trends will follow enrollment projections because of students' anticipated retention and completion under the new program. Overall, these are conservative estimates, and we are confident that we will see these numbers in the future based on interest and demand at UTK and enrollment numbers at other higher education institutions that offer Customizable degree programs.

We expect to admit several transfer students with and without an associate degree through TTP. Assuming such transfer students (with two years completed) would begin entering in year 1, we expect one or two graduates already in years 2 and 3 (Table 8).

**Table 8: Projected Enrollments and Graduates.**

Year	Academic Year	Projected Total Fall Enrollment	Projected Attrition	Projected Graduates
1	2024-2025	10	3	-
2	2025-2026	15	4	-
3	2026-2027	20	5	-
4	2027-2028	30	6	7
5	2028-2029	40	8	11

The projected fall enrollment is the total number of majors in the program (new enrollments are the difference between one row to the next, factoring in graduations and attrition). Assumes a 10% approximate attrition rate based on the UTK-wide student retention rate of approximately 90% (<https://studentsuccess.utk.edu>).

## Section V: Projected Costs to Deliver the Proposed Program

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### *Faculty and Instructional Staff*

The BS-ITS Program at UTK is spearheaded by a Program Director, a tenured faculty member, who is responsible for the program's initiation, delivery, and continuous progression. The Program Director oversees the ITS program and other college activities and divides their time equally among the program and the other college related activities, therefore 50% of the program director salary is charged to the ITS program during the planning phase (Academic Year 2023) and continue through Year 5 with an increment of three percent annually. The program director's salary is \$160,000 annually plus benefits at a rate of 32% in 2023-2024.

Based on the Student Credit Hour (SCH) estimate, we estimate the number of FTE Lecturers needed based on a 4/4 teaching load. SCH estimates are based on a slowly growing number of classes and students: Two ITS core courses are taught in Year 1, four courses in Year 2, ten in Year 3, and twelve in Year 4. It's important to note that a 10% yearly attrition rate is anticipated, which is applied to all student levels each year, thereby affecting the number of students progressing to the subsequent year. With this attrition rate in mind, for Year 1, the recruitment target is set at 10 first-year students, with 9 of them expected to return the following year. Year 2 will recruit 15 first-year students, with 13 of those expected to advance to the next year. Year 3 will recruit 20 first-year students, with 18 expected to advance to the next year. Year 4 will recruit 25 first-year students, with 22 expected to advance to the next year. Year 5 will recruit 30 first-year students, with 27 expected to advance to the next year. Based on these estimations, we project having 10 students in Year 1, 21 students in Year 2, 37 students in Year 3, 55 students in Year 4, and 60 students in Year 5.

Each lecturer's salary is estimated at \$90,000 annually plus benefits at a rate of 32%. This is a maximum cost estimate, as UTK TT faculty could be bought out occasionally to teach as faculty fellows. In the planning year and years 1 and 2, two Faculty Fellows are recruited annually to contribute to curriculum development, teaching, and program service, each at a cost of \$10,000 per semester.

### *Non-Instructional Staff*

For the introductory courses, there are weekly assignments to be graded, and we expect class sizes to increase over the five years. Student graders will be hired at \$20.00/hour, for 10 hours per week, 16 weeks per semester. Across all the courses in the degree, we increase from 1 grader in year 1 to 5 student graders in Year 5. This will cost \$28,800 in Year 5.

Support across all programs at CECS is provided by a Program Coordinator. Currently supporting three proposed programs, the Program Coordinator's cost to the BS-ITS program is 1/3 of their

salary and benefits for the five years. The Internship Coordinator will support the junior and senior internship courses starting Year 3, they will split their time between the three CECS degree programs and therefore only 1/3 of their salary is included in the cost for non-instructional faculty.

### *Graduate Assistants*

None – Lecturers, UTK faculty, and undergraduate graders will deliver instruction.

### *Accreditation*

There are no costs associated with accreditation for this program.

### *Consultants*

\$2000 one-time cost for the external evaluator for the program in 2023.

### *Equipment*

No additional costs associated with equipment needed for this program.

### *Information Technology*

No additional costs associated with information technology are needed for this program.

### *Library Resources*

No additional costs associated with library resources are needed for this program.

### *Marketing*

\$2000 per year miscellaneous marketing expenses.

### *Facilities*

No additional costs are anticipated for facilities.

### *Travel*

No travel expenses are specifically associated with this program.

### *Other Resources*

No additional resources may be needed to support the program.

## Section VI: Projected Revenues for the Proposed Program

The THEC Financial Projections Form in Appendix B reflects anticipated revenues associated with the proposed program.

### *Tuition*

Income is \$378 per SCH for Tennessee residents and \$759 per SCH for non-residents. We assume that 20% of undergraduate students pay non-resident tuition. The total tuition revenue is calculated on the basis of offering one section of each of the ITS courses as per the schedule in Table 11. With current projection numbers, the BS-ITS program will break-even in Year 6 and be profitable from then on.



## Section VII: Implementation Timeline

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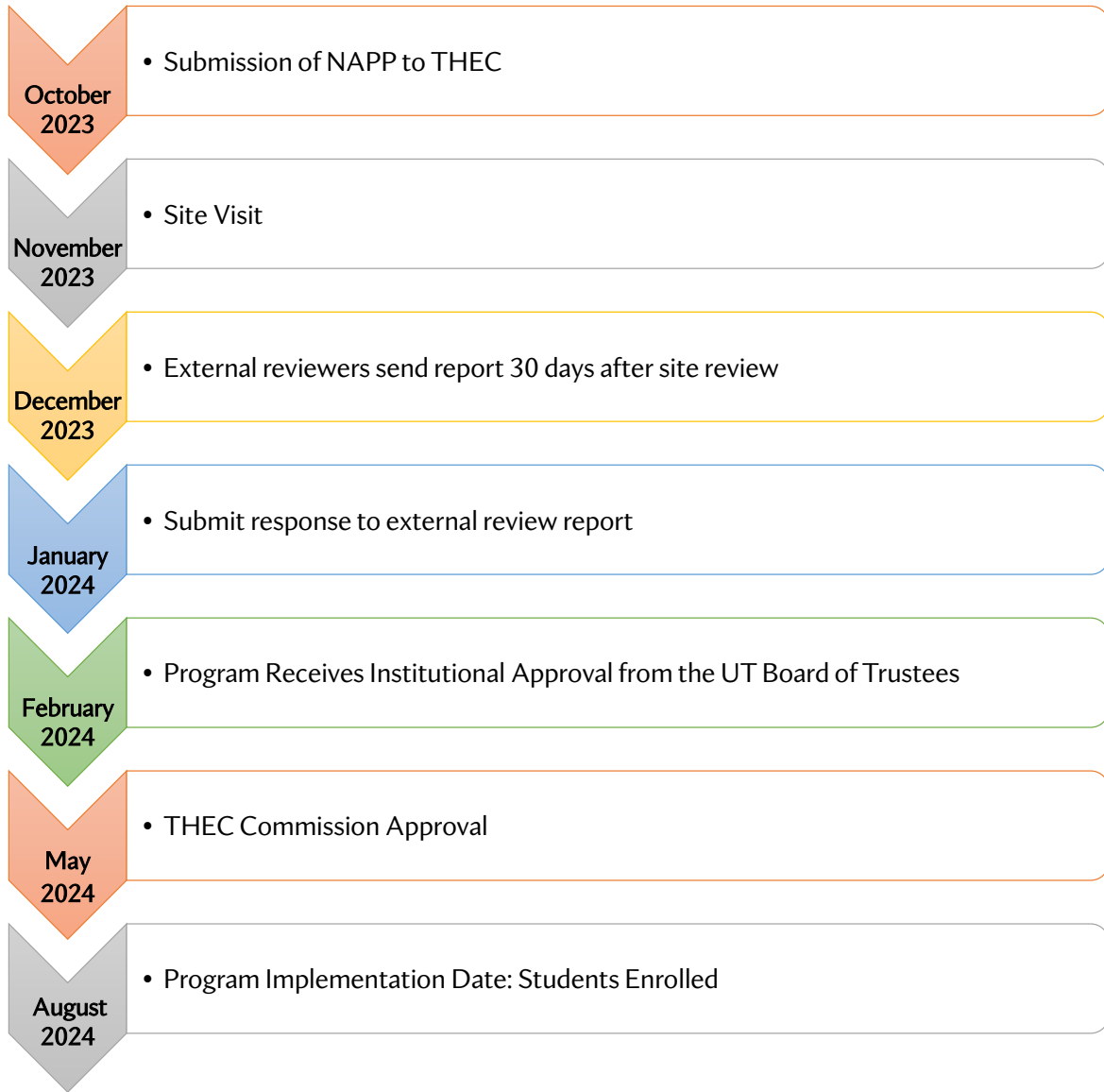


Figure 9: Implementation Timeline

***Accreditation Considerations*****SACSCOC Accreditation:**

The undergraduate major, like all academic programs at the University of Tennessee-Knoxville, will be regionally accredited by SACSCOC (<https://sacs.utk.edu/>). There is no accrediting body for undergraduate transdisciplinary programs. Therefore, no professional disciplinary accreditation organizations are identified. Heather Hartman is the SACS liaison at UTK and is responsible for keeping the accreditation updated for all undergraduate programs at UTK. [hhartma3@utk.edu](mailto:hhartma3@utk.edu)

**Programmatic Accreditation:**

No programmatic accreditation is planned for this degree.

## Section VIII: Curriculum

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The Bachelor of Science in Innovative Transdisciplinary Studies (BS-ITS) will consist of 120 total student credit hours, as required for any bachelor's degree at the University of Tennessee. Out of the 120 credit hours, 27 will be Innovative Transdisciplinary Studies core courses, including two capstone courses. The BS-ITS is designed to prepare all the enrolled students to succeed in the transdisciplinary workforce and therefore these 27 credit hours (9 courses) will orient students with concepts of transdisciplinary studies, including synthesizing relevant content from across disciplines, research methods and problem-solving for transdisciplinary projects. Each student will then choose a combination of certificates from the College of Emerging and Collaborative Studies which consist of courses from all the colleges at the University of Tennessee Knoxville colleges. The advising center will support the students to customize their program by selecting relevant stackable certificates.

Each certificate will consist of 12 student credit hours, 3 of which will be taught by CECS as gateway courses and 9 credit hours will be from outside CECS at UTK. Students will be able to develop a completely customized curriculum by selection of certificates, and elective courses from across the University. Students will complete 51-58 credit hours of VolCore courses that set the foundation for all the bachelor's students at the University of Tennessee. Additionally, students will have college and university-wide unrestricted electives to complete the customized program.

The BS-ITS major will include all new courses developed by CECS and existing courses from across the university. All new and current courses with an established certificate are listed below. Please refer to Appendix C for the syllabi for each of these courses. Appendix D includes the course descriptions for new and existing electives for the proposed BS-ITS major.

### *Program-specific Goals/Objectives*

The Bachelors in Innovative Transdisciplinary Studies is designed to provide students with a holistic and multidimensional education that goes beyond traditional disciplinary boundaries. Specific program outcomes for the graduates of this degree are:

1. **Transdisciplinary Knowledge:** Graduates should have a deep understanding of multiple academic disciplines and how they can be integrated to address complex real-world problems.
2. **Innovation and Creativity:** The program fosters creativity and innovation in problem-solving, encouraging students to think outside the box.
3. **Collaboration:** The program develops the ability to work collaboratively with individuals from diverse backgrounds and perspectives and excel in teamwork.
4. **Critical Thinking and Problem Solving:** Students will develop the ability to think critically, analyze information from diverse sources, and make informed decisions in complex, dynamic environments. They will acquire the skills to identify, analyze, and solve complex problems that may not fit neatly into one academic discipline.
5. **Career Preparedness:** The curriculum is designed to equip students with practical skills and experiences that make them competitive in a variety of career paths, including those that require interdisciplinary expertise. Graduates will be able to adapt to rapidly changing circumstances and evolving knowledge, which is particularly important in interdisciplinary fields.

### *Student Learning Outcomes*

1. Demonstrate a deep understanding of concepts, theories, and methods from multiple disciplines relevant to the chosen transdisciplinary field of study.
2. Identify connections, patterns, and interdependencies between different disciplines and integrate this knowledge to address complex problems.
3. Apply systems thinking principles to comprehend the complexity and interconnectedness of social, environmental, and technological systems.
4. Consider the societal and environmental implications of transdisciplinary solutions and propose responsible courses of action.
5. Plan and conduct transdisciplinary research projects, employing appropriate methodologies from different disciplines.
6. Synthesize and interpret data from diverse sources to support evidence-based conclusions.
7. Design and execute a comprehensive transdisciplinary project that integrates insights from different disciplines to address a complex issue.
8. Collaborate effectively with individuals from different disciplines to collectively address transdisciplinary problems.
9. Communicate ideas and findings clearly and coherently to diverse audiences, including those without specialized knowledge in particular disciplines.

**Table 8: Student Learning Outcomes Mapped to Course Courses**

<p><b>Learning Outcome</b></p> <p><i>Students will...</i></p>	ITS 102: Design Your Degree Design Your Career	ITS 102: Introduction to Team Science	ITS 201: Introduction to Data Science	ITS 202: Design Thinking and Innovation	ITS 301: Transdisciplinary Problem Solving	ITS 302: Transdisciplinary Research Methods	ITS 399: Junior Capstone	ITS 401: Advanced Applications of Transdisciplinary Research Concepts	ITS 499: Senior Capstone
Demonstrate a deep understanding of concepts, theories, and methods from multiple disciplines relevant to the chosen transdisciplinary field of study.		X			X	X		X	
Identify connections, patterns, and interdependencies between different disciplines and integrate this knowledge to address complex problems.	X	X			X	X		X	
Apply systems thinking principles to comprehend the complexity and interconnectedness of social, environmental, and technological systems.	X	X			X			X	
Consider the societal and environmental implications of transdisciplinary solutions and propose responsible courses of action.					X	X			
Plan and conduct transdisciplinary research projects, employing appropriate methodologies from different disciplines.			X			X	X		X
Synthesize and interpret data from diverse sources to support evidence-based conclusions.		X	X					X	
Design and execute a comprehensive transdisciplinary project integrating insights from different disciplines to address a complex issue.			X				X		X

Collaborate effectively with individuals from different disciplines to collectively address transdisciplinary problems.	X	X			X			X	
Communicate ideas and findings clearly and coherently to diverse audiences, including those without specialized knowledge in particular disciplines.	X	X					X	X	X

*Academic Program Requirements***Table 9: ITS Program Curriculum**

Course Prefix, #, and Title	Course Catalog Description	Credit Hours	New or Existing
<b>Prerequisite Course(s) (General Education): 51-58 Hours</b>			
Vol Core WC	Written Communication (WC): 3 courses, including ENGL 101 and ENGL 102, plus an approved WC course	9	Existing
Vol Core OC	1 Oral Communication (OC) course	1-3	Existing
Vol Core AOC	1 Applied Oral Communication course	1-3	Existing
Vol Core NS	2 Natural Sciences (NS), one 4-credit w/ lab	7-8	Existing
Vol Core QR	2 Quantitative Reasoning (QR) courses	6-7	Existing
Vol Core AH	1 Arts and Humanities	3	Existing
Vol Core EP	2 Expanded Perspectives (EP) courses	6	Existing
Vol Core GCI and GCIUS	1 GCI and 1 GCIUS course	6	Existing
Vol Core SS	1 Social Sciences (SS) course	3	Existing
Vol Core EI	3 Engaged Inquiries (EI) courses	9	Existing
<b>Core Classes: 21 Hours</b>			
ITS 101: Design Your Degree Design Your Career	Design Your Degree, Design Your Career" is an innovative and student-centered course designed to empower incoming freshmen with the ability to craft a personalized educational journey that aligns with their unique interests and career aspirations. In a rapidly evolving world, where transdisciplinary knowledge and adaptability are highly valued, this course equips students with the tools to shape their academic experience and future career path. The course will use the methods of Design	3	New

	Thinking to spur curiosity and creativity, pushing students to think both broadly and deeply.		
ITS 102: Introduction to Team Science	This course provides students with an understanding of the principles and practices of team science in the context of research and innovation. Students will explore theories of collaboration, communication, conflict resolution, and leadership in interdisciplinary and diverse research teams. Through case studies, discussions, and practical exercises, students will develop essential skills for effective teamwork in complex scientific projects.	3	New
ITS 201: Transdisciplinary Data Analytics for Decision Making	This course is designed to equip students with the knowledge and skills necessary to leverage data analytics techniques for effective decision-making in a variety of fields. Through a transdisciplinary approach, students will learn how to collect, process, analyze, and interpret data from diverse sources to inform strategic decisions. The course will emphasize the integration of data analysis with real-world applications and ethical considerations.	3	New
ITS 202: Transdisciplinary Thinking and Innovation	This course introduces students to the principles of design thinking and innovation, providing them with a comprehensive understanding of the creative problem-solving process and how it can be applied to generate innovative solutions. Students will learn to empathize with users, define problems, ideate solutions, prototype concepts, and test their ideas through real-world projects and case studies.	3	New
ITS 301: Transdisciplinary Problem Solving	This course equips students with the skills and mindset necessary for addressing complex problems that transcend traditional disciplinary boundaries. Through a combination of theoretical frameworks, case studies, and hands-on projects, students will learn to collaborate effectively with experts from various fields, analyze complex challenges, and develop innovative solutions.	3	New
ITS 302: Transdisciplinary Research Methods	This course provides students with a comprehensive understanding of effective research methods for transdisciplinary projects. Students will explore qualitative, quantitative, and mixed methods approaches, as well as strategies for integrating diverse disciplinary	3	New



	perspectives. Through case studies, practical exercises, and discussions, students will learn to design, execute, and analyze research projects that tackle complex, real-world challenges.		
ITS 401 Advanced Applications of Transdisciplinary Research Concepts	This course delves into advanced concepts, methods, and challenges of transdisciplinary research. It will equip students with the skills and knowledge necessary to conduct research transcending traditional disciplinary boundaries fostering innovative problem-solving and collaboration.	3	New
<b>Elective Courses: 3 Certificates (3 x 12 hours) = 36 Hours</b>			
Choose 3 certificates (4 courses each) from the list in Table 10 <i>Data Science, Applied Artificial Intelligence, Cybersecurity, Sustainable Future, Forensic Studies, Music Applied Intelligence, Game Design, and Medical Applied Intelligence</i>			
<b>Unrestricted Electives: 6 Hours</b>			
<b>Additional Requirements: 6 Hours</b>			
ITS 399: Junior Capstone		3	New
ITS 499: Senior Capstone		3	New

**Total Program Credit Hours: 120**

Table 10: Stackable Certificates available to BS-ITS students (Currently under review at UTK)

<i>List of Certificates available to BS-ITS students (Each 12 credit hours)</i>		
<i>Certificate Name</i>	<i>Certificate Requirements</i>	<i>New or Existing</i>
<i>Data Science</i>	<p><b>Required Course (3 SCH)</b></p> <ul style="list-style-type: none"> <li>▪ DATA 101 Data Knowledge and Discovery OR</li> <li>▪ DATA 202 Data Management and Visualization</li> </ul> <p><b>Choose 3 courses (9 SCH) from:</b></p> <ul style="list-style-type: none"> <li>▪ DATA 102 – Data Stewardship and Ethics</li> <li>▪ INSC 384 – Database Design</li> <li>▪ IE 340 – Design of Experiments</li> <li>▪ IARC 321 – Advanced Representation</li> <li>▪ DATA 302 – Analytical Methods of Data Science</li> <li>▪ MATH 423 – Probability</li> <li>▪ MATH 424 – Stochastic Processes</li> <li>▪ MATH 425 – Statistics</li> <li>▪ INSC 486 – Data Analytics</li> <li>▪ INSC 484 – Database Applications</li> <li>▪ INSC 489 – Information Visualization</li> <li>▪ IE 465 – Applied Data Science</li> <li>▪ DATA 399 – Junior Capstone</li> </ul>	<i>All existing</i>
<i>Applied Artificial Intelligence</i>	<p><b>Required Course (3 SCH)</b></p> <ul style="list-style-type: none"> <li>▪ AI 101 Introduction to AAI OR</li> <li>▪ AI 102 Introduction to AI Tools and Frameworks</li> </ul> <p><b>Choose 3 courses from the list below (9 SCH) from:</b></p> <ul style="list-style-type: none"> <li>▪ AI 301 – Natural Language Processing and Conversational AI</li> <li>▪ AI 302 – AI based Data Handling and Visualization</li> <li>▪ AI 311-AI for Cybersecurity</li> <li>▪ AI 399 – Junior Capstone</li> </ul>	AI 101 is existing; all others are new courses

<i>Applied Cybersecurity</i>	<p><b>Required Course (3 SCH)</b></p> <ul style="list-style-type: none"> <li>▪ CYBR 101 Introduction to Cybersecurity Concepts</li> </ul> <p><b>Choose 3 courses from the list below (9 SCH) from:</b></p> <ul style="list-style-type: none"> <li>▪ CYBR 301 - Cybercrime and Digital Law Enforcement</li> <li>▪ INSC 384 - Database Design</li> <li>▪ CYBR 302 - Cybersecurity Risk Management</li> <li>▪ AI 311-AI for Cybersecurity</li> <li>▪ CYBR 399 - Junior Capstone</li> </ul>	<i>All existing</i>
<i>Sustainable Futures</i>	<p><b>Required Courses – (6 SCH)</b></p> <ul style="list-style-type: none"> <li>▪ SUST 101-Building a Sustainable World</li> <li>▪ ALEC 485 - Global Sustainable Development Goals</li> </ul> <p><b>Choose ONE course from 3 SCH) -</b></p> <ul style="list-style-type: none"> <li>▪ AGNR 491 International Experience in Agriculture and Natural Resources,</li> <li>▪ BUAD 400 – International Business,</li> <li>▪ GEOG 440 - Global Perspectives on Urban Sustainability,</li> <li>▪ PLSC 491 International Study: History and Culture of International Gardens and Landscapes,</li> <li>▪ WFS 425 Tropical Ecology, Conservation and Field Methods</li> <li>▪ ALEC 492 Internship in Agricultural Leadership, Education and Communications,</li> <li>▪ ANSC 492 Animal Science Experiential Learning</li> <li>▪ AREC 492 Off-Campus Internship</li> <li>▪ ESS 492 Internship</li> <li>▪ FORS 496 Internship in Forestry,</li> <li>▪ GEOG 490 Internship in Sustainability,</li> <li>▪ PLSC 492 Internship in Horticultural and Plant Sciences</li> </ul> <p><b>Choose ONE course from (3 SCH):</b></p> <p><b>A) Equity:</b></p> <ul style="list-style-type: none"> <li>▪ ANTH 370/WGS 370 Gender and Globalization</li> <li>▪ ANTH 419 Anthropology of Human Rights,</li> </ul>	<i>All existing</i>

	<ul style="list-style-type: none"> <li>▪ ANTH 421 Refugees and Displaced People,</li> <li>▪ ANTH 422 Anthropology of Global Inequality,</li> <li>▪ ANTH 425 Humanitarianism,</li> <li>▪ GEOG 349 Geography of Human Rights: Europe and Asia,</li> <li>▪ GEOG 350 Geography of Human Rights: Africa and the Americas,</li> <li>▪ HTM 484 Critical Sustainable Tourism,</li> <li>▪ PHIL 441/GLBS 441 Global Justice and Human Rights,</li> <li>▪ PHIL 346/348 Environmental Ethics,</li> <li>▪ POLS 413 Race, Ethnicity, and Politics,</li> <li>▪ PSYC 471 Psychology of Prejudice,</li> <li>▪ SOCI 341 Social Inequalities, SOCI 342 Globalization and Justice,</li> <li>▪ SOCI 361 Environmental Justice,</li> <li>▪ SOCI 463 Community, Sustainability, and Justice,</li> <li>▪ SOCI 464 Political Economy of Natural Resources and the Environment.</li> </ul> <p><b>B) Environment:</b></p> <ul style="list-style-type: none"> <li>▪ CBE 481 Green Engineering,</li> <li>▪ EEB 419 Global Change Ecology,</li> <li>▪ EEB 423 Conservation Decision Making,</li> <li>▪ EEB 484 Conservation Biology,</li> <li>▪ ESS 462 Environmental Climatology,</li> <li>▪ FWF 320 Human Dimensions of Natural Resources</li> <li>▪ FWF 324 Applied Ecosystem Restoration,</li> <li>▪ FWF 420/427 Natural Resource Issues,</li> <li>▪ GEOG 333 Climate Change and Human Response</li> <li>▪ GEOG 345 Population and Environment,</li> <li>▪ GEOG 372 Geography of Africa,</li> <li>▪ GEOG 436 Water Resources,</li> <li>▪ GEOL 443 Sustainable Cities and Landscapes</li> <li>▪ GEOL 454 Environmental Restoration,</li> <li>▪ GEOL 464 Water Sustainability and Climate,</li> </ul>	
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	<ul style="list-style-type: none"> <li>▪ GEOL 466 Water and Air Pollution,</li> <li>▪ MICR 305 Global Emerging Infectious and One Health,</li> <li>▪ PLSC 311/455 Management of Landscape Systems</li> </ul> <p><b>C) Economics/Policy:</b></p> <ul style="list-style-type: none"> <li>▪ AGNR 480 How to Feed the World,</li> <li>▪ AREC 332 Food Policy,</li> <li>▪ AREC 333 Agricultural Conservation Policy,</li> <li>▪ AREC 345 Climate Change and Renewable Energy Economics,</li> <li>▪ AREC 470 Policy Analysis for Environmental and Natural Resource Management,</li> <li>▪ ECON 362 Envir/Natural Resource Policy,</li> <li>▪ ECON 463 Environmental Economics,</li> <li>▪ GEOG 346 Energy, Governance, and Sustainability,</li> <li>▪ GERM 383 Aiming at Sustainability,</li> <li>▪ HBS 443 Energy Transitions,</li> <li>▪ POLS 352 Political Challenges of Globalization,</li> <li>▪ PUBH 420 Environmental Public Health,</li> <li>▪ SCM 440 Social and Environmental Sustainability in Supply Chain Management,</li> <li>▪ SOCI 360 Environment &amp; Natural Resources,</li> <li>▪ SOCI 363 Food, Agriculture, and Society,</li> <li>▪ SOCI 442/AFST 442 Comparative Poverty and Development.</li> </ul>	
<i>Forensic Studies</i>	<p><b>Required Course (6 SCH) –</b></p> <ul style="list-style-type: none"> <li>▪ FOST 101 - Introduction to Forensic Studies</li> <li>▪ ANTH 105 - Scene of the Crime: Demystifying Forensic Science</li> </ul> <p><b>Choose ONE course from (3 SCH):</b></p> <ul style="list-style-type: none"> <li>▪ POLS 330 - Law in American Society</li> <li>▪ INPG 220 - Introduction to Law and the Legal Profession</li> <li>▪ FOST 300: Forensic Biology</li> </ul> <p><b>Choose ONE course from (3 SCH):</b></p> <ul style="list-style-type: none"> <li>▪ SOCI 350 - Criminology</li> </ul>	<i>All existing</i>

	<ul style="list-style-type: none"> <li>▪ FOST 350: Forensic Chemistry</li> <li>▪ POLS 435 - Criminal Law and Procedure</li> <li>▪ GEOG 313 - Geospatial Field Methods of UAVs, LiDAR, and GPS</li> <li>▪ GEOG 424 - LiDAR Technology and Applications</li> </ul>	
<i>Music AI</i>	<p><b>Required Course –</b>  <b>AI 101: Introduction to the World of AI (3 SCH)</b>  <b>Choose ONE from: (3 SCH)</b></p> <ul style="list-style-type: none"> <li>▪ AI 102: Natural Language-based Programming Techniques</li> <li>▪ AI 201: AI, Ethics, and Legal Frameworks</li> <li>▪ AI 202: Human-AI Interaction and Experience Design</li> <li>▪ AI 301: Natural Language Processing and Conversational AI</li> </ul> <p><b>Choose TWO courses from (6 SCH)</b></p> <ul style="list-style-type: none"> <li>▪ MUTC 320 - Scoring for Film and Media</li> <li>▪ MUTC 325 - Commercial Scoring for Media</li> <li>▪ MUTC 330 - Virtual Audio Modeling</li> <li>▪ MUTC 335 - Interactive Game Audio</li> <li>▪ MUTC 340 - Introduction to Computer Music Transcription</li> <li>▪ MUTC 390 - Sound Synthesis Techniques</li> <li>▪ MUTC 450 - Computer Projects</li> </ul>	<i>All existing</i>
<i>Game Design</i>	<p><b>Required Course –</b>  GAME 399 – Collaborative Game Design - Junior Capstone  <b>Choose 3 courses from:</b></p> <ul style="list-style-type: none"> <li>▪ GAME 101 – Foundations of Game Design</li> <li>▪ COSC 111 - Computational Thinking and the Art of Programming</li> <li>▪ GAME 329 - Game Design</li> <li>▪ GAME 429 – Games for Training and Teaching</li> <li>▪ MUTC 335 – Interactive Game Audio</li> <li>▪ COSC 452- Graphics for Gaming</li> </ul>	<i>All existing</i>
<i>Medical AI</i>	<p><b>Required Courses - (6SCH)</b>  AI 351: AI-Driven Clinical Solutions and Projects.</p>	<i>All existing</i>

	<p>AI 451: Advanced Research in AI and Multidisciplinary Medical Applications  <i>Select one course from the following courses (3 SCH):</i>                  AI 101: Introduction to World of AI      OR                  AI 102: Natural Language-based Programming Techniques,  <i>Select one course from the following courses (3 SCH):</i>                  AI 201: AI, Ethics, and Legal Frameworks                  AI 202: Human-AI Interaction and Experience Design                  AI 301: Natural Language Processing and Conversational AI                  AI 302: AI-based Data Handling and Visualization                  AI 311: AI for Cybersecurity</p>	
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*Program of Study***Table 11: Sample Course Enrollment Schedule/ Plan of Study**

<i>Semester 1: Fall 2024</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 101	Design Your Degree Design Your Career	3
ENG 101 (EC 1)	English Composition I	3
ESS 110 (NS)	Energy for the World	2
DS 150 (AH)	The Idea of Design	4
MATH 113 (QR)	Mathematical Reasoning	3
Total Semester Credit Hours: 15		
<i>Semester 2: Spring 2025</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 102	Introduction to Team Science	3
ENG 102 (EC2)	English Composition II	3
ALEC 102 (EI)	Interpersonal Leadership Development	3
PHIL 244	Professional Responsibility	3
SOCI 120 (GCUS and SS - EP)	Introduction to Sociology	3
Total Semester Credit Hours: 15		
<i>Semester 3: Fall 2025</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 201	Transdisciplinary Data Analytics for Decision Making	3
DATA 201 (QR)	Data Knowledge and Discovery	3
POLS 311 (EI)	Contemporary Issues in American Public Policy	3
ALEC 303 (AOC)	Analysis of Leadership Approaches and Styles	3
Unrestricted Elective 1		3
Total Semester Credit Hours: 15		
<i>Semester 4: Spring 2026</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 202	Transdisciplinary Thinking and Innovation	3
ALEC 330 (AAH - EP1)	Foundations of Practical Skills for Communicating Natural Sciences	3
SOCI 250 (GCI and SS)	Introduction to Global Studies	3
GEOG 206 (EI)	Sustainability Principles and Practices	3
Certificate 1 Course 1		3
Total Semester Credit Hours: 15		
<i>Semester 5: Fall 2026</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 301	Transdisciplinary Thinking and Innovation	3



Certificate 1 Course 2		3
Certificate 2 Course 1		3
Certificate 3 Course 1		3
GEOG 132	Landscape and Environment Change	3
Total Semester Credit Hours: 15		
<i>Semester 6: Spring 2027</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 302	Transdisciplinary Research Methods	3
Certificate 1 Course 3		3
Certificate 2 Course 2		3
ANTH 130		3
ITS 399	Junior Capstone	3
Total Semester Credit Hours: 15		
<i>Semester 7: Fall 2027</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 401	Advanced Applications of Transdisciplinary Research Concepts	3
Certificate 2 Course 3		3
Certificate 3 Course 2		3
CECS Electives 1		3
ALEC 443	Video Production Campaigns for Natural Science	3
Total Semester Credit Hours: 15		
<i>Semester 8: Spring 2028</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 499	Senior Capstone	3
Certificate 3 Course 3		3
CECS Elective 2		3
ITS 492	Internship	3
Unrestricted Elective 2		3
Total Semester Credit Hours: 15		
Total program hours: 120		

**Table 12 Data Science, AI, and Cybersecurity certificate**

<i>Semester 1: Fall 2024</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 101	Design Your Degree Design Your Career	3
ENG 101 (EC 1)	English Composition I	3
ESS 110 (NS)	Energy for the World	2
DS 150 (AH)	The Idea of Design	4
MATH 113 (QR)	Mathematical Reasoning	3
Total Semester Credit Hours: 15		
<i>Semester 2: Spring 2025</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 102	Introduction to Team Science	3
ENG 102 (EC2)	English Composition II	3
ALEC 102 (EI)	Interpersonal Leadership Development	3
PHIL 244	Professional Responsibility	3
SOCI 120 (GCUS and SS - EP)	Introduction to Sociology	3
Total Semester Credit Hours: 15		
<i>Semester 3: Fall 2025</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 201	Transdisciplinary Data Analytics for Decision Making	3
<b>DATA 101 (QR)</b>	Data Knowledge and Discovery	3
POLS 311 (EI)	Contemporary Issues in American Public Policy	3
ALEC 303 (AOC)	Analysis of Leadership Approaches and Styles	3
Unrestricted Elective 1		3
Total Semester Credit Hours: 15		
<i>Semester 4: Spring 2026</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 202	Transdisciplinary Thinking and Innovation	3
ALEC 330 (AAH - EP1)	Foundations of Practical Skills for Communicating Natural Sciences	3
SOCI 250 (GCI and SS)	Introduction to Global Studies	3
GEOG 206 (EI)	Sustainability Principles and Practices	3
<b>DATA 102</b>	Data Stewardship and Ethics	3
Total Semester Credit Hours: 15		
<i>Semester 5: Fall 2026</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 301	Transdisciplinary Thinking and Innovation	3
<b>INSC 484</b>	Database Applications	3
<b>AI 102</b>	Natural Language-based Programming Techniques	3

CYBR 101	Introduction to Cybersecurity Concepts	3
GEOG 132	Landscapes and Environmental Change	3
Total Semester Credit Hours: 15		
<i>Semester 6: Spring 2027</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 302	Transdisciplinary Research Methods	3
DATA 302	Analytical Methods of Data Science	3
AI 301	Natural Language Processing and Conversational AI	3
ANTH 130	Cultural Anthropology	3
ITS 399/CYBR 399	Junior Capstone	3
Total Semester Credit Hours: 15		
<i>Semester 7: Fall 2027</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 401	Adv App of Transdisciplinary Research Concepts	3
AI 302		3
AI 311/AI 311	AI for Cybersecurity	3
CECS Electives 1		3
Alec 443	Video Production for Campaigns for Natural Science	3
Total Semester Credit Hours: 15		
<i>Semester 8: Spring 2028</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 499	Senior Capstone	3
CYBR 302	Cybersecurity Risk Management	3
CECS Elective 1		3
ITS 492	Internship	3
Unrestricted Elective 2		3
Total Semester Credit Hours: 15		
Total program hours: 120		

**Table 13-Data Science Minor and Sustainability Certificate**

<i>Semester 1: Fall 2024</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 101	Design Your Degree Design Your Career	3
ENG 101 (EC 1)	English Composition I	3
ESS 110 (NS)	Energy for the World	2
DS 150 (AH)	The Idea of Design	4
MATH 113 (QR)	Mathematical Reasoning	3
Total Semester Credit Hours: 15		
<i>Semester 2: Spring 2025</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 102	Introduction to Team Science	3
ENG 102 (EC2)	English Composition II	3
ALEC 102 (EI)	Interpersonal Leadership Development	3
PHIL 244	Professional Responsibility	3
SOCI 120 (GCUS and SS - EP)	Introduction to Sociology	3
Total Semester Credit Hours: 15		
<i>Semester 3: Fall 2025</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 201	Transdisciplinary Data Analytics for Decision Making	3
<b>DATA 101 (QR)</b>	Data Knowledge and Discovery	3
POLS 311 (EI)	Contemporary Issues in American Public Policy	3
ALEC 303 (AOC)	Analysis of Leadership Approaches and Styles	3
Unrestricted Elective 1		3
Total Semester Credit Hours: 15		
<i>Semester 4: Spring 2026</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 202	Transdisciplinary Thinking and Innovation	3
ALEC 330 (AAH - EP1)	Foundations of Practical Skills for Communicating Natural Sciences	3
SOCI 250 (GCI and SS)	Introduction to Global Studies	3
GEOG 206 (EI)	Sustainability Principles and Practices	3
<b>DATA 202</b>	Data Management and Visualization	3
Total Semester Credit Hours: 15		
<i>Semester 5: Fall 2026</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 301	Transdisciplinary Thinking and Innovation	3
<b>INSC 484</b>	Database Applications	3
<b>DATA 102</b>	Data Stewardship and Ethics	3

SUST 101	Foundations of Sustainability	3
GEOG 132	Landscapes and Environmental Change	3
Total Semester Credit Hours: 15		
<i>Semester 6: Spring 2027</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 302	Transdisciplinary Research Methods	3
DATA 302	Analytical Methods of Data Science	3
GEOG 333	Climate Change and Human Response	3
ANTH 130	Cultural Anthropology	3
ITS 399/DATA 399	Junior Capstone	3
Total Semester Credit Hours: 15		
<i>Semester 7: Fall 2027</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 401	Adv App of Transdisciplinary Research Concepts	3
ALEC 485	Global Sustainable Development Goals	3
CECS Electives 1		3
CECS Electives 2		3
ALEC 443	Video Production for Campaigns for Natural Science	3
Total Semester Credit Hours: 15		
<i>Semester 8: Spring 2028</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 499	Senior Capstone	3
SOCI 465	Social Values and the Environment	3
CECS Elective 3		3
ITS 492	Internship	3
Unrestricted Elective 2		3
Total Semester Credit Hours: 15		
Total program hours: 120		

**Table 14 - AI, Cybersecurity, and Game Design**

<i>Semester 1: Fall 2024</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 101	Design Your Degree Design Your Career	3
ENG 101 (EC 1)	English Composition I	3
ESS 110 (NS)	Energy for the World	2
DS 150 (AH)	The Idea of Design	4
MATH 113 (QR)	Mathematical Reasoning	3
Total Semester Credit Hours: 15		
<i>Semester 2: Spring 2025</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 102	Introduction to Team Science	3
ENG 102 (EC2)	English Composition II	3
ALEC 102 (EI)	Interpersonal Leadership Development	3
PHIL 244	Professional Responsibility	3
SOCI 120 (GCUS and SS - EP)	Introduction to Sociology	3
Total Semester Credit Hours: 15		
<i>Semester 3: Fall 2025</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 201	Transdisciplinary Data Analytics for Decision Making	3
DATA 201 (QR)	Data Knowledge and Discovery	3
POLS 311 (EI)	Contemporary Issues in American Public Policy	3
ALEC 303 (AOC)	Analysis of Leadership Approaches and Styles	3
Unrestricted Elective 1		3
Total Semester Credit Hours: 15		
<i>Semester 4: Spring 2026</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 202	Transdisciplinary Thinking and Innovation	3
ALEC 330 (AAH - EP1)	Foundations of Practical Skills for Communicating Natural Sciences	3
SOCI 250 (GCI and SS)	Introduction to Global Studies	3
GEOG 206 (EI)	Sustainability Principles and Practices	3
<b>COSC 111</b>	Computational Thinking and the Art of Programming	3
Total Semester Credit Hours: 15		
<i>Semester 5: Fall 2026</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 301	Transdisciplinary Thinking and Innovation	3
<b>GAME 329</b>	Game Design	3
<b>AI 102</b>	Natural Language-based Programming Techniques	3

CYBR 101	Introduction to Cybersecurity Concepts	3
GEOG 132	Landscapes and Environmental Change	3
Total Semester Credit Hours: 15		
<i>Semester 6: Spring 2027</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 302	Transdisciplinary Research Methods	3
CYBR 202	Data Protection and Privacy	3
AI 301	Natural Language Processing and Conversational AI	3
ANTH 130	Cultural Anthropology	3
ITS 399/GAME 399	Junior Capstone	3
Total Semester Credit Hours: 15		
<i>Semester 7: Fall 2027</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 401	Adv App of Transdisciplinary Research Concepts	3
AI 302	AI-based Data Handling and Visualization	3
AI 311/AI 311	AI for Cybersecurity	3
COSC 452	Graphics for Gaming	3
ALEC 443	Video Production for Campaigns for Natural Science	3
Total Semester Credit Hours: 15		
<i>Semester 8: Spring 2028</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 499	Senior Capstone	3
CYBR 302	Cybersecurity Risk Management	3
CECS Elective 1		3
ITS 492	Internship	3
Unrestricted Elective 2		3
Total Semester Credit Hours: 15		
Total program hours: 120		

Table 15 - AI and Forensics certificates

<i>Semester 1: Fall 2024</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 101	Design Your Degree Design Your Career	3
ENG 101 (EC 1)	English Composition I	3
ESS 110 (NS)	Energy for the World	2
DS 150 (AH)	The Idea of Design	4
MATH 113 (QR)	Mathematical Reasoning	3
Total Semester Credit Hours: 15		
<i>Semester 2: Spring 2025</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 102	Introduction to Team Science	3
ENG 102 (EC2)	English Composition II	3
ALEC 102 (EI)	Interpersonal Leadership Development	3
PHIL 244	Professional Responsibility	3
SOCI 120 (GCUS and SS - EP)	Introduction to Sociology	3
Total Semester Credit Hours: 15		
<i>Semester 3: Fall 2025</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 201	Transdisciplinary Data Analytics for Decision Making	3
DATA 201 (QR)	Data Knowledge and Discovery	3
POLS 311 (EI)	Contemporary Issues in American Public Policy	3
ALEC 303 (AOC)	Analysis of Leadership Approaches and Styles	3
Unrestricted Elective 1		3
Total Semester Credit Hours: 15		
<i>Semester 4: Spring 2026</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 202	Transdisciplinary Thinking and Innovation	3
ALEC 330 (AAH - EP1)	Foundations of Practical Skills for Communicating Natural Sciences	3
SOCI 250 (GCI and SS)	Introduction to Global Studies	3
GEOG 206 (EI)	Sustainability Principles and Practices	3
<b>FORS 101</b>	Foundations of Forensic Studies	3
Total Semester Credit Hours: 15		
<i>Semester 5: Fall 2026</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 301	Transdisciplinary Thinking and Innovation	3
<b>ANTH 105</b>		3
<b>AI 102</b>	Natural Language-based Programming Techniques	3



GEOG 132	Landscapes and Environmental Change	3
CECS Electives 1		3
Total Semester Credit Hours: 15		
<i>Semester 6: Spring 2027</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 302	Transdisciplinary Research Methods	3
<b>POLS 330</b>	Law in American Society	3
<b>AI 301</b>	Natural Language Processing and Conversational AI	3
ANTH 130	Cultural Anthropology	3
ITS 399/	Junior Capstone	3
Total Semester Credit Hours: 15		
<i>Semester 7: Fall 2027</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 401	Adv App of Transdisciplinary Research Concepts	3
<b>AI 302</b>	AI-based Data Handling and Visualization	3
<b>AI 311</b>	AI for Cybersecurity	3
<b>POLS 435</b>	Criminal Law and Procedure	3
ALEC 443	Video Production for Campaigns for Natural Science	3
Total Semester Credit Hours: 15		
<i>Semester 8: Spring 2028</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 499	Senior Capstone	3
CECS Elective 2		3
CECS Elective 3		3
ITS 492	Internship	3
Unrestricted Elective 2		3
Total Semester Credit Hours: 15		
Total program hours: 120		

**Table 16 - Minor in Cybersecurity and Certificate in Game Design and AI**

<i>Semester 1: Fall 2024</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 101	Design Your Degree Design Your Career	3
ENG 101 (EC 1)	English Composition I	3
ESS 110 (NS)	Energy for the World	2
DS 150 (AH)	The Idea of Design	4
MATH 113 (QR)	Mathematical Reasoning	3
Total Semester Credit Hours: 15		
<i>Semester 2: Spring 2025</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 102	Introduction to Team Science	3
ENG 102 (EC2)	English Composition II	3
ALEC 102 (EI)	Interpersonal Leadership Development	3
PHIL 244	Professional Responsibility	3
SOCI 120 (GCUS and SS - EP)	Introduction to Sociology	3
Total Semester Credit Hours: 15		
<i>Semester 3: Fall 2025</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 201	Transdisciplinary Data Analytics for Decision Making	3
DATA 201 (QR)	Data Knowledge and Discovery	3
POLS 311 (EI)	Contemporary Issues in American Public Policy	3
ALEC 303 (AOC)	Analysis of Leadership Approaches and Styles	3
GEOG 132	Landscapes and Environmental Change	3
Total Semester Credit Hours: 15		
<i>Semester 4: Spring 2026</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 202	Transdisciplinary Thinking and Innovation	3
ALEC 330 (AAH - EP1)	Foundations of Practical Skills for Communicating Natural Sciences	3
SOCI 250 (GCI and SS)	Introduction to Global Studies	3
GEOG 206 (EI)	Sustainability Principles and Practices	3
<b>CYBR 101</b>	Introduction to Cybersecurity Concepts	3
Total Semester Credit Hours: 15		
<i>Semester 5: Fall 2026</i>		

CRN/Course Abbreviation	Course Title	Credit Hours
ITS 301	Transdisciplinary Thinking and Innovation	3
COSC 111	Computational Thinking and the Art of Programming	3
GAME 329	Game Design	3
CYBR 202	Data Protection and Privacy	3
AI 102	Natural Language-based Programming Techniques	3
Total Semester Credit Hours: 15		
<i>Semester 6: Spring 2027</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 302	Transdisciplinary Research Methods	3
COSC 452	Computer Graphics	3
AI 301	Natural Language Processing and Conversational AI	3
ANTH 130	Cultural Anthropology	3
ITS 399/CYBR 399	Junior Capstone	3
Total Semester Credit Hours: 15		
<i>Semester 7: Fall 2027</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 401	Adv App of Transdisciplinary Research Concepts	3
GAME 399	Junior Capstone	3
AI 311/AI 311	AI for Cybersecurity	3
CECS Electives 1		3
ALEC 443	Video Production for Campaigns for Natural Science	3
Total Semester Credit Hours: 15		
<i>Semester 8: Spring 2028</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 499	Senior Capstone	3
CYBR 302	Cybersecurity Risk Management	3
AI 302	AI-based Data Handling and Visualization	3
ITS 492	Internship	3
Unrestricted Elective 1		3
Total Semester Credit Hours: 15		
Total program hours: 120		

**Table 17 - AI-MUSIC Certificate and Game Design Certificate**

<i>Semester 1: Fall 2024</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 101	Design Your Degree Design Your Career	3
ENG 101 (EC 1)	English Composition I	3
ESS 110 (NS)	Energy for the World	2
DS 150 (AH)	The Idea of Design	4
MATH 113 (QR)	Mathematical Reasoning	3
Total Semester Credit Hours: 15		
<i>Semester 2: Spring 2025</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 102	Introduction to Team Science	3
ENG 102 (EC2)	English Composition II	3
ALEC 102 (EI)	Interpersonal Leadership Development	3
PHIL 244	Professional Responsibility	3
SOCI 120 (GCUS and SS - EP)	Introduction to Sociology	3
Total Semester Credit Hours: 15		
<i>Semester 3: Fall 2025</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 201	Transdisciplinary Data Analytics for Decision Making	3
DATA 201 (QR)	Data Knowledge and Discovery	3
POLS 311 (EI)	Contemporary Issues in American Public Policy	3
ALEC 303 (AOC)	Analysis of Leadership Approaches and Styles	3
Unrestricted Elective 1		3
Total Semester Credit Hours: 15		
<i>Semester 4: Spring 2026</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 202	Transdisciplinary Thinking and Innovation	3
ALEC 330 (AAH - EP1)	Foundations of Practical Skills for Communicating Natural Sciences	3
SOCI 250 (GCI and SS)	Introduction to Global Studies	3
GEOG 206 (EI)	Sustainability Principles and Practices	3
AI 101	Introduction to the World of AI	3
Total Semester Credit Hours: 15		
<i>Semester 5: Fall 2026</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 301	Transdisciplinary Thinking and Innovation	3
GAME 329	Game Design	3
AI 202	Human AI Interaction and Experience Design	3

COSC 111	Computational Thinking and the Art of Programming	3
GEOG 132	Landscapes and Environmental Change	3
Total Semester Credit Hours: 15		
<i>Semester 6: Spring 2027</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 302	Transdisciplinary Research Methods	3
CECS Elective 1		3
MUTC 330	Virtual Audio Modeling	3
ANTH 130	Cultural Anthropology	3
ITS 399/GAME 399	Junior Capstone	3
Total Semester Credit Hours: 15		
<i>Semester 7: Fall 2027</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 401	Adv App of Transdisciplinary Research Concepts	3
MUTC 340	Introduction to Computer Music Transcription	3
AI 311	AI for Cybersecurity	3
COSC 452	Graphics for Gaming	3
ALEC 443	Video Production for Campaigns for Natural Science	3
Total Semester Credit Hours: 15		
<i>Semester 8: Spring 2028</i>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 499	Senior Capstone	3
CECS Elective 2		3
CECS Elective 3		3
ITS 492	Internship	3
Unrestricted Elective 2		3
Total Semester Credit Hours: 15		
Total program hours: 120		

**Table 18: Sample Course Enrollment Schedule/ Plan of Study for TRANSFER STUDENTS with certificates in AI and Game Design**

<b><i>Semester 5: Fall Year 3</i></b>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 101	Design Your Degree Design Your Career	3
ITS 102	Introduction to Team Science	3
COSC 111	Comp Thinking and the Art of Programming	3
AI 102	Natural Language-based Programming Techniques	3
CECS Elective		3
Total Semester Credit Hours: 15		
<b><i>Semester 6: Spring Year 3</i></b>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 201	Transdisciplinary Data Analytics for Decision Making	3
ITS 202	Transdisciplinary Thinking and Innovation	3
DATA 201	Data Knowledge and Discovery	3
AI 301	Natural Language Processing and Conversational AI	3
GAME 329	Game Design	3
Total Semester Credit Hours: 15		
<b><i>Semester 7: Fall YEAR 4</i></b>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 301	Transdisciplinary Thinking and Innovation	3
ITS 399	Junior Capstone	3
ITS 302	Transdisciplinary Research Methods	3
AI 302	AI-based Data Handling and Visualization	3
GAME 399	Junior Capstone	3
Total Semester Credit Hours: 15		
<b><i>Semester 8: Spring YEAR 4</i></b>		
CRN/Course Abbreviation	Course Title	Credit Hours
ITS 401	Adv App of Transdisciplinary Research Concepts	3
ITS 499	Senior Capstone	3
ITS 492	Internship	3
AI 311	AI for Cybersecurity	3
COSC 452	Graphics for Gaming	3
Total Semester Credit Hours: 15		
Total Credit Hours – 60		

### *Assessment and Evaluation*

The schedule for program assessments includes data collection required by the University's Academic Program Review; necessary for the SACSCOC accreditation evaluation; and other summative assessments to evaluate student learning outcomes. A ten-year cycle for program reviews was adopted in 2011 at the University of Tennessee (<https://ie.utk.edu/program-review/>).

Assessment activities include data collection on both the program's operations and the evaluation of the major. The assessment activities related to the program operations concern the personnel facilitating the major and information technology infrastructure, services, and resources to enable learning. Annual performance reviews assess faculty teaching and service performance related to the major. The assessment activities related to evaluation of the major concerns (a) recruitment, (b) retention, (c) graduation, (d) placement, (e) curriculum review, (f) student satisfaction, (g) program and student learning outcomes, and (h) student organization activities. The following lists evaluations of the primary assessment activities.

- Annual reports provide data on recruitment, retention, graduation statistics, student organization activities, and other items.
- Student Exit Surveys are conducted each semester with graduating students for a reflection on their experience in the undergraduate program.
- Every three years a Curriculum Review assesses Program Learning Outcomes through a 20 percent sample of artifacts (e.g., papers, projects). Curricular changes will occur when learning outcomes are not met.
- A biannual Alumni Survey assesses placement of graduates.
- A biannual Employer Survey (in alternating years from the Alumni Survey) assesses curriculum relevance to current jobs.
- An advisory board will convene to provide additional feedback on the major.

The Program Director for the BS-ITS degree at the College of Emerging and Collaborative Studies oversees the implementation of all program assessments related to the program's operations and the evaluation of the major. In collaboration with the Dean and Associate Dean of CECS, the program director will manage all faculty and lecturer appointments, reviews, and retainment. The Program Coordinator compiles data for the Annual reports related to the evaluation of the major, including recruitment, retention, graduation statistics, student organization activities, and other items related to the program's operations. The Director of Advising will administer the Student Exit Survey, Curriculum Review, and Alumni and Employer Surveys. Samples of the assessment documents are provided in Appendix E.

### *Articulation and Transfer*

Transferring into BS-ITS is a clear path for students who earn an Associate of Science (AS) degree via an approved Tennessee Transfer Pathway (TTP). Transfer students admitted to UTK will be considered by CECS for the BS-ITS, with a preference for students with an AS degree and a GPA of 2.3 or higher. UTK has a competitive admission process for transfer applicants and utilizes a holistic application review process considering all parts of the transfer student's academic record.<sup>1</sup>

Transfer applicants who have earned an AS degree from institutions in the Tennessee Board of Regents (TBR) system will have fulfilled the Volunteer Core (general education) requirement for UTK (the same is true for TBR associate degrees in arts, Fine Arts, and Science in Teaching). With Vol Core requirements satisfied, transfer students entering the BS-ITS program in CECS can focus on completing the core ITS courses and their chosen certificates to complete the degree requirements.

For transfer students entering the BS-ITS as full-time CECS students, our normal guidance would be that the student takes two core courses per semester, plus electives from the approved list for the program. Because the electives are upper level, most will have prerequisites. Fulfilling the prerequisites for the upper-division electives will often need guidance from advising and uTrack (the tool that identifies milestones designed to keep students on track for timely graduation). Transfer students and advisors will review the BS-ITS curriculum and list of electives (see Table 10 above) to ensure they complete milestones to facilitate transfer into specific majors.

The best strategy for the BS-ITS degree will use the prerequisites already satisfied via the student's AS degree. For this reason, the best-positioned transfer students would have an AS in a subject related to their chosen focus in the BS-ITS degree.

Table 18, on the previous page, shows a sample degree plan for a student entering the BS-ITS program with an AS from Roane State Community College.

<sup>1</sup> Full details at: [https://catalog.utk.edu/content.php?catoid=43&navoid=8258#Transfer\\_Admission](https://catalog.utk.edu/content.php?catoid=43&navoid=8258#Transfer_Admission)



## Section IX: Students

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### *Academic Standards*

At the University of Tennessee, Undergraduate Admissions is responsible for administration of all admissions (e.g., high school seniors, international students, transfer students, and so forth) (<https://admissions.utk.edu/>). The processes and deadlines for undergraduate admissions are outlined on the university website. When applying to the University of Tennessee, students choose a major and if they choose Innovative Transdisciplinary Studies, they will be automatically admitted to the College of Emerging and Collaborative Studies, no additional admission requirements need to be fulfilled. Admissions to the BS-ITS major will be handled by the University of Tennessee and will follow the same requirements:

- Completed and submitted an application for admission.
- Core GPA evaluated.
- Standardized test scores
- High school and/or college official transcripts
- One required essay
- Recommendations from teachers or counselors (optional)
- Personal statement (optional)
- TOEFL or IELTS for international students

Requirements described reflect the minimum requirements for consideration and do not guarantee acceptance.

### *Admissions*

Students seeking admission to the major may select it upon application to the University. Students seeking to change their major must be in good academic standing. A student is in good academic standing when both the student's term and cumulative GPAs are 2.0 or higher or, if after two consecutive terms, the student's cumulative GPA is 2.0 or higher and at least one term GPA is also 2.0 or higher.

### *Retention*

Retention standards for students match those of the University. Students in good academic standing will be retained. Students are placed on Academic Probation when (1) his/her cumulative GPA falls below the minimum acceptable level of 2.0 for one semester or (2) the semester GPA falls below the minimum acceptable level of 2.0 two consecutive terms of enrollment. During the semester that a student is placed on Academic Probation, and any other semesters in Academic

Probation, a student must participate in a special directive advising program to help the student address concerns impacting his/her academic performance and outline a plan for achieving academic success. Other details related to Academic Probation and Academic Dismissal for the major will match those found in the University of Tennessee [Academic Policies and Procedures \(https://onestop.utk.edu/academic-policies/\)](https://onestop.utk.edu/academic-policies/).

### *Graduation*

Program graduation standards for the major follow the University of Tennessee [Academic Policies and Procedures \(https://onestop.utk.edu/academic-policies/\)](https://onestop.utk.edu/academic-policies/). The University of Tennessee, Knoxville, requires a minimum of 120 credit hours to earn a bachelor's degree. At least 36 credit hours should be completed within the major. Students must achieve a grade point average of at least 2.0 on all work attempted at the University of Tennessee, Knoxville.

### *Marketing and Recruitment*

CECS will utilize several mediums to reach students and prospective students. Messaging will be tailored to the student audience, with the benefits of CECS programs, including the opportunity to customize their educational experience, highlighted within that messaging. Below is a sample of the opportunities CECS will participate in. CECS intends to collect data and feedback to determine the best-performing avenues and what may not work as well to maximize exposure.

#### **Promotion of Programs:**

- **Social Media:** Our student audience is largely on Instagram. We will engage via Instagram and other relevant social media by sharing content that showcases the innovative and collaborative approach to learning found in CECS. We will also launch a TikTok to engage with students.
- **Email:** Students and prospective students will receive periodic emails from CECS about programs, events, relevant news and content, and opportunities to engage with CECS.
- **Content:** CECS will create, publish, and share content that showcases our programs, our expertise, and our innovative approach to higher education and preparing students for the future of work.
- **Paid Media:** CECS will use targeted paid media campaigns on platforms like Google AdWords and Meta to connect with prospective students. Ads will showcase the benefits of a CECS degree and how it will prepare them for the future.
- **Activations/Events:** CECS will be active on campus and in the Knoxville community through student fairs, student events, and participating in both campus and community opportunities to showcase CECS.

## Recruitment Events

- **College Fairs:** CECS will participate in and/or provide material for college fairs for undergraduate recruitment. The material will include handouts on curriculum and the benefits of a CECS degree, as well as CECS swag and the opportunity to sign up for CECS emails to learn more.
- **Campus Events:** CECS will continue participating in campus events such as College Connect and Big Orange Preview to promote CECS degrees to prospective and current students. CECS will also host our events in the coming months.

## Industry

- **Career Fairs:** Where applicable, CECS will participate in career fairs and opportunities to share more about CECS with industry partners and/or prospective students learning more about career fields of interest.
- **Industry Opportunities:** CECS will continuously look for opportunities to partner with industries to discuss how CECS can help students prepare for their careers, internships available, opportunities for hands-on experience, etc.

## *Student Support Services*

- **[The Writing Center:](#)** The Writing Center is to help students with writing papers, help with citations and all other paper-writing questions.
- **[Stat Lab:](#)** For students needing help with statistics, a tutoring service is available on the second floor of Hodges Library.
- **[The Math Place:](#)** Used as both a study space and a tutoring location, the website for this service details the support provided for specific math courses.
- **[OneStop Student Services:](#)** One-stop help service for enrollment, academic records, financial aid, and payment, OneStop is located on the ground floor of Hodges Library.
- **[Student Disability Services:](#)** Offers support in the coordination of accommodations in the classroom.
- **[Division of Student Success:](#)** With a wealth of resources, from academic success to career development resources to national scholarships, their mission is to help students recognize and apply their strengths.
- **[Student Health Center:](#)** Taking care of your physical health is important, and the Student Health Center is here to help. Visit their website to learn about eligibility and cost, services, and to book appointments.

- **[Counseling Center](#)**: Just as important as your physical health, taking care of your mental health is essential. Visit their website to learn more about the counseling services available to students.
- **[974-HELP](#)**: Are you or another Vol experiencing distress? Developed to help students reach their academic goals and to help maintain a safe community and learning environment for all students, 974-HELP creates a safe, nonjudgmental place for students to be understood and supported.
- **[Pride Center](#)**: The lesbian, gay, bisexual, transgender, and queer (LGBTQ+) resource center at UTK, the Pride Center provides events, programming, community space, and initiatives to engage and explore issues relating to gender and sexuality.
- **[Frieson Black Cultural Center](#)**: This gathering place offers a library/reading room, computer lab, student lounge, gallery, multipurpose rooms, a student organization suite, conference rooms, and more. It serves as a place for the campus community to learn, share ideas, and discuss experiences.
- **[Veterans' Resource Center](#)**: Located on the ground floor of Hodges Library, this resource assists active duty service members, veterans, reservists, guardsmen, and family members using their VA educational benefits.
- **[Student Disability Services](#)**: This service establishes an inclusive environment where every aspect of the university experience is readily accessible for all students without barriers or bias.
- **[Big Orange Meal Share](#)**: A short-term assistance programs that allocates meals to students in need, visit their website to either sign up or donate meals.
- **[Big Orange Pantry](#)**: Open Wednesdays and Fridays from 2-5pm, this service provides emergency food assistance to UT students, faculty, and staff.
- **[Smokey's Pantry](#)**: Smokey's Pantry serves the UT community to combat food insecurity. No qualifying information is required.
- **[Smokey's Closet](#)**: Smokey's Closet provides free, gently used professional clothing and accessories to students at UT. Students check-in and can receive one free outfit.
- **[The Free Store](#)**: The Free Store is a community share space that allows UT students to shop for free, high-quality, lightly-used clothing, kitchenware, accessories, and small appliances at regularly scheduled Free Store Pop-Up events held throughout each academic year. Look out for events on their [Instagram](#) page.
- **[Student Organizations](#)**: Finding a group of people who share your interests is a great way to enhance your university experience. This list details 600+ student organizations at the University of Tennessee, Knoxville.

### Other Support Needed

The college is currently interviewing for the Director of Advising at CECS, anticipating the needs of the new undergraduate major. The program coordinator will support the director of advising and the program directors.

## Section X: Instructional and Administrative Resources

### *Faculty Resources: Current Faculty*

The table below provides an overview of all program faculty.

**Table 19: Summary of Faculty Who Contribute to the Proposed Program**

Faculty Name	Faculty Dept.	Rank or Title	Highest Degree	Role in Program
Mehmet Aydeniz	College of Education, Health, and Human Services	Professor	Ph.D.	A, B
Edmon Begoli	Tickle College of Engineering	Joint Faculty Professor	Ph.D.	B
Alex Bentley	College of Emerging and Collaborative Studies	Professor	Ph.D.	A, B, C, D
Dania Bilal	School of Information Sciences	Professor	Ph.D.	A, B
Brianne Dosch	Libraries	Librarian	MSIS	A
Jianguen He	College of Communication & Information	Assistant Professor	Ph.D.	B
Ben Horne	College of Communication & Information	Assistant Professor	Ph.D.	B
Mingzhou Jin	Tickle College of Engineering	Professor, ISSE Dir.	Ph.D.	B
Brendan McConville	College of Music	Professor	Ph.D.	A, B
Vasileios Maroulas	College of Arts and Sciences	Professor	Ph.D.	A, B
Nicholas Nagle	College of Arts and Sciences	Professor	Ph.D.	B
Adam Petrie	Haslam College of Business	Senior Lecturer	Ph.D.	B
Marshall Prado	College of Architecture & Design	Assistant Professor	Ph.D.	B
Jonathan Ring	Baker School of Public Policy and Public Affairs	Lecturer	Ph.D.	B
Louis Rocconi	College of Education, Health, and Human Sciences	Associate Professor	Ph.D.	A, B

Faculty Name	Faculty Dept.	Rank or Title	Highest Degree	Role in Program
Vandana Singh Avasty	College of Emerging and Collaborative Studies	Professor	Ph.D.	A, B, C, D
Jorge Variego	College of Music	Assistant Professor	Ph.D.	B
Xiaopeng Zhao	College of Emerging and Collaborative Studies	Professor	Ph.D.	A, B, C, D
Jie Zhuang	UT Institute of Agriculture	Professor	Ph.D.	B

Note: As shown in the Table above 19 contributions to the program are keyed as:

- A - Will teach in the program
- B - Will design curriculum for the program
- C - Will conduct related research
- D - Will advise students in the program

**Appendix F includes the curriculum vitas for all faculty who will teach in the proposed BS-ITS program.**

### *How Faculty Will Support the Program*

The faculty engaged in the CECS certificates is eager to teach, mentors and conduct research with CECS students. Each certificate has a curriculum committee managed by the Program Director (Vandana Singh) and a Curriculum Committee Lead. The curriculum committee for each certificate owns the curriculum. The committee is constituted of the program director, a curriculum committee lead, and representative members from each of 13 colleges at UTK. The committee guidelines are:

The Curriculum committees are formed after a campus kick-off event, where all members of UTK are invited to collaborate on future certificate topics. Each committee has one representative from each college, who is a voting member. If there are multiple members from one college only one member can be a voting member. The voting member is decided by the CECS and the respective college dean. All the committee members are expected to be a liaison between their college and CECS and have to update their department heads and faculty members on their engagement in CECS certificates.

Open door policy – any UTK faculty member interested in joining the curriculum committee is welcome to attend the meetings. All the meeting dates and minutes are made available to UTK faculty through CECS website. The committee conceptualizes the focus of the certificate, the basic set of skills for each certificate and finally develops the courses for each certificate. The participating faculty or additional faculty can be hired by CECS to teach these certificate courses. The curriculum committee is critical in maintaining a high-quality curriculum built by transdisciplinary expertise and will have the final say on updating and/or sunseting certificates, and recommendations for launching new programs.

One lecturer is already in place and CECS is undergoing hiring process for five new lecturers to start in Fall 2024. Hiring lectures is done by a committee with representation from CECS and relevant faculty members from across the campus. Each lecturer has a teaching capacity of 8 courses in one academic year. Tenured and tenure track faculty will teach in the program, including the core ITS courses and the collaborative courses created across the campus.

Table 19 lists the key members of CECS faculty and the faculty across campus engaged in the CECS certificates.

### *Anticipated Faculty*

CECS faculty and lecturers, with their specialized knowledge, took the lead in crafting the courses, ensuring that the program's foundational elements are robust and cutting-edge. Moreover, Faculty Fellows will be strategically recruited from across the campus to infuse multidisciplinary perspectives and promote holistic learning. These Fellows will collaboratively co-develop and co-teach the collaborative core courses and a range of elective courses. In the ITS program we also envision industry partners playing a role in teaching. The program director, program coordinator and the lecturers will be supporting multiple programs (three) and therefore their effort is split equally between these programs. (Details on page 30, and 31)



Table 20: *Anticipated Faculty and Instructional Staff*

Faculty Rank or Employment Classification	Part-Time or Full-Time for ITS	Salary	Anticipated/ Start Date	Comments
Program Director	Part time	\$160,000	July 2023	BS-ITS Program Director
Full-time Lecturers	Full-time	\$90,000 / year	Aug 2024	To teach ITS 101, 102, 201, 202, 301, 302, 399, 401, 499 as needed
CECS Faculty Lead	Part-time	\$10,000/year	August 2024	Program planning and curriculum development
CECS Faculty Fellows	Part-time	\$10,000 / semester	Aug 2026	To co-develop and co-teach ITS 201, 202, 301, 302 as needed.

### *Administrative Support*

The CECS **Program Director** oversees the degree program operations, including enrollment, appointing GTAs, advertising, course scheduling, assessment, accreditation, and capstone course content. The Program Director will also engage campus, community, and industry partners to support experiential learning in the program as well as foster pathways to employment. For the Program Director 50% of their salary and benefits is budgeted to the ITS program to reflect their time split between the ITS program and other college activities.

CECS has a full-time **Director of Advising (DoA)** to provide advising to undergraduate CECS students. As this BS-ITS is intercollegiate, the DoA liaises with other advising directors across UTK to ensure that CECS students can scheduling courses that meet their interests while achieving the requirements of the degree, course prerequisites and Vol Core. The DoA also manages academic planning, petitions, registration issues, retention initiatives, graduation and degree completion matters for students enrolled in CECS. The DoA will also oversee internal transfers and change of major advising, academic advising development, assisting in problem resolution, and using positive open-ended questions and intentional strategies to help students explore their goals and interests. Additionally, the advisor educates students about curricular requirements, collaborates in developing academic plans, advises on majors, minors, honors, and college policies, assists transfer students, and conducts academic reviews each semester.

For internship placement, CECS has a Director of Partnerships and Economic Engagement (DPEE), who has already developed numerous partnerships with industry partners (see support letters in **Appendix A**) and government agencies such as Knoxville. The DPEE also liaises with local, regional, and national economic development organizations and businesses to encourage industry collaborations, and support CECS student success by expanding educationally relevant opportunities such as internships, co-op and employment upon graduation. The DPEE works with the UTK Center for Career Development to ensure students' working conditions meet academic goals. Internships will be available via ongoing partnerships CECS has been actively developing such as the companies listed in the section, "Community and Industry Partnerships," with letters of their support in Appendix A. Each bachelors degree program at CECS will have a Advisory Board with industry partners. With the new college structure supporting the undergraduate programs program, CECS will have a dedicated office to fostering deep relations with employees to help students forge their unique paths as they customize the degree to their future career aspirations. Internship courses will be developed in partnership with employees, and they will count as credit for up to 6 credit hours (in addition to internships students may pursue in summer).

Each of the certificates that is developed under CECS will have a Board of Visitors that relies on industry expertise and guidance in launching and managing emerging areas. CECS also has a Leadership Advisory Board (LAB) that is made up of leadership representation from each of the college across campus, the curriculum committee submits its proposals to the LAB before going through the approval process from the undergraduate council, this ensures transparency and input from everyone on campus.

**Table 21: *Anticipated Non-Instructional Staff***

The cost for positions that support all CECS programs are not included in the budget for BS-ITS.

Job Title	Part-Time or Full-Time	Anticipated Salary	Anticipated/ Start Date	Comments
Program Coordinator	Full-time	\$70,000	Sept 2023	Support all CECS programs
Director of Marketing and Communications*	Full-time	\$90,000	Aug 2023	Supports all CECS programs
Director of Advising*	Full-time	\$80,000	Nov 2023	Supports all CECS programs
Director of Business Operations*	Full-time	\$80,000	Aug 2023	Supports all CECS programs
Director of Partnerships*	Full-time	\$90,000	Aug 2023	Supports all CECS programs
Internship Coordinator	Full-time	\$10,000	Aug 2026	Supports ITS students
Undergraduate Graders	Part-time	\$20/hour * for 10 hours per week 16 week per semester	Aug 2024	Grade homework (ITS 101, 102, 201, 202) as needed

## Section XI: Resources

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### *Equipment*

The Claxton environment has been curated to champion interdisciplinary learning and collaboration. Whiteboards adorn hallway walls, fostering spontaneous intellectual exchanges, while dedicated discussion areas and a lounge space further facilitate group interactions. Such a layout is optimal for Applied AI capstone projects, enabling instructors to guide student groups in synergizing their varied skill sets.

In line with the experiential learning approach of the program, a spacious area originally intended as a kitchen is undergoing transformation into the Applied Living and Learning Lab. This lab will be a melting pot of state-of-the-art equipment and technology. Students and instructors will have access to innovative tools like extended reality (XR) setups, GPU-enhanced computers tailored for intricate computational tasks like game design, and interactive robots and drones to bring AI concepts to life.

To aid students in their academic journey, a designated drop-in advising office is in place. Here, students can chart their academic paths, plan internships, and discuss placements. Given the comprehensive nature of the ITS I program, which spans core AI subjects, electives, and the mandatory Vol Core requirements, this dedicated space for face-to-face consultations becomes indispensable. The Claxton facility will also host the Director of Advising and the Director of Partnerships, ensuring seamless collaboration among the faculty. The Claxton Education Building is also poised to be the welcoming point for incoming Tennessee Transfer partnership students joining from affiliate Tennessee community colleges. Moreover, Faculty Fellows associated with the program will have flexible office accommodation within the Claxton space, including shared desks in the primary office suite.

### *Information Technology*

In addition to the library and journal resources listed, the University of Tennessee also offers UT students, faculty, and staff up to 15 hours of research computing assistance per semester at no additional cost. Our Office of Information and Technology (OIT), a customer-driven organization, provides live support on online instructor toolkits, including Zoom and Canvas, and helps faculty review the best practices for integrating third-party content, including textbooks, into the courses. OIT also provides workshops and self-paced training to prepare students, staff, and faculty to tackle academic, career, research, and everyday life technology demands. Students, staff, and Faculty can also contact the OIT HelpDesk online to inquire about scheduling training for a group or ask for a one-on-one consultation. OIT online testing, plagiarism, and proctoring tools are used for instructors to facilitate academic integrity assessment. OIT's media services support includes

digitizing course content for online, hybrid, and live classroom delivery and includes text scanning, slide scanning, course recording, conversion, and video digitization within copyright standards. OIT helps host and manage students, staff, and faculty's video content in a single cloud-based storage solution (powered by Panopto) and share it easily through the Canvas courses or websites.

UT students, faculty, and staff can access many software packages through their connection to the university, often at a reduced cost. OIT also provides technical assistance with various analysis methods the students, staff, and faculty need. OIT tests new releases thoroughly, teaches their use through workshops or one-on-one tutorials, and usually has more than one knowledgeable consultant available to assist students, staff, and faculty. OIT can help students, staff, and faculty install it on a computer or start it on their computers. OIT can point students, staff, and faculty towards tutorials and documentation and be able to help with importing or exporting data. In addition, UTK provides information on security tools and resources to help students, staff, and faculty prevent and mitigate possible security issues associated with online communications and to help better secure personal, teaching, and research information. OIT maintains firewalls in our data centers and many locations on campus.

### *Library Resources*

The [John C. Hodges Library](#) in the heart of campus houses most of the UT Libraries' collections and many unique services. This building is right across from the Claxton Building, where the College of Emerging and Collaborative Studies is located. Research assistance and technology services are available almost all hours of the week in the student-centric [Commons](#) in the Hodges Library, it is a popular venue for both studying and socializing. Hodges Library can seat 2,000 users in its 350,000 square foot building. Technology-rich facilities and services include a multimedia digital production [Studio](#) and ever-expanding, easily discoverable virtual resources. Unique historical documents and images from the Betsey B. Creekmore Special Collections and University Archives are available as [digital collections](#). Two branch libraries offer specialized collections and services: the [Webster C. Pendergrass Agriculture and Veterinary Medicine Library](#) and [George F. DeVine Music Library](#).

According to the Association of Research Libraries (ARL), the UT Libraries ranked 23rd among public research university libraries in the United States in 2019. The ARL is a coalition of 124 major research libraries in the United States and Canada and includes the National Library of Medicine and the Library of Congress. The Chronicle of Higher Education currently ranks UT Knoxville libraries 13th in the nation for the most money spent on subscriptions, with 69% of those electronic subscriptions. In 2017, the UT libraries received the 2017 John Cotton Dana Library Public Relations Award for outstanding library public relations sponsored by the American Library Association, the H.W. Wilson Foundation, and EBSCO Information Services. Digital Media Services (DMS) at UT also provides several Information Technology services such as video production, digitization, and image or text scanning. The UT Libraries offer access to hundreds of electronic resources. These include databases, e-books, e-journals, datasets, primary sources, maps, streaming

videos, and other electronic research tools.<sup>2</sup> All but a few of these materials are available to authorized users at off-campus locations as well as through the campus network. Providing this access is an absolute necessity for the success of the School's Distance Education Program.

The Tennessee Electronic Library (TEL) is a Web-based collection of databases available to every academic, public, school, and special library in Tennessee since November 1999. TEL is comprised of several separate collections of full-text and indexing databases on a variety of topics. A total-access interface allows users to search across databases and selected websites.<sup>3</sup>

The libraries also make available publications related to information technology from computing and engineering societies, including the Association for Computing Machinery (ACM), American Society of Civil Engineers (ASCE), American Society of Mechanical Engineers (ASME), Institute of Electrical Engineers (IEE), Institute of Electrical and Electronics Engineers (IEEE), and the Society for Industrial and Applied Mathematics (SIAM). The UT Libraries is a national leader in [digital collections](#); in support of open access through our digital repository, [Trace](#); and through a rich history of designing innovative spaces and building key partnerships that enhance the teaching/learning enterprise. The UT Libraries is a member of the Association of Research Libraries, the Association of Southeastern Research Libraries, HathiTrust, the Library Publishing Coalition, LYRASIS, and the Center for Research Libraries. The UT Libraries collaborate actively at the state level with the other University of Tennessee System libraries as well as the libraries in the Tennessee Board of Regents system.

UT Libraries offer the following services for undergraduate students at the University of Tennessee.

- **Study Rooms:** All of UT libraries have study rooms for student use - some are first-come, first-served, while others can be [reserved](#) up to two weeks in advance.
- **The Studio:** Multimedia lab located in Commons South in Hodges Library, the Studio is home to a number of helpful resources. From large format printing to audio production rooms, from virtual reality to video production labs, the Studio has both the resources and the people with knowledge to help you with projects both academic and personal.
- **Special Collections:** Special Collections, located on the first floor of Hodges Library is home to a vast array of manuscripts, rare books, and materials from University Archives, as well as librarians who are here to help support the UT research community. Check the [Digital Collections](#) to browse unique resources from on or off-campus.
- **Commons Partners:** All student-focused research, technology, and academic support services are located in one convenient location at the Hodges Library, which is across from the CECS office in the Claxton building.

<sup>2</sup> University of Tennessee Libraries. <http://libguides.utk.edu/databases>

<sup>3</sup> TEL: Tennessee Electronic Library, <http://tntel.tnsos.org/> (last accessed 8/19/23).

- **Checking Out Material:** Using their VolCard, students are able to check out a book, at the public service desk (located at the Melrose entrance on the second floor at Hodges Library). Librarians are available to assist students or they can opt for the self-checkout kiosks.
- **Printing:** There are two different ways students can print at UT Libraries. 1) Log in to one of the available computers and print from there. 2) Print wirelessly from their device using Vol Card.
- **3D Printing:** 3D printers at Pendergrass Library are available for students, faculty, and staff.
- **Patrons with Disabilities:** The University of Tennessee Libraries is committed to providing access to library services and resources to all users. This page provides information about access to Hodges and branch libraries, as well as resources, services, and contacts.

### *Facilities*

CECS is located in ground floor of the Claxton Education Building, on Volunteer Boulevard at the center of the Knoxville campus. The 3,200 square feet of Claxton devoted to CECS has a “unique boutique college” feel which represents CECS well and needs minimal renovation. The available classrooms upstairs in Claxton, as well as the multi-purpose seminar room in the CECS space will be ideal for upper-level CECS courses of small to medium sizes. The Claxton space is ideal for interdisciplinary instruction and collaboration with students: whiteboards on the hallway walls for interactive teaching, discussion space, lounge space upstairs, all of which being oriented toward collaborative instruction and experiential and group learning by CECS. The space is particularly ideal for CECS capstone courses for advanced students in ITS, where CECS instructors based in one of the office suites can lead small groups of students to focus their complimentary skills. The Claxton offices are being renovated for the staff to support the ITS program, this is expected to cost \$62,006 to the ITS program.

### *Other Resources*

Below is a list of campus resources dedicated to students' academic success at the University of Tennessee Knoxville:

Considering resources currently offered through the UTK libraries, no additional library and information technology acquisitions would be needed to support the launch and success of the BS-Its during its first five years of operation.

*Evidence of Willingness to Partner*

Several entities have confirmed a willingness to partner with the proposed program. Each entity listed below has a signed letter of support; see Appendix A.

Dr. Flora W. Tydings  
Chancellor  
Tennessee Board of Regents  
Nashville, TN

Edward Chang,  
Co-founder & CEO Moment  
Energy  
[Edward@momentenergy.com](mailto:Edward@momentenergy.com)

Dr. Iman Tahamtan,  
Senior UX Researcher  
JPMorgan Chase 1111  
Polaris Pkwy  
Columbus, OH 43240 Lecturer  
University of Tennessee, Knoxville

Patrick M. Hanley, Jr., Esq. Head  
of Government Affairs Viridi  
Parente  
1001 E Delavan Ave, Buffalo, NY 14215  
<https://viridiparente.com/>

Ryan Herring  
Sales Director, Partnerships & Alliances  
Quantum Computing, Services and Solutions,  
IonQ  
<https://ionq.com/>

Britton Garrett CEO,  
iO Urology  
<https://i-ourology.com/>

Carbon Rivers  
David Morgan  
Chief Strategy Officer  
<https://www.carbonrivers.com/>

Dr. David G. White  
Interim Dean  
Herbert College of Agriculture University of  
Tennessee Knoxville [herbert@utk.edu](mailto:herbert@utk.edu)

Matthew M. Mench, PhD, MBA  
Dean and Wayne T. Davis Dean's Chair  
Chancellor's Professor  
456 Zeenah Engineering Complex  
Knoxville, TN 37996 [www.tickle.edu](http://www.tickle.edu)

Diane Ward  
Vice President of Student Learning Chief  
Academic Officer  
Roane State Community College  
Harriman, TN 37748-5011



## Appendix A: Letters of Support

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Office of the Chancellor  
1 Bridgeway Park, Third Floor  
Nashville, TN 37214  
615-366-4400 OFFICE 615-366-3922 FAX  
tbr.edu

July 19, 2023

To Whom It May Concern:

As Chancellor of the Tennessee Board of Regents, I am writing in support of the Customizable degree being developed at the College of Emerging and Collaborative Studies (CECS). This 4-year degree, highly accessible to community colleges of Tennessee, will instill workforce skills relevant to emerging fields such as Artificial Intelligence, Data Science and Cybersecurity, customized to apply to the areas of each student's interest. With access to 4-year higher education via the Tennessee Transfer Pathway (TTP), the CECS customizable degree will channel Tennessee community college graduates into employment in the new innovation economy centered around digital intelligence.

As a home for new cohorts of interdisciplinary UTK students seeking future-oriented degrees, CECS was mandated by the UT Board of Trustees towards enhanced student engagement, creativity, and collaboration. With new majors in CECS in emerging topics such as Data Science, AI, and Cybersecurity, CECS will provide highly interdisciplinary, motivated students in the Custom degree program with the core set of classes as a basis for the Custom degree, as well as advising and informal interaction that is crucial for students to develop their own 4-year curriculum and career goals.

Among 4-year colleges and universities in Tennessee, CECS is unique in how it engages industry and community partners with internship and service opportunities for students. The goal is for each student to engage with the real-world in preparation for future employment. The requirement for each CECS student to take at least one service-research course and one internship course off campus is an innovative approach to help CECS graduates develop awareness and align with workforce needs.

CECS aims to capture a significant fraction of the TTP students per year, to position them to entering the workforce with highly advanced skills at the cutting edge of the innovation economy. In a 2021 Report, the Tennessee Higher Education Commission reported that students (in the 2014 cohort) who complete a vertical transfer (from a two-year institution to a four-year institution) earned a wide variety of degrees, with almost three-quarters earning a degree in six years, including over 25% of students earning both an associate and a bachelor's degree. The customizable degree can provide UT students with an entry into a wide range of the workforce sector. In Tennessee and in the nation, almost every sector is now applying, or seeking to apply A.I. and data science to their business, which then also requires the continual evolution of the cyber defense component.

Along these lines, CECS is poised to continue to add new partnerships within the state—as well as nationally and even internationally. This will contribute highly skilled employees to the workforce of Tennessee, which in turn attracts new and established companies to invest in our state. The customizable degree also expands the career aspirations of a diverse range of students, many of whom use the Tennessee Transfer Pathway to pursue a 4-year degree directly after community college or after a period of work experience as CECS will be flexible to recognize such experiences as credit.

Chattanooga State Community College | Cleveland State Community College | Columbia State Community College | Dyersburg State Community College | Jackson State Community College  
Molloy State Community College | Nashville State Community College | Northeast State Community College | Pellissippi State Community College | Roane State Community College  
Southwest Tennessee Community College | Volunteer State Community College | Walters State Community College | Tennessee Colleges of Applied Technology

Page 2

In our rapidly evolving world, where new technologies and industries emerge unprecedentedly, academic institutions must adapt to prepare graduates for the future. The state of Tennessee would benefit from CECS's stackable certificate program, combining disciplines integral entrepreneurial skills that will fuel the economy and prosperity of the state. For these reasons, I strongly support the creation of the custom degree under CECS.

Sincerely,



Flora W. Tydings, Ed.D.  
Chancellor



TO  
 University of Tennessee Knoxville  
 College of Emerging and Collaborative Studies  
 513 Andy Holt Tower  
 Knoxville, TN 37996

DATE  
 July 18, 2023

Re: Letter of support for CECS

To whom it may concern,

I am writing this letter to convey our utmost admiration and support for the pioneering programs being developed at the College of Emerging and Collaborative Studies (CECS). As a prospective local employer, we are wholeheartedly committed to the progress and advancement of our community. We firmly believe that CECS stands at the vanguard of educational innovation, empowering students with the skills and knowledge necessary to thrive in their careers and engage with future employers.

In an era of unprecedented technological advancements and rapidly evolving industries, it is vital for academic institutions to adapt swiftly and equip their graduates to meet the challenges of tomorrow. We strongly assert that CECS's tailored degree programs not only allow students to align their education with the careers of the future, but also provide them with invaluable practical experiences that will greatly benefit our organization's educational requirements. The emphasis on internships, interdisciplinary research, collaborative team projects, and community engagement ensures that CECS graduates possess the sought-after workforce skills that employers like us actively seek.

Moreover, CECS's commendable role as an incubator for the creation of new, customizable, and stackable degrees deserves the utmost recognition. By fostering collaboration across multiple disciplines and serving as a central hub, CECS acts as a catalyst for innovative research and teaching methodologies. This approach not only enriches the educational journey for students but also enables local employers such as ourselves to access a highly talented pool of graduates with a diverse skill set and specialized knowledge relevant to our industry.

We are extremely eager to forge a partnership with CECS in order to develop a tailor-made curriculum that addresses the specific needs of our industry. The immense value that CECS brings to the University of Tennessee Knoxville and the East TN Region is profoundly recognized and appreciated by our organization.

Thank you for considering our genuine support and sincere interest in establishing a collaborative relationship. We eagerly anticipate the remarkable possibilities that lie ahead and look forward to exploring opportunities for mutual growth and prosperity.

Sincerely,

*Edward Chiang*

**Edward Chiang**  
 Co-founder & CEO | Moment Energy  
 Edward@momentenergy.com



Iman Tahamtan  
 Senior UX Researcher, JPMorgan Chase  
 Lecturer, School of Information Sciences,  
 University of Tennessee, Knoxville, TN  
 tahamtan@vols.utk.edu  
 380-799-1247  
 July 24, 2023

Subject: Letter of Support for the Custom Bachelors Degree Program at the College of Emerging and Collaborative Studies (CECS) at the University of Tennessee in Knoxville

To whom it may concern

As a User Experience (UX) researcher and an undergraduate instructor with considerable experience in both academia and the corporate world, I am writing to express my support for the establishment of a custom degree program at the University of Tennessee in Knoxville (UTK). I firmly believe that such a program is essential to meet the growing demands of the industry and equip students with the skills needed to excel in fast-evolving fields such as UX, cybersecurity, or data science.

As someone actively involved in the field of UX, I have observed traditional syllabi often fail to address all the diverse requirements of modern-day UX professionals. In UX, there is an increasing need for graduates who can seamlessly blend technical expertise with strong social skills, including effective communication, collaboration, and empathy. By offering a custom degree, UTK can bridge the gap between academia and industry, providing students with a unique opportunity to acquire a comprehensive skill set that is directly aligned with real-world needs.

As an instructor, I have had the privilege of witnessing the growth and development of numerous students who have shown a keen interest in pursuing careers in UX. However, I have also observed that many of these students lack the necessary exposure to both technical and social aspects of UX. A custom degree program would enable us to cater to the specific needs of each student, empowering them to select courses that align with their interests and strengths while also challenging them to explore new horizons.

School of Information Sciences  
 College of Communication and Information  
 1345 Circle Park Dr., Suite 451, Knoxville, TN 37996-0341  
 865-974-2148 865-974-4967 fax sis.utk.edu sis@utk.edu

**BIG ORANGE. BIG IDEAS.**

Flagship Campus of the University of Tennessee System 



Drawing from my own experiences in the corporate world, I can attest to the fact that successful professionals possess a unique combination of technical proficiency and the ability to effectively communicate and collaborate with multidisciplinary teams. As a UX researcher, I collaborate with cross-functional teams such as product, engineering, design, and data analytics teams. A custom degree would allow a UX researcher to develop a unique skill set, such as research, product development, business acumen, and behavioral psychology, as well as soft skills that can set them apart in the job market and lead to numerous career opportunities.

In conclusion, a custom degree would undoubtedly benefit aspiring professionals by offering a specialized curriculum that addresses the specific demands of dynamic fields. By allowing students to choose from a range of technical and social skill-oriented courses, we can produce well-rounded individuals capable of driving innovation and success in today's fast-growing industry.

I firmly support the proposal for a custom degree program at UTK because I firmly believe that this initiative will not only elevate the academic offerings of UTK but also equip our students with the tools they need to thrive in such a competitive world.

I look forward to witnessing the positive impact of this forward-thinking program on the lives and careers of our students.

Sincerely,

*imantahamtan*

Iman Tahamtan, PhD

Senior UX Researcher, JPMorgan Chase

Lecturer, University of Tennessee, Knoxville

---

**BIG ORANGE. BIG IDEAS.**

Flagship Campus of the University of Tennessee System 



July 18, 2023

University of Tennessee Knoxville  
 College of Emerging and Collaborative Studies  
 513 Andy Holt Tower  
 Knoxville, TN 37996

To Whom It May Concern,

Please accept this letter of support on behalf of Viridi Parente, Inc. for the programs being developed at the College of Emerging and Collaborative Studies (CECS). While not a local employer, Viridi does business in the area and is invested in the growth and development of the East TN Region. Viridi believes that CECS offers novel and innovative educational programs that equip students with the skills and knowledge they need to land meaningful opportunities with employers and to develop their careers.

Viridi designs fail-safe lithium-ion battery products to fulfill energy needs in a range of applications and settings, including commercial, industrial, and state and local government. Viridi's scalable 50-kWh battery pack, which has been integrated into a 600-kWh installation in a medical research facility, passively detects and stops thermal runaway, allowing the pack to be installed in buildings where energy is used. Alongside the stationary energy storage options, Viridi's fail-safe pack has been incorporated into a 150-kWh mobile power unit that can be towed anywhere power is needed. Safe, point-of-use storage, whether stationary or mobile, is a critical component of a stable, resilient, and clean energy system, enabling companies and governments to shift to a low-carbon energy supply while minimizing disruptions and costly infrastructure investments.

Headquartered in a low-income neighborhood with few economic opportunities, Viridi created GreenForce, a job-opportunity agency that recruits and trains workers from the surrounding neighborhood to work for Viridi, thereby helping people who may not have formal education attain, navigate and sustain successful careers in the green energy future.

However, the unprecedented pace of technological advancement in today's rapidly changing world necessitates academic institutions to adapt their programming to prepare their graduates to meet the demands of the future. Viridi firmly believes that a customized degree program offered by CECS allows students to align their education with the careers of the future and provides them with the practical, hands-on experiences that add value to organizations like Viridi. Further, the emphasis on internships, interdisciplinary research, collaborative team projects, and community engagement that CECS programs provide ensures that graduates possess the necessary workforce skills that employers like Viridi seek in prospective employees.

CECS's role as an incubator for the creation of new, customizable, and stackable degrees distinguishes CECS among educational programs. CECS's innovative and collaborative approach catalyzes multidisciplinary research and teaching strategies, an approach that not only enhances the educational experience for students but also allows employers like Viridi to access a talented pool of graduates with a diverse skill set and industry-specific knowledge.

716.968.8658 | 1001 E. Delavan Ave, Buffalo NY 14215 | viridiparente.com



Viridi is very interested in partnering with CECS to establish a customized curriculum that addresses the specific needs of the battery storage industry. Viridi recognizes and appreciates the significant value that CECS brings to the University of Tennessee Knoxville, the East TN Region, and the labor market beyond.

Thank you for considering Viridi's support and interest in forging a collaborative partnership that will create opportunities for mutual growth and success.

Sincerely,

A handwritten signature in black ink, appearing to read "P. Hanley, Jr.", written over a light grey background.

Patrick M. Hanley, Jr., Esq.  
Head of Government Affairs  
[phanley@viridiparente.com](mailto:phanley@viridiparente.com)

716.968.8658 | 1001 E. Delavan Ave, Buffalo NY 14215 | [viridiparente.com](http://viridiparente.com)

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July 31, 2023

University of Tennessee Knoxville  
College of Emerging and Collaborative Studies  
513 Andy Holt Tower  
Knoxville, TN 37996

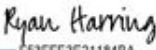
To whom it may concern,

The purpose of this letter is to express IonQ's support for the programs being developed at the College of Emerging and Collaborative Studies (CECS). As a stakeholder in multiple quantum-related projects across the State of Tennessee, we recognize the importance of developing undergraduate curriculum that is specific to emerging industry topics which include quantum computing.

IonQ's mission is to build the world's best quantum computers to solve the world's most complex problems. Important steps in that direction are creating opportunities for university students to work directly with IonQ through internships and co-ops, and establishing joint research agreements to further develop quantum technology and expertise in the academic community.

Thank you for considering our support. We are excited about the possibilities that lie ahead and look forward to exploring opportunities to solve the world's most complex problems together.

Sincerely,

DocuSigned by:  
  
F53FFE3E21184BA...

Ryan Harring  
Sales Director, Partnerships & Alliances  
Quantum Computing, Services and Solutions, IonQ





July 28, 2023

University of Tennessee Knoxville  
 College of Emerging and Collaborative Studies  
 513 Andy Holt Tower  
 Knoxville, TN 37996

To whom it may concern,

The purpose of this letter is to express our support for the programs being developed at the College of Emerging and Collaborative Studies (CECS). As a local employer, we are deeply invested in the growth and development of our region. We firmly believe that CECS is at the forefront of educational innovation, equipping students with the skills and knowledge they need as they develop their careers and partner with employers.

In today's rapidly changing world, where new technologies and industries emerge at an unprecedented pace, it is crucial for academic institutions to adapt and prepare their graduates to meet the demands of the future. We firmly believe that a customized degree program offered by CECS not only allows students to align their education with the careers of the future but also provides them with practical, hands-on experiences that will be invaluable to our educational requirements within our organization. The emphasis on internships, interdisciplinary research, collaborative team projects, and community engagement ensures that graduates possess the necessary workforce skills that employers like us seek in prospective employees. It also enables organizations like iO Urology to develop the pipeline of organizational talent needed to move our company forward.

Furthermore, CECS's role as an incubator for the creation of new, customizable, and stackable degrees is truly commendable. By providing a central point of contact and facilitating collaborations across multiple disciplines, CECS acts as a catalyst for innovative research and teaching strategies.

We are very interested in partnering with CECS to establish a customized curriculum that addresses the specific needs of our organization. We recognize and appreciate the significant value that CECS brings to the University of Tennessee Knoxville and the East TN Region.

Thank you for considering our support and interest in forging a collaborative partnership. We are excited about the possibilities that lie ahead and look forward to exploring opportunities for mutual growth and success.

Sincerely,

A handwritten signature in cursive script that reads "Britton Garrett".

Britton Garrett, CEO

iO Urology



July 28, 2023

University of Tennessee Knoxville  
 College of Emerging and Collaborative Studies  
 513 Andy Holt Tower  
 Knoxville, TN 37996

To whom it may concern,

Carbon Rivers is an engineering consulting firm and is interested in supporting the programs being developed at the College of Emerging and Collaborative Studies (CECS). Carbon Rivers develops and employs local talent from various technical and engineering disciplines. CECS is and will be a valuable entity to specialize the training and internships needed for the diverse manufacturing, energy, and technological industries in the greater East Tennessee region.

Carbon Rivers has specific needs in a variety of labor training and work skill sets, so support of CECS with specific curricula, lectureships, internships, research projects, and even collaborations with the University and the Department of Energy are in the interests of Carbon Rivers. CR is quite optimistic to support the CECS initiatives and be a collaborative partner.

Thank you for your efforts in providing this region of Tennessee the focused and experienced talent that will continue to showcase and increase the University of Tennessee and its strategic partners in the areas of advanced technologies, manufacturing, and other industries that thrive in East Tennessee.  
 Sincerely,

*David Morgan*

David Morgan  
 Chief Strategy Officer  
 Carbon Rivers

---

CarbonRivers.com ›› 865.630.9656 ›› 2409 Sycamore Drive • Knoxville, TN 37921

**Office of the Dean**

2621 Morgan Circle

126 Morgan Hall

Knoxville, TN 37996

865-974-7303

[herbert.tennessee.edu](http://herbert.tennessee.edu)

7/26/23

To whom it may concern,

As Interim Dean of the Herbert College of Agriculture, I am writing to support the launching of the Customizable B.S./B.A. degree program in the College of Emerging and Collaborative Studies (CECS) at the University of Tennessee Knoxville.

This 4-year degree, allows students to combine 12-credit certificates in emerging fields such as Artificial Intelligence and Data Science, through coursework delivered by CECS (a gateway course plus three additional courses), and apply them to the areas of each student's interest in other colleges offering their own 9-credit (three course) certificates.

CECS looks to incorporate a certificate related to the UT One Health Initiative (UTOI), in which Herbert is a key participant. The 9-credit, "stackable" certificates of the CECS Customizable Degree would be ideal entry for students into One Health, for example, as we offer the course "Introduction to One Health" (AGNR 101) as well as "Global Dynamics: Food, Biodiversity, and the Environment" (AGNR 180). The One Health theme, as well as Sustainability theme being developed by CECS will benefit through Herbert strengths—in agriculture, natural resources, veterinary science, ecology among others—that could be combined for example with stackable certificates in data sciences, health and human sciences, business and law.

The CECS Customizable degree is not only about topics but about the ability to bring interdisciplinary teams together and to apply innovative approaches to solve real-world problems. In this capacity, we offer a number of courses in leadership and team-building (AGNR 103; ALEC 102, 202, 303) that could contribute to a 9-credit certificate in this crucial development skill for CECS students.

For the customizable degree, each CECS student is required to take at least one service-research course and one internship course off campus. Herbert will be able to assist CECS in engaging industry and community partners with internship and service opportunities for students. Across the Institute of Agriculture, faculty and students partner with numerous organizations including ORNL, Volkswagen, Jack Daniels Distillery, and Tyson Foods and are able to conduct real world research at our 10 research education centers spread across the state. Related to CECS, Herbert offers a wealth of instruction and research (capstone project) opportunities across our 11 majors that are highly aligned with Data science and AI applications. Our new faculty appointment in precision agriculture, for instance, establishes strengths in applying statistics and data science to agriculture sciences and natural resources management. The UT Precision Livestock Farming program, for example, is essentially based in data science, through the real-time monitoring of images, sounds, physiological and environmental data in livestock and poultry housing, feeding and watering systems as well as other production system components.

The Herbert College of Agriculture is a partnership of the University of Tennessee  
Institute of Agriculture and the University of Tennessee, Knoxville.



In summary, we are looking forward to partnering with the CECS Customizable degree program. Herbert College of Agriculture fully understands the need for students in the future workforce to combine a wide range of skills and emerging disciplines to address the complex challenges of population growth, evolving technology, and increasing globalization, including data-driven intelligence solutions for food and nutrition security, climate-adapted agriculture, and the evolving bioeconomy.

Please let me know if I may be of any further assistance in this regard.

Sincerely,



David G. White, Ph.D.  
Interim Dean  
Herbert College of Agriculture  
University of Tennessee Institute of Agriculture  
University of Tennessee Knoxville





August 1, 2023

Dean Ozlem Kilic, CECS  
513 Andy Holt Tower  
CAMPUS

Dear Ozlem,

As Dean of the Tickle College of Engineering (TCE), University of Tennessee, I am writing to support the launching of the Customizable B.S./B.A. in the College of Emerging and Collaborative Studies (CECS). There is already a strong relationship between TCE and CECS, as CECS Dean Ozlem Kilic previously served as Associate Dean of Academic and Student Affairs in TCE.

CECS develops content from the perspective of emerging topics by bringing multiple disciplines together. The 4-year Customizable B.S. degree allows students to combine 12-credit certificates in emerging fields such as Artificial Intelligence and Data Science, through coursework delivered by CECS (a gateway course plus three additional courses), and apply them to the areas of each student's interest in other colleges offering their own 9-credit (three course) certificates.

For the student interested in applying intelligence sciences to a broad range of problems, CECS provides breadth of applications to many of the tools that TCE teaches in depth. While TCE develops topics of information systems, data analysis and machine learning from fundamental principles of computer science, the CECS program focuses on applying these tools to contemporary challenges, ranging from public health to logistics, social and natural sciences, legal copyright, game design for professional development and food security, just to name some of the possibilities. In other words, CECS makes technology and engineering—which TCE covers in depth— accessible to all backgrounds and breadth of applications. This fills the growing gap of skills needed in other disciplines outside of engineering.

The involvement of TCE already led to the success of the intercollegiate Data Science minor, which included a core course taught by TCE, and which will become a standalone B.S. launched by CECS in Fall 2024. The new Data Science B.S. incorporates numerous TCE courses as electives, particularly in the ABET-accredited version of Data Science planned as an optional pathway. This success has paved way for the development of new courses and programs including a B.S. in Applied Artificial Intelligence and a minor in Cybersecurity (in Fall 2024), with a B.S. in Cybersecurity future degrees. In the first years of planned releases, CECS has prioritized technological topics because these technologies are transforming all aspects of life. The Customizable Degree allows students to take advantage of this opportunity to combine user skills from these different domains. On the horizon are degrees that make use of these intelligence technologies, including in Human-Computer interaction, One Health and Sustainability.

The Customizable Degree allows students to establish these interdisciplinary applications right away. For CECS certificates, TCE offers considerable potential, given that TCE already offers graduate certificates in artificial intelligence and in data driven decision-making, as well as an undergraduate

**Office of the Dean**

456 Zeonah Engineering Complex Knoxville, TN 37996 2346  
865-974-5321 tickle.utk.edu

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Flagship Campus of the University of Tennessee System 

Ozlem Kilic  
 August 1, 2023  
 Page 2

program in collaboration with Haslam Business School. A certificate in computer science, for example, could include Introduction to Programming (COSC 101), Introduction to Computer Science (COSC 102) and Data Structures and Algorithms I (COSC 202). This would provide sound foundations for custom degrees that leveraged Applied AI or Cybersecurity in another field such as business, precision agriculture, supply chain management, etc. To be best positioned for the workforce, students would benefit from various CECS stackable certificates which can instill the skills of collaboration, teamwork, leadership and innovative multidisciplinary thinking. The internship and capstone projects enable students to apply all these skills and tools together to address a real-world problem.

In summary, we are looking forward to partnering with the CECS Customizable degree program. TCE recognizes the need for students in the future workforce to lead teams of complementary skills and knowledge, to create their own interdisciplinary specialties to address the complex challenges of the fully connected, digital intelligence world.

Sincerely,



Matthew M. Mench, PhD, MBA  
 Dean and Wayne T. Davis Dean's Chair  
 Chancellor's Professor

**BIG ORANGE. BIG IDEAS.**

*Flagship Campus of the University of Tennessee System* 



276 Patton Lane Harriman, TN 37748-5011  
 (865) 882-4513 Fax (865) 882-4601  
 www.roanestate.edu

August 1, 2023

Alex Bentley  
 Professor and Associate Dean of Academic Affairs  
 College of Emerging and Collaborative Studies  
 University of Tennessee

Dear Professor Bentley:

I am writing in support of the Customizable B.S./B.A. degree being developed at the College of Emerging and Collaborative Studies (CECS), University of Tennessee-Knoxville. The degree provides an excellent opportunity for a transfer partnership with Roane State.

The CECS customizable degree—which will allow students to take 9 credits in different subjects and assemble these as “stackable certificates” with their Vol Core and elective requirements into a 4-year B.S. degree—would articulate very well with compatible programs at Roane State. As such, we see the opportunity for Roane State graduates to transfer into this CECS customizable degree.

As CECS is also launching new Bachelor degrees in Data Science and Applied Artificial Intelligence, as well as a minor (and future major) in Cybersecurity, there is clear compatibility with programs at Roane State. For example, Roane State offers a cyber defense concentration within the two-year computer information technology (CITC) Associate degree program. Besides just the compatibility of subject matter, we are also encouraged by the overall mission of CECS to provide highly interdisciplinary, motivated students with a college home in which to learn, be advised, interact, and belong. In addition to classes, CECS provides advising and informal interaction that is crucial for students to develop their interdisciplinary goals in a 4-year degree context. Student class planning can be combined with bespoke career advice and the all-important internship placements that each CECS student can expect to engage in as they complete their degree program.

In a world of growing digital intelligence, where new technologies and industries emerge unprecedentedly, academic institutions must adapt to prepare graduates for the future. Roane State could prepare students for CECS's customizable degree program, allowing them to combine disciplines integral to their entrepreneurial skills. These graduates will help improve the economy and prosperity of East Tennessee.

For these reasons, we at Roane State are supportive of the CECS customizable degree and are looking forward to being a partner with it.

Sincerely,

Vice President of Student Learning  
 Chief Academic Officer

Serving the counties of  
 Roane ♦ Anderson ♦ Campbell ♦ Cumberland ♦ Fentress ♦ Loudon ♦ Morgan ♦ Scott  
 (Knox and Blount for Health Sciences)

## Appendix B: THEC Financial Projection Form

<b>Institution</b>	University of Tennessee Knoxville					
<b>Program Name</b>	Innovative Transdisciplinary Studies, Bachelor of Science					
<b>Projected One-Time Expenditures</b>						
<b>Category</b>	<b>Planning</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>	<b>Year 5</b>
Faculty & Instructional Staff						
Non-Instructional Staff						
Graduate Assistants						
Accreditation						
Consultants	\$2,000					
Equipment						
Information Technology						
Library resources						
Marketing						
Facilities						
Travel						
Other	\$62,006					
<b>Total One-Time Expenditures</b>	<b>\$64,006</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>
<b>Projected Recurring Expenditures</b>						
<b>Category</b>	<b>Planning</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>	<b>Year 5</b>
Faculty & Instructional Staff <sup>1</sup>	\$105,600	\$165,200	\$188,168	\$215,981	\$278,742	\$282,204
Non-Instructional Staff <sup>2</sup>		\$39,866	\$44,166	\$61,699	\$72,466	\$83,268
Graduate Assistants						
Accreditation						
Consultants						
Equipment						
Information Technology						
Library						
Marketing		\$2,000	\$2,000	\$2,000	\$1,000	\$1,000
Facilities						
Travel						
Other						
<b>Total Recurring Expenditures</b>	<b>\$105,600</b>	<b>\$207,066</b>	<b>\$234,334</b>	<b>\$279,680</b>	<b>\$352,208</b>	<b>\$366,472</b>
<b>Grand Total (One-Time and Recurring)</b>	<b>\$169,606</b>	<b>\$207,066</b>	<b>\$234,334</b>	<b>\$279,680</b>	<b>\$352,208</b>	<b>\$366,472</b>
<b>Projected Revenue</b>						
<b>Category</b>	<b>Planning</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>	<b>Year 5</b>
Tuition		\$27,252	\$65,405	\$122,634	\$218,016	\$314,761
Grants						
Other						
<b>Total Revenues</b>		<b>\$27,252</b>	<b>\$65,405</b>	<b>\$122,634</b>	<b>\$218,016</b>	<b>\$314,761</b>

**Note 1:** Include Program Director (all years), Faculty Fellows (years 1 and 2), and lecturers (years 1-5).

**Note 2:** Include student graders, program coordinator, and internship coordinator (beginning in year 3)



## Appendix C: Course Syllabi

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### *Listing of Course:* New ITS Courses

	Course Number	Course Title	Credit Hours
1	ITS 101	Design Your Degree, Design Your Career	3
2	ITS 102	Introduction to Team Science	3
3	ITS 103	Emerging Topics for Future Workforce	3
4	ITS 201	Transdisciplinary Data Analytics for Decision Making	3
5	ITS 202	Transdisciplinary Thinking and Innovation	3
6	ITS 301	Transdisciplinary Problem Solving	3
7	ITS 302	Transdisciplinary Research Methods	3
8	ITS 401	Advanced Transdisciplinary Research Concepts	3
9	ITS 492	Internship	3
10	ITS 399	Junior Capstone	3
11	ITS 499	Senior Capstone	3
12	DATA 101	Data Knowledge and Discovery	3
13	DATA 102	Data Stewardship and Ethics	3
14	DATA 203	Analytical Methods of Data Science	3
15	AI 101	Intro to the World of AI	3
16	AI 102	Natural Language-based Programming Techniques	3
17	AI 301	Natural Language Processing and Conversational AI	3
18	AI 302	AI-based Data Handling and Visualization	3
19	CYBR 101	Introduction to Cybersecurity Concepts	3
20	CYBR 102	Data Protection and Data Privacy	3
21	CYBR 311/AI 311	AI for Cybersecurity	3



THE UNIVERSITY OF  
TENNESSEE  
KNOXVILLE

## ITS 101 – Design Your Degree, Design Your Career, Fall 2024

University of Tennessee, Knoxville

### Course Webpage

*Course Section:* Insert Course Section Here

### Course Credit Hours:

### Prerequisite(s):

*Meeting Time and Place:* Insert Meeting and Place Here

### Final Exam:

#### Course Description:

"Design Your Degree, Design Your Career" is an innovative and student-centered course designed to empower incoming freshmen with the ability to craft a personalized educational journey that aligns with their unique interests and career aspirations. In a rapidly evolving world, where transdisciplinary knowledge and adaptability are highly valued, this course equips students with the tools to shape their academic experience and future career path. The course will use the methods of Design Thinking to spur curiosity and creativity, pushing students to think both broadly and deeply.

#### Value Proposition:

Students will engage in the Design Thinking process to help them create a personalized degree leading to a personalized career.

#### Student Learning Outcomes/Objectives:

- Explore and identify personal interests, passions, and goals.
- Develop a customized degree plan by selecting from a list of stackable certificates.
- Cultivate where transdisciplinary knowledge and skills to enhance future employability.
- Foster critical thinking, problem-solving, and decision-making abilities.
- Build a strong foundation for academic and career success.
- Enhance self-awareness and lifelong learning skills.

#### Learning Environment:

The course meets two times per week in an in-person setting with optional Zoom call ins for if you are unable to attend in person. Design principles and practices are presented in presentations, demonstrations, class assignments, and critiques. Students work in-class and out-of-class on individual and group design assignments.

#### Course Communications:

Email is the preferred method of communication. Assignments, files, and other resources will be available on Canvas.

For technical issues, contact the OIT HelpDesk via phone (865) 974-9900 or online at <http://help.utk.edu/>.

#### How to Be Successful in This Course:

##### *Student's Responsibility*

Be prepared for all classes

Be respectful of others

Actively contribute to the learning activities in class

Abide by the UT Honor Code

Communicate concerns and confusions to me

##### Instructor's Responsibility

Be prepared for all classes

Evaluate all fairly and equally

Be respectful of all students

Create and facilitate meaningful learning activities

Behave according to University codes of conduct

Actively listen to concerns and confusions and work to find solutions or alternative methods of explanation

##### Texts/Resources/Materials:

Designing Your Life, Bill Burnett and Dave Evans

Innovating For People: Handbook of Human-Centered Design Methods, LUMA Institute

Communicating The New: Methods to Shape and Accelerate Innovation, Kim Erwin

##### Course Requirements, Assessments, and Evaluations:

##### Major Assignments and Exams

Exams and Class assignments will be a mix of Design Thinking activities such as conducting interviews, creating diagrams, compiling information, and creating prototypes as well as more traditional activities such as writing short essays, creating and giving presentations, and working in group settings.

#### Attendance

Class attendance, working during class time, and participation at all meetings, except when specifically exempted by individual faculty, is assumed to be a prerequisite to successful completion of the course. Course grades are subject to attendance and participation. More than two absences will lower the final grade a student receives for the course by one letter grade per day missed. All policies regarding allowable excused attendance as outlined in Hilltopics are in effect in this course.

An important reason for requiring you to be in class is the benefit of student interaction -- seeing and learning from your classmates. This is a good way to get feedback and develop skills. This is also how good design happens, talking through problems, getting other people's points of view, and working through the details with your teammates. With all students in attendance, impromptu meetings, discussions and pin-ups can be held. Note that, unless you are excused from class, you are expected to be in the class during scheduled meeting times.

#### Key Campus Resources for Students:

[Center for Career Development and Academic Exploration](#) (Career counseling and resources; Handshake job search system)

[Course Catalogs](#) (Listing of academic programs, courses, and policies)

[Hilltopics](#) (Campus and academic policies, procedures and standards of conduct)

[OIT HelpDesk \(865\) 974-9900](#)

[Schedule of Classes/Timetable](#)

[Student Health Center](#) (visit the site for a list of services)

[Academic Success Center](#) (Academic support resources)

[Undergraduate Academic Advising](#) (Advising resources, course requirements, and major guides)

[University Libraries](#) (Access to library resources, databases, course reserves, and services)

#### Course Outline/Assignments/Units of Instruction/Clinic Schedule:

<b>Module</b>	<b>Objectives</b>	<b>Texts</b>	<b>Activities</b>
<b>Module 1: Introduction</b>	<p>Welcome students to the course and provide an overview of its objectives and structure.</p> <p>Inspire curiosity and enthusiasm for self-directed learning.</p>	<b>Designing Your Life</b>	<b>Self-Reflection – What brings you Joy?</b>
<b>Module 2: What is a degree? What is a career?</b>	<p>Explore the fundamental concepts of academic degrees and career paths.</p> <p>Begin reflecting on personal interests and career aspirations.</p> <p>Begin exploring UT’s many degrees and disciplines</p>	<b>Designing Your Life</b>	<p><b>How do we get there?</b></p> <p><b>Letter from the Future.</b></p>
<b>Module 3: What is design?</b>	<p>Introduce the concept of design and its relevance to education and career development.</p> <p>Highlight the importance of creativity and innovation in shaping one’s journey.</p> <p>Highlight the difference between science, art, engineering, and design. In design there isn’t one single right answer, but it is more about the process and iteration.</p>	<b>Innovating For People</b>	<b>Map Out the Design Process</b>
<b>Module 4: Design Thinking Crash Course</b>	<p>Dive into the principles and methodologies of design thinking.</p> <p>Participate in Design Project 0, a fast-paced workshop where one goes through the entire design thinking process in 1 sitting.</p>	<b>Innovating For People</b>	<b>Workshop + Presentation</b>
<b>Module 5: How do you design a career?</b>	<p>Guide students in crafting a vision for their future careers.</p>	<b>Innovating For People +</b>	<b>Diagram creation – What I Love, What</b>

	<p>Develop strategies for aligning interests with potential career opportunities.</p> <p>Use activities and examples from “Designing Your Life”, begin to understand what would make a good career for You, and how transdisciplinary work fits together.</p>	<b>Designing Your Life</b>	<b>the World Needs, What Pays</b>
<b>Module 6: Investigating Certificates and their Careers</b>	<p>Explore the diverse range of ITS certificates and how they relate to future careers.</p> <p>Interview people in those fields.</p> <p>Identify areas of interest and potential intersections between certificates.</p>	<b>Communicating The New</b>	<b>Sketching Degrees -</b>
<b>Module 7: Prototype a Degree</b>	<p>Encourage students to design a preliminary degree plan, combining chosen certificates.</p> <p>Emphasize the importance of flexibility and adaptability in degree design.</p> <p>Think deeply about how the certificates and career intersects with who you are and what you are passionate about.</p>	<b>Communicating The New</b>	<b>Build To Think Prototypes + Share Out</b>
<b>Module 8: Test It Out</b>	<p>Simulate real-world experiences by testing the feasibility of the preliminary degree plan.</p> <p>Gather feedback from peers, instructors, and mentors.</p>	<b>Communicating The New</b>	<b>Build To Think Prototypes</b>

<b>Module 9: Iterate</b>	Refine and enhance the degree plan based on feedback and self-reflection.  Continue exploring interdisciplinary connections and potential career paths.		<b>SCAMPER activity with Certificates</b>
<b>Module 10: Finalize and Present</b>	Guide students in finalizing their personalized degree plan.  Prepare students to present their plans, showcasing their journey and vision for the future.		<b>Presentation</b>
	<b>Final Exam</b>		

*The instructor reserves the right to revise, alter or amend this syllabus as necessary. Students will be notified in writing / email of any such changes. [Optional section/language]*

#### The Campus Syllabus

Dear Student,

The purpose of this **Campus Syllabus** is to provide you with important information that applies to all UTK courses. Please observe the following policies and familiarize yourself with the university resources listed below. At UT, we are committed to providing you with a high-quality learning experience. I want to wish you the best for a successful and productive semester.

–Dr. John Zomchick, Provost and Senior Vice Chancellor

#### ACADEMIC INTEGRITY

Each student is responsible for their personal integrity in academic life and for adhering to UT’s Honor Statement. The Honor Statement reads: “An essential feature of the University of Tennessee, Knoxville is a commitment to maintaining an atmosphere of intellectual integrity and academic honesty. As a student of the university, I pledge that I will neither knowingly give nor receive any inappropriate assistance in academic work, thus affirming my own personal commitment to honor and integrity.”

#### YOUR ROLE IN IMPROVING THE COURSE THROUGH ASSESSMENT

At UT, it is our collective responsibility to improve the state of teaching and learning. During the semester you may be requested to assess aspects of this course, either during class or at the

completion of the class, and through the TNVoice course evaluation. Please take the few moments needed to respond to these requests as they are used by instructors, department heads, deans and others to improve the quality of your UT learning experience.

STUDENTS WITH DISABILITIES – <http://sds.utk.edu>

The University of Tennessee, Knoxville, is committed to providing an inclusive learning environment for all students. If you anticipate or experience a barrier in this course due to a chronic health condition, a learning, hearing, neurological, mental health, vision, physical, or other kind of disability, or a temporary injury, you are encouraged to contact [Student Disability Services](#) (SDS) at 865-974-6087 or [sds@utk.edu](mailto:sds@utk.edu). An SDS Coordinator will meet with you to develop a plan to ensure you have equitable access to this course. If you are already registered with SDS, please contact your instructor to discuss implementing accommodations included in your course access letter.

ACCESSIBILITY POLICY AND TRAINING – <http://accessibility.utk.edu>

The University of Tennessee, Knoxville, provides reasonable accommodations for individual students with disabilities through its office of [Student Disability Services](#). The university is also committed to making information and materials accessible, when possible. Resources and assistance to support these efforts can be found at <http://accessibility.utk.edu/>.

WELLNESS – <http://wellness.utk.edu/> and <http://counselingcenter.utk.edu/>

The [Center for Health Education and Wellness](#) empowers all Volunteers to thrive by cultivating personal and community well-being. The Center can answer questions about general wellness, substance use, sexual health, healthy relationships, and sexual assault prevention. The [Student Counseling Center](#) is the university's primary facility for personal counseling, psychotherapy, and psychological outreach and consultation services.

Any student who has difficulty affording hygiene products, groceries, or accessing sufficient food to eat every day is urged to contact the [Big Orange Pantry](#) for support. The Big Orange Pantry, located in Greve Hall, is a free resource for all students, faculty, and staff, no matter how great or small their need is. Students who need emergency financial assistance can also request funding from the [Student Emergency Fund](#).

Students who are experiencing non-academic difficulty or distress and need assistance should call 974-HELP or [submit an online referral](#). The 974-HELP team specializes in aligning resources and support to students experiencing mental health distress.

EMERGENCY ALERT SYSTEM – <http://safety.utk.edu/>

The University of Tennessee is committed to providing a safe environment to learn and work. When you are alerted to an emergency, please take appropriate action. Learn more about what to



do in an emergency and sign up for [UT Alerts](#). Check the emergency posters near exits and elevators for building specific information. In the event of an emergency, the course schedule and assignments may be subject to change. If changes to graded activities are required, reasonable adjustments will be made, and you will be responsible for meeting revised deadlines.



## **ITS 102: Introduction to Team Science, Fall 2024**

College of Emerging and Collaborative Studies, University of Tennessee, Knoxville

*Course Section:* ITS 102

*Meeting Time and Place:* TBD

*Course Credit Hours:* 3

**Faculty Contact Information:** TBD

### **Course Description/Information:**

This course provides students with an understanding of the principles and practices of team science in the context of research and innovation. Students will explore theories of collaboration, communication, conflict resolution, and leadership in interdisciplinary and diverse research teams. Through case studies, discussions, and practical exercises, students will develop essential skills for effective teamwork in complex scientific projects.

### **Value Proposition:**

In the rapidly evolving landscape of research and innovation, the ability to collaborate effectively within diverse and interdisciplinary teams is paramount. This course empowers students with the knowledge, skills, and attitudes essential for thriving in this collaborative ecosystem. By fostering a deep understanding of collaboration theories, communication strategies, conflict resolution techniques, and leadership principles, this course equips students with the tools they need to excel in complex scientific projects.

### **Student Learning Outcomes/Objectives:**

By the end of the course, students should be able to:

- Understand the concepts and theories of team science.
- Identify the benefits and challenges of interdisciplinary collaboration.
- Communicate effectively within diverse research teams.
- Apply conflict resolution techniques in team settings.
- Demonstrate leadership skills in scientific collaboration.
- Evaluate the role of ethics and inclusivity in team science.

Analyze real-world case studies of successful and unsuccessful team collaborations.  
Participate actively and contribute effectively to team projects.

### **Learning Environment:**

This course may be offered in either an in-person or online format. The in-person course will meet on campus at its regularly scheduled time. The online course option offers course content asynchronously and using Canvas, the University of Tennessee's Learning Management System. Synchronous sessions will be conducted using Zoom [if applicable]. Additional [Canvas](#) and [Zoom](#) resources are available for students unfamiliar with these online environments.

### **Course Communications:**

The course instructor is required to communicate with students through their UTK email address. When you send me an email please make sure you are using your UTK email and have **ITS 102** in the subject line. If you use a non UTK email id, there is a high chance that it will be filtered to my spam folder and hence be missed.

Feel free to contact me for questions or to share ideas! To ensure quick response, start your message subject line with **ITS 102**. I will reply to your messages within 48 hours.

If this course is being offered in a virtual mode using Canvas & Zoom, the delivery of the course content will include lectures, videos, discussions, live demonstrations, and hands-on training activities.

All lecture slides will be posted on Canvas. Read the class announcement posted on Canvas to stay current with course matters.

Submit assignments on Canvas. Do not email them to the instructor.

### **How to Be Successful in This Course:**

Readings for each week will be given in advance and it will be the responsibility of the student to complete the readings and contribute to the class discussions based on the readings. Read the assigned materials prior to the class for which they are assigned, and be prepared to refer to passages or issues of interest to you during our discussions

Your presence and participation is vital to the success of this class: attendance and class participation are expected and do affect the "participation and attendance" portion of your final grade. Class participation includes contributing during class discussions – sharing your thoughts and experiences about lecture related topics – and monitoring and posting to the asynchronous discussion boards (located on Canvas) each week. The quality of your contributions is more important than the quantity of contributions.

This course adopts an active learning approach. Students are required to complete all required readings, attend all class lectures, complete graded activities and assignments, and participate in all class activities, including instructor-led and student-led discussions, and small-group and individual activities. All recommended readings will be uploaded on the course Canvas site.

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#### **Texts/Resources/Materials:**

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#### **Required Equipment:**

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#### **Course Resources:**

All course resources will be available through the course's Canvas site.

#### **Course Requirements, Assessments, and Evaluations:**

##### **Grading:**

Class Participation: 15%

Individual Assignments and Reflections: 30%

Group Projects and Presentations: 40%

Final Exam or Project: 15%

#### **Key Campus Resources for Students:**

[Center for Career Development and Academic Exploration](#) (Career counseling and resources; Handshake job search system)

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### Course Outline:

#### **Week 1-2: Introduction to Team Science**

Understanding team science: definitions and key concepts  
Historical context and evolution of interdisciplinary collaboration  
Importance of team science in modern research and innovation

#### **Week 3-4: Theories of Collaboration and Communication**

Social psychology and team dynamics  
Communication models for interdisciplinary teams  
Strategies for effective communication and information sharing

#### **Week 5-6: Conflict Resolution and Negotiation**

Sources of conflicts in scientific teams  
Conflict resolution styles and strategies  
Negotiation techniques for resolving differences

#### **Week 7-8: Leadership and Team Roles**

Leadership theories and their relevance in team science  
Understanding and assigning team roles  
Developing leadership skills for scientific collaboration

#### **Week 9-10: Diversity and Inclusion in Team Science**

Importance of diversity in research teams  
Addressing bias and promoting inclusivity  
Case studies of successful diverse collaborations

#### **Week 11-12: Ethical Considerations in Team Science**

Ethical challenges and dilemmas in collaborative research  
Ensuring responsible conduct in interdisciplinary projects  
Balancing individual and team interests ethically

#### **Week 13-14: Case Studies in Team Science**

Analysis of real-world successful and failed interdisciplinary collaborations  
Lessons learned from case studies  
Extracting best practices and insights for future projects

**Week 15: Future Trends in Team Science and Reflection**

Emerging trends in collaborative research and innovation

Students reflect on their learning and growth as team collaborators

Presentations of final projects or exam (depending on assessment approach)

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### **ITS 103: Emerging Topics for Future Workforce, Fall 2024**

College of Emerging and Collaborative Studies, University of Tennessee, Knoxville

*Course Section:* ITS 103

*Meeting Time and Place:* TBD

*Course Credit Hours:* 3

**Faculty Contact Information:** TBD

#### **Course Description/Information:**

This course aims to provide students with a comprehensive understanding of the emerging trends, technologies, and challenges that are shaping the future workforce. Students will explore topics such as artificial intelligence, remote work, sustainability, ethics, and more. The course will equip students with the knowledge and skills necessary to thrive in an ever-evolving work environment.

#### **Value Proposition:**

In the rapidly evolving landscape of research and innovation, the ability to collaborate effectively within diverse and interdisciplinary teams is paramount. This course empowers students with the knowledge, skills, and attitudes essential for thriving in this collaborative ecosystem. By fostering a deep understanding of collaboration theories, communication strategies, conflict resolution techniques, and leadership principles, this course equips students with the tools they need to excel in complex scientific projects.

#### **Learning Environment:**

This course may be offered in either an in-person or online format. The in-person course will meet on campus at its regularly scheduled time. The online course option offers course content asynchronously and using Canvas, the University of Tennessee's Learning Management System. Synchronous sessions will be conducted using Zoom [if applicable]. Additional [Canvas](#) and [Zoom](#) resources are available for students unfamiliar with these online environments.



**Course Communications:**

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Submit assignments on Canvas. Do not email them to the instructor.

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**Texts/Resources/Materials:**

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**Required Equipment:**

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**Course Resources:**

"The Future of Work: Attract New Talent, Build Better Leaders, and Create a Competitive Organization" by Jacob Morgan

"Human + Machine: Reimagining Work in the Age of AI" by Paul R. Daugherty and H. James Wilson

Relevant articles from reputable sources like Harvard Business Review, MIT Technology Review, and World Economic Forum reports

Online courses and webinars on specific emerging technologies and skills platforms

**Course Requirements, Assessments, and Evaluations:**

Class participation and discussions

Individual or group presentations

Case studies and analysis of real-world scenarios

Research papers or essays on specific future workforce trends

Final project: Creating a future-focused career development plan

**Key Campus Resources for Students:**

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### Course Outline:

#### Week 1-2: Future Workforce Trends

The future workforce

Major trends shaping the workforce

Globalization and demographic changes

#### Week 3-4: Technology and the Workforce

Role of artificial intelligence, automation, and robotics in the workplace

Implications of technological advancements for job roles and skills

Case studies of industries disrupted by technology

#### Week 5-6: Remote Work and Digital Collaboration

Evolution of remote work and telecommuting

Effective digital collaboration and communication

Work-life balance in remote settings

#### Week 7-8: Skills for the Future

Identifying key skills needed in the future workforce (e.g., critical thinking, adaptability, emotional intelligence)

Strategies for continuous learning and upskilling

Guest speakers from industries discussing skills demand

#### Week 9-10: Ethical Considerations in the Future Workplace

Exploring ethical dilemmas posed by emerging technologies

Addressing biases and fairness in AI and automation

Promoting inclusivity and diversity in future work environments

#### Week 11-12: Sustainability and Green Initiatives

Understanding the importance of sustainability in the workplace

Green technologies and their impact on job opportunities

Corporate social responsibility and sustainable business practices

#### Week 13-14: Future Workforce Challenges and Opportunities

Discussing potential disruptions and uncertainties in the job market  
 Exploring entrepreneurial opportunities in the gig economy  
 Strategies for navigating career transitions and uncertainties

#### Week 15-16: Assessments and Reflection

Emerging trends in future workforce  
 Students reflect on their learning and growth as team collaborators  
 Presentations of final projects or exam (depending on assessment approach)

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## ITS 201: Transdisciplinary Data Analytics for Decision Making, Fall 2024

College of Emerging and Collaborative Studies, University of Tennessee, Knoxville

*Course Section:* ITS 201

*Meeting Time and Place:* TBD

*Course Credit Hours:* 3

**Faculty Contact Information:** TBD

### **Course Description/Information:**

This course is designed to equip students with the knowledge and skills necessary to leverage data analytics techniques for effective decision-making in various fields. Through a transdisciplinary approach, students will learn how to collect, process, analyze, and interpret data from diverse sources to inform strategic decisions. The course will emphasize integrating data analysis with real-world applications and ethical considerations.

### **Value Proposition:**

In the rapidly evolving landscape of research and innovation, the ability to collaborate effectively within diverse and interdisciplinary teams is paramount. This course empowers students with the knowledge, skills, and attitudes essential for thriving in this collaborative ecosystem. By fostering a deep understanding of collaboration theories, communication strategies, conflict resolution techniques, and leadership principles, this course equips students with the tools they need to excel in complex scientific projects.

### **Learning Environment:**

This course may be offered in either an in-person or online format. The in-person course will meet on campus at its regularly scheduled time. The online course option offers course content asynchronously and using Canvas, the University of Tennessee's Learning Management System. Synchronous sessions will be conducted using Zoom [if applicable]. Additional [Canvas](#) and [Zoom](#) resources are available for students unfamiliar with these online environments.

**Course Communications:**

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Feel free to contact me for questions or to share ideas! To ensure quick response, start your message subject line with **ITS 201**. I will reply to your messages within 48 hours.

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**How to Be Successful in This Course:**

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**Texts/Resources/Materials:**

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**Required Equipment:**

A personal computer, headset and microphone are required for this course. Any additional required or recommended equipment will be discussed during the first course meeting.

**Course Resources:**

All course resources will be available through the course's Canvas site. They may include

"Data Science for Business" by Foster Provost and Tom Fawcett

"Python for Data Analysis" by Wes McKinney

Relevant research papers from data science and analytics journals

Online platforms for learning data analytics tools (e.g., Python, R, Tableau)

Ethical guidelines and codes of conduct for data analysis and decision-making

**Course Requirements, Assessments, and Evaluations:**

Class participation and engagement in discussions

Individual or group data analysis projects using real-world datasets

Presentations showcasing data visualization and analysis techniques

Quizzes and exams assessing understanding of concepts and methods

Final project: Applying data analytics to solve a specific decision-making challenge

**Key Campus Resources for Students:**

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### **Course Outline:**

#### **Week 1-2: Introduction to Transdisciplinary Data Analytics**

Understanding the role of data analytics in decision-making processes

Exploring the interdisciplinary nature of data analysis

Overview of data sources, types, and the data lifecycle

#### **Week 3-4: Data Collection and Preprocessing**

Techniques for collecting and cleaning diverse data sources

Data quality assessment and data integration challenges

Ethical considerations in data collection and privacy preservation

#### **Week 5-6: Exploratory Data Analysis and Visualization**

Descriptive statistics and visualization techniques

Identifying patterns, trends, and anomalies in data

Effective communication of insights through visualization

#### **Week 7-8: Quantitative Methods for Decision Making**

Introduction to statistical analysis for decision support

Hypothesis testing, correlation, and regression analysis

Applying statistical tools to real-world scenarios

#### **Week 9-10: Machine Learning for Predictive Analytics**

Fundamentals of machine learning algorithms (e.g., classification, regression)

Feature selection, model training, and evaluation

Ethical considerations in algorithmic decision-making

#### **Week 11-12-13: Decision Support Systems and Case Studies**

Building decision support systems using data-driven approaches

Integrating analytics into decision-making frameworks

Case studies from various domains (e.g., healthcare, finance, marketing)

#### **Week 14-16: Assessments and Reflection**

Emerging trends in future workforce

Students reflect on their learning and growth as team collaborators

Presentations of final projects or exam

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## **ITS 202: Transdisciplinary Thinking and Innovation, Fall 2024**

College of Emerging and Collaborative Studies, University of Tennessee, Knoxville

*Course Section:* ITS 202

*Meeting Time and Place:* TBD

*Course Credit Hours:* 3

**Faculty Contact Information:** TBD

### **Course Description/Information:**

This course introduces students to the principles of design thinking and innovation, providing them with a comprehensive understanding of the creative problem-solving process and how it can be applied to generate innovative solutions. Students will learn to empathize with users, define problems, ideate solutions, prototype concepts, and test their ideas through real-world projects and case studies.

### **Value Proposition:**

In the rapidly evolving landscape of research and innovation, the ability to collaborate effectively within diverse and interdisciplinary teams is paramount. This course empowers students with the knowledge, skills, and attitudes essential for thriving in this collaborative ecosystem. By fostering a deep understanding of collaboration theories, communication strategies, conflict resolution techniques, and leadership principles, this course equips students with the tools they need to excel in complex scientific projects.

### **Student Learning Outcomes/Objectives:**

- Understand the core principles of design thinking and innovation.
- Apply design thinking methodologies to solve complex problems.
- Employ empathy and user-centered approaches to identify user needs.
- Generate creative ideas through ideation and brainstorming techniques.
- Develop prototypes and iterate concepts based on user feedback.
- Analyze and evaluate the feasibility of innovative solutions.
- Communicate design ideas effectively through various mediums.
- Collaborate in cross-functional teams to drive innovation.

**Learning Environment:**

This course may be offered in either an in-person or online format. The in-person course will meet on campus at its regularly scheduled time. The online course option offers course content asynchronously and using Canvas, the University of Tennessee's Learning Management System. Synchronous sessions will be conducted using Zoom [if applicable]. Additional [Canvas](#) and [Zoom](#) resources are available for students unfamiliar with these online environments.

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**How to Be Successful in This Course:**

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Your presence and participation is vital to the success of this class: attendance and class participation are expected and do affect the "participation and attendance" portion of your final grade. Class participation includes contributing during class discussions – sharing your thoughts and experiences about lecture related topics – and monitoring and posting to the asynchronous discussion boards (located on Canvas) each week. The quality of your contributions is more important than the quantity of contributions.

This course adopts an active learning approach. Students are required to complete all required readings, attend all class lectures, complete graded activities and assignments, and participate in all class activities, including instructor-led and student-led discussions, and small-group and individual activities. All recommended readings will be uploaded on the course Canvas site.

If you have questions about the class, look at the "Questions About Class / General Discussion" discussion board. Please post your questions first to the class discussion board unless the question is of a confidential nature (e.g., grades). Sharing your questions is helpful because (1) other people may have the same or similar questions and (2) you may get a faster or better response from other people in the class. I will be reading the discussion boards almost daily.

#### **Texts/Resources/Materials:**

The required textbook for this course will be listed on the course's Canvas site and available for purchase from the VolBooks, the VolShop's online bookstore.

#### **Required Equipment:**

A personal computer, headset and microphone are required for this course. Any additional required or recommended equipment will be discussed during the first course meeting.

#### **Course Resources:**

All course resources will be available through the course's Canvas site.

#### **Course Requirements, Assessments, and Evaluations:**

Class Participation: 15%

Individual Assignments: 30%

Group Projects: 40%

Final Presentation: 15%

#### **Key Campus Resources for Students:**

[Center for Career Development and Academic Exploration](#) (Career counseling and resources; Handshake job search system)

[Course Catalogs](#) (Listing of academic programs, courses, and policies)

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**Course Outline:****Week 1-2: Introduction to Design Thinking and Innovation**

What is Design Thinking?  
Historical context and evolution of design thinking  
Importance of innovation in various contexts  
Understanding the design thinking process

**Week 3-4: Empathize and Define**

User-centered design principles  
Conducting user research and interviews  
Developing personas and empathy maps  
Defining problem statements and design challenges

**Week 5-6: Ideation and Brainstorming**

Techniques for generating creative ideas  
Brainstorming sessions and idea mapping  
Divergent and convergent thinking  
Idea selection and refinement

**Week 7-8: Prototyping and Iteration**

Types of prototypes (low-fidelity to high-fidelity)  
Creating prototypes using various tools and materials  
User testing and feedback collection  
Iterating and refining prototypes based on feedback

**Week 9-10: Testing and Validation**

Planning and conducting usability testing  
Analyzing user feedback  
Iterative testing and refining solutions  
Pivoting vs. persevering with ideas

**Week 11-12: Implementation and Execution**

Strategies for implementing innovative solutions  
Overcoming implementation challenges  
Scaling up successful solutions  
Considering business models and feasibility

**Week 13-14: Communication and Presentation**

Storytelling for design and innovation  
Creating compelling presentations  
Visual communication techniques

Pitching ideas to stakeholders

### **Week 15: Future of Design Thinking and Ethical Considerations**

Emerging trends in design thinking and innovation

Ethical implications of innovation

Balancing creativity and responsibility

### **Final Week: Project Presentations**

Teams present their final projects

Demonstration of design thinking process and innovation outcomes

Peer and instructor feedback

*The instructor reserves the right to revise, alter or amend this syllabus as necessary. Students will be notified in writing / email of any such changes.*

## **ACADEMIC INTEGRITY**

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## EMERGENCY ALERT SYSTEM

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### **ITS 301: Transdisciplinary Problem Solving, Fall 2024**

College of Emerging and Collaborative Studies, University of Tennessee, Knoxville

**Course Section:** ITS 301

**Meeting Time and Place:** TBD

**Course Credit Hours:** 3

**Faculty Contact Information:** TBD

#### **Course Description/Information:**

This course equips students with the skills and mindset necessary for addressing complex problems that transcend traditional disciplinary boundaries. Through a combination of theoretical frameworks, case studies, and hands-on projects, students will learn to collaborate effectively with experts from various fields, analyze complex challenges, and develop innovative solutions.

#### **Value Proposition:**

In the rapidly evolving landscape of research and innovation, the ability to collaborate effectively within diverse and interdisciplinary teams is paramount. This course empowers students with the knowledge, skills, and attitudes essential for thriving in this collaborative ecosystem. By fostering a deep understanding of collaboration theories, communication strategies, conflict resolution techniques, and leadership principles, this course equips students with the tools they need to excel in complex scientific projects.

#### **Student Learning Outcomes/Objectives:**

- Understand the principles and challenges of transdisciplinary problem solving.
- Analyze complex issues from multiple perspectives.
- Collaborate effectively in diverse and interdisciplinary teams.
- Apply creativity and innovation to develop novel solutions.
- Communicate complex ideas to both specialized and non-specialized audiences.
- Integrate ethical considerations into transdisciplinary problem solving.
- Reflect on their own learning and growth as transdisciplinary problem solvers.

**Learning Environment:**

This course may be offered in either an in-person or online format. The in-person course will meet on campus at its regularly scheduled time. The online course option offers course content asynchronously and using Canvas, the University of Tennessee's Learning Management System. Synchronous sessions will be conducted using Zoom [if applicable]. Additional [Canvas](#) and [Zoom](#) resources are available for students unfamiliar with these online environments.

**Course Communications:**

The course instructor is required to communicate with students through their UTK email address. When you send me an email please make sure you are using your UTK email and have **ITS 301 in the subject line. If you use a non UTK email ID, there is a high chance that it will be filtered to my spam folder and hence be missed.**

Feel free to contact me for questions or to share ideas! To ensure quick response, start your message subject line with **ITS 301**. I will reply to your messages within 48 hours.

If this course is being offered in a virtual mode using Canvas & Zoom, the delivery of the course content will include lectures, videos, discussions, live demonstrations, and hands-on training activities.

All lecture slides will be posted on Canvas. Read the class announcement posted on Canvas to stay current with course matters.

Submit assignments on Canvas. Do not email them to the instructor.

**How to Be Successful in This Course:**

Readings for each week will be given in advance and it will be the responsibility of the student to complete the readings and contribute to the class discussions based on the readings. Read the assigned materials prior to the class for which they are assigned and be prepared to refer to passages or issues of interest to you during our discussions.

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#### **Texts/Resources/Materials:**

The required textbook for this course will be listed on the course's Canvas site and available for purchase from the VolBooks, the VolShop's online bookstore.

#### **Required Equipment:**

A personal computer, headset and microphone are required for this course. Any additional required or recommended equipment will be discussed during the first course meeting.

#### **Course Resources:**

All course resources will be available through the course's Canvas site. These resources may include:

"Data Science for Business" by Foster Provost and Tom Fawcett

"Python for Data Analysis" by Wes McKinney

Relevant research papers from data science and analytics journals

Online platforms for learning data analytics tools (e.g., Python, R, Tableau)

Ethical guidelines and codes of conduct for data analysis and decision-making

#### **Course Requirements, Assessments, and Evaluations:**

Class participation and engagement in discussions

Individual or group data analysis projects using real-world datasets

Presentations showcasing data visualization and analysis techniques

Quizzes and exams assessing understanding of concepts and methods

Final project: Applying data analytics to solve a specific decision-making challenge

#### **Key Campus Resources for Students:**

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### Course Outline:

#### Week 1-2: Introduction to Transdisciplinary Problem Solving

Defining transdisciplinary problem solving  
Historical context and examples of transdisciplinary projects  
Importance of collaboration and integration in complex problem-solving

#### Week 3-4: Understanding Complex Challenges

Characteristics of complex problems  
Systems thinking and its role in transdisciplinary problem solving  
Identifying root causes and interconnections in complex issues

#### Week 5-6: Interdisciplinary Collaboration and Communication

Effective communication across disciplines  
Overcoming communication barriers and jargon  
Strategies for building interdisciplinary teams

#### Week 7-8: Integrative Approaches and Methods

Methods for integrating knowledge from multiple disciplines  
Synthesizing information to generate new insights  
Brainstorming and ideation techniques for cross-disciplinary teams

#### Week 9-10: Ethical Considerations in Transdisciplinary Work

Ethical challenges in interdisciplinary collaboration  
Balancing conflicting values and perspectives  
Ensuring responsible research and innovation

#### Week 11-12: Creative Problem Solving and Innovation

Fostering creativity in transdisciplinary teams  
 Innovation frameworks and methodologies  
 Prototyping and testing innovative solutions

### **Week 13-14: Case Studies in Transdisciplinary Problem Solving**

Analysis of real-world transdisciplinary projects  
 Lessons learned from successful and unsuccessful endeavors  
 Extracting best practices and insights for future projects

### **Week 15: Future of Transdisciplinary Problem Solving and Reflection**

Emerging trends in transdisciplinary research and problem solving  
 Students reflect on their learning and growth as transdisciplinary problem solvers  
 Final reflections and portfolio presentations

*The instructor reserves the right to revise, alter or amend this syllabus as necessary. Students will be notified in writing / email of any such changes.*

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### **ITS 302: Transdisciplinary Research Methods, Fall 2024**

College of Emerging and Collaborative Studies, University of Tennessee, Knoxville

*Course Section:* ITS 302

*Meeting Time and Place:* TBD

*Course Credit Hours:* 3

**Faculty Contact Information:** TBD

#### **Course Description/Information:**

This course provides students with a comprehensive understanding of research methods that are effective for transdisciplinary projects. Students will explore qualitative, quantitative, and mixed-methods approaches, as well as strategies for integrating diverse disciplinary perspectives. Through case studies, practical exercises, and discussions, students will learn to design, execute, and analyze research projects that tackle complex, real-world challenges.

#### **Value Proposition:**

In the rapidly evolving landscape of research and innovation, the ability to collaborate effectively within diverse and interdisciplinary teams is paramount. This course empowers students with the knowledge, skills, and attitudes essential for thriving in this collaborative ecosystem. By fostering a deep understanding of collaboration theories, communication strategies, conflict resolution techniques, and leadership principles, this course equips students with the tools they need to excel in complex scientific projects.

#### **Student Learning Outcomes/Objectives:**

Understand the characteristics and challenges of transdisciplinary research.  
 Select and apply appropriate research methodologies for transdisciplinary projects.  
 Design research that integrates insights from multiple disciplines.  
 Collaborate effectively in multidisciplinary research teams.  
 Analyze and interpret data in complex problem-solving contexts.  
 Communicate research findings to specialized and non-specialized audiences.  
 Reflect on ethical considerations in transdisciplinary research.



**Learning Environment:**

This course may be offered in either an in-person or online format. The in-person course will meet on campus at its regularly scheduled time. The online course option offers course content asynchronously and using Canvas, the University of Tennessee's Learning Management System. Synchronous sessions will be conducted using Zoom [if applicable]. Additional [Canvas](#) and [Zoom](#) resources are available for students unfamiliar with these online environments.

**Course Communications:**

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Feel free to contact me for questions or to share ideas! To ensure quick response, start your message subject line with **ITS 302**. I will reply to your messages within 48 hours.

If this course is being offered in a virtual mode using Canvas & Zoom, the delivery of the course content will include lectures, videos, discussions, live demonstrations, and hands-on training activities.

All lecture slides will be posted on Canvas. Read the class announcement posted on Canvas to stay current with course matters.

Submit assignments on Canvas. Do not email them to the instructor.

**How to Be Successful in This Course:**

Readings for each week will be given in advance and it will be the responsibility of the student to complete the readings and contribute to the class discussions based on the readings. Read the assigned materials prior to the class for which they are assigned, and be prepared to refer to passages or issues of interest to you during our discussions

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### **Texts/Resources/Materials:**

The required textbook for this course will be listed on the course's Canvas site and available for purchase from the VolBooks, the VolShop's online bookstore.

### **Required Equipment:**

A personal computer, headset and microphone are required for this course. Any additional required or recommended equipment will be discussed during the first course meeting.

### **Course Resources:**

All course resources will be available through the course's Canvas site. They may include:

"Transdisciplinary Research and Practice for Sustainability Outcomes" edited by Katri Huutoniemi and Michaela Spencer

"Transdisciplinary Research: Theory and Practice" by Julie Thompson Klein

Relevant research papers and case studies showcasing successful transdisciplinary projects

Online resources on design thinking and collaborative problem-solving

### **Course Requirements, Assessments, and Evaluations:**

Class Participation: 15%

Research Design and Proposal: 25%

Group Research Project: 40%

Final Presentation and Reflection: 20%

### **Key Campus Resources for Students:**

[Center for Career Development and Academic Exploration](#) (Career counseling and resources; Handshake job search system)

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### Course Outline:

#### **Week 1-2: Introduction to Transdisciplinary Research**

Defining transdisciplinary research and its significance

Characteristics of complex problems requiring transdisciplinary approaches

Ethical considerations in transdisciplinary research

#### **Week 3-4: Research Design and Problem Framing**

Developing research questions that require interdisciplinary insights

Formulating transdisciplinary research hypotheses

Creating research designs that integrate diverse methodologies

#### **Week 5-6: Qualitative Research Methods**

Overview of qualitative research paradigms

Techniques such as interviews, focus groups, and content analysis

Analyzing qualitative data within transdisciplinary contexts

#### **Week 7-8: Quantitative Research Methods**

Introduction to quantitative research principles

Surveys, experiments, and statistical analysis in interdisciplinary research

Integrating quantitative and qualitative data for holistic insights

#### **Week 9-10: Mixed-Methods Research**

Combining qualitative and quantitative approaches

Designing mixed-methods studies for complex problem-solving

Analyzing and interpreting mixed-methods data

#### **Week 11-12: Collaborative Data Collection and Integration**

Strategies for collecting data across disciplines

Methods for integrating data from multiple sources

Handling data discrepancies and triangulating findings

**Week 13-14: Case Studies in Transdisciplinary Research**

Analyzing successful and unsuccessful transdisciplinary research projects  
 Identifying challenges and best practices in interdisciplinary collaboration  
 Extracting lessons and insights from case studies

**Week 15: Future Trends in Transdisciplinary Research and Reflection**

Emerging trends in transdisciplinary research methodologies  
 Students reflect on their learning and growth as transdisciplinary researchers  
 Final presentations of group research projects

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## **ITS 401: Advanced Transdisciplinary Research Concepts, Fall 2024**

College of Emerging and Collaborative Studies, University of Tennessee, Knoxville

*Course Section:* ITS 401

*Meeting Time and Place:* TBD

*Course Credit Hours:* 3

**Faculty Contact Information:** TBD

### **Course Description/Information:**

This course aims to delve into the advanced concepts, methods, and challenges associated with transdisciplinary research. It will equip students with the skills and knowledge necessary to conduct research that transcends traditional disciplinary boundaries, fostering innovative problem-solving and collaboration.

### **Value Proposition:**

In the rapidly evolving landscape of research and innovation, the ability to collaborate effectively within diverse and interdisciplinary teams is paramount. This course empowers students with the knowledge, skills, and attitudes essential for thriving in this collaborative ecosystem. By fostering a deep understanding of collaboration theories, communication strategies, conflict resolution techniques, and leadership principles, this course equips students with the tools they need to excel in complex scientific projects.

### **Student Learning Outcomes/Objectives:**

- Understand the principles and philosophy of transdisciplinary research.
- Explore advanced methods for integrating diverse disciplines in research projects.
- Analyze case studies of successful transdisciplinary research.
- Develop critical thinking and problem-solving skills necessary for tackling complex, real-world issues.
- Collaborate effectively with colleagues from different disciplines.
- Identify and address challenges and ethical considerations in transdisciplinary research.

**Learning Environment:**

This course may be offered in either an in-person or online format. The in-person course will meet on campus at its regularly scheduled time. The online course option offers course content asynchronously and using Canvas, the University of Tennessee's Learning Management System. Synchronous sessions will be conducted using Zoom [if applicable]. Additional [Canvas](#) and [Zoom](#) resources are available for students unfamiliar with these online environments.

**Course Communications:**

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#### **Course Outline:**

##### **Week 1: Introduction to Transdisciplinary Research**

Defining transdisciplinary research  
Historical development and evolution  
Philosophical underpinnings



**Week 2: Transdisciplinary Research Frameworks**

Multi-, inter-, and transdisciplinary distinctions  
Complex problem-solving approaches  
The role of systems thinking

**Week 3: Integrating Diverse Disciplines**

Methods for interdisciplinary collaboration  
Overcoming disciplinary barriers  
Developing a transdisciplinary research team

**Week 4: Case Studies in Transdisciplinary Research**

Examining successful transdisciplinary projects  
Lessons learned from real-world examples

**Week 5: Ethical Considerations in Transdisciplinary Research**

Ethical challenges in interdisciplinary work  
Responsible conduct of research  
Ethical decision-making frameworks

**Week 6: Data Collection and Analysis**

Collecting and managing diverse data sources  
Advanced statistical and analytical techniques  
Visualization of complex data

**Week 7: Communication and Knowledge Transfer**

Effective communication in transdisciplinary research  
Knowledge transfer strategies  
The role of stakeholders and the public

**Week 8: Midterm Exam****Week 9: Transdisciplinary Research in Practice**

Project development and management  
Funding and grant writing  
Evaluating research impact

**Week 10: Challenges and Critiques**

Common challenges and obstacles  
Critiques of transdisciplinary research  
Strategies for addressing criticism

**Week 11: Future Trends and Innovations**

Emerging trends in transdisciplinary research  
 Incorporating technology and AI  
 Preparing for the future of interdisciplinary work

### **Week 12: Final Project Presentations**

Students present their transdisciplinary research project proposals.

### **Week 13: Final Project Presentations (Continued)**

Continued presentations and peer feedback.

### **Week 14: Final Project Submission and Reflection**

Submission of the final transdisciplinary research project.

Reflecting on the course and its impact on students' research perspectives.

### **Week 15: Course Review and Wrap-Up**

Course review

Preparing for the next steps in transdisciplinary research

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THE UNIVERSITY OF  
TENNESSEE  
KNOXVILLE

### **ITS 492: Internship, Fall 2024**

College of Emerging and Collaborative Studies, University of Tennessee, Knoxville

*Course Section:* ITS 492

*Meeting Time and Place:* TBD

*Course Credit Hours:* 3

**Faculty Contact Information:** TBD

#### **Course Description/Information:**

Designed to offer students practical work experience related to their core skill sets in a professional setting. This course facilitates applying classroom learning to real-world situations, fostering personal and professional growth. Students will work closely with industry professionals, apply their knowledge and skills, and reflect on their experiences to enhance their readiness for future career opportunities.

**Prerequisites:** completion of required and pertinent advanced courses relevant to the student's Internship. Written permission of advisor and approval of internship coordinator. May be repeated with written permission.

#### **Value Proposition:**

In the rapidly evolving landscape of research and innovation, the ability to collaborate effectively within diverse and interdisciplinary teams is paramount. This course empowers students with the knowledge, skills, and attitudes essential for thriving in this collaborative ecosystem. By fostering a deep collaboration with industry professionals, apply their knowledge and skills, and reflect on their experiences to enhance their readiness for future career opportunities.

**Student Learning Outcomes/Objectives:**

Students will set personal and professional development goals based on their internship experience.

Students will better understand the specific industry or field in which the internship is based. Students will expand their professional network by connecting with colleagues, mentors, and industry professionals.

Students will actively seek networking opportunities within the organization and industry.

Students will adapt to changing work environments, tasks, and priorities as required by the internship experience.

**Learning Environment:**

This course will be completed off campus at the location of the company or remotely via online working arrangements.

**Course Communications:**

Students are responsible for maintaining communication with the instructor and site supervisor.

**How to Be Successful in This Course:**

Set clear goals with your instructor and supervisor.

Be punctual and reliable.

Learn and be flexible to adapt to real-world challenges.

Ask questions!

Be flexible.

Communicate effectively.

Build relationships.

**Texts/Resources/Materials:**

No required readings, your supervisor and advisor may prescribe you recommended readings.

**Required Equipment:**

A personal computer, headset and microphone are required for this course. Any additional required or recommended equipment will be discussed during the first course meeting.

**Course Resources:**

Selected articles, reports, and online resources will be provided throughout the course.

**Course Requirements, Assessments, and Evaluations:**

Student activity log, report from the supervisor and learning goals will be evaluated by the instructor to determine the grade for this course.

### Key Campus Resources for Students:

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## **ITS 399: Junior Capstone, Fall 2025**

College of Emerging and Collaborative Studies, University of Tennessee, Knoxville

*Course Section:* ITS 399

*Meeting Time and Place:* TBD

*Course Credit Hours:* 3

**Faculty Contact Information:** TBD

### **Course Description/Information:**

This course is designed to equip students with the knowledge and skills necessary work in transdisciplinary team in collaborative real life projects.

### **Value Proposition:**

In the rapidly evolving landscape of research and innovation, the ability to collaborate effectively within diverse and interdisciplinary teams is paramount. This course empowers students with the knowledge, skills, and attitudes essential for thriving in this collaborative ecosystem. By fostering a deep understanding of collaboration theories, communication strategies, conflict resolution techniques, and leadership principles, this course equips students with the tools they need to excel in complex scientific projects.

### **Student Learning Outcomes/Objectives:**



**Learning Environment:**

This course may be offered in either an in-person or online format. The in-person course will meet on campus at its regularly scheduled time. The online course option offers course content asynchronously and using Canvas, the University of Tennessee's Learning Management System. Synchronous sessions will be conducted using Zoom [if applicable]. Additional [Canvas](#) and [Zoom](#) resources are available for students unfamiliar with these online environments.

**Course Communications:**

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Feel free to contact me for questions or to share ideas! To ensure quick response, start your message subject line with **ITS 201**. I will reply to your messages within 48 hours.

If this course is being offered in a virtual mode using Canvas & Zoom, the delivery of the course content will include lectures, videos, discussions, live demonstrations, and hands-on training activities.

All lecture slides will be posted on Canvas. Read the class announcement posted on Canvas to stay current with course matters.

Submit assignments on Canvas. Do not email them to the instructor.

**How to Be Successful in This Course:**

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#### **Texts/Resources/Materials:**

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#### **Required Equipment:**

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#### **Course Requirements, Assessments, and Evaluations:**

Class participation and engagement in discussions

Individual or group data analysis projects using real-world datasets

Presentations showcasing data visualization and analysis techniques

Quizzes and exams assessing understanding of concepts and methods

Final project:

#### **Key Campus Resources for Students:**

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## ITS 499: Junior Capstone, Fall 2025

College of Emerging and Collaborative Studies, University of Tennessee, Knoxville

**Course Section:** ITS 499

**Meeting Time and Place:** TBD

**Course Credit Hours:** 3

**Faculty Contact Information:** TBD

### Course Description/Information:

This course is designed to equip students with the knowledge and skills necessary work in transdisciplinary team in collaborative real life projects.

### Value Proposition:

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### Student Learning Outcomes/Objectives:

#### Learning Environment:

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## DATA 101: Data Knowledge and Discovery

Fall 2024

LECTURES: Mondays and Wednesdays, 11:30am – 12:20, Perkins Hall 319

LAB SESSIONS: Fridays, 11:30am – 12:20pm, online via Zoom

INSTRUCTOR: Alex Bentley, [rabentley@utk.edu](mailto:rabentley@utk.edu)

LAB INSTRUCTOR: Nick Sokol [nsokol44@gmail.com](mailto:nsokol44@gmail.com)

**Course Overview:** DATA 201 will focus on data from a variety of fields. The course will introduce the essential elements of data science: (i) collection and management; (ii) exploring and visualizing data, (iii) modeling, (iv) computing, and (v) larger picture. Students will also gain hands-on experience using basic Python programming commands. *No prerequisites, satisfies Gen Ed-QR.*

In this semester, we use a powerful, freely-available software platform, Anaconda (Installation: see last two pages of this syllabus), which we use all semester. For this reason, we ask that all students use their own laptop computer Friday labs and assignments.

Text: Weekly class Jupyter notebooks, via Canvas (online, free)

**Methods of Instruction:** Mondays and Wednesdays lectures in the classroom; Fridays are online coding lab sessions (via Zoom) where students are assisted with a practical exercise (Jupyter notebook) made available on Canvas earlier in the week. If students finish the practical before Friday, they do not need to attend the lab session. The Friday coding labs are on Zoom, because it facilitates sharing of screens and is good for learning coding in a group.

**Objectives. By the end of this course, you should be able to:**

- Understand the steps of data science from data collection to interpretation.
- Distinguish different ways of collecting data.
- Manage, summarize and visualize data using the Python programming language.
- Apply regression methods and assess the quality of predictions.

### **Assessment (all submitted via Canvas)**

- Ten homework/lab assignments: 10pts each, 100 pts total
- Final exam (December, TBA): 25 points
- Attendance to Monday & Wednesday lectures: 25 points
- Total: 150 points

Each lab is posted on Canvas on Monday, we work on it/discuss it on Friday, and it is due on the next Monday evening (you can turn it in early). See schedule below. If you have completed and turned in the lab before Friday, you don't have to attend lab.

Schedule of topics covered

Lecture Monday	Lecture Wednesday	Coding lab Friday	Read
	23 Aug: Data science	25 Aug: Install Anaconda	1
28 Aug: Causality and observation	30 Aug: Python & Jupyter	1 Sept: Lab 1–Python	2,3
4 Sept: LABOR DAY (Lab 1 due)	6 Sept: Data Types	8 Sept: Lab 2–Data types	4
11 Sept: Sequences (Lab 2 due)	13 Sept: Sequences practice	15 Sept: 3–Arrays	5
18 Sept: Data frames (Lab 3 due)	20 Sept: Data frames practice	22 Sept: Lab 4–Data frames	6
25 Sept: Visualizing (Lab 4 due)	27 Sept: Visualizing practice	29 Sept: Lab 5–Plots	7
2 Oct: Functions (Lab 5 due)	4 Oct: Functions practice	6 Oct: Lab 6–Functions	8
14 Oct: FALL BREAK	11 Oct: Conditionals	13 Oct: Catch-up	9
16 Oct: Probability (Lab 6 due)	18 Oct: Sampling	20 Oct: Lab 7–Randomness	10
23 Oct: Hypotheses (Lab 7 due)	25 Oct: A/B testing	27 Oct: Lab 8–Hypotheses	11,12
30 Oct: Estimation (Lab 8 due)	1 Nov: Confidence intervals	3 Nov: Lab 9–A/B testing	13,14
6 Nov: Correlation (Lab 9 due)	8 Nov: Regression	10 Nov: Lab 10–Prediction	15
13 Nov: Prediction (Lab 10 due)	15 Nov: Multivariate prediction	17 Nov: Chat GPT	16
20 Nov: Chat GPT	22 Nov: THANKSGIVING	24 Nov: THANKSGIVING	
4 Dec: Looking ahead	6 Dec: Review		
December TBA: EXAM			

## DATA 102: DATA STEWARDSHIP AND ETHICS

**Meeting Time and Place:**

Tuesday & Thursday, 11:20 am - 12:35pm  
HSS 206

**Sections:** All sections

**Course Credit Hours:** 3 credit hours

support these activities. Students will also learn differences among data and records management principles and practices across diverse settings and data types, and examine the legal, ethical, and technological challenges in developing and implementing policies for managing data.

Satisfies Gen. Ed. - Global Challenges.

**Student Learning Objectives**

- Students completing DATA 301 should be able to...
- be ethical and responsible managers and users of data
- consider the consequences of data use and its impact on various stakeholders,
- know how to maintain and add value to data to increase its usability, usefulness, and quality.

**Course Design**

This course will include a mix of traditional readings and multimedia materials. Students will complete weekly quizzes, as well as larger assignments throughout the semester. The course includes a mix of individual and group work.

**Required Text(s)**

All required and recommended course materials will be provided via Canvas.

**Assignments**

This table provides a brief summary of assignment by name, due date, point value and percentage of final grade. A full description of the assignments can be found in Canvas.

All assignments will be submitted and graded in Canvas.

Assignment	Point Value	Percentage of Final Grade	Due Date
<a href="#">Weekly Quizzes</a>	15	15	ongoing
<a href="#">Weekly Labs/Activities</a>	30	30	ongoing
<a href="#">Discussion Lead</a>	15	15	ongoing
<a href="#">Open Science Comic</a>	15	15	Week 5
<a href="#">Dataset Selection</a>	p/f	-	Week 7
<a href="#">What Gets Counted Counts</a>	25	25	Week 14
Course Evaluation*	2	*	-
<b>TOTAL</b>	<b>100</b>	<b>100</b>	

*\*If 90% of the students in class complete the course evaluation at the end of the semester, I will add up to 2 points to everyone's final grade as a bonus.*

Week	Tuesday	Thursday	Topic
1	1/24	1/26	Introduction: What Are Data?
2	1/31	2/2	Understanding Digital Objects, Data Lifecycle Models
3	2/7	2/9	Open Science & Open Data
4	2/14	2/16	Repositories, Roles, & Responsibilities
5	2/21	2/23	Data Management Planning & Data Curation Profiles
6	2/28	3/2	Organization, Description, & Metadata
7	3/7	3/9	Data Quality
-	-	-	<i>spring break</i>
8	3/21	3/23	Access & FAIRness
9	3/28	3/30	Sharing & Reuse
10	4/4	-	Privacy
11	4/11	4/13	Threat Assessments & Risk Management
12	4/18	4/20	Long-Term Preservation
13	4/25	4/27	Climate & Sustainability
14	5/2	5/4	Presentations/Wrap-Up
15	5/9	-	Presentations/Wrap-Up

## DATA 203: Analytical Methods of Data Science

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Class sessions: TR 9:45 am – 11:00 am, Perkins Hall 218

Instructor: Nana Bryan (PhD)

Office hours: MW 10:00 am – 12:00 pm or by appointment

SMC 205

Email: [nvepkhva@utk.edu](mailto:nvepkhva@utk.edu)

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### Course Description and Information

DATA 302 examines modern algorithms and methods in data science with a focus on how, why, and when each of these tools work. Topics will be drawn from statistics, machine learning, and optimization.

**Course Notes:** Course lecture notes will be available through Canvas.

**Software:** Nearly all work in this course will be done using Python.

### Course objectives

At the end of the class students should be able to

- propose an appropriate probability model based on the phenomenon being studied, fit it using data, and assess the fit;
- develop the most appropriate predictive model by auditioning and assessing a variety of machine learning models using the Python programming language;
- explain how each model in the predictive analytics toolbox works;
- be comfortable using popular clustering methods like K-Means and understand what they do and do not tell us about the data

### Topics covered

- Probability models
- Monte Carlo simulation
- Market Basket Analysis
- Maximum likelihood estimation
- Linear and Logistic Regression
- Tree-based models for learning, numerical prediction, and classification
- Selecting and validating a predictive model
- K-means and hierarchical clustering and its uses

## AI 101: Intro to the World of AI, Fall 2023

Course Webpage (<https://utk.instructure.com/courses/177618>)

Course Credit Hours: 3

Prerequisite(s): None

Meeting Time and Place: MWF 10:20-11:10 AM

Meeting Place: Ayres Hall G004

Exams: Final - December 8th 3:30-6:00 PM

### Faculty Contact Information

Dr. Joshua Fagan (<https://sites.google.com/vols.utk.edu/jfagan2>)

Email: [jfagan2@utk.edu](mailto:jfagan2@utk.edu)

Office Hours: By appointment only via Zoom (Meeting ID: 845 8563 2050)

### Course Description:

Introduction to foundational concepts, techniques, and applications of Artificial Intelligence (AI) relevant for all disciplines – especially across non-computer science fields. Explores the history and current scope of AI, data sources and tools, and fundamental components of AI solutions. Special attention will be placed on the strengths and weaknesses of the methods as well as on identifying bias, social impacts, and other ethical considerations of AI. Students will gain experience with hands-on activities using no-code AI platforms.

### Student Learning Outcomes/Objectives:

1. Explain the fundamentals of AI and how it relates to other fields.
  - a. Identify and describe different AI domains, such as machine learning, deep learning, natural language processing, and computer vision.
  - b. Summarize and explain the main components and processes involved in AI techniques, such as data preparation, feature engineering, and model evaluation.
  - c. Recall key concepts and terminology related to AI.
2. Evaluate the performance and effectiveness of AI models and techniques.
  - a. Compare and contrast different AI models and techniques to identify strengths, weaknesses, and trade-offs.
  - b. Explain the limitations and challenges of AI, such as interpretability, transparency, robustness, and data quality.
3. Apply AI techniques to real-world problems, using critical thinking and problem-solving skills to analyze data and make decisions.

- a. Design and implement AI algorithms and models using popular No-Code/Low-Code solutions.
  - b. Collaborate effectively in interdisciplinary teams to develop AI solutions.
4. Evaluate the ethical and social implications of AI to identify potential biases, risks, and fairness concerns.
5. Collaborate and communicate effectively with peers and stakeholders in interdisciplinary teams.
6. Communicate effectively about AI concepts, techniques, and applications to both technical and non-technical audiences.
7. Be able to stay informed about the latest developments and trends in the field of AI and apply them to their own work.

### **Learning Environment:**

I prefer teaching a "flipped" style classroom where I assign lecture material that you go over outside of class, and then we use class time for more interactive activities. The lecture material assigned for outside consumption could be book readings, videos, AI tool demos, blog readings, or technical paper readings. The typical activities we will do in class will be more interactive discussions and working together on problems and challenges.

### **How to Be Successful in This Course:**

The general guideline for college courses is that students should spend about 2-3 hours per week outside of class for every credit hour. So, for this course, a student should expect to spend approximately 6-9 hours per week working on this course outside of class time. This includes time for reading, studying, completing assignments, preparing for exams/quizzes, and engaging in any other course-related activities. Keep in mind that the actual time required may vary depending on the individual student's learning style and prior knowledge of the subject.

### **Student's Responsibility**

- Be prepared for all classes. Be respectful of others
- Actively contribute to the learning activities in class
- Abide by the UT Honor Code
- Communicate concerns and confusion to me

### **Instructor's Responsibility**

- Be prepared for all classes. Evaluate all fairly and equally Be respectful of all students
- Create and facilitate meaningful learning activities Behave according to university codes of conduct
- Actively listen to concerns and confusions and work to find solutions or alternative methods of explanation

**Texts:**

There are no selected text books at this time. Extra readings will be made available on Canvas. Students are expected to read the assigned materials before classes so they can understand and actively participate in class discussion.

**Attendance**

AI is a highly interdisciplinary field and working in an environment where we can collaborate and have discussions with a diverse group of peers is invaluable. As such, attendance is required in this class. We will discuss finer points in class that likely just reading content on your own would not provide. We will also have more practice in class, and you will be able to ask questions.

Attendance and participation are set at 10% of the final grade. Those with 90% or higher rate of attendance will receive the full 10% of their final course score. The fact that 90% counts for full attendance credit is introduced to adjust for eventual unavoidable situations when students might not be able to attend, so no absence will be excused for the attendance rate, unless it is an extended absence and we have worked out a solution well in advance.

**Assessments and Grading:**

We will have:

- No/Low Code problem-based assignments
- Final Exam.

This course will be graded as follows:

Attendance and general participation	10%
Discussions	20%
Lab assignments	50%
Final	20%

**Schedule**

Here is our tentative schedule. I reserve the right to make adjustments as needed as we go through the material.



#	Date	Module	Other
1	8/28-9/1	Foundations of Artificial Intelligence	
2	8/6-8/8	Introduction to Ethics in AI	No class Monday: Labor Day
3	9/11-9/15	Understanding Data	
4	9/18-9/20	Evaluating AI Solutions	No class Friday: AI Symposium
5	9/25-9/29	Introduction to AI Tools	
6	10/2-10/6	Machine Learning with No-Code Tools	
7	10/11-10/13	Deep Learning with No-Code Tools	No Class Monday: Fall Break
8	10/16-10/20	Natural Language Processing with No-Code Tools	
9	10/23-10/27	Computer Vision with No-Code Tools	
10	10/30-11/3	Intelligent Agents, Robotics, and Expert Systems	
	12/8	Final Exam	1:30-3PM

## Course Tools

You will need a laptop that can connect to the internet to use the wide array of AI tools we will explore in our classes.

## Course Policies

### Homework Policy

Homework will be posted on Canvas.

**Assignments are individual!** We will work together during class, and I encourage questions and discussions; you can work with someone else and ask for help, but you should be able to understand the ideas and write your own solutions!

**Note:** Do not use Canvas' assignment comments to contact me about HW. Please just write me an email. I do not get notified about comments made on HW and it will likely go unnoticed for longer than if you email me.

### Web Tools

You are welcome to look up anything you need online to get help understanding concepts.

### Late Homework Policy

Late homework will incur a penalty of 10% per day (prorated accordingly) unless a valid excuse is provided. Moreover, assignments over 5 (calendar) days late will not be graded (and receive 0 points), unless again a valid excuse is provided.

Note that Canvas automatically applies the penalty. If you provided an excuse for a late HW that was accepted, it is your responsibility to check Canvas to make sure that your grade is correct (with no extra penalty). If it is not, you must contact me by email so that I can manually fix it.

### Legal Issues

#### Conduct

All students should be familiar with Hilltopics (<https://hilltopics.utk.edu/>), Students Code of Conduct (<https://hilltopics.utk.edu/student-code-of-conduct/>) and maintain their Academic Integrity: Academics (<https://hilltopics.utk.edu/academics/>).

#### Integrity

Study, preparation, and presentation should involve at all times the student's own work, unless it has been clearly specified that work is to be a team effort. Academic honesty requires that the student present their own work in all academic projects, including tests, papers, homework, and class presentations. When incorporating the work of other scholars and writers into a project, the student must accurately cite the source of that work. For additional information, see the applicable catalog (<https://catalog.utk.edu/>) or

the UT Libraries (<http://www.lib.utk.edu/instruction/plagiarism>) site. See also the Student Code of Conduct (<https://studentconduct.utk.edu/standards-of-conduct-overview/>) and Honor Statement (below).

All students should follow the Honor Statement (also from Hilltopics (<https://hilltopics.utk.edu/>) Academics: <https://hilltopics.utk.edu/academics/>

### **Honor Statement**

"An essential feature of the University of Tennessee, Knoxville, is a commitment to maintaining an atmosphere of intellectual integrity and academic honesty. As a student at the university, I pledge that I will neither knowingly give nor receive any inappropriate assistance in academic work, thus affirming my own personal commitment to honor and integrity."

You should also be familiar with the Classroom Behavior Expectations

(<https://web.math.utk.edu/~finotti/files/ClassroomBehaviorExpectations.pdf>).

**We are in an honor system in this course!**

### **Disabilities**

Students with disabilities that need special accommodations should contact the Student Disability Services (<https://sds.utk.edu/>) and bring me the appropriate letter/forms.

### **Discrimination and Harassment**

For Discrimination and Harassment (<https://oed.utk.edu/complaints/>), please visit the Office of Equity and Diversity (<https://oed.utk.edu/>).

### **Campus Syllabus**

Please, see also the Campus Syllabus (<https://utk.instructure.com/courses/55015/pages/ut-knoxville-campus-syllabus-%7C-2022-2023>).

## AI 102: Natural Language-based Programming Techniques

**Course Credit Hours:** 3

**Meeting Time:** TBD

**Meeting Place:** TBD

**Instructor:** TBD

### Course Description:

In this foundational course, students will delve deeply into the field of Natural Language Processing (NLP), exploring its significance and applications in today's tech-driven world. The course will elucidate the intersection of natural language and programming, arming students with the necessary tools and techniques to manipulate, analyze, and interpret human language using computational methods. Emphasizing both theoretical understanding and hands-on experiences, students will gain insights into how machines understand and respond to human language, laying the groundwork for advanced studies in AI and machine learning.

### Student Learning Outcomes/Objectives:

Upon successful completion of this course, students will be able to:

1. Understand and explain the foundational principles of natural language and its computational representations.
2. Employ basic string processing, text normalization techniques, and regular expressions in text processing.
3. Utilize tokenization, stemming, and lemmatization for efficient language processing.
4. Implement simple to intermediate language-based applications using common NLP libraries and tools.
5. Analyze and interpret the results of NLP techniques in real-world applications.

### Recommended Texts:

"Speech and Language Processing" by Daniel Jurafsky and James H. Martin

"Natural Language Processing with Python" by Steven Bird, Ewan Klein, and Edward Loper

### Grading:

- Class Participation: 10%
- Homework Assignments: 50%
- Midterm Exam: 20%
- Quizzes: 10%
- Final Exam: 20%

## AI 301: Natural Language Processing and Conversational AI

**Course Credit Hours:** 3

**Meeting Time:** TBD

**Meeting Place:** TBD

**Instructor:** TBD

### Course Description:

"Natural Language Processing and Conversational AI" offers students an immersive experience in the world of human-computer linguistic interactions. This course delves deeper into the advanced mechanisms of NLP, expanding upon tokenization, sentiment analysis, and machine translation. Through a mix of theoretical lectures and hands-on labs, students will be exposed to the development of chatbots, voice assistants, and other conversational interfaces, understanding the nuances of creating machines that can understand and generate human language effectively and naturally.

### Student Learning Outcomes/Objectives:

1. Understand the advanced principles of natural language processing and its computational applications.
2. Develop and fine-tune conversational agents tailored to specific user needs.
3. Analyze and process large volumes of text data, extracting meaningful insights.
4. Grasp the challenges of machine translation and the current solutions in place.

### Recommended Texts:

"Foundations of Statistical Natural Language Processing" by Christopher D. Manning and Hinrich Schütze

### Grading:

- Class Participation: 10%
- Homework Assignments: 40%
- Midterm Exam: 20%
- Quizzes: 10%
- Final Exam: 20%

## AI 302: AI-based Data Handling and Visualization

**Course Credit Hours:** 3

**Meeting Time:** TBD

**Meeting Place:** TBD

**Instructor:** TBD

### Course Description:

This course focuses on the pivotal role of data in AI systems, teaching students how to manage, process, and visualize information using AI techniques. Emphasizing real-world applications, students will be introduced to various AI tools for data preprocessing, analysis, and visualization. The course will also touch upon the challenges of working with high-dimensional data, and the solutions AI offers in transforming such data into comprehensible and actionable insights.

### Student Learning Outcomes/Objectives:

1. Understand the principles of data handling and management in AI-driven tasks.
2. Utilize AI algorithms to process, analyze, and visualize complex datasets.
3. Transform raw data into meaningful insights using AI tools.
4. Recognize the challenges and pitfalls of data management in AI and devise strategies to overcome them.

### Recommended Texts:

"Python for Data Analysis" by Wes McKinney

"Data Visualization: A Practical Introduction" by Kieran Healy

### Grading:

- Class Participation: 10%
- Homework Assignments: 40%
- Midterm Exam: 20%
- Quizzes: 10%
- Final Exam: 20%

# CYBR 101: Introduction to Cybersecurity Concepts

## Course Description

Provides foundational training and knowledge in and a broad overview of cybersecurity concepts and the field, including the nature of cyber-attacks on computers and networks and identification and mitigation of attacks from the perspective of applications in real-world scenarios and sectors. Human factors in cybersecurity, ethics, privacy, and the governance and policy around cybersecurity, in addition to the terminology, approaches, and underlying technologies used in cybersecurity, are also covered.

## Course Learning Outcomes

1. Understand the fundamental concepts and principles of cybersecurity, including the nature of cyber-attacks, vulnerabilities, threats, and risks.
  - a. Explain the key terms, concepts, and principles related to cybersecurity, such as confidentiality, integrity, availability, and risk management.
2. Identify and assess common types of cyber-attacks on computers and networks, such as malware, phishing, social engineering, and denial-of-service attacks.
3. Apply practical techniques to secure digital assets.
  - a. Acquire hands-on skills in implementing security measures, such as setting up firewalls, configuring secure network connections, and employing encryption methods to protect data and communication channels.
4. Recognize the importance of human factors in cybersecurity, including user awareness, behavior, and responsibility in protecting information systems.
  - a. Identify, investigate, and respond to security incidents, including incident detection, containment, eradication, and recovery strategies.
  - b. Cultivate a proactive approach to cybersecurity, promoting responsible digital behavior, and adopting best practices.
5. Analyze ethical and legal considerations in cybersecurity
  - a. Ethical considerations including privacy, data protection, and responsible use of technology.
  - b. Evaluate the governance and policy frameworks that shape cybersecurity practices in various sectors, such as government, healthcare, finance, and education.
6. Communicate effectively about cybersecurity concepts, issues, and best practices, both orally and in writing, to diverse audiences.
7. Explore and stay updated on emerging trends, threats, and technologies in the field of cybersecurity, fostering a lifelong learning mindset.

## Modules

### Module 0: Course Welcome

1. [Module X: Introduction to Cybersecurity](#)
  - a. Overview of cybersecurity as a field
  - b. Importance of cybersecurity in today's interconnected world
  - c. Historical context and evolution of cyber threats
  - d. Understanding the digital landscape
2. [Module X: Understanding Vulnerabilities and Threats](#)
  - a. Common vulnerabilities in computer systems and networks
  - b. Threat modeling and risk assessment
  - c. Methods for identifying and categorizing threats

3. **Module X: Fundamentals of Cyber Attacks**
  - a. Different types of cyber-attacks (e.g., malware, social engineering, phishing)
  - b. Techniques used by attackers and their motivations
  - c. Case studies of prominent cyber-attacks
4. **Module X: Fundamentals of Information Security**
  - a. Explore confidentiality, integrity, availability, and non-repudiation
  - b. Study encryption, authentication, access control, and secure communication.
5. **Module X: Security Technologies and Tools**
  - a. Overview of essential security technologies (e.g., firewalls, antivirus software)
  - b. Intrusion detection and prevention systems
  - c. Security assessment and penetration testing tools
6. **Module X: Human Factors in Cybersecurity**
  - a. The role of human behavior in cybersecurity
  - b. User awareness, training, and education
  - c. Social engineering and psychological manipulation techniques
7. **Module X: Ethics and Privacy in Cybersecurity**
  - a. Ethical considerations in cybersecurity practices
  - b. Privacy laws and regulations
  - c. Balancing security and privacy concerns
8. **Module X: Cybersecurity Governance and Policy**
  - a. Government and industry regulations related to cybersecurity
  - b. Cybersecurity frameworks and standards (e.g., NIST, ISO)
  - c. Incident response and disaster recovery planning
9. **Module X: Cryptography and Data Protection**
  - a. Principles of cryptography and encryption
  - b. Secure communication protocols (e.g., SSL/TLS)
  - c. Key management and digital signatures
10. **Module X: Network Security**
  - a. Network architecture, security zones, and vulnerabilities
  - b. Secure network protocols (e.g., VPN, SSH)
  - c. Wireless network security considerations
  - d. Intrusion detection systems, and virtual private networks (VPNs).
11. **Module X: Emerging Trends in Cybersecurity**
  - a. Current and emerging threats in cybersecurity
  - b. Advances in cybersecurity technologies (e.g., AI, blockchain)
  - c. Professional development and career opportunities in cybersecurity
12. **Module X: Incident Response and Disaster Recovery**
  1. Develop incident response plans
  2. Identify security incidents
  3. Implement effective recovery strategies

## References and Resources

TBD



# CYBR 102 Data Protection and Data Privacy

## Course Description:

This course provides an introduction to the principles, concepts, and practices of cybersecurity and data privacy. Students will explore the various aspects of securing information systems and protecting sensitive data in a digital world.

## Prerequisites:

None

## Course Objectives:

Upon completion of the course, students should be able to:

- Understand the fundamental principles and concepts of cybersecurity and data privacy.
- Identify common cyber threats and vulnerabilities.
- Apply security best practices to protect digital assets and sensitive information.
- Analyze legal and ethical aspects of data privacy.
- Develop and implement security policies and procedures.
- Demonstrate the ability to investigate and respond to security incidents.

Course Duration: One semester (15 weeks)

## Course Outline:

### **Week 1-2: Introduction to Cybersecurity and Data Privacy**

Defining cybersecurity and data privacy

Importance of cybersecurity in the digital age

Key terminology and concepts

### **Week 3-4: Cyber Threats and Attack Vectors**

Types of cyber threats (e.g., malware, phishing, DDoS)

Attack vectors and techniques

Case studies of cyberattacks

### **Week 5-6: Information Security Fundamentals**

Security principles (confidentiality, integrity, availability)

Security models and risk assessment

Security controls and countermeasures

### **Week 7-8: Network Security**

Network vulnerabilities and threats

Network security protocols (e.g., SSL/TLS, IPsec)

Firewalls and intrusion detection systems

### **Week 9-10: Application and System Security**

Secure coding principles

Secure software development lifecycle

Operating system and application security

**Week 11-12: Data Privacy and Regulations**

Privacy laws and regulations (e.g., GDPR, HIPAA)

Ethical considerations in data handling

Data encryption and protection mechanisms

**Week 13-14: Security Management and Incident Response**

Security policies and procedures

Incident response and recovery

Security awareness and training

**Week 15: Emerging Trends and Future of Cybersecurity**

Current and future cybersecurity trends

Guest speakers or industry experts

**Final exam and course review**

**Assessment:**

Weekly quizzes or assignments, Midterm examination, Final project or presentation, Final examination

**Textbook:**

"Principles of Computer Security: CompTIA Security+ and Beyond" by Dwayne Williams

**Additional Resources:**

Online articles, whitepapers, and case studies

Security tools and software for hands-on experience

## AI 311: AI for Cybersecurity

**Course Credit Hours:** 3

**Meeting Time:** TBD

**Meeting Place:** TBD

**Instructor:** TBD

### Course Description:

"AI for Cybersecurity" offers a deep dive into the symbiotic relationship between artificial intelligence and cybersecurity. In an era defined by evolving cyber threats, this course equips students with the knowledge to utilize AI-driven solutions for threat detection, mitigation, and response. Through hands-on labs and simulations, students will confront real-world cybersecurity scenarios, devising AI strategies to counteract and prevent cyberattacks.

### Student Learning Outcomes/Objectives:

1. Understand the foundational principles of cybersecurity and the challenges posed by modern cyber threats.
2. Apply AI tools and techniques to detect, analyze, and mitigate cyber threats.
3. Simulate real-world cybersecurity scenarios, leveraging AI for defense and response.
4. Analyze case studies of AI-driven cyberattacks and devise counter-strategies.

### Recommended Texts:

"Machine Learning and Security: Protecting Systems with Data and Algorithms" by Clarence Chio and David Freeman

Kaur, R., Gabrijelčič, D. and Klobučar, T., 2023. Artificial intelligence for cybersecurity: Literature review and future research directions. *Information Fusion*, p.101804.

### Grading:

- Class Participation: 10%
- Homework Assignments: 40%
- Midterm Exam: 20%
- Quizzes: 10%
- Final Exam: 20%

## Appendix D: Elective Course Descriptions

Electives in addition to the DATA, CYBR, and AAI courses

Electives for BS-ITS			
Course Number	Course Title	# SCH	Course Type
COSC 111	<b>Computational Thinking and the Art of Programming</b>	3	Existing
An introduction to the thought processes of computer science and the art of programming. Topics include learning to think algorithmically, and solving problems efficiently, using a high-level programming language and a variety of software tools and technologies. Skills learned include designing programs to solve problems, developing the algorithms needed, using abstractions, data structures and encapsulation, writing code to implement algorithms, testing the code for errors, and documenting the process and the outcome. This course welcomes students with limited or no programming experience.			
COSC 452	<b>Computer Graphics</b>	3	Existing
Digital image synthesis, geometric modeling, and animation. Topics may include visual perception, displays and color spaces, frame buffers, affine transformations, data structures for geometric primitives, visible surface determination, shading and texturing, anti-aliasing computing light transport, rendering equation, shader programming, general purpose GPU programming, level of detail, curves and surfaces, and graphics hardware.			
GEOG 333	<b>Climate Change and Human Response</b>	3	Existing
Controversies and uncertainties about present-day climate change, future climate scenarios and mitigation strategies, and individual and policy responses to climate predictions.			
INSC 484	<b>Database Applications</b>	3	Existing
Applying database models to develop applications using a database management system. Developing prototype client/server applications. Advanced Structured Query Language (SQL).			
ALEC 485	<b>Global Sustainable Development Goals</b>	3	Existing
The United Nations' (UN) Sustainable Development Goals (SDG) were adopted in 2015 and provide a framework and direction for all countries of the world towards 17 common global goals. The SDGs are goals towards which our global society has agreed and outline high-level targets in all spheres of human interaction with each other and the planet. This course will provide a transdisciplinary introduction and assessment of these global SDGs. The course will present each of the SDGs, look at global progress towards each SDG, and provide opportunities for students to explore the synergies of the SDGs. While emphasis will be placed on the global nature of the SDGs, this course will provide students with the opportunities to reflect on these goals and participate in multidisciplinary teams to develop action plans for addressing multiple SDGs as individuals and for the UT community.			
SOCI 465	<b>Social Values and the Environment</b>	3	Existing
Human dimensions of ecosystem management and public policy. An applied focus on how social values are activated within specific biophysical and social settings. Writing-emphasis course.			
ANTH 105	<b>Scene of the Crime: Demystifying Forensic Science</b>	3	Existing
This course gives students an overview of the history, practice, and problems of forensic science and crime scene investigation. Participants will learn about the application of scientific approaches to the collection			

and analyses of evidentiary material.			
<b>POLS 330</b>	<b>Law in American Society</b>	<b>3</b>	<b>Existing</b>
Law as a process through which social problems are addressed in the United States. Examples from case law, legislation, and administrative regulation. Writing-emphasis course.			
<b>POLS 435</b>	<b>Criminal Law and Procedure</b>	<b>3</b>	<b>Existing</b>
An overview of substantive and procedural law in the criminal justice field with emphasis on constitutional questions and public policy issues.			
<b>MUTC 330</b>	<b>Virtual Audio Modeling</b>	<b>3</b>	<b>Existing</b>
Development of the basic musical and technological skills required to create models or “mock-ups” of concert music scores via DAW (Digital Audio Workstation) and sample library technology. Projects will include models of students’ own works as well as those of chamber and large form masterworks from the canon.			
<b>MUTC 340</b>	<b>Introduction to Computer Music Transcription</b>	<b>3</b>	<b>Existing</b>
Exercise in notation, playback, and publishing incorporating elements of word processing, graphic design, sequencing, and page layout. Study of Music Instrument Digital Interface protocol as it applies to computer music workstation design.			
<b>FORS 101</b>	<b>Introduction to Forensic Studies</b>	<b>3</b>	<b>New</b>
This course provides an overview to the discipline of forensic studies and equips students with the basic terminology, concepts, and career pathways of forensic studies.			
<b>SUST 101</b>	<b>Introduction to Sustainability</b>	<b>3</b>	<b>New</b>
This course provides an overview to sustainable futures as outlined in the UN created sustainable development goals and equips students with the basic terminology, concepts and career pathways in sustainability and environment.			
<b>GAME 329</b>	<b>Game Design</b>	<b>3</b>	<b>New</b>
This course is designed to provide students with a comprehensive understanding of the theory and practice of game design. It covers the fundamental principles and techniques necessary for creating interactive and engaging games across various platforms, including video games, board games, and virtual reality experiences. Students will explore the multidisciplinary nature of game design, combining elements of art, programming, storytelling, and psychology to craft compelling gaming experiences.			
<b>GAME 399</b>	<b>Collaborative Game Design</b>	<b>3</b>	<b>New</b>
In this course, students from different disciplines with diverse skillset come together to develop a video game as a final capstone project with all the elements needed for a complete video game.			

Source: 2023-24 UTK Undergraduate Catalog

## Appendix E: Assessment Documents

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### Sample Assessment Document

**Institution:** University of Tennessee Knoxville

**Program:** Bachelor of Science in Innovative Transdisciplinary Studies

**Date:** [Date]

#### Annual Program Assessment Report

1. **Program Objective:**  
Ensure students gain comprehensive knowledge and practical skills in transdisciplinary studies to excel in the industry or further studies.
2. **Enrollment & Graduation:**
  - Total students enrolled: [Number]
  - Total graduates: [Number]
3. **Student Performance Metrics:**
  - Average GPA: [Value]
  - Capstone project success rate: [Value]%
4. **Faculty Metrics:**
  - Faculty-student ratio: [Value]
  - Faculty publications: [Number]
5. **Feedback Analysis:**
  - Student satisfaction rate: [Value]%
  - Faculty satisfaction rate: [Value]%
6. **Industry Collaboration Outcome:**
  - Internships secured: [Number]
  - Placement rate: [Value]%
7. **Areas of Improvement Identified:**
  - [Area 1]: [Suggested improvements]
  - [Area 2]: [Suggested improvements]
8. **Future Plans:**
  - Curriculum updates based on latest AI trends.
  - Enhance industry partnerships.

This assessment report is based on data collected throughout the academic year and aims to ensure continuous improvement of the BS-ITS program.

## Sample Employer Survey: Applied AI Program Graduates Feedback

**Institution:** University of Tennessee, Knoxville

**Program:** Bachelor of Science in Innovative Transdisciplinary Studies

**Date:** [Date]

Dear [Employer Name],

We kindly request your feedback on the performance of our graduates from the ITS program who are currently employed at your organization. Your insights will help us evaluate and continuously improve our program.

**Company Name:** \_\_\_\_\_

**Respondent's Name and Position:** \_\_\_\_\_

**Duration of employing the graduate(s):** \_\_\_\_\_

Please rate the following statements on a scale of 1 to 5, where:

1 = Strongly Disagree

2 = Disagree

3 = Neutral

4 = Agree

5 = Strongly Agree

- 1) The graduate demonstrates a strong foundational knowledge of in transdisciplinary studies concepts and techniques.
- 2) The graduate applies in transdisciplinary studies techniques effectively to solve real-world problems.
- 3) The graduate is aware of the ethical, social, and legal implications of in transdisciplinary studies applications.
- 4) The graduate collaborates well with team members from diverse disciplines.
- 5) The graduate exhibits strong problem-solving skills, especially in transdisciplinary studies scenarios.
- 6) The graduate adapts quickly to emerging in transdisciplinary studies trends and technologies.
- 7) The graduate communicates complex transdisciplinary studies concepts effectively to both technical and non-technical team members.
- 8) The graduate demonstrates professionalism and a strong work ethic.

**Open-ended Questions:**

1. Please provide specific strengths you've observed in our in transdisciplinary studies program graduate(s).
  - Response: \_\_\_\_\_
2. Are there any areas of improvement you suggest for our in transdisciplinary studies program based on your experience with our graduate(s)?
  - Response: \_\_\_\_\_
3. Would you be interested in continuing to hire graduates from our in transdisciplinary studies program in the future?
  - Response: Yes/No
4. Any additional comments or feedback:
  - Response: \_\_\_\_\_



## Sample Transdisciplinary Program Assessment Rubric

**Institution:** University of Tennessee Knoxville

**Program:** Bachelor of Science in Innovative Transdisciplinary Studies

**Date:** [Date]

### Assessment Criteria:

**Interdisciplinary Collaboration (IC):** To what extent do participants demonstrate the ability to collaborate across disciplines effectively?

Poor (1)

Fair (2)

Good (3)

Excellent (4)

**Integration of Knowledge (IK):** How well do participants integrate knowledge from various disciplines to solve complex problems?

Poor (1)

Fair (2)

Good (3)

Excellent (4)

**Critical Thinking (CT):** How effectively do participants engage in critical thinking and analysis, incorporating multiple perspectives and methods?

Poor (1)

Fair (2)

Good (3)

Excellent (4)

**Communication (COM):** How well do participants communicate their ideas, findings, and solutions across disciplines?

Poor (1)

Fair (2)

Good (3)

Excellent (4)

**Application of Transdisciplinary Skills (TS):** To what extent do participants apply transdisciplinary skills in real-world situations?

Poor (1)

Fair (2)

Good (3)

Excellent (4)

Ethical and Social Responsibility (ESR): How well do participants demonstrate ethical awareness and social responsibility in their transdisciplinary work?

Poor (1)

Fair (2)

Good (3)

Excellent (4)

Overall Assessment:

Inadequate (1-6)

Developing (7-12)

Proficient (13-18)

Exemplary (19-24)

Comments:

[Provide specific comments on each criterion, highlighting strengths and areas for improvement. Include examples or evidence where possible.]

Recommendations:

[Offer recommendations for program improvement based on the assessment, such as changes to curriculum, teaching methods, or additional resources.]

## Appendix F: Faculty Curricula Vitae

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## Curriculum Vitae: 2023

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### MEHMET AYDENIZ, Ph.D.

Department of Theory and Practice in Teacher Education  
 College of Education Health and Human Sciences  
 University of Tennessee, Knoxville  
 Tel: 865-242-9916  
 E-mail: [maydeniz@utk.edu](mailto:maydeniz@utk.edu), [bilge63@gmail.com](mailto:bilge63@gmail.com)

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### EDUCATION HISTORY

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<b>2002- 2007</b>	<b>Ph.D.</b>	<b>Florida State University</b> , Science Education Department of Middle and Secondary Education Tallahassee, FL
<b>1999- 2001</b>	<b>MS.</b>	<b>Florida State University</b> Science Education Department of Curriculum and Instruction Tallahassee, FL

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### PROFESSIONAL EMPLOYMENT HISTORY

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<b>2019- Present</b>	<b>Professor of STEM Education</b> Program Coordinator, Science Education University of Tennessee, Knoxville Department of Theory and Practice in Teacher Education Knoxville, TN.
<b>2013- 2019</b>	<b>Associate Professor of Science Education</b> Program Coordinator, Science Education University of Tennessee, Knoxville Department of Theory and Practice in Teacher Education Knoxville, TN,
<b>2007- 2013</b>	<b>Assistant Professor of Science Education</b> Program Coordinator, Science Education University of Tennessee, Knoxville Department of Theory and Practice in Teacher Education Knoxville, TN,

## PROJECTS, GRANTS, COMMISSIONS, AND CONTRACTS

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### Current:

- Quantum Networks Training and Research Alliance in the Southeast, \$3,000,000 07/01/2022 -06/30/2027, Role **Co-PI**. Sponsor: **National Science Foundation(NSF)**
- Collaborative Research ORCC: The role of bioenergetic budgets in defining elevation limits and modeling geographic range of species. 10/1/2022- 9/31/2025, \$614,280, Role: **SP. National Science Foundation (NSF)**.

### Completed

- [One UT 1000 STEMS](#), the University of Tennessee System, \$50,000. Role: CoPI
- CS for ALL, National Science Foundation, \$254,000, Role: Senior Personnel.
- Basic Aerospace Education Workshop for Teachers, Tennessee Department of Transportation, \$50,000, 3/14/2018-313/2019. Role: PI
- *A Meta-analysis of Teacher Belief Studies in Science Education*, \$3,600 **University of Tennessee, Summer Research Funds**, Principal Investigator, 05/01/09-09/30/09
- *Exploring the Impact of Kitbook on Elementary School Students' Conceptual Understanding of Electricity*, \$7,942, **Center for Industrial Services, State of Tennessee** Principal Investigator, 8/25/07-06/30/08

## RESEARCH AND/OR SCHOLARLY PUBLICATIONS

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- Cuddington, K., Abbott, K., Adler, F., **Aydeniz, M** and others (2023). Challenges and opportunities to build quantitative self-confidence in biologists, *BioScience*, 73(5), 364–375, <https://doi.org/10.1093/biosci/biad015>
- Aydeniz, M.** & Stone, M. (2023). Creativity and Innovation in Science and Technology Education. In B. Akpan, B. Zhang, B. Cavas, & T. Kennedy (Eds), *Contemporary Issues in Science and Technology Education (pp)*. ICASE.
- Aydeniz, M.** (2021). Learning and teaching chemistry through argumentation. In S. Erduran (Ed) *Argumentation in Chemistry Education (pp. 11-25)*. Royal Society of Chemistry. London.
- Aydeniz, M.**, Bilican, K. & Senler, B. (2021). Development of the Inquiry-Based Science Teaching Efficacy Scale for Primary Teachers. *Sci & Educ* 30, 103–120. <https://doi.org/10.1007/s11191-020-00168-w>
- Cakmakci, G., **Aydeniz, M.** Brown, A., & Makokha, J.M. (2020). Situated cognition and cognitive apprenticeship. B.Akpan, and T. Kennedy (Eds), *Science Education in Theory and Practice*. Springer (pp.293–310), The Netherlands.
- Huang, Y., Xueping Li, X., Wyatt, T., & **Aydeniz, M.** (2015). m-Learning Adoption: An Empirical investigation for engineering education. *International Journal of Engineering Education*, 31(4), 1081–1091.
- Aydeniz, M.**, & Bilican, K. (2014). What do scientists know about the nature of science? A case study of novice scientists' views of NOS. *International Journal of Science and*

*Mathematics Education*, 12 (5), 1083-1115. DOI 10.1007/s10763-013-9449-

### **PAPERS PRESENTED AT TECHNICAL AND PROFESSIONAL MEETINGS**

- Aydeniz, M.**, Byrd, C., Churkina, O., & Eze-Echesi, O. (2023, May). The Impact of Team Diversity on Research Productivity. Paper presented at *The Atlanta Conference on Science and Innovation Policy*. Atlanta, GA.
- Aydeniz, M.** (2022). Scientific collaboration journey maps: A tool for forming, leading, and evaluating scientific collaborations. *Paper presented at the International Society for Science of Team Science Conference*. [Online].
- Aydeniz, M.** (2021, **invited keynote**). Addressing the Leadership Gap in STEM Education Reforms. *Presented at the International Conference on Entrepreneurship, Science, Mathematics and Technology*. October, 2021.
- Aydeniz, M.** (2021). Navigating The Collaborative Space: Culture, Leadership and Identities. *Presented at the International Network for the Science of Team Science Conference*, Blacksburg, VA.

### **UNIVERSITY TEACHING**

#### **Courses Taught (Repeated):**

Summer	SCE 550	Classroom Assessment and Evaluation Techniques (3)
Summer	SCE 565	Instructional Trends in Science Education (3)
Spring	SCE 572	Nature of Science and Mathematics (3)
Spring	SCE 696	Advanced Studies in Science Education (3) Development (3)

### **LEADERSHIP & COMMITTEE EXPERIENCES**

- Program coordinator**, Science Education, Department of Theory and Practice in Teacher Education, The University of Tennessee, Knoxville. 2008-current.
- Chair**, [The Graduate Council](#), The University of Tennessee, Knoxville.- 2018-2019.
- Chair**, Personnel Committee, Department of Theory and Practice in Teacher Education, The University of Tennessee, Knoxville. 2016-2021.
- Chair**, Mentoring Faculty Committee, Department of Theory and Practice in Teacher Education, The University of Tennessee, Knoxville. 2019-current.
- Chair**, Tenure and Promotion Committee, College of Education, Health and Human Sciences, The University of Tennessee, Knoxville. 2023-2024.
- Program coordinator**, UT STEM Leadership Certificate-Distance Education, Graduate School of Education, The University of Tennessee, Knoxville.-current.
- Member**, ToolKit Committee, International Network for Science of Team Science.
- Member**, Education and Training Committee, International Network for Science of Team Science.

**Edmon Begoli, PhD, begolie@ornl.gov — ebegoli@utk.edu**


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PROFESSIONAL AND RESEARCH APPOINTMENTS	<p><b>Distinguished Scientist and Section Head</b>, AI Systems R&amp;D Section  <b>Director</b>, Center of AI Security Research (CAISER)  National Security Sciences Directorate  Oak Ridge National Laboratory (ORNL)</p> <p><b>Associated Researcher (Visiting)</b>  SKY Computing Lab  The Department of Electrical Engineering and Computer Science (EECS)  The University of California (UC Berkeley), Berkeley, CA</p>
ACADEMIC APPOINTMENTS	<p><b>Joint Faculty Professor of Computer Science / Lecturer</b>  The Department of Electrical Engineering and Computer Science (EECS)  The University of Tennessee, Knoxville, TN</p>
RESEARCH INTERESTS AND EXPERTISE	<ul style="list-style-type: none"> <li>• Resilient and Robust AI/ML Systems and Architectures</li> <li>• High-performance analytic processing</li> </ul>
EDUCATION	<p><b>University of Tennessee</b>, Knoxville, Tennessee USA  Ph.D., Computer Science, May 2014</p> <p><b>University of Colorado-Boulder</b>, Boulder, Colorado USA  M.S., Computer Science, May 2003</p> <p><b>East Tennessee State University</b>, Johnson City, Tennessee USA  B.S., Computer Science, <i>Magna Cum Laude</i> August, 1998</p>
PROFESSIONAL EXPERIENCE	<p><b>Oak Ridge National Laboratory</b>, Oak Ridge, Tennessee USA  <i>R&amp;D Section Head / Distinguished Scientist</i> <b>October, 2020 - present</b>  <i>Director, Scalable Protected Data Facilities (SPDF)</i> <b>May, 2016 - September 2020</b></p> <p><b>PYA Analytics</b>, Knoxville, Tennessee USA  <i>Chief Technology Officer</i> <b>May, 2013 - May, 2016</b></p> <p><b>Joint Institute for Computational Sciences (JICS)</b>, Oak Ridge, Tennessee USA  <i>Chief Data Officer</i> <b>October, 2014 - May, 2016</b></p> <p><b>Oak Ridge National Laboratory (ORNL)</b>, Oak Ridge, Tennessee USA  <i>Chief Architect/Researcher</i> <b>October, 2007 - April, 2013</b></p> <p><b>Y-12 National Security Complex</b>, Oak Ridge, Tennessee USA  <i>Solutions Architect, Java Developer</i> <b>August, 2004 - September, 2007</b></p> <p><b>Laboratory Corporation of America (LabCorp)</b>, Burlington, North Carolina USA  <i>Enterprise Architect - Java EE Applications</i> <b>January, 2003 - 2004</b></p> <p><b>Lucent Technologies</b>, Greensboro, North Carolina USA  <i>Software Architect - Java EE Applications, Software developer</i></p>
HONORS, AWARDS AND RECOGNITION	<ul style="list-style-type: none"> <li>• IEEE Computer Society Distinguished Contributor</li> <li>• 2022 Google Research Innovator</li> <li>• IEEE and ACM Senior Member</li> <li>• Department of Energy, Secretary's Letter of Recognition for Service to the DOE-VA Program</li> </ul>

- Department of Energy, Deputy Under Secretary for AI, Letter of Commendation for Service as a PI on the DOE-VA MVP CHAMPION program
- Heidelberg Laureate Forum - Early Career Researcher, 2016. Mentor: Sir Michael Atiyah
- Top 9% Contributor on Stack Overflow
- Nashville Technology Council (NTC) - CTO of the Year, finalist, 2014
- White House Big Data Fact Sheet<sup>1</sup> Pg.6, references 'Big Data' project for CMS
- Tennessee Commissioner Mitchel (Department of Safety), A Letter of Commendation, 2011
- OPM e-Government Initiative, NSC Y-12 Team Award, 2005
- Made in Express, Microsoft Global Programming Competition, finalist, 2005
- Lucent Technologies, EAI Implementation, CIO's Letter of Commendation for Outstanding Performance, 2002
- Multiple Undergraduate Honors, Magna Cum Laude, Upsilon Pi Epsilon CS Honors Society

#### GRANTS AND FUNDING AWARDS

- 2013-present, ORNL AI Initiative, Co-lead
- 2018-present, Principal Investigator (PI), HPC/AI RADV Program, Center for Medicare and Medicaid Services (CMS), \$14.5M
- 2016-present, Principal Investigator (PI), MVP CHAMPION, VICTOR Program, The Department of Veterans Affairs (VA), \$20M
- 2019-present, Google Cloud Platform Teaching Credits
- 2019-present, Google Cloud Platform Research Grant, \$7500
- 2016, NSF Full Travel Grant for 2016 Heidelberg Laureate Forum attendance. \$2200
- 2016, Data Accelerated Neuroimaging Library (DANIL), 2016 Intel Parallel Computing Center (Intel PCC) Grant, \$125,000 annually<sup>2</sup>
- 2013, National Science Foundation, Travel Grant, Artificial Intelligence in Education Conference, Doctoral consortium
- 2012, Co-PI, Laboratory Directed Research and Development (LDRD), Hybridizing HPC: Modern Cray Architectures for Big Data Problems, \$650,000
- 2010, Principal Investigator (PI), South Eastern Region Research Initiative (SERRI), Multi-state Information Sharing Initiative, PI, \$450,000
- 2010, Principal Investigator (PI), South Eastern Region Research Initiative (SERRI), CLAERA: Collaborative, Location Aware Emergency Response Application, \$450,000
- 2009, Co-PI, Laboratory Directed Research and Development (LDRD) ID: 32112302, Inferring and Predicting the Social Dynamics of Groups via Psycho-Textual and Communications Flow Analysis, Co-PI, \$650,000

#### TEACHING EXPERIENCE AND CURRICULUM DESIGN

- COSC 592 Natural Language Processing with Transformers, Fall 2023
- ECE 692 Adversarial AI Methods, Spring 2020-2023
- ECE 692 Natural Language Processing, Fall 2020-2023
- ECE 691 Scalable and Resilient AI/ML Systems, Spring 2020
- ECE 691 Scalable Data Analytics, Fall 2019

<sup>1</sup>[https://www.whitehouse.gov/sites/default/files/microsites/ostp/big\\_data\\_fact\\_sheet\\_final.pdf](https://www.whitehouse.gov/sites/default/files/microsites/ostp/big_data_fact_sheet_final.pdf)

<sup>2</sup>grant transferred to JICS PI L. Crosbie because of a move to ORNL.



ACADEMIC	Maria Mahbub, PhD, Computer Science, PhD, EECS, UTK
ADVISING AND	Ioana Danciu, 2018-ongoing, Biomedical Informatics, PhD, Vanderbilt University
RESEARCH	Eduardo Ponce Mojica, 2016-ongoing, Computer Science, PhD, University of Tennessee, EECS
MENTORING	Sudarshan Srinivas, PhD, 2019, Computer Science, PhD, University of Tennessee, EECS
	Kris Brown, 2018, Computer Science, MS, University of Tennessee, EECS
	Michael Bowie, 2016-ongoing, Computer Science, BS/MS, UTK EECS / Oak Ridge National Laboratory
	Jeevith Bopaiah, Prashant Chandrasekar, Ashwin Kumar Vajantri, Kunwar Deep Singh Toor, Summer 2017, Computer Science, graduate, Oak Ridge National Laboratory
	Jordan Chapien, 2014, Computer Science, graduate
	Linnet Vacha, Fall 2012, Mathematics, undergraduate, Oak Ridge National Laboratory
	Chelsey Dunnivan, Summer 2012, Computer Science, undergraduate, Oak Ridge National Laboratory
PUBLICATIONS	Edmon Begoli Google Scholar Profile
PROFESSIONAL	Apache Software Foundation, 2018-Present
ACTIVITIES,	The Association for Computing Machinery (ACM)
MEMBERSHIPS AND	The Institute of Electrical and Electronics Engineers (IEEE), Senior Member, Computer Society
SERVICE	Distinguished Contributor
	Reviewer for Nature Communications, Nature Machine Intelligence, SIGMOD, VLDB, NeurIPS
	Synthetic Data Workshop, Lancet

**R. ALEXANDER BENTLEY**

Interim Associate Dean, College of Emerging and Collaborative Studies,  
University of Tennessee  
rabentley@utk.edu

**Professional Preparation**

Bowdoin College	Brunswick, ME	Physics	B.A.	1992
Cornell University	Ithaca, NY	Archaeology	M.A.	1996
Cornell University	Ithaca, NY	Geology	M.S.	1997
University of Wisconsin	Madison, WI	Anthropology	Ph.D.	2001

**Appointments (UTK: University of Tennessee, Knoxville)**

2023-present	Interim Associate Dean, College of Emerging and Collaborative Studies, UTK
2023-present	Student Success Advisory Council, Division of Student Success, UTK
2017-present	Professor, Dept. of Anthropology, UTK
2017-2020	Department Head, Dept. of Anthropology, UTK
2015-2017	Professor, Dept. of Comparative Cultural Studies, University of Houston
2016-2017	Research Associate, Hobby School of Public Affairs, University of Houston
2014-present	External faculty, Northwestern Institute on Complex Systems, Evanston, IL
2007-2016	Affiliate Graduate Faculty, Anthropology Department, University of Hawai'i
2011-2015	Full Professor, Dept. of Archaeology and Anthropology, Bristol University, U.K.
2012-2014	Chair of the Dept. of Archaeology and Anthropology, Bristol University, U.K.
2011	Deputy Director, Leverhulme 'Tipping Points' Project, Durham University, U.K.
2008-2011	Reader in Anthropology (full-time, tenured), Durham University, U.K.
2005-2008	Lecturer in Anthropology (full-time), Durham University, U.K.
2002-2005	Postdoctoral fellow, Institute of Archaeology, University College London, U.K.

**University of Tennessee undergraduate teaching**

- **Data Knowledge and Discovery** (DATA 201) Spring 2022, Fall 2023, Spring 2024.
- **Data Science Capstone** (DATA 499), Fall 2023.
- **Introduction to Archaeology** (ANTH 120 & ANTH 127) Spring 2021, Fall 2022
- **Big Data Social Sciences** (ANTH 449/603) Spring 2018, Spring 2019, Spring 2020.
- **Archaeology of Europe** (ANTH 469): Spring 2023
- **Archaeology of Asia** (ANTH 469): Spring 2022.
- **Statistics in Anthropology** (ANTH 504) Fall 2020.
- **Biology and Society** (ANTH 303) Fall 2020, Fall 2021.
- **Behavioral Neuroscience** (INPG 400) Fall 2018.

**Publications related to proposed program (e.g., data science, computational social science)**

- Horne, B.D., N.M. Rice, C.A. Luther, D.J. Ruck, J. Borycz, S.L. Allard, M. Fitzgerald, O. Manaev, B.C. Prins, M. Taylor, **R.A. Bentley** (2023) Generational effects of culture and digital media in former Soviet Republics. *Humanit Soc Sci Commun* 10: 172.
- **Bentley, R.A.**, J. Borycz, B.D. Horne (2023) Climate complacency reflects cultural values of nations. *Current Research in Ecological and Social Psychology* 5: 100137
- **Bentley R.A.**, B.D. Horne, J. Borycz, S. Carrignon, G. Shteynberg, B.Vidiella, S. Valverde, M.J. O'Brien (2023) Cultural evolution, disinformation, and social division. *Adaptive Behavior*, in press.
- Duran-Nebreda, S., M.J. O'Brien, **R.A. Bentley**, S. Valverde (2022) Dilution of expertise in the rise and fall of collective innovation. *Humanities and Social Science Communications* 9: 365.
- Vidiella B., S. Carrignon, **R.A. Bentley**, M.J. O'Brien and S. Valverde (2022). A cultural evolutionary theory that explains both gradual and punctuated change. *J. Roy. Soc. Interface* 19: 20220570.
- Borycz, J.D., B.D. Horne, R.A. Bentley (2022) Forking paths of cultural complexity: A case study of research paradigms. *Advances in Complex Systems*. DOI: 10.1142/S0219525922400045
- **Bentley R.A.**, J. Borycz, S. Carrignon, D.J. Ruck, M.J. O'Brien (2022). Machine learning for rediscovering revolutionary ideas of the past. *Adaptive Behavior* 30(3): 279–286.
- Houle, C., D.J. Ruck, R.A. Bentley, S. Gavrillets (2022). Inequality between identity groups and social unrest. *Journal of the Royal Society Interface* 19: 20210725.
- Pritchard, A., M. Silk, S. Carrignon, R.A. Bentley, N. Fefferman (2022). Balancing timeliness of reporting with increasing testing probability for epidemic data. *Infect. Dis. Model.* 7: 106-116.
- Rice, N.M., B.D. Horne, C.A. Luther, J.D. Borycz, S.L. Allard, D.J. Ruck, M. Fitzgerald, O. Manaev, B.C. Prins, M. Taylor, **R.A. Bentley** (2022). Monitoring event-driven dynamics on Twitter: a case study in Belarus. *Springer Nature Social Sciences* 2: Article 36.
- Carrignon, S., R.A. Bentley, M.J. Silk, N.H Fefferman (2022). How social learning shapes the efficacy of preventative health behaviors in an outbreak. *PLOS ONE* 17(1): e026505.
- **Bentley, R.A.**, S. Carrignon, D.J. Ruck, S. Valverde, M.J. O'Brien (2021). Neutral models are a tool, not a syndrome. *Nature Human Behaviour* 5(7): 807-808.
- Clark J., **R.A. Bentley**, V. Maroulas, N. Nagle (2022). Expectations and disciplinary blends. In (Short, P., et al., eds.). *Age of Inference: Cultivating a Scientific Mindset*. Information Age Pub.
- Ruck, D. J., **R.A. Bentley**, J. Borycz (2021). Early warning of vulnerable counties in a pandemic using socio-economic variables. *Economics & Human Biology* 41: 100988
- Ruck, D J., J. Borycz, **R.A. Bentley** (2021). Cultural values predict national COVID-19 death rates. *Springer Nature Social Sciences* 1(3), article 74.
- **Bentley, R.A.**, D.J. Ruck & H.N. Fouts (2020). U.S. obesity as delayed effect of excess sugar. *Economics and Human Biology* 36: article 100818.
- Ruck, D.J., **R.A. Bentley** and D.J. Lawson (2018). Religious change preceded economic change in the 20th century. *Science Advances* 4(7): eaar8680.
- Carrignon, S., **R.A. Bentley**, D.J. Ruck (2019). Modelling rapid online cultural transmission. *Palgrave Communications* 5, article 83.
- **Bentley, R.A.**, W.A. Brock, C.C.S. Caiado and M.J. O'Brien (2016). Evaluating reproductive decisions as discrete choices under social influence. *Phil. Transactions of the Royal Society B* 371: 20150154.
- **Bentley, R.A.**, Acerbi, A., V. Lampos, P. Ormerod (2014). Books average previous decade of economic misery. *PLoS ONE* 9(1): e83147.
- **Bentley, R.A.**, M.J. O'Brien, W.A. Brock (2014). Mapping collective behavior in the big-data era. *Behavioral & Brain Sciences* 37: 63-119.

**Books related to the proposed program**

1. **Bentley, R.A.** & M.J. O'Brien (2017). *The Acceleration of Cultural Change*. MIT Press.
2. O'Brien, M.J., **R.A. Bentley**, W.A. Brock (2019). *The Importance of Small Decisions*. MIT Press.
3. **Bentley, R.A.**, M.J. O'Brien, M. Earls (2011). *I'll Have What She's Having: Mapping Social Behavior*. M.I.T. Press

**Relevant awards and synergistic activities**

- Teaching award for “Big Data Anthropology” (2019) and College of Arts & Sciences Interdisciplinary research award (2019).
- Marketing science consultant in the UK (2008-2014) on projects for UK Department of Health, Unilever, Sony Europe, Gates Foundation, Sanofi Pasteur and other companies.
- Committee member for development of UTK’s Data Science minor, and creator and instructor of record for its core course, “Data Science and Discovery” (DS 201).
- In 2010 was Deputy Director of the £1.75M Leverhulme ‘Tipping Points’ Project, Durham University, which brought together scientists, mathematicians, social scientists and humanities faculty to study a world of complexity and abrupt change.
- co-I on **\$1.6M** MINERVA (Department of Defense, 2019), “Russian disinformation campaigns in three former Soviet republics.” (M. Taylor, P.I.).

**Grants – Externally funded**

- 2020 \$199K NSF (#2028710) “Modeling coupled social and epidemiological networks that determine the success of behavioral interventions on limiting COVID-19 spread” (co-P.I. w/ N. Fefferman).
- 2019 \$1.2M (MINERVA, Department of Defense), “Monitoring the Content and Measuring the Effectiveness of Russian Disinformation and Propaganda Campaigns in Selected Former Soviet Union States.” (co-I, with M. Taylor, P.I., S., Allard, C. Luther, B. Prins co-Is)
- 2019 \$30,000 NSF “SUMMIT-P: Data Science” (co-I, with J. Clark, P.I., V. Maroulas, N. Nagle)
- 2018 \$335,000 NSF (# 1648630) “Acquisition of a TIMS for Expanding Applications at the University of Houston” (co-PI, with P.I. A. Brandon)
- 2014 £15,000 GW4 “Collective Human-Information Interaction” (w/ A Preece, P Johnson, R Maull)
- 2014 £34,965 – AHRC (REACT scheme): “Bristol Remembered Interactively So That Others Learn.”
- 2013 £45,010 NERC LSMSF (w/ C. Jarman) “Untangling Viking Age identities through combined isotope analyses.”
- 2012 £187,903 – Royal Society “Cultural evolution online: new models for a new era.”
- 2012 €209,033 – (ERC FP7-PEOPLE-301460) “Movement and Migration in Irish Prehistory.”
- 2009 £1,674,345 – Leverhulme Trust (Award # F/00128/BF; Co-PI with PI S. Lane.): “Tipping Points in economic and environmental systems.”
- 2009 €10,000 ESF/COST conference grant: “Anthropology and physics: prospects & challenges.” (with Paul Ormerod & Peter Richmond)
- 2008 £199,848 – AHRC Early Career Research Grant (PI, project reference AH/F009275/1): “Social diversity and the origins of complex society at Ban Non Wat, Thailand”.
- 2008 £610,127 – AHRC (Co-I with PI A.W.R. Whittle, D.G. Pearson & R.E.M. Hedges, project reference AH/F018126/1) “The first farmers of Central Europe - diversity in LBK lifeways”
- 2006 £375,000 for three RCUK fellowships – (co-I with R. Barton, K. Dobney)
- 2005 £1,350,000 – AHRC Centre for the Evolution of Cultural Diversity (Co-I, AH/F111956/1)

**Dr. Dania Bilal, Professor**  
 University of Tennessee  
 School of Information Sciences  
 1345 Circle Park Dr., Suite 451  
 Knoxville, TN 37996-0341 USA  
[danial@utk.edu](mailto:danial@utk.edu)

### Education

**PhD**, Florida State University  
**MSLS**, Florida State University  
**BS**, Lebanese University

### Professional Experience (most recent)

**University of Tennessee, School of Information Sciences, Knoxville, TN**

- Professor, August 2007-present
- Interim Director, July 1, 2015-August 7, 2016
- Associate Professor, August 2002-July 2007
- Assistant Professor, August 1997-May 2002

### Teaching (current)

- Information Science Theory
- Human-Computer Interaction
- Foundations of User Experience
- Usability Methods and Tools
- Seminar in Youth Informatics

### Work Experience

**University of Tennessee, Knoxville, TN (most recent)**

*School of Information Sciences, College of Communication, and Information*

- Interim Director, July 1, 2015-August 7, 2016
- Professor, August 2007-present
- Associate Professor, August 2002-July 2007
- Assistant Professor, August 1997-May 2002

### Research and Scholarly Publications

#### Books

- Bilal, D., & Beheshti, J. (Eds.). (2014). *New directions in children's and adolescents' information behavior research*. Badfork, U.K.: Emerald Group Publishing, Inc.
- Bilal, D. (2014). *Library automation: Core concepts and practical systems analysis*. Westport, CT: Libraries Unlimited, ABC-CLIO.
- Nahl, D., & Bilal, D. (Eds.). (2007). *Information and emotion: The emergent affective paradigm in information behavior research and theory*. Medford, NJ: Information Today.  
<http://books.infotoday.com/assist/InformationAndEmotion.shtml>
- Bilal, D. (2002). *Automating media centers and small libraries: A microcomputer-based approach* (2<sup>nd</sup> ed.). Westport, CT: Libraries Unlimited.

#### Peer-Reviewed Publications

- Bilal, D. (202). Theoretical applications in children and youth information behavior research: 1999-2019. *Proceedings of the 85th Annual Meeting of the Association for Information Science & Technology*, Oct 29-Nov 1, Pittsburgh, PA (forthcoming; long paper).
- Yuan, F., Boltz, M., Bilal, D., Duzan J., Bahour, A., Crane, M., & Zhao, X. (2022). Cognitive exercise for persons with Alzheimer's Disease and related Dementia using a social robot. *IEEE Transactions on Robotics Journal*.
- Bilal, D., Chu, C.M., & Rieh, S.Y. (2022). AI education in iSchools: Reshaping the curricula for an equitable and inclusive information landscape. *Proceedings of the 17th International Conference, iConference*, February 28-March 4. Abstract.

- Rieh, S.Y., Chu, C.M., & Bilal, D. (2022). AI in the real world: Strengthening connections between LIS research and practice. *Proceedings of the 85th Annual Meeting of the Association for Information Science & Technology, Oct 20-Nov 1, Pittsburgh, PA. (Forthcoming). Extended abstract.*
- Yuan, F., Boltz, M., Bilal, D., Duzan, J., Crane, M., & Zhao, X. (2022). Cognitive rehab for people with dementia based on human-robot communication modeling. *MECC: 2022 Modeling, Estimation and Control Conference, October 2-5, New Jersey City, NJ. (Abstract).*
- Bilal, D., & Barfield, J. (2021). Voice switching in voice-enabled digital Assistants (VDAs). *Proceedings of the 2021 Human-Computer Interaction International Conference, July 24-29 (pp. 507-520).*
- Bilal, D., & Barfield, J. K. (2021). Hey there! What do you look like? User voice switching and Interface mirroring in voice-enabled digital assistants (VDAs). *Proceedings of the 84th Annual Meeting of the Association for Information Science & Technology, Oct. 29 – Nov. 3, 2021, Salt Lake City, UT (pp. 1-12).*
- Yuan, F., Zhang, R., Bilal, D., & Zhao, X. (2021). Learning-based strategy design for robot-assisted reminiscence therapy based on a developed model for people with Dementia. *Social Robotics: Proceedings of the 13th International Conference on Social Robotics (ICSR 2021), November 10-13, Singapore (pp. 432-442).*
- Barfield, J., & Bilal, D. (2021). The Effect of race, ethnicity, gender, religion, and cultural competence on user perception of embodied voice interfaces in digital assistants. *Proceedings of the 84th Annual Meeting of the Association for Information Science & Technology, Social Informatics Workshop, Oct. 29 – Nov. 3, 2021, Salt Lake City, UT. Extended abstract.*
- Bilal, D., & Chu, C.M. (2021). Educating the next generation of AI leaders in libraries: IDEA Institute on AI. *Lebanese Library Association/IFLA Oceania Section Conference, Libraries as Power of Change. May 19, 2021, Beirut, Lebanon. Extended abstract. (Virtual). Invited.*  
<https://lebaneselibRARYassociation.org/presentations>
- Rieh, S. Y, Chu, C. M., & Bilal, D. (2021). Artificial Intelligence in information research and practice: Fostering interconnected communities. *Proceedings of the 84th Annual Meeting of the Association for Information Science & Technology, Oct. 29 – Nov. 3, 2021, Salt Lake City, UT. Extended abstract.*
- Allard, S., Bilal, D., Fleming-May, R., Forrester, A., Frame, A., Mayes, R., & Tenopir, C. (2018). Merging coursework with real world experience: Testing user experience in a science agency. *Proceedings of the iConference 2018, Special Program: iSchools and Industry Partnerships, March 25-18, Sheffield, UK (pp. 1-7).* Springer Lecture Note Series.  
<https://ischools.org/resources/Documents/iconf%202018/iSchool-industry.partnerships-UXA.pdf>
- Fleming-May, R., Mays, R., Forrester, A., Walker, T., Tenopir, C., Bilal, D., & Allard, S. (2017). Experience assessment: Designing an innovative curriculum for assessment and UX professionals. *Performance Measurement and Metrics, 19(1), 30-39.*  
<https://doi.org/10.1108/PMM-09-2017-0036>
- Bilal, D. (2012). Ranking, relevance judgment, and precision of information retrieval on children's queries: Evaluation of Google, Yahoo!, Bing, Yahoo! Kids, and Ask Kids. *Journal of the American Society for Information Science and Technology, 63(9), 1879-1896.*  
<http://onlinelibrary.wiley.com/doi/10.1002/asi.22675/full>
- Bilal, D., Sarangthem, S., & Bachir, I. (2008). Toward a model of children's information seeking behavior in using digital libraries. *ACM International Conference Proceeding Series, 348.* Proceedings of the Second International Symposium on Information Interaction in Context (IliX). October 14-17, London, UK (pp. 145-151). <http://dl.acm.org/citation.cfm?doid=1414694.1414727>
- Bilal, D. (2006). Measuring the usability of an international user interface: Culture and design representations. In *Human-Computer Interaction Symposium, The American Society for Information Science & Technology.* <http://web.utk.edu/~dania/HCI%20Symposium.doc>
- Bilal, D. (2003). Draw and tell: Children as designers of web interfaces. *Proceedings of the 66th Annual Meeting of the American Society for Information Science & Technology. October 18-22, Long Beach, CA (pp. 135-141).*  
<http://onlinelibrary.wiley.com/doi/10.1002/meet.1450400117/abstract?deniedAccessCustomisedMessage=&userIsAuthenticated=false>

- Bilal, D., & Kirby, J. (2002). Differences and similarities in information seeking: Children and adults as web users. *Information Processing & Management*, 38(5), 649-670. <http://www.sciencedirect.com/science/article/pii/S0306457301000577>
- Bilal, D. (2002). Children's use of the Yahoo!igans! web search engine. III. Cognitive and physical behaviors on fully self-generated tasks. *Journal of the American Society for Information Science & Technology*, 53(13), 1170-1183. <https://doi.org/10.1002/asi.10145>
- Bilal, D. (2001). Children's use of the Yahoo!igans! web search engine. II. Cognitive and physical behaviors on research tasks. *Journal of the American Society for Information Science & Technology*, 52(2), 118-137. [http://twiki.cite.hku.hk/pub/MITE6025/GroupD/Childrens use of the Yahoo!igans! Web search engine.pdf](http://twiki.cite.hku.hk/pub/MITE6025/GroupD/Childrens%20use%20of%20the%20Yahoo!igans!%20Web%20search%20engine.pdf)
- Bilal, D. (2000). Children's use of the Yahoo!igans! web search engine. I. Cognitive, physical, and affective behaviors on fact-based tasks. *Journal of the American Society for Information Science*, 51(7), 646-665. <http://ithreads.pbworks.com/f/yhoo1.pdf>
- Bilal, D., Barry, J., & Penniman, D. W. (1999). Automated system marketplace 1999: A balancing act. *Library Journal*, April 1, 45-54.
- Bilal, D. (1994). Automating library media centers in Georgia: A survey of practices, knowledge, issues, and trends. *School Library Media Quarterly*, 22(4), (pp. 221-230).

### Grants & Research Proposals

- Bilal, D. (PI), Chu, C. (Co-PI), & Rieh, S.Y. (Co-PI). (2020-2023). IDEA (Innovation, Disruption, Enquiry, Access) Institute on Artificial Intelligence (AI). IMLS Laura Bush 21<sup>st</sup> Century Librarian Program. Funded (\$208,142), September 1, 2020, August 31, 2022; Extended until August 31, 2023).
- Bilal, D. (Co-PI), Tenopir, C. (PI), Fleming-May, R. (Co-PI), & Mays, R. (Co-PI). Experience Assessment: Building User Experience and Assessment Capabilities in Libraries and Information Centers. IMLS Laura Bush 21<sup>st</sup> Century Librarian Program. Funded: \$811,500.00. June 1, 2016-May 31, 2018.
- Bilal, D. (PI), & Gwizdzka, J (Co-PI). Child-friendly SERPs: Towards a better understanding of Google search results readability by children. August 2014. Google, Inc. \$41,363.

### Awards

#### Association of Information Science and Technology (ASIST)

- SIG USE Outstanding Contributions to Information Behavior Research Award, 2017.
- SIG Publication-of-The-Year Award 2008 for the book, *Information and Emotion: The Emergent Affective Paradigm in Information Behavior Research and Theory*. Medford, New Jersey: Information Today.

#### Association of Library and Information Science Education (ALISE)

- Teaching Excellence Award, 2007

#### University of Tennessee, College of Communication and Information

- The Carol Tenopir Faculty Award for Outstanding Contributions. 2022. A special award given in celebration of the School of Information Sciences celebration of its 50th Anniversary of ALA accreditation
- Distinguished Administrative Service Award, 2015-2016

### Service (School of Information Sciences-SIS)

#### Committees (Current)

- Strategic Plan Committee, Chair, Fall 2022
- Tenure and Promotion Committee, Chair, Fall 2018-2020
- Director's Research Advisory Committee, Fall 2019

## Brianne R. Dosch

John C. Hodges Library, 1015 Volunteer Blvd. Knoxville, TN 37996  
bdosch@utk.edu

### EDUCATION

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Master of Science in Information Sciences, University of Tennessee, Knoxville, TN 2018  
Bachelor of Arts, English Literature, Brigham Young University – Hawaii, Laie, HI 2013

### EXPERIENCE

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#### **Head, Data and Digital Scholarship, Assistant Professor**

John C. Hodges Library, University of Tennessee, Knoxville, Aug 2023- Present

Provides vision and strategic direction for the University Libraries in support of a broad range of digital and data-intensive scholarly activities. Helps foster a responsive, user-oriented department that works collegially to build relationships with students, staff, faculty, organizations and people Knoxville and Tennessee, and the greater research community. The Data and Digital Scholarship department supports the research data life cycle and digital scholarship by convening research support in digital humanities, geographic information systems, computational social science support, data discovery, and data management across all disciplines.

#### **Social Sciences Data Librarian, Assistant Professor**

John C. Hodges Library, University of Tennessee, Knoxville, 2019-2023

Provided in-depth consultation, engagement and instruction to the Department of Psychology and developed specialized expertise in data support to serve interdisciplinary research needs in the social sciences. Proactively built relationships with faculty and students across the social sciences to understand and anticipate research needs. Worked closely with other social sciences librarians to provide in depth and discipline specific data services to students, staff, faculty, and Tennessee community members.

#### **Grant Program Manager, Research Associate**

Center for Information & Communication Studies, University of Tennessee, Knoxville 2018-2019

Directly supervised and managed the research work of MSIS graduate students sponsored by the UX-A IMLS grant. Planned and lead information meetings and instruction for MSIS graduate students. Compiled and communicated the final grant report to IMLS and other key grant program members. Worked directly with Dr. Carol Tenopir to update the bibliographic database associated with the ARL Lib-Value project in addition to work on the IMLS grant.

#### **Information Management Specialist**

Spallation Neutron Source, Oak Ridge National Laboratory, Oak Ridge, TN Jan-May 2019

Proactively developed relationships with laboratory staff to understand their user-experience and support their information and document management needs. Collaborated with laboratory programmers to develop and test interfaces which meet staff needs and improve the overall



usability and user-experience of laboratory interfaces. Developed protocols within the document management system ProjectWise to capture critical metadata and integrate processes to address unique staff member needs. Developed and delivered training and training resources for staff to use the electronic document management system ProjectWise.

## HONORS AND AWARDS

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2022, Library Society Service Endowment Award for Extraordinary Customer Service, UT Libraries' Spirit Awards

## PUBLICATIONS

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### *Articles Published in Refereed Journals*

Dosch, B., & Martindale, T. (2021). Reading the fine print: A review and analysis of business journals' data sharing policies. *Journal of Business & Finance Librarianship*, 25(3–4), 261–280. <https://doi.org/10.1080/08963568.2020.1847549> (Primary author)

Kaufman, J., Dosch, B., & Clement, K.A. (2019) “No Failure, Just Feedback: A Reflection on Experiential Space Assessment in an Academic Library,” *Serials Review*, 44:3, 221-227, <https://doi.org/10.1080/00987913.2018.1513749> (Equal author)

Clement, K. A., Carr, S., Johnson, L., Carter, A., Dosch, B. R., Kaufman, J., ... Walker, T. (2018). Reading, writing, and ... running? Assessing active space in libraries. *Performance Measurement and Metrics*, 19(3), 166–175. <https://doi.org/10.1108/PMM-03-2018-0011> (Equal author)

### *Contributions to Edited Volumes*

Dosch, B. (2024). Building a campus-wide lifelong learning book club: Supporting faculty ideas and centering the library in community building. In A. Dye-Reeves & E. Watson (Eds.), *How to Work with Academic Faculty: Partnerships, Collaborations, and Services in the Academic Library*. Association of College and Research Libraries. (Solo and primary author)

Ortiz-Baco, J. & Dosch, B. (2024). In W. Kramer, E. Muzzall, I. Burgos (Eds.), *Text and Data Mining Literacy for Librarians*. Association of College and Research Libraries. (Equal author)

### *Papers Published in Refereed Conference Proceedings*

Dosch, B., Urquieta-Cortes, C. (2023). Building the Holistic E-resource Acquisition Transparency (HEAT) Communication Tool for Academic Librarians. *15th International Conference on Performance Measurement in Libraries*, 15(1). (Primary author)

Cannon, L., Dosch, B., & Gunderman, H. (2020). Preparing, Not Repairing. *Qualitative And Quantitative Methods In Libraries*, 9(1), 9-18. <http://www.qqml.net/index.php/qqml/article/view/546> (Equal author)

### *Articles published in non-refereed journals*

Dosch, B. (2022). How academic liaison librarians can self-assess – and why they should. *Elsevier's Library Connect*. <https://www.elsevier.com/connect/library-connect/how-academic-liaison-librarians-can-self-assess-and-why-they-should> (Primary author)

### ***Invited Workshops/Seminars/Presentations***

Dosch, B. “Data sources and services for academic librarians.” Presentation LS 502 Research Methods Course, School of Library and Information Studies, University of Alabama, virtual, January 26, 2023.

Dosch, B. (2021, October) “Finding Available Data Related to Sensitive Topics.” Invited webinar for the University of Michigan’s Inter-university Consortium for Political and Social Research (ICPSR), Virtual, October 27, 2021.

### GRANTS, FELLOWSHIPS, AND SCHOLARSHIPS

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2021 ICPSR Visiting Representative Fellow, Inter-university Consortium for Political and Social Research at the University of Michigan, \$2800

2019, Conference Travel Grant, Institute of Museum and Library Services, User Experience and Assessment, Center of Information and Communication Studies, University of Tennessee, \$4,000  
2016-present, Conference Travel Grant, Institute of Museum and Library Services via University of Tennessee, \$2,000

2016-present, Institute of Museum and Library Services funded Master’s degree, User Experience and Assessment, School of Information Science University of Tennessee, \$9,000

### SERVICE

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#### *Committees and Task Forces*

Data Science Curriculum Committee, member, 2023-Present  
AI Curriculum Committee, member, 2023-Present  
UT Promise Mentoring Program, mentor, 2020-Present  
Data Science Librarian Search Committee, member, December 2022-February 2023  
Strategic Visioning Committee, co-chair, March 2022 – January 2023  
ACRL Academic Library Trends & Statistics Survey Editorial Board, member, 2022 - Present

#### *Service and Leadership Roles*

Lifelong Learning Book Club, University of Tennessee, organizer and leader, 2020-Present  
Inter-university Consortium for Political and Social Research (ICPSR), Official Representative for University of Tennessee, July 2019-present  
Tennessee State Data Center, Affiliate Representative for UT Libraries, July 2019-Present

Updated 10/13/2023

# Jianguen He

1345 Circle Park Drive, Room 449, Knoxville, TN 37996-0332, United States  
 jianguen@utk.edu • jianguenhe.com • (865) 974-5882

- RESEARCH INTERESTS**
- Information Visualization, Visual Analytics, Machine Learning
  - Quantitative Studies of Science, Informetrics, Science Mapping, Open Science, Peer Review
  - Human-AI Interaction, Conversational AI
- WORK EXPERIENCE**
- School of Information Sciences, The University of Tennessee, Knoxville
- **Assistant Professor** Aug 2020 – present
- College of Computing and Informatics, Drexel University
- **Research Assistant**, Visual Analytics and Text Mining Sep 2014 – Jun 2020
- Social Network Business Group, Tencent Inc
- **Front-end Development Engineer** Jul 2012 – May 2014
    - Development of web games and web apps.
- EDUCATION**
- Drexel University**, Philadelphia, USA
- Doctor of Philosophy in Information Studies Sep 2014 – Jun 2020
    - Dissertation topic: Predictive and Visual Analytics of Scientific Development
- Wuhan University**, Wuhan, China
- Master of Management Science in Information Science Aug 2010 – Jun 2012
    - Graduated with Outstanding Dissertation Award.
- Nanjing Tech University**, Nanjing, China
- Dual Bachelor in Business Administration & Computer Science Sep 2006 – Jun 2010
    - Graduated with Honors and Outstanding Dissertation Award.
- GRANTS**
- [4] 2022 The University of Tennessee, Student/Faculty Research Awards, \$5,000.
- [3] 2021 - 2024, Erjia Yan. (lead PI), Jianguen He (site PI), Chaoquan Ni (site PI), Robert Palmer (site PI), & Mat Kelly (co-PI). Collaborative Research: Examining the effects of academic mobility on individual professors' research activity and institutional human capital at HBCUs. **NSF SOS:DCI**, #2122691, \$737,596 (UT share: \$191,102).
- [2] 2021 The University of Tennessee, Research Development Academy, \$4,000.
- [1] 2018 Drexel University ExCITe Center Research Funding Award, \$5,000.
- PUBLICATIONS**
- Journal Papers**
- [13] Lou, W., He, J., Zhang, L., Zhu, Z., and Zhu, Y. (2023). Support behind the scenes: the relationship between acknowledgement, coauthor, and citation in Nobel articles. *Scientometrics*, 1-24.
- [12] Luo, Z., He, J., Qian, J., Wang, Y., and Lu, W. (2023). Do the paper's connections to existing work disclose its citation impact? A study based on graph representation learning. *Journal of Information Science*.
- [11] Lou, W., He, J., Xu, Q., Zhu, Z., Lu, Q. and Zhu, Y. (2023), "Rhetorical structure parallels research topic in LIS articles: a temporal bibliometrics examination", *Aslib Journal of Information Management*, Vol. ahead-of-print No. ahead-of-print.
- [10] Zhuoran Luo, Wei Lu, Jianguen He, and Yuqi Wang. "Combination of Research Questions and Methods: A New Measurement of Scientific Novelty", *Journal of Informetrics*, Accepted, 2022.
- [9] Yang Li, Jianguen He, and Chuanren Liu, "Peer Influence in the Adoption of Video Games", *International Journal of E-Business Research*, Accepted, 2022
- [8] Wen Lou, Zilong Su, Jianguen He, Kai Li, "A temporally dynamic examination of research method usage in the Chinese library and information science community," *Information Processing & Management*, 58(5), 102686, 2021.

- [7] Erjia Yan, Yongjun Zhu, Jianguan He, “Analyzing academic mobility of U.S. professors based on the ORCID data and the Carnegie Classification,” *Quantitative Science Studies*, 1(4), pp. 1451-1467, 2020.
- [6] Jianguan He, Qing Ping, Chaomei Chen, Wen Lou, “PaperPoles: Toward Supporting Exploration of Citations Based on Evolving Information Needs,” *Journal of the Association for Information Science and Technology*, vol. 70, issue. 8, pp. 843-857, 2019.
- [5] Jianguan He, Chaomei Chen, “Temporal Representations of Citations for Understanding the Changing Roles of Scientific Publications,” *Frontiers in Research Metrics and Analytics*, vol. 3, pp. 27, 2018.
- [4] Jianguan He, Chaomei Chen, “Predictive Effects of Novelty Measured by Temporal Embeddings on the Growth of Scientific Literature,” *Frontiers in Research Metrics and Analytics*, vol. 3, pp. 9, 2018.
- [3] Wen Lou, Hui Wang, and Jianguan He, “Of the People for the People: Digital Literature Resource Knowledge Recommendation Based on User Cognition,” *Information Technology and Libraries*, vol. 37, issue. 3, pp. 66–83, 2018 .
- [2] Qing Ping, Jianguan He and Chaomei Chen, “How many ways to use CiteSpace? A study of user interactive events over 14 months,” *Journal of the Association for Information Science and Technology*, vol. 68, issue. 5, pp. 1234–1256, 2017 .
- [1] Wei Lu, Jianguan He, Xiaoguang Wang and Jiaxin Wu, “A Visualization Technique for Multidimensional Data with Hierarchical and Temporal Structure,” *Journal of the China Society for Scientific and Technical Information*, vol. 31, no. 11, pp. 1131–1139, 2012.

#### Conference Papers

- [14] He, Jianguan; Feng, Changyang; Lou, Wen; Song, Bo; Zang, Yizhou “The Role of Open Code in Scholarly Communication: A Citation Analysis in Computational Linguistics”, *2023 International Conference on Scientometrics & Informetrics*.
- [13] Yan, Erjia; Kelly, Mat; Zarrillo, Deanna; He, Jianguan; Ni, Chaoqun; Palmer, Robert, “Examining the academic mobility at Historically Black Colleges and Universities in the U.S.”, *2023 International Conference on Scientometrics & Informetrics*.
- [12] Zhijie Zhu, Lingxin Zhang, Jianguan He, & Wen Lou, “The impact of acknowledgement on coauthorship and citation: who were acknowledged in Nobel Price Laureates’ publications?”, *Metrics 2021: Workshop on Informetric and Scientometric Research (SIG-MET)*. October 2021. Salt Lake City, United States
- [11] Jianguan He, Erjia Yan, and, Chaoqun Ni, “Examining International Research Collaboration under the COVID-19 Pandemic by arXiv Preprints”, *2021 International Conference on Scientometrics & Informetrics*.
- [10] Wen Lou, Zilong Su, Shaodan Zheng, and Jianguan He, “The Effects of Rhetorical Structure on Citing Behavior in Research Articles”, *2021 International Conference on Scientometrics & Informetrics*.
- [9] Yuting Liao, Jianguan He, “The Effects of Racial Mirroring in Chatbot-Based Psychotherapeutic Conversation ” *The 25th International Conference on Intelligent User Interfaces (ACM IUI 2020)*. Cagliari, Italy.
- [8] Jianguan He, Wen Lou, and Kai Li, “How were science mapping tools applied? The Application of science mapping tools in LIS and non-LIS domains” *ASIST 2019*. October 19 - 25, 2019. Melbourne, Australia.
- [7] Zhen Yang, Yanliu Huang, Barbara Kahn, and Jianguan He, “Voice or Click? How Shopping by Voice Influences Consumer’s Product Choices” *2019 Association for Consumer Research Conference (ACR 2019)*. October 17 - 20, 2019. Atlanta, United States.
- [6] Jianguan He, Chaomei Chen, “The Citations of Papers with Conflicting Reviews and Confident Reviewers” *ISSI 2019*. September 2 - 5, 2019. Rome, Italy.
- [5] Zhen Yang, Jianguan He, YanLiu Huang, Barbara Kahn, “Understand Consumer Behavior and Product Decision Making in Voice-Assisted vs. Mouse-Click Shopping” *Theory + Practice in Marketing (TPM) Conference*. May, 2019. New York, United States.

- [4] Yang Li, Chuanren Liu, and Jianguan He, “Do Recommendation from Friends Matter? Evidence from Video Game Platforms” *Northeast Decision Sciences Institute 2019 Annual Conference*. April 4-6, 2019. Philadelphia, United States.
- [3] Jianguan He, Chaomei Chen, “Visualizing Temporal Patterns in Representation Data,” *2017 Workshop on Visual Analytics for Deep Learning*. October 1, 2017. Phoenix, United States.
- [2] Jianguan He, Chaomei Chen, “Understanding the changing roles of scientific publications via citation embeddings,” *Proceedings of 2nd Workshop on Mining Scientific Papers: Computational Linguistics and Bibliometrics*, pp. 42-48. October 16, 2017. Wuhan, China.
- [1] Jianguan He, Chaomei Chen, “Spatiotemporal Analytics of Topic Trajectory,” *Proceedings of the 9th International Symposium on Visual Information Communication and Interaction*, pp. 112-116. September 24-26, 2016. Dallas, Texas, United States.

**AWARDS**

- 2021 The University of Tennessee, Research Development Academy Scholar.
- 2020 Beta Phi Mu Eugene Garfield Doctoral Dissertation Fellowship (\$3,000).
- 2019 ISSI Eugene Garfield Doctoral Dissertation Scholarship (\$3,000)
- 2019 *Publications* Travel Award (\$850).
- 2018 Drexel University International Presentation Award (\$750).
- 2016, 2017, 2018 Drexel University CCI Travel Award (\$3,000).
- 2011, 2012 Wuhan University the First Prize Scholarship for Graduate Students.
- 2009 National Computer Design Competition for Chinese College Students, National First Prize.

**TEACHING****Instructors**

- INSC 486 Data Analytics (Undergraduate), University of Tennessee, 2021 Spring, 2021 Fall.
- INSC 489 Data Visualization (Undergraduate), University of Tennessee, 2021 Spring.
- INSC 210 Foundations of Information Technology (Undergraduate), University of Tennessee, 2020 Fall, 2021 Fall.
- INFO 210 Database Management System (Undergraduate), Drexel University, 2019.

**SERVICE****Internal**

- Research Advisory Committee Member, College of Communication and Information, University of Tennessee, 2021-2022, 2022-2023.
- Data Science Curriculum Committee Member, University of Tennessee, 2021-2022
- Tenure-track Assistant Professor Search Committee Member, School of Information Sciences, University of Tennessee, 2021-2022

**External**

- Committee Member, **ALISE Bohdan S. Wynar Research Paper Competition**, 2021.
- Committee member, 2nd Workshop on Extraction and Evaluation of Knowledge Entities from Scientific Documents, 2021.
- Committee member, IEEE International Workshop on Data Quality for Intelligent Systems, 2021.
- Associate Editor, **Frontiers in Research Metrics and Analytics**, 2021-present.
- Instructor and Advisory Board Member, **IDEA Institute on Artificial Intelligence**, 2021, 2022.
- Panel & Alternative Events Co-Chair, **ASIS&T**, 2021.
- Doctoral Dissertation Committee Member, Kathleen Padova, Drexel University, 2021.
- Program Committee Member, The 10th International Symposium on Visual Information Communication and Interaction, **VINCI**, 2017.

[CV compiled on 2023-10-11]

## Benjamin D. Horne

School of Information Sciences, The Bredesen Center  
The University of Tennessee Knoxville

<https://benjamindhorne.github.io>  
bhorne6@utk.edu

### *Education*

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<b>Rensselaer Polytechnic Institute</b>	Troy, NY
Ph.D. in Computer Science	<i>Fall 2014 – Spring 2020</i>
<b>Union University</b>	Jackson, TN
B.S. in Computer Science, Minor in Mathematics	<i>Fall 2010 – Spring 2014</i>
<b>Union University</b>	Jackson, TN
B.S. in Business Administration, Concentration in Management	<i>Fall 2010 – Spring 2014</i>

### *Academic and Research Appointments*

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<b>The University of Tennessee Knoxville</b>	Knoxville, TN
Founding Fellow, CCI Information Integrity Institute ( <i>I</i> <sup>3</sup> )	<i>Fall 2023 – Present</i>
Affiliate, National Security and Foreign Affairs, The Baker School of Public Policy	<i>Fall 2023 – Present</i>
Assistant Professor (Joint), Data Science and Engineering, The Bredesen Center	<i>Fall 2023 – Present</i>
Assistant Professor, School of Information Sciences	<i>Fall 2020 – Present</i>
<b>Rensselaer Polytechnic Institute</b>	Troy, NY
Graduate Research Assistant, Computer Science	<i>Fall 2014, Fall 2017 – Spring 2020</i>
NSF GK-12 Teaching Fellow, Science and Technology Studies	<i>Summer 2015 - Fall 2016</i>
Graduate Teaching Assistant, Computer Science	<i>Spring 2015</i>
<b>U.S. Army Research Laboratory</b>	Adelphi, MD
Visiting Graduate Researcher, Network Science Research Laboratory	<i>Summer 2017</i>
<b>Cornell University</b>	Ithaca, NY
NSF Undergraduate Researcher, Information Sciences	<i>Summer 2013</i>
<b>Texas Tech University</b>	Lubbock, TX
NSF Undergraduate Researcher, Computer Science	<i>Summer 2012</i>

### *Selected Project Relevant Publications*

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1. Climate Complacency Reflects Cultural Values of Nations  
Current Research in Ecological and Social Psychology (CRESP) 2023  
R. Alexander Bentley, Joshua Borycz, and Benjamin D. Horne
  2. Cultural Evolution, Disinformation and Social Division  
Adaptive Behavior 2023  
R. Alexander Bentley, Benjamin D. Horne, Joshua Borycz, Simon Carrignon, Garriy Shteynberg, Blai Vidiella, Sergi Valverde, Michael O'Brien
  3. Generational Effects of Culture and Digital Media in Former Soviet Republics  
Humanities and Social Sciences Communications (HSSCOMMS) 2023  
Benjamin D. Horne, Natalie Rice, Catherine Luther, Damian Ruck, Joshua Borycz, Suzie L. Allard, Michael Fitzgerald, Oleg Manaev, Brandon C. Prins, Maureen Taylor, R. Alexander Bentley
  4. Monitoring Event-driven Dynamics on Twitter: A Case Study in Belarus  
Springer Nature Social Sciences (SNSS) 2022  
Natalie M. Rice, Benjamin D. Horne, Catherine Luther, Joshua Borycz, Suzie L. Allard, Damian J. Ruck, Michael Fitzgerald, Oleg Manaev, Brandon C. Prins, Maureen Taylor, and R. Alexander Bentley

5. Characterizing YouTube and BitChute Content and Mobilizers During U.S. Election Fraud Discussions on Twitter  
14th ACM Web Science Conference (WebSci) 2022  
Matthew C. Childs\*, Milo Trujillo, Cody Buntain, and Benjamin D. Horne
6. Local News Online and COVID in the U.S.: Relationships among Coverage, Cases, Deaths, and Audience  
The 16th International Conference on Web and Social Media (ICWSM) 2022  
Kenneth Joseph, Benjamin D. Horne, Jon Green, John P. Wihbey
7. The Reasoning Behind Fake News Assessments: A Linguistic Analysis  
AIS Transactions on Human-Computer Interaction (THCI) 2022  
Lydia Manikonda, Dorit Nevo, Benjamin D. Horne, Clare Arrington, and Sibel Adalı
8. How Topic Novelty Impacts the Effectiveness of News Veracity Interventions  
Communications of the ACM (CACM) 2022  
Dorit Nevo and Benjamin D. Horne
9. Partisanship over security: Public narratives via Twitter on Foreign Interferences in the 2016 and 2020 U.S. Presidential Elections  
First Monday 2021  
Catherine Luther, Benjamin D. Horne, and Xu Zhang
10. Tailoring Heuristics and Timing AI Interventions for Supporting News Veracity Assessments  
Computers in Human Behavior Reports (CHB Reports) 2020  
Benjamin D. Horne, Dorit Nevo, Sibel Adalı, Lydia Manikonda, Clare Arrington
11. What is BitChute? Characterizing the "Free Speech" Alternative to YouTube  
31st ACM Conference on Hypertext and Social Media (HT'20) 2020  
Milo Trujillo, Mauricio Gruppi, Cody Buntain, and Benjamin D. Horne
12. Different Spirals of Sameness: A Study of Content Sharing in Mainstream and Alternative Media  
The 13th International Conference on Web and Social Media (ICWSM) 2019  
Benjamin D. Horne, Jeppe Nørregaard, and Sibel Adalı
13. Rating Reliability and Bias in News Articles: Does AI Assistance Help Everyone?  
The 13th International Conference on Web and Social Media (ICWSM) 2019  
Benjamin D. Horne, Dorit Nevo, John O'Donovan, Jin-Hee Cho, and Sibel Adalı
14. Identifying the Social Signals that Drive Online Discussions: A Case Study of Reddit Communities  
International Conference on Computer Communications and Networks (ICCCN) 2017  
Benjamin D. Horne, Sibel Adalı, and Sujoy Sikdar

#### *Selected Project Relevant Funding*

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1. Co-PI, Minerva Research Initiative, United States Department of Defense, Office of Naval Research  
**Title:** Monitoring the Content and Measuring the Effectiveness of Russian Disinformation and Propaganda Campaigns in Selected Former Soviet Union States  
**Funding:** \$1.3 Million over 6 years.

#### *Selected Awards & Honors*

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1. **2023**, Bonnie Carroll and Roy Cooper Faculty Enrichment Award (\$2,500)
2. **2020**, Robert McNaughton Prize at RPI, for Ph.D. Dissertation: *Robust News Veracity Detection*
3. **2017**, Best Research Paper Award at MIT Sloan Sports Analytics Conference (\$10,000)

## Curriculum Vitae

### Mingzhou Jin

John D. Tickle Professor

Industrial and Systems Engineering Department, The University of Tennessee at Knoxville (UTK)

Institute for a Secure and Sustainable Environment, UTK

525E John D. Tickle Engineering Building, TN, 37996, jin@utk.edu

## EDUCATION

- Ph.D. (2001) Industrial and Systems Engineering, Lehigh University
- M.S. (1998) Management Science, Business School of Zhejiang University
- B.S. (1995) Electrical Engineering, Zhejiang University, China

## APPOINTMENTS

### ✓ 2012 – Present UTK

Department Head of Industrial and Systems Engineering, 2023~present

Director of the FERSC Center, a DOT/UTC Tier Center, 2023~present

Director of the Institute for a Secure and Sustainable Environment, 2018~present

Professor of Industrial and Systems Engineering, 2015~present

Associate Department Head of Industrial and Systems Engineering, 2012~2023

Director of Graduate Studies, Industrial and Systems Engineering, 2017~2018

Affiliated Faculty of the Bredesen Center, 2017~present

Associate Professor of Industrial and Systems Engineering, 2012~2015

### ✓ 2002 – 2011, Mississippi State University (MSU)

Assistant and then Associate Professor of Industrial and Systems Engineering, 2002~2021

## TEACHING

**Courses taught at UTK and MSU** (average teaching evaluation: 4.5/5.0)

IE 301 Operations Research I, IE 310 Operations Research II, IE 404 Senior Design I, IE 405 Engineering Economy, IE 430/530 Supply Chain Engineering, IE 422 Senior Design II, IE 550 Graduate Seminar, IE 522 Optimization Method in Industrial Engineering, IE 530 Research Methods, IE 692 Stochastic Processes. IE 4373/6373 Linear Programming, IE 4623/6623 Engineering Statistics II, IE 4753/6753 Systems Engineering and Analysis, IE 4543/6543 Logistics Engineering (Supply Chain Management), IE 8353 Manufacturing Systems Modeling, IE 8723 Operations Research II (Stochastic Processes), IE 8990 Special Topics in Industrial Engineering: Optimization, IE 8753 Nonlinear Programming, IE 8990 Special Topics in Industrial Engineering: Network Flows

## RESEARCH

### Research Grants in the Last Three Years

1. *Center for Freight Transportation for Efficient and Resilient Supply Chain (FERSC)*, US DOT, 2023-2028, PI, \$10,000,000.
2. *U.S.-Japan Exchange Program for Green Growth Collaboration through Clean Energy Technologies (EXCET)*, US Embassy in Tokyo, 2023-2025, PI, \$70,000 with \$140,000 matching.
3. *A Community Co-design-based Weatherization and Micro-grid Plan for an Equitable Energy Security and Environmental Health*, Welcome Trust, 2023~2026, Co-PI, \$1,675,910.
4. *East Tennessee Initiative for Smart Energy Management (ETISE)*, DOE, 2023-2026, PI, \$396,813.
5. *Realization of energy efficiency and carbon emission reduction of semiconductor supply chains through cybersecurity*, The Cybersecurity Manufacturing Innovation Institute, 2022-2023, PI, \$60,000.
6. *SRS RN: People-Centric Integrated Assessment Model for Regional Sustainability (PIAMRS): Focusing on the Central Appalachian Region*, NSF, 2022, PI, \$145,749.
7. *US Food, Loss, and Waste and Its Relationship with Energy consumption and Carbon Emissions*, Oak Ridge National Lab, 2022-2024, PI, \$125,145.
8. *Administrative Support for East Tennessee Clean Fuels*, Tennessee Clean Fuels, 2018-2024, PI, \$2,7179,774.
9. *Support for Land Freight Lifecycle*, OnTrackNorthAmerica, 2021-2022, PI, \$54,839.
10. *CPS: Medium: Bio-socially Adaptive Control of Robotics-Augmented Building-Human Systems for Infection Prevention by Cybernation of Pathogen Transmission*, NSF, 2021-2023, Co-PI, \$1,199,129.



11. *Machine Learning Methods for Predicting Irregularities, trip coverage and duty deformation*, 2021-2022, FedEx, PI, \$256,888.
12. *Workplace Charging Requirement Analysis*, Tennessee Valley Authority, 2021, PI, \$100,000.
13. *UNS: International Research Coordination Network for Creating Transdisciplinary Nodes of Food-Energy-Water to Support Sustainable Urban Systems*, NSF, 2020-2023, co-PI, \$500,000.
14. *Coupled FEWS Modeling for Sustainability of the Global Crop Supply Chain with a Focus on US-China Interactions*, NSF, 2019-2023, PI, \$500,000.
15. *Smart Manufacturing Readiness Evaluation*, Oak Ridge National Lab, 2020-2021, PI, \$57,556.
16. *Materials Management Optimization via Technology Deployment*, DOE/Consolidated Nuclear Security, 2019-2022, PI, \$554,072.
17. *Analysis for Regional and Global Land Ecosystem Modeling*, Oak Ridge National Lab, 2015-2022, PI, \$244,379.
18. *Data Analytics Support for Integrated Earth Model*, Oak Ridge National Lab, 2019-2022, Co-PI, \$178,649.
19. *Additive Manufacturing Support and Research*, DOE/Consolidated Nuclear Security, 2017-2022, PI, \$261,466.
20. *Industrial Landfill Waste Management (Reduce, Recycle, and Reuse) Technology Assessment*, Oak Ridge National Lab, 2018-2022, PI, \$55,051.
21. *Flight Reserve Optimization*, FedEx, 2018-2021, PI, \$74,834.
22. *Flight Risk Analysis, Validation, and Optimization Phases I-IV*, FedEx, 2014-2021, PI, \$284,000.
23. *Policy Study - Adoption of Alternative Fuel Vehicles*, Oak Ridge National Lab, 2018-2022, PI, \$193,698.

#### Selected Journal Papers in the Last Three Years

1. W. Dong and **M. Jin\***, “Automated Storage and Retrieval System Design with Variant Lane Depths,” Accepted by *European Journal of Operational Research*, 2023.
2. Y. Zhang, J. Mao, D. M. Ricciuto, **M. Jin**, Y. Yu, X. Shi, S. Wullschleger, R. Tang, and J. Liu. "Global fire modelling and control attributions based on the ensemble machine learning and satellite observations." *Science of Remote Sensing* 7, 2023.
3. D. Vance, **M. Jin\***, C. Price, S. U. Nimbalkar, and T. Wenning. "Smart manufacturing maturity models and their applicability: a review." *Journal of Manufacturing Technology Management* ahead-of-print, 2023,
4. T. Cokuyasar and **M. Jin\***, “Additive Manufacturing Capacity Allocation Problem over a Network,” *IIEE Transactions*, 55(8), 807-820, 2023.
5. M. Erkoc, H. Gurnani\*, S. Ray, and **M. Jin**, “Quality Investment, Inspection Policy and Pricing Decisions in a Decentralized Supply Chain,” *Production and Operations Management*, 32 (1), 2023.
6. Y. Wang, J. Mao\*, F. Hoffman, C. Bonfils, H. Douville, **M. Jin**, P. Thornton, D. Ricciuto, X. Shi, H. Chen, S. Wullschleger, S. Piao, and Y Dai, “Quantification of human contribution to soil moisture–based terrestrial aridity,” *Nature Communications*, 13(1), 1-11, 2022.
7. R. Zhou, Y. Wang, **M. Jin\***, J. Mao, and X. Zheng, “Coffee Supply Chain Planning under Climate Change,” *the Journal of Integrative Environmental Sciences*, 19, 1-15, 2022.
8. C. Griffin, J. Hale, and **M. Jin\***, “A Framework for Assessing Investment Costs of Additive Manufacturing,” *Progress in Additive Manufacturing*, 7, 903-915, 2022.
9. W. Dong, K. Armstrong, **M. Jin\***, S. Nimbalkar, W. Guo, J. Zhuang and J. Cresko, “A framework to quantify mass flow and assess food loss and waste in the US food supply chain,” *Communications Earth & Environment*, 3(1), pp.1-11, 2022.
10. S. Zhou, Z. Jia, **M. Jin\***, and N. Du, “Minimizing makespan on parallel batch processing machines with two-dimensional rectangular jobs”. *Computers & Industrial Engineering*, 169, p.108167, 2022.
11. Y. Wang, Z. Yu, L. Shen, and **M. Jin\***, “Operational modes of E-closed loop supply chain considering platforms’ services,” *International Journal of Production Economics*, p.108551, 2022.
12. S. Zhou, **M. Jin\***, C. Liu, X. Zheng, and H. Chen, Scheduling a single batch processing machine with non-identical two-dimensional job sizes. *Expert Systems with Applications*, 201, p.116907, 2022.
13. H. Sun, Y. Sun, **M. Jin**, S.A. Ripp, G.S. Saylor, and J. Zhuang\*, “Domestic plant food loss and waste in the United States: Environmental footprints and mitigation strategies. *Waste Management*, 150, pp.202-207, 2022.

14. R. Li, **M. Jin**<sup>\*</sup>, Z. Pei, and D. Wang, "Geometrical Defect Detection on Additive Manufacturing Parts with Curvature Feature and Machine Learning," *The International Journal of Advanced Manufacturing Technology*, 120 (5), pp.3719-3729, 2022.
15. K. Zhang, X. Li<sup>\*</sup>, **M. Jin**, "Efficient Solution Methods for A General R-Interdiction Median Problem with Fortification," *INFORM Journal on Computing*, 34(2), pp.1272-1290. 2022.
16. R. Chai, J. Mao<sup>\*</sup>, H. Chen, Y. Wang, X. Shi, **M. Jin**, T. Zhao, F.M. Hoffman, D.M. Ricciuto, and S.D. Wullschlegler, "Human-caused Long-Term Changes in Global Aridity," *npj Climate and Atmospheric Science*, 4(1), pp.1-8, 2021
17. W. Dong and **M. Jin**<sup>\*</sup>, "Travel Time Models for Tier-To-Tier SBS/RS with Different Storage Assignment Policies and Shuttle Dispatching Rules," *Transportation Research Part E: Logistics and Transportation Review*, 155, p.102485, 2021
18. R. Tang, J. Mao, **M. Jin**, A. Chen, Y. Yu, X. Shi, Y. Zhang, F. M. Hoffman, M. Xu, and Y. Wang, "Interannual Variability and Climatic Sensitivity of global Wildfire Activity", *Advances in Climate Change Research*, 12(5), pp.686-695, 2021.
19. W. Dong, **M. Jin**<sup>\*</sup>, Y. Wang, and P. Kelle, "Retrieval Scheduling in Crane-based 3D Automated Retrieval and Storage Systems with Shuttles," *Annals of Operations Research*, 302, 111-135, 2021.
20. Y. Wang, J. Mao, **M. Jin**, F.M. Hoffman, X. Shi, S.D. Wullschlegler, and Y. Dai, "Development of Observation-based Global Multi-layer Soil Moisture Products for 1970 to 2016," *Earth System Science Data*, 13, 4385-4405, 2021.
21. J. Hale and **M. Jin**<sup>\*</sup>, "A Conceptual Framework for Witness Builds and Witness Artifacts in Additive Manufacturing", *Rapid Prototyping Journal*, 27 (6), 2021
22. R. Li, **M. Jin**<sup>\*</sup>, and V. Paquit, "Geometrical Defect Detection for Additive Manufacturing with Machine Learning Models," *Materials & Design*, 206, 109726, 2021.
23. N. Liu, F. Xie, Z. Lin<sup>\*</sup>, and **M. Jin**, "Empirical Estimation of Route Length Along U.S. Interstate Highways Based on Great Circle Distance," *Transportation Research Record*, 2675(10), pp.1248-1253, 2021.
24. Y. Wang, Z. Yu, **M. Jin**<sup>\*</sup>, and J. Mao, "Decisions and Coordination of Retailer-led Low-carbon Supply Chain under Altruistic Preference," *European Journal of Operational Research*, 293, (3) 910-925, 2021.
25. T. Cokoyasar<sup>\*</sup>, W. Dong, **M. Jin**, I.O. Verbas, "Designing a Drone Delivery Network with Automated Battery Swapping Machines", *Computers and Operations Research*, 129, 105177, 2021.
26. Z. Liu, Y. Wang, **M. Jin**<sup>\*</sup>, H. Wu, and W. Dong, "Energy Consumption Model for Shuttle-Based Storage and Retrieval Systems", *Journal of Cleaner Production*, 282, 124480, 2021.
27. Y. Gong, **M. Jin**, and Z. Yuan<sup>\*</sup>, "Robotic Mobile Fulfillment System Considering Customer Classes", *International Journal of Production Research*, 59(16), 5032-5049, 2021.
28. Y. Ding, **M. Jin**, S. Li, and D. Feng<sup>\*</sup>, "Smart Logistics Based on the Internet of Things Technology: An Overview", *International Journal of Logistics Research and Applications*, 24(4), 323-345, 2021.

#### **Selected Professional Service**

- Editor-in-Chief of Cleaner and Circular Bioeconomy, 2021 – present
- Executive Editor of the Journal of Cleaner Production, 2020 – present
- Editorial board member of the International Journal of Production Economics, 2014 - 2021
- Editorial board member of the Engineering Economist, 2013 – present
- Proposal panelist for National Science Foundation and Department of Energy, 2015, 2020, 2021

#### **HONORS IN THE LAST THREE YEARS**

- 2023 Dr. Kenneth Kirby Endowed Faculty Award
- John D. Tickle Professorship, UTK, 2021-present
- 2021 UTK Success in Multidisciplinary Research Award
- 2020 UTK Chancellor's Research and Creative Achievement Award
- 2020 Tickle College of Engineering Research Achieve Award

#### **PH.D. STUDENT ADVISEES**

**Ongoing (9):** David Vance, Jingwei Chen, Beau Groom, Rui Zhou, Yue Yao, Adam Thomas, Ziwei Liu, Sarita Rattanakunuprakarn, Robin Clark

**Brendan P. McConville**

1741 Volunteer Blvd, Knoxville, TN 37916

(865) 974-7546 • [bmcconvi@utk.edu](mailto:bmcconvi@utk.edu)[www.mcconvillemusic.com](http://www.mcconvillemusic.com)<https://music.utk.edu/people/mcconville/>**EDUCATION**

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Rutgers University, Mason Gross School of the Arts, New Brunswick, NJ

Ph.D., Music Theory and Composition, May 2007

M.A., Music Theory and Composition, January 2005

Johns Hopkins University, musical training at Peabody Conservatory of Music, Baltimore, MD

Honors Bachelors of Arts Degree, May 2000

Honors: Phi Beta Kappa, Omicron Delta Kappa, Golden Key International Honor Society

**TEACHING AND WORK EXPERIENCE**

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The University of Tennessee, College of Arts &amp; Sciences, Knoxville, TN

*Interim Associate Dean for Academic & Faculty Affairs*

June 2023 – Present

- Selected Responsibilities: Oversight of all matters of academic (curriculum, advising, student wellness and success, etc.) and faculty (annual evaluation, promotion & tenure, searches, etc.) affairs for the College of Music.
- Selected University Committees: Chancellor's Leadership Academy, College of Emerging and Collaborative Studies (CECS) Advisory Board, CECS Curriculum Program, UTK Provost's Artificial Intelligence Task Force, Undergraduate Curriculum Committee, Undergraduate Council, Undergraduate Academic Policies Committee, Graduate Curriculum Committee, Graduate Council, College Teaching Council

The University of Tennessee, College of Arts &amp; Sciences, Knoxville, TN

*Associate Dean for Academic Programs*

September 2022 – June 2023

- Selected Responsibilities: Provide leadership and direction for students and their concerns, including information and guidance regarding the college's undergraduate and graduate degree programs and activities. In addition, leadership collaborates with students and campus administration to address issues related to orientation and student activities, as well as curriculum development and implementation.
  - Leadership of:
    - undergraduate programs in the College (nearly 10,000 students in over 150 majors, minors, certificates, concentrations, and pre-professional programs)
    - graduate programs in the College (nearly 1,500 students in approximately 50 graduate programs and certificates)
    - fully online degree programs in the College
  - College of Arts & Sciences oversight and coordination of:
    - all curriculum changes

- strategic vision for academic and online programming
- student enrollments and planning
- student success (e.g. identifying high DFW, coaching/tutoring, mentoring, etc.)
- College Teaching Council (e.g. general education, best practices in online instruction, inclusive teaching initiatives, etc.)
- teaching issues, awards and recognition, strategic teaching hires
- student issues, grade appeals, awards and graduate funding, etc.
  
- Selected Dean’s cabinet high-priority topics:
  - annual College budget
  - promotion and tenure
  - diversity and inclusion initiatives
  - faculty and staff issues
  - retention offers
  - University spacing issues
- University Committees: UTK Fall 2023 Provost Task Force, UTK Provost’s Artificial Intelligence Task Force, Undergraduate Curriculum Committee, Undergraduate Council, Undergraduate Academic Policies Committee, Graduate Curriculum Committee, Graduate Council, College Teaching Council, Executive Associates Deans’ Committee (Office of Vice Provost for Academic Affairs), Noodle Online Programs Planning Committee, Nursing/College of Arts & Sciences Timetable Committee, Curriculog Pilot Committee
- Strategic Initiatives: (projects in development)
  - Nursing and foreign language minor
  - Arts administration (School of Art, College of Business)
  - Sustainability Chain concentrations (Dept of Geography and Sustainability, College of Agriculture, College of Business)
  - Jumpstart: College and Provost-funded program to develop fully online courses
  - Leading group of A&S faculty to study AI & online learning at Arizona State U.

The University of Tennessee, School of Music, Knoxville, TN	
<i>Director for Undergraduate Studies</i>	January 2018 – 2022
<i>Coordinator, Music Theory and Composition</i>	January 2017 – 2022
<i>Manager, School of Music Timetable of Classes</i>	August 2013 – 2022
<i>Professor</i>	August 2020 – Present
<i>Associate Professor</i>	August 2014 – July 2020
<i>Assistant Professor</i>	August 2008 – July 2014
<i>Lecturer</i>	August 2007 – July 2008

Conservatorio Luisa D’Annunzio, Pescara, Italy	
<i>Guest Instructor</i>	Spring 2016

- Taught compositional techniques, theoretical concepts and technology to conservatory students (taught in Italian)

Chief Academic Officer	Spring 2011 – Summer 2013
Appademia, LLC	

Sony Music Entertainment, Inc., New York, NY

*Production Assistant, New Technology and Business Development* August 2000 – August 2002

## SELECTED PUBLICATIONS

### *Book*

- McConville, Brendan and Barbara Murphy. 2020. *Foundations of Music Theory: an Interactive eBook, Second Edition*. Dubuque: Kendall-Hunt.
  - Online textbook includes interactive drills and presentations, flashcards, and assessments that pull from banks of nearly 4,000 questions.

### *Scholarly Peer Reviewed Articles*

- McConville, Brendan. 2021. “Constructivist Peer Review in Music Theory and Composition Courses: Technologies and Practice,” *Journal of the Association for Technology in Music Instruction*, 2 (1).
- McConville, Brendan and Barbara Murphy. 2017. “What is Online? A Survey and Study of Online Music Courses.” *College Music Symposium* 57: 1 – 18 (JSTOR and online).
  - Citations:
- McConville, Brendan. 2012 “Noteflight as a Web 2.0 Tool for Music Theory Pedagogy.” *Journal of Music Theory Pedagogy* 26: 265 – 289.

### *Commercial Recordings*

- *Fantasia e Romanze*. 2020. DaVinci Classics (Japan).
- *Un D’Annunzio Nuovo*. 2018. Wide Classique (Italy).
- *Punto de Encuentro*. 2017. Centro par la Música y Tecnología (National University of Rosario, Argentina) and the University of Tennessee (USA).
- *Rapport: Vocal Chamber Music*. 2010. Navona Records (USA), distributed by Naxos.
- *Masterworks of the New Era, Volume 11*. 2007. ERM Media (USA).

## SELECTED HONORS/AWARDS

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- 2022. Affiliated Fellow, American Academy of Rome.
- 2019. The American Prize in Music Composition (vocal chamber) for *Quattro Canzoni da ‘La Pioggia nel Pineto’* [National Finalist]
- 2019. Winner, Global Music Award Silver Medal – Outstanding Achievement, *Un D’Annunzio Nuovo*, album category.
- 2019. Winner, Global Music Award Silver Medal – Outstanding Achievement, Brendan McConville, composer category for *Un D’Annunzio Nuovo*.
- 2019. Winner, Global Music Award Silver Medal – Outstanding Achievement, *Un D’Annunzio Nuovo*, modern classical category.
- 2015 – 2016. Fulbright Core Scholar Award to Italy

**Dr. Vasileios Maroulas**  
**Assistant Vice Chancellor/ Deputy Director AI TENNessee Initiative/ Professor**  
**University of Tennessee**

**Office address:** 202 Ayres Hall, 1403 Circle Drive, Knoxville, TN 37996  
**Office phone #:** 865-974-4302; **Email address:** [vasileios.maroulas@utk.edu](mailto:vasileios.maroulas@utk.edu)

#### Research Interests

- AI and Dynamic Data Learning
- Mathematical Foundations of Data Science
- Bayesian Computational Statistics
- Quantum Machine Learning/Deep Learning
- Applications to Health, Biology, Neuroscience Chemistry, Materials Science

#### Professional Appointments

- Assistant Vice Chancellor and Deputy Director of AI TENNessee Initiative, October 2023 -
- Professor (with tenure), Department of Mathematics, Department of Business Analytics & Statistics, Bredesen Center Data Science and Engineering, University of Tennessee, August 2019-
- Senior Research Fellow, Army Research Lab, September 2019-September 2021.
- Associate Professor (with tenure), Department of Mathematics, Department of Business Analytics & Statistics, and Bredesen Center in Data Science & Engineering, University of Tennessee, August 2016-July 2019.
- Assistant Professor, Department of Mathematics, University of Tennessee, August 2010-July 2016.
- Assistant Professor, Department of Business Analytics and Statistics, University of Tennessee, February 2015-July 2016.
- Leverhulme Trust Visiting Fellow, Mathematical Sciences Dept., University of Bath, UK, 10/2013-7/2014.
- Industrial Postdoctoral Fellow, joint appointment with the Institute for Mathematics and its Applications (IMA), University of Minnesota and Lockheed Martin. September, 2008-July, 2010.

#### Education

- PhD (2008), Department of Statistics and Operations Research, University of North Carolina at Chapel Hill, NC.
- BSc (2003), Department of Mathematics, University of Athens, Greece. Major in Applied Mathematics.

#### Selected Awards and Honors

- Chancellor's Award for Research and Creative Achievement, UTK, 2023
- Graduate Research Mentor of the Year, UTK, 2020.
- Senior Research Fellowship, Army Research Lab
- Elected Member of the International Statistical Institute, 2018.
- Interdepartmental Collaborative Research and Scholarship Award, College of Arts & Sciences, University of Tennessee, 2018.
- Leverhulme Trust Fellow, University of Bath, UK, 2012.

#### Selected Recent Publications (Total: 71)

1. **V. Maroulas**, J. Mike and C. Oballe. Nonparametric Estimation of Probability Density Functions of Random Persistence Diagrams. *Journal of Machine Learning Research*, 20 (151), pp.1-49, 2019.
2. **V. Maroulas**, F. Nasrin, and C. Oballe. A Bayesian framework for persistence homology. *SIAM Journal on Mathematics of Data Science*, 2(1), pp. 48-74, 2020.
3. J. Townsend, C. Micucci, J. H. Hymel, **V. Maroulas**, and K. Vogiatzis. Representation of Molecular Structures with Persistent Homology Leads to the Discovery of Molecular Groups with Enhanced CO<sub>2</sub> Binding. *Nature Communications*, 11(1), pp. 1-11, 2020.
4. **V. Maroulas**, C. Micucci, and F. Nasrin. Bayesian Topological Learning for Determining the

- Structure of Biological Networks. *Bayesian Analysis*, 17(3), 711-736, 2022
5. T. Papamarkou, F. Nasrin, A. Lawson, N. Gong, O. Rios, and **V. Maroulas**. A Random Persistence Diagram Generation. *Statistics and Computing*, 32 (88), 2022.
  6. A. Aristotelous, E. Mitchell, **V. Maroulas**. ADLGM: An Efficient Adaptive Sampling Deep Learning Galerkin Method. *Journal of Computational Physics*, 477, 2023.
  7. E. Love, B. Fillipenko, **V. Maroulas** and G. Carlsson. Topological Convolutional Layers for Deep Learning. *Journal of Machine Learning Research*, 24: 1-35, 2023.
  8. O. Queen, G. McCarver, S. Thatigotla, B. Abolins, C. Brown, **V. Maroulas**, and K. Vogiatzis. Polymer Graph Neural Networks for Multitask Property Learning. *npj Computational Materials*. 9 (90), 2023.

#### **Funding Awards (Total: \$6,560,000; Current: \$4,911,342)\***

- **ARL – STRONG (\$1,200,000)**: Towards Robust Human-Agent Teaming via a Neuro-mimetic Architecture. (**Role: PI**; co-PI: Katia Sycara (CMU), Sam Neymotin (NKI)): 09/15/23 – 09/14/26
- **NSF (\$240,000)**: Center of Advanced Materials and Manufacturing (CAMP) (Role: Senior Personnel; PI: A. Tennant; Total: \$18,000,000): 09/01/2023 – 08/31/2029
- **Tennessee Higher Education (\$19,386)**: VA Reconnect (Role: co-PI; PI: B. LaMattina; Total: 27,711): 01/01/2023 – 10/15/2024
- **ORNL/ Veteran Affairs (\$193,506)**: Opioid Modeling Plan (Role: co-PI; PI: C. Strickland; Total: \$458,453): 1/11/23 – 6/30/24
- **ARL (\$100,000)**: Multi Modal Anomaly Detection Using Bio-Driven Artificial Attention Networks (INCUBATOR); (**Role: PI**): 7/1/22-6/30/23
- **ARL (\$2,424,735)**: Spatiotemporal Awareness via Topological Artificial Intelligence (SPARTAN) (**Role: PI**); 9/1/21-8/31/26
- **ARO (\$433,715)**: Computational Bayesian Learning via Topology (CoBILT) (**Role: PI**); 2/1/21-1/31/24.
- **Eastman (\$40,000)**: Molecular Encoding for Machine Learning (**Role: co-PI**; PI: K. Vogiatzis; Total \$110,000); 1/1/2021-12/31/2021.
- **NSF (\$300,000)**: Quantum Topological Signal Classification (QuATOMIC) (**Role: PI**; coPI: G. Siopsis); 8/1/2020-7/31/2024.
- **Summit-P/NSF (\$30,000)**: Data Science-toward understanding Earth and its Humans. (Education Grant to develop a Data Science Course; **Role: co-PI**; PI: Jeneva Clark); 1/1/2020-8/31/2021.
- **Army Research Lab (\$150,000)**: Stochastic Topological Analysis of EEG data. (**Role: PI**); 9/16/2019-9/15/2021.
- **UTK Office of Research (\$50,000)**: Force-energy Atomic Landscapes through Computationally Optimized Numerics (FALCON) (**Role: co-PI**; TOTAL: \$100K); 5/1/2019-4/30/2021.
- **NSF (\$100,000)**: Online spatiotemporal filtering and Bayesian topology for Tracking in dynamically designed sensor networks, (**Role: PI**); 8/15/2018-8/14/2021.
- **NSF (\$267,131)**: Mechanisms of Cytoplasmic Streaming, (**Role: co-PI**; PI: A. Nebenfuhr (UTK), co-PI: S. Abel (UTK); TOTAL: \$857,914); 8/1/2017-7/31/2021.
- **Army Research Office (\$457,465)**: Construction of distributions on complex topological spaces of signals and their application to machine learning and state estimation, (**Role: PI**); 7/1/2017-3/30/2021.
- **Army Research Lab/Thor Industries (\$200,000)**: Statistical Topological Learning of EEG data (**Role: PI**); 10/1/2017-8/31/2019.
- **IMA (\$5,000)**: 2017 John H. Barrett Memorial Lectures, Mathematical Foundations of Data Science, (**Role: PI**; co-PI: J. Rosinski, C. Webster, and S. Wise); 4/1/2017-3/31/2018.
- **NSF (\$16,000)**: 2017 John H. Barrett Memorial Lectures, Mathematical Foundations of Data Science, (**Role: PI**; co-PI: J. Rosinski, C. Webster, and S. Wise); 4/1/2017-3/31/2018.
- **Air Force Office of Scientific Research (\$100,637)**: A distributed dynamic data driven framework for multi-threat tracking. (**Role: co-PI**; PI: I. D. Schizas of UT, Arlington; TOTAL: \$225K); 2/15/2015-4/15/2018.

- **Simons Foundation (\$35,000)**: Collaboration grants for mathematicians-Large deviations for stochastic systems and applications, 9/2013-8/2018 (**Role: PI**).
- **ORNL/Department of Energy (\$159,676)**: Analyzing Data-Specific Model-Selection Criteria, 1/8/2015-5/31/2017 (**Role: PI**).
- **ORNL/Department of Energy (\$120,300)**: Bioenergy sustainability assessment, 8/1/2014-7/31/2016 (**Role: PI**).
- **NSF (\$10,000)**: John H. Barrett Memorial Lectures, Stochastic Filtering, Computations and their Applications, (**Role: PI**; co-PI: J. Rosinski and J. Xiong); 3/1/2015-2/28/2016
- **IMA (\$5,000)**: John H. Barrett Memorial Lectures, Stochastic Filtering, Computations and their Applications (**Role: PI**; co-PI: J. Xiong); 3/1/2015-2/28/2016.
- **Leverhulme Trust Visiting Grant (£29,190)**: Collaborative Work in Statistics at the University of Bath, 10/1/2013-7/31/2014 (**Role: PI**).
- **Summer Teaching Institute Award (\$2,000)**: Transforming Online the Probability and Statistics for Teachers Course, Math 507, Summer 2013 (**Role: PI**).
- **UTK Professional Development Award (\$4,000)**: Mathematical Modeling of Intracellular Movements, 5/2010-6/2010 (**Role: PI**).

\* **Bold numbers in parentheses indicate total funding to Vasileios Maroulas.**

### Teaching Experience

- Taught multiple courses in mathematics of AI, machine learning, and computational statistics
- Developed two brand new courses i) Linear Algebra for Data Science, ii) Mathematical Foundations of Data Science (this is a very popular grad course)
- Mentored (so far) 10 postdocs, 16 PhD Students, 4 Masters, 15 undergraduates, and 3 high school researchers. All were funded by various grants.

### Professional Service

#### *University of Tennessee*

- Chair of two Hiring Committees for two senior hires in AI in Math, 2023-2024
- Elected Member of the Advisory Committee, August 2022- May 2024
- Lead of the Science informed AI Cluster Hire, 2022-
- Member of the Board of Visitors Committee, 2023-2024
- Chair of Hiring Committee for a TT Assistant Prof. in Statistics, August 2019-May 2020.
- Faculty Senator, Fall 2020-2023
- Executive Committee representing the College of Arts and Sciences of the UTK Data Science Initiative, Spring 2020- Fall 2021
- Dean's Advisory Council, Member, Fall 2017-2019.

#### *Profession At Large*

- Member of the Strategic Planning in Mathematical Sciences in the US Army, 2021
- Letter writer for various promotions in the ranks of other R1 Universities, 2020, 2021, 2023.
- AFOSR Proposals Reviewer, 2015, 2016, 2017.
- ARO Proposals Reviewer 2020, 2021, 2022, 2023
- NSF Panel 2018, 2019, 2020, 2021, 2022, 2023.
- NIH Panel 2021.

#### *Editorial Roles*

- Editor-In-Chief, Foundations of Data Science, January 2019-.
- Editor, Statistics and Computing, Springer Nature, January 2022-.
- Senior Advisory Editor, Probabilistic Machine Learning, ACM, January 2023-
- Editor, Scientific Reports, May 2023-
- Associate Editor of Mathematical Biosciences and Engineering, 9/2018-.



## Curriculum Vita

### Nicholas N. Nagle

University of Tennessee-Knoxville  
 Burchfiel Geography Building 307  
 Knoxville, Tennessee 37996-0925  
[nnagle@utk.edu](mailto:nnagle@utk.edu)  
 865-974-6035

#### Research Expertise

*Geographic Information Science:* spatial data science, survey statistics,  
*Population Geography:* applied demography

#### Teaching Expertise

*Quantitative Methods in Geography:* Spatial and temporal statistics, sample design  
*Population Geography:* data collection, demography, migration

#### Education

Ph.D., University of California, Santa Barbara, 2005, Geography. Dissertation: "Continuous field statistical methods for spatial analysis in the social sciences"

#### Appointments

2021-present Professor & Head, Department of Geography, University of Tennessee, Knoxville  
 2015–2021 Associate Professor, Department of Geography, University of Tennessee, Knoxville  
 2009–2015 Assistant Professor, Department of Geography, University of Tennessee, Knoxville  
 2012–2015 UT Joint Faculty Affiliate, Oak Ridge National Laboratory.  
 2009–2012 Research Assistant Professor, Center for Business and Economic Research, University of Tennessee.  
 2005–2009 Assistant Professor, Department of Geography, University of Colorado at Boulder.

#### Courses Taught

##### University of Tennessee, Department of Geography (2009–present)

611 Seminar in GIS: Spatial Data Fusion and Classification  
 611 Seminar in GIS: Spatio-Temporal Bayesian Data Analysis  
 599 Geographic Concept & Method  
 515 Quantitative Methods in Geography  
 509: Special Topics: Introduction to Bayesian Data Analysis  
 509 Special Topics in Geography: Spatial Demography  
 441 Geography of US Cities  
 415 Introduction to Quantitative Methods  
 344 Population Geography  
 111 Our Digital World

##### University of Colorado at Boulder, Department of Geography (2005–2009)

1992 Introduction to Human Geographies  
 3023 Statistics for Earth Sciences  
 3612 Geography of American Cities  
 3662 Economic Geography

4023/5023 Quantitative Methods in Geography  
4622 City Life

**Selected Publications** (\* indicates student first author)

- Tuccillo, J., Stewart, R., Rose, A., Trombley, N., Moehl, J., Nagle, N., & Bhaduri, B. (2023). UrbanPop: A spatial microsimulation framework for exploring demographic influences on human dynamics. *Applied Geography*, 151, 102844. doi:[10.1016/j.apgeog.2022.102844](https://doi.org/10.1016/j.apgeog.2022.102844)
- Hipp, J. R., Boessen, A., Butts, C. T., Nagle, N. N., & Smith, E. J. (2023). The spatial distribution of neighborhood safety ties: Consequences for perceived collective efficacy?. *Journal of Urban Affairs*. doi:[10.1080/07352166.2023.2192940](https://doi.org/10.1080/07352166.2023.2192940)
- Stewart, R., Erwin, S., Piburn, J., Nagle, N., Kaufman, J., Peluso, A., . . . Bhaduri, B. (2022). Near real time monitoring and forecasting for COVID-19 situational awareness. *Applied Geography*, 146, 102759. doi:[10.1016/j.apgeog.2022.102759](https://doi.org/10.1016/j.apgeog.2022.102759)
- Schroeder, T. A., Nagle, N. N., & McCollum, J. M. (2022). RegRake: A Web-Based Application for Custom Small Area Estimation and Mapping of Forest Survey Data With Regularized Raking. *Frontiers in Forests and Global Change*, 5. doi:[10.3389/ffgc.2022.769268](https://doi.org/10.3389/ffgc.2022.769268)
- Rose\*, M Brooke, Nagle, Nicholas N. (2021) Characterizing Forest Dynamics with Landsat-Derived Phenology Curves. *Remote Sensing* 13(2) 267. <https://doi.org/10.3390/rs13020267>
- Nagle, Nicholas N, Todd A Schroeder, Brooke Rose. (2019) A Regularized raking estimator for small-area mapping from forest inventory surveys. *Forests*, 10(11), 1045 <https://doi.org/10.3390/f10111045>
- Bohon, Stephanie A and Nicholas N Nagle. (2019) Method for measuring gender Diversity among college and university faculty. *Journal of Higher Education Theory and Practice* 19(6):28—39. <https://doi.org/10.33423/jhetp.v19i6.2302>
- Odoi\*, E. W., Nagle, N., Roberson, S., & Kintziger, K. W. (2019). Geographic disparities and temporal changes in risk of death from myocardial infarction in Florida, 2000-2014. *BMC PUBLIC HEALTH*, 19, 13 pages. doi:[10.1186/s12889-019-6850-x](https://doi.org/10.1186/s12889-019-6850-x)
- Fowler, Christopher S, Nathan Frey, David C. Folch, Nicholas N. Nagle, and Seth Spielman. (2019) Who are the people in my neighborhood?: The “Contextual Fallacy” of measuring individual context with census geographies. *Geographical Analysis* 52(2): 155—168. <http://doi.org/10.1111/gean.12192>
- Grace, K., Nagle, N. N., Burgert-Brucker, C. R., Rutzick, S., Van Riper, D. C., Dontamsetti, T., & Croft, T. (2019). Integrating Environmental Context into DHS Analysis While Protecting Participant Confidentiality: A New Remote Sensing Method. *POPULATION AND DEVELOPMENT REVIEW*, 45(1), 197-+. doi:[10.1111/padr.12222](https://doi.org/10.1111/padr.12222)
- Jurjevich, J. R., Griffin, A. L., Spielman, S. E., Folch, D. C., Merrick, M., & Nagle, N. N. (2018). Navigating Statistical Uncertainty: How Urban and Regional Planners Understand and Work With American Community Survey (ACS) Data for Guiding Policy. *JOURNAL OF THE AMERICAN PLANNING ASSOCIATION*, 84(2), 112-126. doi:[10.1080/01944363.2018.1440182](https://doi.org/10.1080/01944363.2018.1440182)
- Schmidt, E. H., Bhaduri, B. L., Nagle, N., & Ralston, B. A. (2018). Supervised classification of electric power transmission line nominal voltage from high-resolution aerial imagery. *GIScience & Remote Sensing*, 55(6), 860-879. doi:[10.1080/15481603.2018.1460933](https://doi.org/10.1080/15481603.2018.1460933)

- Boessen, Adam, John R Hipp, Carter T Butts, Nicholas N Nagle, Emily J Smith. 2016. "Social fabric and fear of crime: Considering spatial location and time of day," *Social Networks*. <http://dx.doi.org/10.1016/j.socnet.2016.12.001>
- Amy Rose\* and Nicholas N. Nagle. 2017. "Validation of Spatiodemographic Estimates Produced Through Data Fusion of Small Area Census Records and Household Microdata." *Computers, Environment and Urban Systems*. 63: 38—49.. <http://dx.doi.org/10.1016/j.compenvurbsys.2016.07.006>
- Kathryn Grace, Nicholas N. Nagle and Greg Husak. 2016. "Can small-scale agricultural production improve children's health? Examining stunting vulnerability among very young children in Mali, West Africa" *Annals of the Association of American Geographers*.
- Kathryn Grace and Nicholas N. Nagle. 2015. "Using high resolution remotely sensed data to examine the relationship between agriculture and fertility in a pre-transitional setting: A case study of Mali." *The Professional Geographer* 67(4): 641-654. <http://dx.doi.org/10.1080/00330124.2015.1032899>
- Adam Boessen, John R. Hipp, Emily J. Smith, Carter T. Butts, Nicholas N. Nagle, and Zack Almquist. 2014. "Networks, space and residents' perception of cohesion." *American Journal of Community Psychology*. 53(3-4): 447-461. <http://dx.doi.org/10.1007/s10464-014-9639-1>
- Nicholas N. Nagle, Barbara P. Battenfield, Stefan Leyk, and Seth Spielman. 2014. "Dasymetric Modeling and Uncertainty." *Annals of the Association of American Geographers*. 104(1): 80–95. <http://dx.doi.org/10.1080/00045608.2013.843439>
- ]Stefan Leyk, Matt Ruther, Barbara P. Battenfield, Nicholas N. Nagle, and Alexander Stum. 2014. "Modeling residential developed land in rural areas: A size-restricted approach using parcel data." *Applied Geography*. 47: 33–45. <http://dx.doi.org/10.1016/j.apgeog.2013.11.013>
- Seth E. Spielman, David Folch and Nicholas N. Nagle. 2014. "Understanding uncertainty in the American Community Survey." *Applied Geography*. 46: 147–157. <http://dx.doi.org/10.1016/j.apgeog.2013.11.002>
- Stefan Leyk, Barbara P. Battenfield, Nicholas N. Nagle, and Alexander Stum. 2013. "Establishing relationships between parcel data and landcover for demographic small area estimation." *Cartography and Geographic Information Science*. 40(4): 305–315. <http://dx.doi.org/10.1080/15230406.2013.782682>.
- John R. Hipp, Carter T. Butts, Ryan Acton, Nicholas N. Nagle, and Adam Boessen. 2013. "Extrapolative simulation of neighborhood networks based on population spatial distribution: Do they predict crime?" *Social Networks*. 35(4): 614–625. <http://dx.doi.org/10.1016/j.socnet.2013.07.002>.
- Matt Ruther, Galen Maclauren, Stefan Leyk, Barbara Battenfield, and Nicholas N. Nagle. 2013. "Validation of spatially allocated small area estimates for 1880 census demography." *Demographic Research*. 29: 579–616. <http://dx.doi.org/10.4054/DemRes.2013.29.22>
- Stefan Leyk, Barbara Battenfield, and Nicholas N. Nagle. 2013. "Modeling ambiguity in census microdata allocations to improve demographic small area estimates." *Transactions in Geographic Information Science*. 17(3): 406–425. <http://dx.doi.org/10.1111/j.1467-9671.2012.01366.x/>

## Adam G. Petrie

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University of Tennessee                apetrie@utk.edu  
Knoxville, TN 37996

### Education

- 2003–2007 Rensselaer Polytechnic Institute  
M.S. (2004) in Operations Research and Statistics  
Ph.D. (2007) in Decision Sciences and Engineering Systems  
dissertation title: *Spanning Trees as Tools for Data Analysis*  
dissertation committee: Thomas Willemain (chair), Mark Embrechts, John Mitchell, Malik Magdon-Ismael
- 1998-2001 The University of California, Santa Cruz  
M.S. in Astronomy and Astrophysics
- 1994-1998 California Institute of Technology  
B.S. in Astronomy

### Academic Positions

- 2020-            The University of Tennessee, Knoxville  
Senior Lecturer, Department of Business Analytics and Statistics
- 2014-2019 The University of Tennessee, Knoxville  
Lecturer, Department of Business Analytics and Statistics
- 2007-14        The University of Tennessee, Knoxville  
Assistant Professor, Department of Statistics, Operations, and Management Science
- 2006            Williams College  
Visiting Instructor, Department of Mathematics and Statistics
- 2001–2002 Cañada College  
Adjunct Instructor, Department of Science and Technology

### Teaching Experience

- University of Tennessee    BAS 479: Business Analytics Capstone (11 semesters)  
  BAS 474: Data Mining for Business Analytics (5 semesters)  
  BAS 320: Regression and Modeling with R (11 semesters)  
  BAS 471: Statistical Methods (8 semesters)  
  BZAN 533: Mathematical Methods and Statistics for Business Analytics (8 semesters)  
  STAT 201: Introduction to Statistics (6 semesters)  
  STAT 207: Honors: Introduction to Statistics (6 semesters)  
  STAT 563: Introduction to Probability and Mathematical Statistics (4 semesters)  
  STAT 564: Statistical Inference II (1 semester)  
  STAT 483/583: R for Statistical Programming (1 semester)  
  MGSC 532: Stochastic Models in Management Science (1 semester)

Williams College	MATH 102: Precalculus (1 semester)
Cañada College	ASTR 100: Introduction to Astronomy (3 semesters) ASTR 101: Astronomy Laboratory (2 semesters) PHYS 210: General Physics (1 semester)
Kaplan	MCAT Physics (1 section)
Rensselaer Polytechnic Institute	ENGR 2600: Modeling and Analysis of Uncertainty (TA) DSES 4140: Statistical Analysis (TA) DSES 6160: Applied Regression Analysis (TA)
UC Santa Cruz	LING 80G: The Nature and Language of Computers (TA) ASTR 2: Overview of the Universe (TA) ASTR 3: The Solar System (TA) ASTR 12: Stars and Stellar Evolutions (TA) ASTR 14: Observational Astronomy (TA)

## Publications

- 2017 Unleashing the Potential of Supply Chain Analytics. *MIT Sloan Management Review*, August 2017
- 2016 Graph-theoretic Multisample Tests of Equality in Distribution for High Dimensional Data. *Computational Statistics & Data Analysis*, April 2016
- 2016 Regression and Modeling with R. Cognella Academic Publishing.
- 2013 An Empirical Study of Tests for Uniformity in Multidimensional Data. *Computational Statistics & Data Analysis*, August 2013, pp. 253–268
- 2013 Prediction of ICU In-Hospital Mortality Using Artificial Neural Networks. *Proceedings of the 6th Annual Dynamic Systems and Control Conference* (to appear October 2013)
- 2012 Estimating Eigenvalues of Dynamical Systems from Time Series with Applications to Predicting Cardiac Alternans. *Proceedings of Royal Society A*, Published online before print July 4, 2012, doi: 10.1098/rspa.2012.0098
- 2011 Reconstruction of physiological signals using iterative retraining and accumulated averaging of neural network models. *Physiological Measurement*, 32, pp. 661-675
- 2011 Assessing the Change in Student Attitudes Toward Statistics at the University of Tennessee *2011 Proceedings of the American Statistical Association, Section on Statistical Education [CD-ROM]*. Alexandria, VA: American Statistical Association.
- 2011 Identifying the Intrinsic Dimensionality Using the Minimum Spanning Tree *2011 Proceedings of the American Statistical Association, Section on Statistical Computing [CD-ROM]*. Alexandria, VA: American Statistical Association.
- 2010 Detection of Cardiac Alternans via Statistical Analysis of the Eigenvalues of a Dynamical System *2010 Proceedings of the American Statistical Association, IMS Section [CD-ROM]*. Alexandria, VA: American Statistical Association.
- 2010 The Snake for Visualizing and for Counting Clusters in Multivariate Data. *Statistical Analysis and Data Mining*, Volume 3 Issue 4, pp. 236–252

- 2009 Distributions That Approximately Satisfy Benford's Law. *2009 Proceedings of the American Statistical Association, IMS Section [CD-ROM]*. Alexandria, VA: American Statistical Association.
- 2008 Visualizing Labeled Multivariate Data in Input and Feature Spaces with the Snake. *2008 Proceedings of the International Conference on Multivariate Statistical Modeling & High Dimensional Data Mining*. Kayseri, Turkey. CRC Press.
- 2008 Graph-Theoretic Multisample Tests of Equality for Multivariate Data with Applications to Detecting Changes in Data Streams. *2008 Proceedings of the American Statistical Association, Statistical Computing Section [CD-ROM]*. Alexandria, VA: American Statistical Association.
- 2007 Uniformity Testing in High Dimensions. *2007 Proceedings of the American Statistical Association, Statistical Computing Section [CD-ROM]*. Alexandria, VA: American Statistical Association.
- 2006 Using Spanning Trees as Data Analysis Tools. *2006 Proceedings of the American Statistical Association, Statistical Computing Section [CD-ROM]*. Alexandria, VA: American Statistical Association.
- 2006 New Methods for Detecting Bimodality in Histograms. *Technical Report. Decision Sciences and Engineering Systems at RPI*.

### Research Positions

- 2005 Rensselaer Polytechnic Institute, Department of Decision Sciences and Engineering Systems  
Research Assistant  
Principal Investigator: Ananth Krishnamurthy  
Topic: Numerical approximations for kanban systems in queueing networks
- 1999–2000 University of California, Santa Cruz, Department of Astronomy  
Research Assistant  
Principal Investigator: Sandra Faber  
Topic: STIS spectra of the cores of giant elliptical galaxies
- 1997 California Institute of Technology, Department of Astronomy  
Research Assistant  
Principal Investigator: Wallace Sargent  
Topic: Quasar absorption lines and the detection of H- $\alpha$  regions
- 1996 California Institute of Technology, Department of Astronomy  
Summer Undergraduate Research Fellow  
Principal Investigator: Charles Steidel  
Topic: Filter systems for detecting galaxies at  $z > 4$
- 1994 Northwestern University  
NASA Fellow  
Principal Investigator: Mel Ulmer  
Topic: Detecting gamma-ray pulsars

# Marshall Prado

Marshall Prado is an Assistant Professor of Design and Structural Technology at the University of Tennessee, where he teaches courses on integrative computational design, digital-robotic fabrication, additive manufacturing, and large-scale composite construction. His research is situated at the convergence of multiple disciplines, from architecture to engineering, biology to computer science, to develop a fundamental change in design and production methodologies.

## EDUCATION

### University of Stuttgart - Institute for Computational Design (ICD)

2013-Current    Doctoral Candidate

### Harvard University - Graduate School of Design (GSD)

2011-2012    Master in Design Studies (Advanced Placement) | Technology - with Distinction

2009-2011    Master in Architecture | Post-Professional

### North Carolina State University - College of Design

2004-2005    Bachelor of Architecture | Magna Cum-Laude - with Honors

1998-2004    Bachelor of Environmental Design in Architecture | Magna Cum-Laude with Honors  
*minor: (1) Art + Design, (2) Art Studies, (3) Spanish*

## ACADEMIC APPOINTMENTS

### University of Tennessee, Knoxville (UTK)

2017 -    Assistant Professor of Design and Structural Technology

### University of Stuttgart, Institute for Computational Design

2013 - 2017    Adjunct Professor (equiv) and Research Associate

### University of Hawaii at Manoa

2012    Visiting Assistant Professor

### Harvard University

2011    Research Associate

## SELECTED HONORS/ DESIGN AWARDS

### UTK Filament Tower

2020    Award for Composites Excellence (ACE): Most Creative Application, American Composites Manufacturing Association

2019    University Design Research Fellowship awarded by Exhibit Columbus

### B.Arch Technology Curriculum

2019    Innovation Award in the category of Development of Design or Design Thinking, American Institute of Architecture National

## SCHOLARSHIP AND RESEARCH

### Journal Articles

- 2020 Prado, M., 2020. "Skeletal composites: robotic fabrication processes for lightweight multi-nodal structural components." *Construction Robotics Journal*, 4(3), pp.217-226.
- 2020 Vasey, L., Felbrich, B., Prado, M., Tahanzadeh, B., Menges, A.: 2020, "Physically distributed multi-robot coordination and collaboration in construction: A case study in long-span coreless filament winding for fiber composites." *Construction Robotics Journal*/vol. 4 no. 1–2, pp. 3–18. (DOI: 10.1007/s41693-020-00031-y)
- 2019 Prado, M., 2019, "Morphogenic Spatial Analysis: A Novel Approach for Visualizing Volumetric Urban Conditions and Generating Analytical Morphology," *Technology/Architecture + Design*, 3:1, pp. 65-75, DOI: 10.1080/24751448.2019.1571827

### Book Contributions

- 2023 Prado, M. (2023) "Wind-up Architecture." Interviewed by Zach Cohen, *Homing the Machine*. pending publication expected in 2023
- 2018 Dörstelmann, M., Prado, M., Menges, A.: 2018, "Explorative Design and Fabrication Strategies for Fibrous Morphologies in Architecture." In Yuan, P., Menges, A., Leach, N. (eds): 2018, *Digital Fabrication*, Tongji University Press, Shanghai, pp. 168-181. (ISBN 978-7-5608-7334-3)

### Conference Papers

- 2023 Prado, M., Van Son, N.: 2023, "Hybrid Additive Manufacturing Processes for Lightweight Fiber Composite Structural Components." Abstract accepted to the IASS Annual Symposium 2023, 10-14 July 2023, Melbourne, Australia. *not published*
- 2023 Prado, M., Van Son, N.: 2023, "Hybrid Thermoplastic-Composite Building Components." In the proceedings of the 41st eCAADe Conference, Graz University of Technology, Austria, Sept. 2023, pending publication
- 2022 Van Son, N., Prado, M.: "Computational Schematic Design Utilizing Self-Organizing Programmatic Agents: a Novel approach to visualizing and organizing urban architectural data." In the proceedings of the 40th eCAADe Conference – Volume 2, KU Leuven Faculty of Architecture, Sint-Lucas Ghent, Belgium, Sept. 2022
- 2020 Prado, M.: 2020, "Computational Design of Lightweight Composite Tower Structures," in ACADIA - Distributed Proximities Proceedings of the ACADIA Conference. pp. 556-563.
- 2018 Solly, J., Früh, N., Saffarian, S., Prado, M., Vasey, L., Felbrich, B., Reist, D., Knippers, J., Menges, A.: 2018, "ICD/ITKE Research Pavilion 2016/2017: Integrative Design of a Composite Lattice Cantilever." In the proceedings of the IASS Annual Symposium 2018, 16-19 July 2018, MIT, Boston, Caitlin Mueller, Sigrid Adriaenssens (eds.), 2018
- 2017 Felbrich, B., Früh, N., Prado, M., Saffarian, S., Solly, J., Vasey, L., Knippers, J., Menges, A.: 2017, "Multi-Machine Fabrication: An Integrative Design Process Utilizing an Autonomous UAV and Industrial Robots for the Fabrication of Long-Span Composite Structures," in *Disciplines & Disruption the proceedings of the ACADIA Conference 2017*, Cambridge, MA, pp. 248-259. (ISBN: 978-0-692-96506-1)



## SERVICE

### Service to University

2022-2023	Advanced Construction Initiative, <i>co-chair with S.Swaminathan and H. Zhou</i>
2022	Future of Manufacturing Working Group
2021- Current	College of Emerging and Collaborative Studies, Data Science Committee
2020-2021	Technology-enhanced Teaching Fellow - CoAD Representative

### Service to College

2022-2023	Dean's Advisory Committee
2019-2021	Space and Technology Advisory Committee
2019-2020	CoAD Transition Task Group on Faculty Support and Research
2018-2019	Tenure-Track Faculty Search Committee, Interior Architecture
2018-2019	Lecturer Faculty Search Committee, Interior Architecture
2017	CoAD Undergraduate Research Assistant - Jury Member

### Service to Department

2022-2023	Master of Science Working Group
2022-2023	Director's Advisory Committee member
2021	Third-year Studio coordinator
2019-2021	Graduate Admissions Committee
2018-2021	Undergraduate Curriculum Committee
2020-2021	School of Architecture Director Search Committee
2019-2020	Visualization and Representation Working Group
2017-2018, 2023	Tennessee Architecture Fellow Search Committee ( <i>2018 committee chair</i> )

### Service to Discipline

2021	The Journal of Building Engineering, Peer Review Committee
2021, 2019	International Journal of Architectural Computing, Peer Review Committee
2020 - Current	Construction Robotics Journal, Associate Editor, Peer Review Committee
2020, 2022	Technology   Architecture + Design (TAD), Peer Review Committee
2020	Automation in Construction Journal, Peer Review Committee
2019	Architectural Science Review, Peer Review Committee
2019	ACM Symposium on Computational Fabrication, Peer Review Committee
2019	CAADRIA Conference, Peer Review Committee
2018 - Current	ACADIA Conference, Scientific Committee
2017, 2019	Fabricate Conference, Review Committee
2016	Journal of Composite Materials, Peer Review Committee
2015 - Current	Rob Arch Conference, Paper Committee

## Jonathan J. Ring

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CONTACT INFORMATION	311 Baker Center for Public Policy 1640 Cumberland Avenue University of Tennessee Knoxville, TN 37996	Tel: (865) 974-8574 Fax: (865) 974-7037 E-mail: jring7@utk.edu
ACADEMIC POSITIONS	<i>Director of Student Programs</i> Howard Baker Jr. Center for Public Policy University of Tennessee, Knoxville	<b>2019 - present</b>
	<i>Lecturer</i> Department of Political Science University of Tennessee, Knoxville	<b>2017 - present</b>
	<i>Assistant Professor</i> Cleveland State University	<b>2016 - 2017</b>
	<i>Postdoctoral Research Fellow &amp; Lecturer</i> University of Michigan	<b>2014 - 2016</b>
EDUCATION	Ph.D., Political Science, University of Iowa Dissertation: <i>The Diffusion of Norms in the International System</i>	<b>2014</b>
	M.A., Political Science, University of Iowa	<b>2010</b>
	B.A., Political Science & French, University of South Dakota	<b>2007</b>
PEER-REVIEWED PUBLICATIONS	Ring, Jonathan J. and Gary Uzonyi. 2022. "Rethinking Tests of the IO Effectiveness Hypothesis: Evidence from Counter-Piracy Efforts in the Global South." <i>International Studies Review</i> 24(3).	
	Cohen, Alexander H, John Alden, and Jonathan J. Ring. 2021. "Using a "Gateway Game" to Stimulate Student Interest and Build Foundational Knowledge." <i>Journal of Political Science Education</i> . 17(S1):104-115.	
	Ring, Jonathan J. and Wonjae Hwang. 2020. "Military and Economic Power Networks, Hedging, and Cooperation on the Korean Peninsula." <i>Asian Survey</i> 60(6): 1090-1115	
	Nieman, Mark David and Jonathan J. Ring. 2015. "The Construction of Human Rights: Accounting for Systematic Bias in Common Human Rights Measures." <i>European Political Science</i> . 14(4):473-495.	
	Mitchell, Sara McLaughlin, Jonathan J. Ring, and Mary K. Spellman. 2013. "Domestic Legal Traditions and States' Human Rights Practices." <i>Journal of Peace Research</i> 50(2): 189-202.	

- BOOK** Cohen, Alexander H, John Alden, and Jonathan J. Ring. 2019. *Gaming the System: Nine Games to Teach American Government through Active Learning*, New York: Routledge.
- OTHER PUBLICATIONS** Ring, Jonathan J. 2021. "The Savvy Consumer of Political Science Research." In Julia M. Hellwege, Eric D. Loepp, and Dan J. Mallinson (Eds). *Handbook of Political Research Pedagogy*. New York: Palgrave Macmillan.
- CONFERENCE PARTICIPATION & INVITED TALKS**
- International Studies Association – Annual Meeting, Nashville, TN 2022
  - International Studies Association – Midwest Annual Meeting, St. Louis, MO 2021
  - International Studies Association – Midwest Annual Meeting, Online 2020
  - Southern Political Science Association Annual Meeting, San Juan, Puerto Rico 2020
  - International Studies Association – Midwest Annual Meeting, St. Louis, MO 2019
  - The World Congress for Korean Politics and Society, Seoul, Republic of Korea 2019
  - International Studies Association Annual Meeting, Toronto, ON 2019
  - International Studies Association – Midwest Annual Meeting, St. Louis, MO 2018
  - International Studies Association Innovative Pedagogy conference, St. Louis, MO 2018
  - Facultad Latinoamericana de Ciencias Sociales Sede Ecuador (FLACSO) and ISA Meeting, Quito, Ecuador 2018
  - Midwest Political Science Association Annual Meeting, Chicago, IL 2018
  - International Studies Association – Midwest Annual Meeting, St. Louis, MO 2017
  - International Studies Association – Midwest Annual Meeting, St. Louis, MO 2016
  - Peace Science Society (International) Annual Meeting, South Bend, IN 2016
  - American Political Science Association Annual Meeting, San Francisco, CA 2015
  - Midwest Political Science Association Annual Meeting, Chicago, IL 2015
  - American Political Science Association Annual Meeting, Washington D.C. 2014
  - Shambaugh Conference: New Frontiers in the Study of Policy Diffusion, University of Iowa, Iowa City, IA 2014

- International Studies Association Annual Meeting,  
Toronto, ON 2014
- Midwest Political Science Association Annual Meeting,  
Chicago, IL 2014
- International Studies Association – Midwest Annual Meeting,  
St. Louis, MO 2013
- EITM Summer Institute,  
University of Houston 2013
- International Studies Association Annual Meeting,  
San Francisco, CA 2013
- St. Louis Area Methods Meeting,  
Iowa City, IA 2013
- Peace Science Society (International) Annual Meeting,  
Knoxville, TN 2013

PROFESSIONAL REVIEWER: American Political Science Review, Foreign Policy Analysis, International Interactions, International Studies Quarterly, International Studies Review, Journal of Peace Research, Political Research Quarterly, International Area Studies Review

MEMBER: American Political Science Association, International Studies Association, Midwest Political Science Association,

COMPUTER SKILLS  
Typesetting:  $\LaTeX$   
Statistical and Programming Software: R, Stata, Excel, Python, Netlogo

UPDATED March 8, 2023

**Curriculum Vita**  
**Louis M. Rocconi, Ph.D.**  
<https://lrocconi.github.io/>

**Contact Information:**

Educational Leadership and Policy Studies Department

Phone: 865-974-5479

Email: lrocconi@utk.edu

**Education**

- Ph.D., Educational Psychology & Research, University of Memphis, 2010
- B.S., Mathematics, Delta State University, Cleveland, MS, 2005

**Professional Experience**

- Associate Professor (tenured), Evaluation, Statistics, and Methodology; Affiliated Faculty, Intercollegiate Graduate Statistics and Data Science Program; The University of Tennessee, 2022-Present
- Assistant Professor, Evaluation, Statistics, and Methodology; Affiliated Faculty, Intercollegiate Graduate Statistics and Data Science Program; The University of Tennessee, 2016-2022
- Assistant Research Scientist, Center for Postsecondary Research, Indiana University, Bloomington, 2011 – 2016
- Post-Doctoral Research Fellow, University of Memphis Office of the Vice Provost Academic Programs & Assessment, 2010 - 2011

**Honors & Awards**

- Outstanding Graduate Professor from the Graduate Student Senate at the University of Tennessee, 2023
- Helen B. Watson Faculty/Student Award for Outstanding Doctoral Dissertation from the College of Education, Health, and Human Sciences at the University of Tennessee, 2023
- Excellence in Graduate Student Mentorship Award from the Department of Educational Leadership and Policy Studies, 2023
- Louie M. and Betty M. Phillips Faculty Support in Education Award from the College of Education, Health, and Human Sciences at the University of Tennessee, 2022

**Research** Published over 30 refereed articles in various journals including *Numeracy*, *The Quantitative Methods for Psychology*, *Practical Assessment, Research, and Evaluation*, *Evaluation and the Health Professions*, *School Psychology Review*, *Teaching and Teacher Education*, *Research in Higher Education*, *Journal of Research in STEM Education*, *Research and Practice in Assessment*, *Social Science & Humanities Open*, among others.

**Selected Publications**

- Traga Philippakos, Z., MacAuthur, C., & Rocconi, L. M. (2023). Effects of genre-based writing professional development on K to 2 teachers' confidence and students' writing quality. *Teaching and Teacher Education*, 135.

- Boyd, A., Morrow, J. M., & Rocconi, L. M. (2022). Development and validation of the Parasocial Relationship in Social Media Survey. *The Journal of Social Media in Society, 11*(2), 192-208.
- Traga Philippakos, Z., Rocconi, L. M., Blake, K., & Summers, J. (2022). Teachers' practices during COVID-19: Practices and perspectives in elementary and secondary settings. *Social Science & Humanities Open, 6*, 1-10.
- Peterson, C., Ortiz, R., & Rocconi, L.M., &. (2022). Community food security: The multi-level association between social capital, economic capital, and diet quality. *International Journal of Community Well-Being, 5*, 571-585.
- Rocconi, L. M. & Boyd, A. T. (2022). Measuring Quality in Legal Education: Examining the Relationship between Law School Rank and Student Engagement. *Research in Higher Education, 63*, 1261-1282.
- Wright, S., Skinner, C. H., Crewdson, M., Moore, T., McCurdy, M., Coleman, M. B., & Rocconi, L. M. (2022). Using a tootling intervention to sequentially enhance and maintain at-risk elementary students' performance of multiple social skills. *School Psychology, 37*(3), 248-258.
- McCallum, R., Kirkpatrick, B., Heidel, R., Rocconi, L. M., Price, C., Gee, K., Lewis, J. (2022). Validating a Novel Emotional Intelligence Instrument for Resident Physicians. *Evaluation & the Health Professions, 45*(3), 277-287.
- Pacheco Diaz, N. & Rocconi, L. M. (2021). Science achievement in Chilean students: A multilevel model approach. *Journal of Research in STEM Education, 7*(2), 93-116.
- Parlier, R., Rocconi, L. M., Davison, C., & Skolits, G. (2022). The effects of learning community participation on community college students' learning outcomes and student engagement. *Community College Journal of Research and Practice, 46*(4), 272-283.
- Boyd, A. T. & Rocconi, L. M. (2021) Formatting data for one and two mode undirected social network analysis. *Practical Assessment, Research, and Evaluation, 26*(24), 1-10.
- Walker, J. P. & Rocconi, L. M. (2021). Experiential Learning Student Surveys: Indirect Measures of Student Growth. *Research and Practice in Assessment, 16*(1), 21-35.
- Richardson, R., Rocconi, L.M., & Crewdson, M. (2020). Evaluating English Learner Progress in Reading: How Much Growth Can We Expect? *School Psychology Review*.
- Rocconi, L, Xiqian, L., & Pike, G. R. (2020). Holland's theory and the impact of person-environment fit on grades, perceived gains, and satisfaction. *Higher Education (80)*5, 857-874.
- Gibson, T., Morrow, J. A., & Rocconi, L. M. (2020). A modernized heuristic approach to robust exploratory factor analysis. *The Quantitative Methods for Psychology, 16*(4), 295-307.
- Rocconi, L. M., Dumford, A. D., & Butler, B. (2020). How often is 'often': Examining the meaning of vague quantifiers in higher education. *Research in Higher Education, 61*(2), 229-247.
- Rocconi, L. M., & Gonyea, R. (2018). Contextualizing student engagement effect sizes: An empirical analysis. *Research & Practice in Assessment, 13*, 22-38.
- Zilvinski, J., & Rocconi, L. M. (2018). Revisiting the relationship between institutional rank and student engagement. *The Review of Higher Education, 41*(2), 253-280.
- Dumford, A., & Rocconi, L. M. (2015). Development of the quantitative reasoning items on the National Survey of Student Engagement. *Numeracy, 8*(1), Article 5.

- Rocconi, L. M. (2013). Analyzing multilevel data: Comparing findings from hierarchical linear modeling and ordinary least squares regression. *Higher Education*, 66(4), 439-461.
- Rocconi, L. M., Lambert, A. D., McCormick, A. C., & Sarraf, S. A. (2013). Making college count: An examination of quantitative reasoning activities in higher education. *Numeracy*, 6(2), Article 10.
- Rocconi, L. M. (2011). The impact of learning communities on first year students' growth and development in college. *Research in Higher Education*, 52(2), 178-193.
- Rocconi, L. M., & Ethington, C. A. (2009). Assessing longitudinal change: Adjustment for regression to the mean effects. *Research in Higher Education*, 50(4), 368-376.

**Statistical Analysis Software** Developed multiple R packages including mlmhelper and snafu.

**Current Grants/Contracts** Involved in multiple grants/contracts as a Statistical Consultant with total funding exceeding \$400k.

- Statistical Consultant: "Developing Multisyllabic Decoding and Encoding Skills for Upper Elementary Learners." Reading Reimagined (AERDF). \$388,150
- Statistical Consultant: "From Multiple ACEs to Flourishing Learners in Rural Morgan County Schools." Youth Endowment Fund 2023. \$10,000

**Under Review** Co-PI for multiple grants under review with total funding exceeding \$6m.

- Co-PI: "Early Intervention for Self-Efficacy and Self-Regulation to Prevent Escalating Aggression and Violence." National Institutes of Health. PAR-21-130. \$2,873,182
- Co-PI: "Developing Strategic High School Writers." Institute of Education Sciences. ED 022023-001. \$1,999,997
- Co-PI: "Synthesis Writing Using a Writing-Reading Connections Approach." Institute of Education Sciences. \$1,643,305

**Funded Past Grants/Contracts** PI or Co-PI for multiple funded grants/contracts with total funding exceeding \$120k.

- Co-PI: "Striving to Improve Literacy Instruction and Learning for All. Tennessee Reading Research Center: A Reading 360 Initiative." Proposal funded by the Tennessee Department of Education. \$5,000,000
- Co-PI: "Education Preparation Providers (EPP) Landscape Analysis." Funded by the Tennessee Department of Education: EPP Landscape Analysis 2021 Request for Applications. \$50,000
- Co-PI: "PreK-12 District Landscape Analysis." Funded by the Tennessee Department of Education: PreK-12 District Landscape Analysis 2021 Request for Applications. \$50,000
- PI: "Launching a Microcredential in Educational Data Analytics" College of Education, Health, and Human Sciences Strategic Initiatives. \$10,000
- PI: "Developing easy-to-use and accessible statistical tools for applied researchers." 2020 Summer Graduate Research Assistantship. University of Tennessee, Knoxville. \$3,600
- PI: "Measuring Quality in Legal Education: Examining the Relationship between Law School Rank and Student Engagement." 2018 AccessLex Institute/AIR Research Program. March 2019 – February 2020. \$50,000

**Vandana Singh Avasty**

Interim Program Director

College of Emerging and Collaborate Studies

Professor

School of Information Sciences

University of Tennessee Knoxville

Email: [vandana@utk.edu](mailto:vandana@utk.edu) Website: <https://sis.utk.edu/vandana>**EDUCATION**

B.Sc.	G.B. Pant University, Pantnagar, India	Economics,	1998
M.S.	Wageningen University, the Netherlands,	Knowledge Management Systems,	2001
M.S.	University of Chicago	Computer Science,	2006
Ph.D.	University of Illinois at Urbana Champaign,	Library and Information Science,	2008

**AREAS OF INTEREST**

Human Computer Interaction, Computer Supported Cooperative Work, Open Source Software, Online Communities, Integrated Library Systems, Library & Information Sciences Education, User Experience, Usability, Gender and Information Technology

**WORK EXPERIENCE****College of Emerging and Collaborate Studies**

Interim Program Director	July 2023 – current
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**College of Communication, University of Tennessee, Knoxville**

Director of Diversity, Equity, and Inclusion	July 2022 – June 2023
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**School of Information Sciences, University of Tennessee, Knoxville**

Professor	July 2022 – current
Associate Professor, 2022	August 2014 to July
SIS Director of Undergraduate Studies	May 2017 to April 2019
Assistant Professor,	Aug 2008 to July 2014
Acting Associate Director,	Jan 2013 to Aug 2013
Coordinator, Information Science and Technology Minor	Aug 2008 to July 2011

**School of Library and Information Science, University of North Texas**

Assistant Professor,	Aug 2007 to July 2008
Coordinator, Digital Imaging Track	Aug 2007 to July 2008

**University of Illinois at Urbana Champaign, iSchool**

Instructor, Undergraduate Minor	August 2003-July 2004
Research Assistant,	Academic years 2001-2002, 2002-2003, 2005-2006
Teaching Assistant, Graduate and Undergraduate	

**TEACHING EXPERIENCE****COURSES TAUGHT AT THE UNIVERSITY OF TENNESSEE**

INSC (567) 581: Information Networking Application Spring 2009, Fall 2009, Spring 2010, Fall 2010, Spring 2011, Summer 2011, Fall 2011, Spring 2012, Fall 2013, Spring 2013, Fall 2013, Fall 2014, Spring 2015, Fall 2015, Fall 2016, Spring 2017



INSC 598: Web Design, Spring 2012, Spring 2015, Fall 2016, Fall 2017, Fall 2018  
 INSC 585: Information Technologies Fall 2008, Spring 2009, Fall 2009  
 INSC 590: Web Development Using Content Management Systems Summer 2015  
 INSC 591: Independent Study, 31 since Fall 2008

#### **COURSES TAUGHT AT THE UNIVERSITY OF NORTH TEXAS**

SLIS Topics on Digital Imaging for Information Professional

#### **COURSES TAUGHT AT THE UNIVERSITY OF ILLINOIS AT URBANA CHAMPAIGN**

LIS 201 Information, Technology and Organizations  
 LIS 202 Social Aspects of Information Systems  
 LIS 210 Computing in the Humanities  
 LIS 290 Programming Web Mashups  
 LIS 310 Information, Organization and Access (on Campus and Online)  
 LIS 320 Libraries, Information and Society

#### **SELECTED PUBLICATION**

- Mehra, B., Black, K., Singh, V., Nolt, J., Williams, K.C., Simmons, S., and Renfro, N. (2014). The Social Justice Framework in the Information Technology Rural Librarian Master's Scholarship Program: Bridging the Rural Digital Divides. *Qualitative and Quantitative Methods in Libraries Journal*, Special Issue 2014: Social Justice, Social Inclusion (pp 5-11).
- Mehra, B., and Singh, V. (2014). Recruitment and Retention in the Information Technology Rural Librarian Master's Scholarship Program (Part I and Part II): Implications of Social Justice in the Southern and Central Appalachian Region. *Qualitative and Quantitative Methods in Libraries Journal*, Special Issue 2014: Social Justice, Social Inclusion (pp 13-22).
- Singh, V. (2017). "Long-Term Experiences of Open Source ILS Migration: Maintaining, Adapting, and Learning" *Journal of Librarianship and Information Science*
- Mehra, B., and Singh, V. (2017). Library Leadership-In-Training as Embedded Change Agents to Further Social Justice in Rural Communities: Teaching of Library Management Subjects in the ITRL and ITRL2. In Nicole A. Cooke and Miriam E. Sweeney (Eds.), *Teaching for Justice: Implementing Social Justice in the LIS Classroom*. Sacramento, CA: Library Juice Press.
- Mehra, B., Singh, V., Hollenbach, N. and Partee II, R.P. (2017). "A Community Informatics Model in ICT Use to Train Rural Librarians in the Southern and Central Appalachian Region as Change Agents in the 21 Century" Book Chapter proposal in *Rural and Small Public Libraries: Challenges and Opportunities* (Advances in Librarianship book series). Bingley, United Kingdom: Emerald Group Publishing.
- Mehra, B., Black, K., and Singh, V. (Editors). (under preparation). *Voices of Rural Librarians in the Appalachia: Current Realities and Future Possibilities of Information Technology in the 21st Century*. Manuscript in progress of development. Peer-reviewed Conference Proceedings (last 5 years)
- Singh, V., and Holt, L. (2013). Online Technical Support: How it Works and Why it Fails? *Proceedings of the Hawaii International Conference on System Science (HICSS – 46)*, IEEE, January 2013.
- Singh, V. (2013). A Case Study of Migration to an Open Source ILS: Partnership among State Libraries. *Proceedings of the Qualitative and Quantitative Methods in Libraries International Conference (QQL 2013)*, 3 - 6 June 2013, Rome, Italy.
- Singh, V. (2013) "Evaluating and Improving an Information Portal for Open Source Integrated Library Systems" *Proceedings of the 15th International Conference on Human Computer International 2013 (HCI 2013)*, 21-26 July 2013, Las Vegas, USA.
- Singh, V., (2013). "Challenges of Open Source ILS Adoption" Poster, *Proceedings of 76th Annual Meeting of the Association for Information Science and Technology, Beyond the Cloud: Rethinking Information Boundaries*, November 1-6, 2013, Centre Sheraton, Montreal, Quebec, Canada

- Mehra, B., and Singh, V. (2015). A Social Justice Framework to Further Community Engagement in Pakistan's Information Management and Library Professions, Proceedings of the International Conference on Information Management & Libraries, Department of Information Management, University of Punjab, Quaid-i-Azam Campus, Lahore-Pakistan, from 10-13 November, 2015.
- Singh, V. (2017) "Personas and Scenarios as a methodology for Information Sciences Research: Strengths, Weakness and Example" Proceedings of the Qualitative and Quantitative Methods in Libraries International Conference (QQML 2017), 3 - 6 June 2017, Limerick, Ireland
- Upadhyay, P., Reddy, J., Proctor, T., Sorel, O., Veereshlingam, H., Gandhi, M., Wang, X. and Singh, V., 2023. Expanded PCR Panel Testing for Identification of Respiratory Pathogens and Coinfections in Influenza-like Illness. *Diagnostics*, 13(12), p.2014.
- Malhotra, V., Javed, D., Bharshankar, R., Singh, V., Gautam, N., Mishra, S., Chundawat, D.S., Kushwah, A., Singh, G. and Deep, A., 2023. Prevalence and Predictors of Depression, Anxiety and Stress among Elderly during COVID-19: A Cross-sectional Study from Central India. *Mymensingh Med J*, 32(2), pp.556-566.

## HONORS

- Selected as a 3C Fellow at Duke University Computer Science Program on inclusive computing (2022-2024)
- Awarded College of Communication and Information Faculty Research Award 2021
- Keynote Speaker at ThriveWise Conference, June 30<sup>th</sup>, 2021
- Two Featured Articles relevant for practitioners – for informed Librarian Online July/August 2019 & July/August 2020 issues
- Awarded College of Communication and Information Service and Outreach Award for 2018-2019
- Paper nominated for the best paper award at the 15<sup>th</sup> International Conference of Open Source Systems, 2019
- Nominated by the Dean, College of Communication and Information, for Faculty Appreciation Week, February 2019
- Selected for the UTK Leadership Institute, 2017-2018
- Recognized by Office of Community Engagement & Outreach, University of Tennessee, recognizes 50 Partnerships that Make a Difference: Rural Library Professionals Program [Spring 2015].
- One of Top Five Papers at IFLA 2011, Mehra, B., Black, K., Singh, V., and Nolt, J. (2011). Mapping the Education of Rural Librarians' Technology Literacy and Management Training: Use of Mixed Data Collection Methods in the ITRL Program. Proceedings of the World Library and Information Congress: 77th International Federation of Library Associations and Institutions General Conference and Assembly, 13-18 August 2011, San Juan, Puerto Rico
- Best Conference Paper ALISE 2011, What is the Value of LIS Education? A Qualitative Analysis of the Perspectives of Tennessee's Rural Librarians. Bharat Mehra, Kimberly Black, Vandana Singh Junior Faculty Fellow to Provost, 2010 nominated and selected by School of Information Sciences and College of Communication and Information, July 2010
- Innovative Technology Award 2010, given by College of Communication and Information, University of Tennessee May 2010
- Outstanding Assistant Professor 2010 for the year given by School of Information Sciences, College of Communication and Information, University of Tennessee, May 2010
- Scholar of the Week, University of Tennessee, Week of 7/11/09.
- Best Note of CSCW 2008 - Singh, V. and Twidale, M., "The Confusion of Crowds: non-dyadic help interactions" Short Paper Computer Supported Cooperative Work Conference, 2008.

**Dr. JORGE E. VAREGO**

**SELECT CURRICULUM VITA**

1923 Fall Haven Ln, Knoxville, TN 37932  
Email: jvariego@yahoo.com • Web: www.jorgevariego.com

**EDUCATION**

2011 **PhD**, University of Florida, Gainesville, Florida. Major: Composition.

2006 **Master of Music**, Carnegie Mellon University, Pittsburgh, Pennsylvania. Double Major: Composition and Clarinet Performance (Fulbright Scholar)

2003 **Bachelor degree**, JD equivalent, National University of Rosario, Argentina

**TEACHING EXPERIENCE**

**2014 - today**

University of Tennessee, Knoxville, Assistant Professor of Composition and Technology  
Sewanee Summer Music Festival, Composition Program Director (started 2018)

**2013 - 2014**

Institute of Sonology, The Hague

**2011 - 2013**

Valley City State University, Assistant Professor: Music Theory/Composition/Woodwinds

**2009 - 2011**

University of Florida, Summer 2011, Assistant Professor: Theory II  
University of Florida, Summer 2011, Assistant Professor: Analytical techniques  
University of Florida, Spring 2011, Plant Instructor: Theory I  
University of Florida, Fall 2010, Composition Skills III  
University of Florida, Summer Plant Instructor: Theory II  
University of Florida, Teaching Assistant: Theory I and II  
College of Central Florida Adjunct Instructor

**2005 - 2007**

Carnegie Mellon University, Teaching Assistant: Theory I

**2004 - 2007**

Musikinnovations, Pittsburgh. Clarinet Instructor  
Pittsburgh Center for the Arts, Resident Artists – School outreach programs

**2000 -2003**

Instituto Pro-Musica de Rosario, Rosario, Argentina: Music Theory and Clarinet  
Municipality of Rosario Youth Band, Argentina: arranger, clarinet and saxophone instructor

**1998 – 2003**

Conservatory of Music, Pergamino, Buenos Aires, Argentina: Music Theory, Music Appreciation and Clarinet Performance

**SELECTED PERFORMANCES OF CREATIVE WORKS**

**2023**

*Música del Río de la Plata*

- Big Ears, Walters State, UT

*"Blink" Commissioned by the Knoxville Symphony*

- Bryan Symphony, Knoxville Symphony

*Recompensa*

- Tybee Post Theater and U Georgia Southern, Savannah

**2022***"Blink" Commissioned by the Knoxville Symphony*

- At the Tennessee Theater.

*"What is home" Commissioned by the Roane Chorus*

- At the Princess Theater and by the Oak Ridge Chorus

*Hispanic Heritage Celebrations*

- With guest performers and original music at the UT Student Union Auditorium

**PUBLISHED CREATIVE WORKS AND ARTICLES****Recordings**

- *"Purple Ego"* (Centaur) as leader of the Domino Ensemble. The album is exclusively dedicated to new music and was released in 2019.
- *"La jungla"* was selected for the REDASLA CD series to be released in 2015 in Latin America. This work was also selected for the *Electronic Masters Series* Vol. 4 by Ablaze Records
- *"Quedate con el cambio"* was selected for the REDASLA CD series to be released in 2018 at the Visiones Sonoras Festival in México.
- *60 bandos 60 – included in the CD "Punto de encuentro"* produced by the Universidad Nacional de Rosario and the University of Tennessee
- *Quedate con el cambio* included in the CD *Stannum* by J.M. Solare.
- *Nunca tan lejos* included in the CD *Discordia*, by Empires
- *Regress* (solo CD). Recorded at the CMMAS (México) exclusively dedicated to the music by Argentine composers. Project funded by the North Dakota Council on the Arts, Valley City State University, CMMAS, and Kickstarter (CMMAS 2013)
- *"Walls"* was selected for the SCI CD series with Capstone Records (*Pendulum* 2014)
- Publications in the field of music and architecture: with the University of Rome, Italy; UT Austin; and Universidad de Lanús, in Argentina
- *Necessity* (solo CD) Albany Records, New York
- *"Lamngen"*, for String Orchestra "Música para Peña Hen" by the Fundación de Orquestas Juveniles e Infantiles de Chile
- *"Variaciones sobre la puñalada"*, for tango sextet, Ediciones Musicales of the Municipality of Rosario, Argentina
- *"Static Motion"*, for solo piano, Society of Composers Inc. Student Chapter at the University of Florida Vol. VI
- *"Walls"*, for flutes nonet, Society of Composers Inc. Student Chapter at the University of Florida Vol. VII
- *Calle 6 en vivo (CD recording)* Epsa Editorial, Buenos Aires, Argentina

**INVITED PRESENTATIONS AND PUBLICATIONS**

- *Algorithmic composition: matemáticas y ciencias de la computación en la composición musical*. Published by the Universidad de Quilmes as part of their series of publications about Music and Science. ISBN: 978-987-558-502-7
- *18 + 3 Etudes for Solo Viola*. Published by Lalarva Music in October 2018. ISBN-13: 978-0578210865.
- *Composing with Constraints*. ISBN-13: 978-0190057244. Oxford University Press.
- Universidad Autónoma de Madrid – Ciclo de Conferencias del Espacio e investigación. Invited presenter in May 2018.
- *Vantablack* – First CD production by the UT Electroacoustic Ensemble.
- *Purple Ego* – First album release with the Domino Ensemble.
- *"Architecture in Motion: a model for music composition"* at the MIA-AIM Conference at UT Austin, 2014 (that paper was also published by the University of Rome, in Italy). This work was also published in the ICMC 2015 proceedings.
- *"Charlie Markov: an algorithmic approach to the style of Charlie Parker"* – paper to be presented at the North American Saxophone Alliance region 3 conference in April 2013 and at the Manchester College New Music Festival. This work was published in 2013 by the Centro Mexicano para la Música y las Artes Sonoras (CMMAS) in the latest edition of Ideas Sónicas.
- Paper presented, *"The music identity of Astor Piazzolla"*, Society of Composers Inc. National Convention, Austin, Texas, 2006
- CD reviews in the *Fanfare Magazine* (Sept-Oct 2010)
- Presentation *"Approaches on interactive music for clarinet"*, Carnegie Mellon University, 2008
- Review, Society of Electroacoustic Music in the United States, SEAMUS, 2010
- Paper *"Architecture in motion: a model for music composition"* published by UT Austin, in the 18<sup>th</sup> volume of *"Center"*
- International research collaboration between Valley City State University, University of Florida and the University of Lanus in Argentina, which will appear in the next edition of *"En el limite"* by UNLa.

**Research/Creative**

- Commissioned by the Knoxville Symphony Orchestra for the 20-21 Season.
- Resident Artist at the Visby Centre for Composers, Sweden (2013 and 2018).

- Guest faculty at the Universidad Javeriana (Colombia).
- Thesis Director and Co-Director respectively with students from the Universidad Católica Argentina and Universidad de Galicia.
- Invited presenter at the Universidad Autónoma de Madrid (2018). Title of the presentation: *La creación artística es algorítmica?*
- Member of the Patterns of intuition – Point Project at the Kunst Uni Graz, Austria (2013)
- Resident Artist at the CMMAS, Morelia, Mexico (2012 and 2013)
- Guest Artist at the Studio Phonos, Barcelona, Spain (2010)
- Guest Artists at the Escuela de Musica de Catalunya (ESMUC) (2010)
- Guest Composer, Charleston School for the Arts, South Carolina (2009)
- Guest Composer, New World School for the Arts, Miami (2009)
- Guest Artist, Carnegie Mellon University (2008)
- Guest Lecturer at the CAPA High School, Pittsburgh (2008)
- Artists-in-residence, Pittsburgh Center for the Arts (2005-present)

## PROFESSIONAL ACTIVITIES

### Management / administrative

- UT New Music Festival 2015-2016 and 2019 Co-Director
- Adjudicator Ohio Composer of the Year Competition 2020.
- SCI Region IV Co-chair in the National Council
- Domino Ensemble 501(c)(3) Founder Director
- UT Electroacoustic Ensemble Founder Director
- Nacusa National Conference, Organizer and Host, Spring 2016
- Adjudicator – composers competition Manchester New Music Festival 2015
- Adjudicator – Society of Composers Inc. Journal of Scores 2015
- Adjudicator – SEAMUS 16 and 17 National Conferences
- Clarinet Day at VCSU 2012 (with the Sponsor of Vandoren USA)
- Online Composition Major development (undergraduate at VCSU)
- NDUS Arts and Humanities Summit
- Woodwind area head at VCSU, founded the “Tritones” ensemble, and also directs the saxophone quartet
- Band day at VCSU (Spring 2012)
- Committee member at VCSU, worked on curriculum and course development (emphasizing the links between music and technology)
- Student representative at the National Board (2010-2011), Society of Composers Inc. Coordinated the “Chapter interactions series” (2010)
- Student Chapter Secretary (2009-2010), Society of Composers Inc. at University of Florida.
- Student Chapter President (2008-2009), Society of Composers Inc. at University of Florida. Producer of the Chapter’s CD Vol. VI., organized 4 concerts with 2 international guests and master classes.
- Producer, recording engineer of the CD “Necessity” (2010)
- Program coordinator, Florida Electroacoustic Music Festival, (2008)

## ORGANIZATIONS

- SCI Member of the National Council (2017 – today)
- Seamus and SCI adjudicator (2015-2019)
- Undergraduate Awards – international research judging 2017
- Leonardo Music Journal, reviewer.
- Society of Composers, Inc., Student Representative at the National Committee (2010)
- Society of Composers, Inc., University of Florida Chapter President (2009)
- Phi Kappa Lambda Music Honors Society.
- Society of Electro-Acoustic Music in the United States
- International Clarinet Association
- International Society of Improvised Music
- ASCAP
- Grammy

## GRANTS / SCHOLARSHIPS

- Nora Roberts Foundation 2019, 2020 and 2021
- TN Arts Commission, ABC Grant, 2021, 2022, and 2023.
- Bailey Opportunity Grant.
- PSDA – UT grant 2019 and 2022.
- UT Catalyst Programming Grant 2019-2020.
- Swedish Council on the Arts Grant for the Residency at the VICC in Gotland, June 2018.
- UT Professional Development Grant – for the edition and publication of my book *Composing with constraints* with the Oxford University Press.

- This grant included funds for international travel and editing costs.
- University of Tennessee, SARIF Grant 2015, 2016 and 2017. These grants supported the presentation of new works in Europe and Taiwan.
  - SEC Grant 2017/18 and 19-20 for activities at UA in Tuscaloosa and UG in Athens.
  - CMS Seed Grant 2017
  - University of Tennessee, Teaching for Impact Grant, 2016 (purchase of equipment for the Sound Synthesis course)
  - University of Tennessee, International Travel Grant 2014 (School of Music supported the presentation of new works in the Netherlands in Dec. 2014)
  - North Dakota Council on the Arts, Professional Development 2013
  - Secretary of External Relations of the Mexican Government 2013
  - Visby Centre for Composers, Sweden (residency - 2013)
  - CMMAS, Morelia, Mexico (residency - 2012)
  - VCSU, research grant 2012-2013
  - VCSU, travel grant 2011, 2012 and 2013
  - ASCAP 2007 – 2013
  - CDMC – Liem, Museo Reina Sofia, Madrid, Spain
  - University of Florida, D'Albora Scholarship
  - Meet the Composer Grant, Net life creative connections
  - University of Florida Sung Scholarship
  - University of Florida Didier Graeffe Scholarship
  - University of Florida Grinter Fellowship
  - Carnegie Mellon University Travel Grant for Festival in Europe
  - Pittsburgh Concert Society, Seamen Wickline grant
  - Fulbright Commission Scholar
  - Antorchas Foundation, Argentina
  - Fondo Nacional de las Artes, Argentina
  - Universidad de Santiago de Compostela, Spain

Xiaopeng Zhao, Ph.D.

Interim Program Director, College of Emerging and Collaborative Studies, University of Tennessee, Knoxville  
 Phone: (865) 974-7682 (O), (865) 258-8857 (C)  
 Email: xzhao9@utk.edu

### **Educational History**

<b>Ph.D.</b> , Engineering Science and Mechanics Virginia Tech, Blacksburg, VA	August 2004
<b>M.S.</b> , Engineering Mechanics Tsinghua University, Beijing, China	June 1999
<b>B.S.</b> , Engineering Mechanics Tsinghua University, Beijing, China	June 1996

### **Professional Experience**

2023-present	Interim Program Director, College of Emerging and Collaborative Studies, University of Tennessee, Knoxville
2022-present	Joint Faculty Professor, Bredesen Center, University of Tennessee, Knoxville
2019-present	Professor, Department of Mechanical, Aerospace and Biomedical Engineering University of Tennessee, Knoxville
2019-2020	Faculty Fellow for Strategic Research Initiatives, University of Tennessee
2019-2022	Co-Founder, Rocky Top Chess, Inc. Secretary (2019-2020), President (2020-2021), Past President (2021-2022)
2016-2020	Advisory Board, T&T Scientific Inc.
2016-2017	Visiting Scientist, Institute for Medical Engineering and Science, Massachusetts Institute of Technology
2015-2017	Scientific Advisor on Intelligent Patient Monitoring, Zhejiang Medzone Medical Equipment Co., Ltd.
2014-2019	Adjunct Associate Professor, Department of Mathematics, University of Tennessee, Knoxville
2013-2019	Associate Professor, Department of Mechanical, Aerospace and Biomedical Engineering, University of Tennessee, Knoxville
2013-2016	Core Faculty, Institute of Biomedical Engineering, University of Tennessee, Knoxville
2012-2020	Senior Personnel, National Institute for Mathematical and Biological Synthesis University of Tennessee, Knoxville
2011-2012	Visiting Scientist, Wyss Institute for Biologically Inspired Engineering Harvard University
2007-2013	Assistant Professor, Department of Mechanical Engineering, Aerospace and Biomedical Engineering, University of Tennessee, Knoxville
2005-2007	Research Associate, Department of Biomedical Engineering, Duke University
2004-2005	Research Associate, Department of Engineering Science and Mechanics, Virginia Tech

### **Selected Publications**

I have published more than 150 peer-reviewed journal and conference articles

1. Liao, Yo-Jen; Jao, Ying-Ling; Boltz, Marie; Adekeye, Olayemi; Berish, Diane; Yuan, Fengpei; Zhao, Xiaopeng, Use of a Humanoid Robot in Supporting Dementia Care: A Qualitative Analysis, SAGE Open Nursing, 2023
2. Fengpei Yuan, Marie Boltz, Dania Bilal, Ying-Ling Jao, Monica Crane, Joshua Duzan, Abdurhman Bahour, Xiaopeng Zhao, Cognitive Exercise for Persons with Alzheimer's Disease and Related Dementia Using a Social Robot, IEEE Transactions on Robotics (T-RO), 2023

3. Fengpei Yuan, Wenjun Zhou, Hiroko Dodge, Xiaopeng Zhao, Causal Structural Learning of Conversational Engagement for Socially Isolated Older Adults, *Journal of Smart Health*, 2023
4. Min Xiong, Kai Sun, Xiaowen Su, Alena Talkachova, Xiaopeng Zhao, Dynamics study of constant diastolic interval and constant TR control for cardiac alternans based on a two-dimensional cellular automata model, *Nonlinear Dynamics*, 2022
5. Ziming Liu, Jordan Grant, Skylar Simpson, Asad Khattak, Joel Anderson, and Xiaopeng Zhao, Driving Ability Evaluation and Rehabilitation for People with Alzheimer's Disease and Related Dementia, *Alzheimer Disease & Associated Disorders*, 36 (4), 374-381, 2022
6. Fengpei Yuan, Amir Sadovnik, Ran Zhang, Devin Casenhiser, Eun Jin Paek and Xiaopeng Zhao, A simulated experiment to explore robotic dialogue strategies for people with dementia, *Journal of Rehabilitation and Assistive Technologies Engineering (RATE)*, volume 9, 2022
7. Yang Jiang, William Jessee, Stevie Hoyn, Soheil Borhani, Ziming Liu, Xiaopeng Zhao, Lacey K Price, Walter High, Jerry Suhl, & Sylvia Cerel-Suhl, Sharpening Working Memory with Real-time Electrophysiological Brain Signals: Which Neurofeedback Paradigms Work? *Frontiers in Psychology*, 2022
8. Liu, Z., D., Paek, E.J., Yoon, S.O., Casenhiser, D., Zhou, W., and Zhao, X., Detecting Alzheimer's Disease Using Natural Language Processing of Referential Communication Task Transcripts, *Journal of Alzheimer's Disease*, 2022
9. Andrea Vranic, Yang Jiang and Xiaopeng Zhao, Editorial: Individual Differences in Cognition and Affects in the Era of Pandemic and Machine Learning, *Frontiers in Psychology Cognition*, 2022
10. Fengpei Yuan, Joel Anderson, Tami Wyatt, Ruth Lopez, Monica Crane, Austin Montgomery, Xiaopeng Zhao, Assessing the Acceptability of a Humanoid Robot for Alzheimer's Disease and Related Dementia Care Using an Online Survey, *International Journal of Social Robotics*, 2022

### **Selected Research Grants**

Source: NIH-NIA, 1R21AG082210

The predicative values of vascular and metabolic disorders for risk of incident mild cognitive impairment and dementia

PI: Longjian Liu

Duration: 06/01/2023-05/31/2025

Source: AI TENNessee Initiative

Social Machines and AI Robotics Technology (SMART)

PI: Xiaopeng Zhao

Duration: May 2023-May 2025

Source: Office of Naval Research

Title: STEM Education and Apprenticeship Liaison (SEAL) for Navy

PIs: Ozlem Kilic, Bruce LaMattina, Xiaopeng Zhao, John Schmisser

Duration: 4/1/2022-03/31/2025

Source: HHS - NIH - NIA - National Institute on Aging, R01AG077003

Title: SCH: Robotic Caregiver to Comprehend, Assist, Relieve, and Evaluate for Patients with Alzheimer's Disease (Robotic CARE for AD)

PIs: Xiaopeng Zhao, Hairong Qi, Joel Anderson, Ruth Lopez

Duration: 2/1/2022-1/31/2026

Source: US - VA - Lexington VA Health Care System

Title: Tuning up memory-related brain potentials using real-time neurofeedback in older veterans

PIs: Yang Jiang and Xiaopeng Zhao

Duration: 6/1/2019 – 10/31/2022



**Professional Services**

- University of Tennessee AI in Education Taskforce, Spring 2023
- Tennessee Dementia Action Collaborative (TDAC), Tennessee Department of Health Data Evaluation, and Surveillance Workgroup, Chair
- Steering Committee, Cherokee Health Systems (CHS) and University of Tennessee (UT) Partnership, Fall 2022-
- Associate Editor, Journal of Alzheimer's Disease, 2023-
- Associate Editor, Smart Health Journal, 2022-
- Associate Editor, Frontiers in Rehabilitation Science, 2022-
- Task Group on "Creative Living and Aging through Cross-disciplinary Utilization of Data and Knowledge", Committee on Data (CODATA) of the International Science Council (ISC), 2021
- Brain-Computer Interface Society, Early Career Award Committee, 2020
- Organizing Committee and Publicity Chair, the 14th International Conference on Social Robotics, Florence Italy, December 13-16, 2022
- Technical Program Committee of the IEEE/ACM Conference on Connected Health Applications, Systems, and Engineering Technologies (CHASE), November 17-20, 2022
- Organizing Committee and Chair of the Emerging Technologies Session, 2022 Southeastern Neurodegenerative Disease Conference (SENDCon).
- General Chair, Emerging Technologies for Aging and Dementia, Hybrid Research Symposium, June 8-9, 2022, Knoxville, TN
- Organizing Committee, the 13th International Conference on Social Robotics, Singapore, November 10-13, 2021
- Chair, Biomedical and Rehabilitation Systems, 2020 Dynamic Systems and Control Conference
- Chair, Neurocomputation workshop for the Interdisciplinary Graduate Minor in Neuroscience, Knoxville, TN, August 6-13, 2018
- Growing Access in Mathematics, Engineering, and Science (GAMES), Chair, 2018- GAMES is an outreach program to expose K-12 girls and their parents to STEM education and research. GAMES sponsors the 2019 Tennessee All-girls Chess Championship on March 30, 2019
- UTK Brain Computer Interface Community of Scholars, Faculty Lead, 2018-2019
- 

**Selected Honors and Awards**

- Best Paper Finalist and Honorable Mention, The International Society of Service Innovation Professionals Human-Side of Service Engineering Conference, 2023
- Charles E. Ferris Faculty Award, University of Tennessee, 2023
- B. Ray Thompson Endowed Excellence in Research Award, University of Tennessee, 2023
- Official Nominator of the VinFuture Prize, 2023
- Global Catalyst Award, University of Tennessee, 2023
- Best Paper Award, The International Society of Service Innovation Professionals Human-Side of Service Engineering Conference, 2022
- Faculty Research Assistants Funding Award, University of Tennessee, 2022
- Faculty Fellow for Expanding Horizons, University of Tennessee, 2022
- Global Catalyst Award, University of Tennessee, 2022
- Healthy Longevity Global Competition Finalist, National Academy of Medicine, 2021
- Best Paper Finalist, International Conference on Social Robotics, 2021
- Game Changer Academies Panel Fellow, NSF CMMI, 2021
- Center for Transportation Research Fellow, University of Tennessee, 2020
- Healthy Longevity Global Competition Finalist, National Academy of Medicine, 2020

**Jie Zhuang**

Ph.D &amp; Professor

Department of Biosystems Engineering and Soil Science  
The University of Tennessee, Knoxville, TN 37996, USA

Phone: (865) 974-9467; E-mail: [jzhuang@utk.edu](mailto:jzhuang@utk.edu)

ORCID: 0000-0002-5472-9118

**A. Education and Training**

Oak Ridge National Laboratory, USA	Surface NanoChemistry	Postdoc 2003-2003
University of Delaware, USA	Soil Physics	Postdoc 2000-2003
Shenyang Agricultural University, China	Soil Physics	Ph.D 1990-1993
Shenyang Agricultural University, China	Soil Physics	M.S 1987-1990
Shenyang Agricultural University, China	Soil Science & Agrochemistry	B.S 1983-1987

**B. Professional Experience**

2017-	Professor, Department of Biosystems Engineering and Soil Science (BESS), University of Tennessee (UT), Knoxville, Tennessee
2014-2019	Guest Research Professor, Institute of Applied Ecology, Chinese Academy of Sciences
2013-2016	Research Professor, BESS, UT, Knoxville, Tennessee
2009-2012	Research Associate Professor, BESS, UT, Knoxville, Tennessee
2007-2016	Research Director, Institute for a Secure and Sustainable Environment, UT
2003-2008	Research Assistant Professor, Department of Earth and Planetary Sciences, Center for Environmental Biotechnology, UT
2000-2003	Postdoctoral Research Associate, University of Delaware & Oak Ridge National Laboratory, Tennessee
1998-2000	Research Fellow of Japan Society of Promotion for Sciences, Chiba University and University of Tokyo, Japan
1993-1998	Assistant Professor, Shenyang Agricultural University, China

**C. Synergistic Activities**

- Panelist of NSF programs—Early Career Award; Environmental Sustainability; Innovation at the Nexus of Food, Energy, and Water Systems (INFEWs); Partnership for International Research and Education (PIRE); Graduate Research Fellowship Program (GRFP) and ad hoc reviewer of NSF proposals
- Editorial board and guest editor of refereed journals: *Environmental Management, Engineering, Ecotoxicology, Scientific Reports, Pedosphere, Sustainability, Journal of Applied Ecology, Journal of Resources and Ecology*
- Coordinator and organizing committee of 36 international workshops
- Coordinator-general, China-US Joint PhD Program in Environment, Energy, and Food, Jointly Funded by UT and China Scholarship Council (CSC)
- Instructor: ESS 561 Nexus of Food, Energy and Water Systems; ESS 593: Special Topics in Soil Science; Guest Lectures, Study Abroad Programs
- Lead, Cluster Hire Initiative for Climate-Smart Agriculture and Forestry (6 faculty position, \$7.5M), University of Tennessee

- Director, Graduate Studies of Environmental and Soil Science, Department of Biosystems and Soil Science, University of Tennessee

#### D. Federal Grants Received (2017-2023)

- Radosevich, M., **J. Zhuang**, J. Vymazal, A. Sochacki. 2023-2026. NSF-GACR: Reactive Interfaces for Degrading Contaminants of Emerging Concern and Pathogenic Viruses in Constructed Wetlands. NSF and GACR (Czech Republic), US-\$400,000 and Czech Republic-\$300,000.
- **Zhuang, J.** (PI), F. Löffler, H. Gan, D. Ader, D. Nandwani. 2023-2025. Global Centers Track 2: Climate-Smart Food-Energy-Water Nexus in Small Farms. NSF, \$250,000.
- **Zhuang, J.** (PI), F. Löffler, T. Gill, M. Jin, W. Tate. 2020-2024. International Research Coordination Network for Creating Transdisciplinary Nodes of Food-Energy-Water to Support Sustainable Urban Systems. NSF, \$500,000.
- Schaeffer, S., **J. Zhuang**, D. Hayes, J. DeBruyn, M. Flury. 2020-2023. Fate and Impact of Agricultural Nanoplastics on Soil Health. USDA-NIFA, \$499,688.
- Radosevich, M. (PI), **J. Zhuang**, S.M. Schaeffer, M. Staton. 2018-2022. Soil Health and Sustainable Productivity: Unraveling the Role of Soil Viral Biodiversity in Agroecosystem Function. USDA-NIFA, \$499,955.
- Löffler, F., **J. Zhuang**, G.S. Saylor, T. Rials, V. Dale. 2017-2021. Food-Energy-Water Systems Transdisciplinary Environmental Research Network. NSF, \$300,000.

#### E. Publications during 2022-2023 (\*corresponding author, career total 142)

1. Xiaolong Liang, Mark A. Radosevich, Jennifer DeBruyn, **Jie Zhuang**, Regan W. McDearis, Steven W. Wilhelm. 2023. Incorporating viruses into soil ecology: a new dimension to understand biogeochemical cycling. **Critical Reviews in Environmental Science and Technology**, in press. DOI: 10.1080/10643389.2023.2223123
2. Yuchuan Fan, Michael Essington, **Jie Zhuang**, Xi Zhang, Sindu Jagadamma, John Schwartz, Jinsheng Huang, Jehangir Bhadha, Jaehoon Lee.\* 2023. Recycling silage leachate and biochar for improving nitrate removal by woodchip bioreactor. **Journal of Environmental Management** 345, 118735. DOI: 10.1016/j.jenvman.2023.118735
3. **Jie Zhuang**,\* Tom Gill, Frank Löffler, Mingzhou Jin, Gary S. Saylor. 2023. Can food-energy-water nexus research keep pace with agricultural innovation? **Engineering** 23, 24-28. DOI: 10.1016/j.eng.2022.08.014
4. Fengxian Chen, Bin Zhou, Liqiong Yang, Xijuan Chen,\* **Jie Zhuang**. 2023. Predicting bacterial transport through saturated porous media using an automated machine learning model. **Frontiers in Microbiology** 14, 1152059. DOI: 10.3389/fmicb.2023.1152059
5. Yuchuan Fan, **Jie Zhuang**, Michael Essington, Sindhu Jagadamma, John Schwartz, Jaehoon Lee.\* 2023. Global significance of substrates for nitrate removal in denitrifying bioreactors revealed by meta-analysis. **Engineering** 21(2), 213-225. doi: 10.1016/j.eng.2022.08.017
6. Weipeng Liu, Liqiong Yang,\* Xijuan Chen, Steven A. Ripp, Mark A. Radosevich, **Jie Zhuang**.\* 2023. Depth-specific transport of bacteriophages MS2 and ΦX174 in intact soils. **Soil & Tillage Research** 228, 105650. DOI: 10.1016/j.still.2023.105650
7. Xiaoming Zhang, Fengxian Chen, Liqiong Yang, Fucang Qin,\* **Jie Zhuang**.\* 2022. Quantifying bacterial concentration in water and sand media during flow-through experiments using a noninvasive, real-time, and efficient method. **Frontiers in Microbiology** 13, 1016489. DOI: 10.3389/fmicb.2022.1016489

8. Ning Duan, Mark Radosevich, **Jie Zhuang**, Jennifer M. DeBruyn, Margaret Staton, Sean M. Schaeffer.\* 2022. Identification of novel viruses and their microbial hosts from soils with long-term N-fertilization and cover cropping management. **mSystems** 7(6), e00517-22. DOI: 10.1128/msystems.00571-22
9. Xijuan Chen, Yuanyuan Dai, Mingyang Zhao, Frank E. Löffler, **Jie Zhuang**.\* 2022. A hydrobiological mechanism controlling the effects of unsaturated flow on degradation of emerging organic contaminants in soils. **Environmental Science and Technology** 56(16), 11409–11417. DOI:10.1021/acs.est.2c03013
10. Yuchuan Fan, Michael E. Essington, Sindhu Jagadamma, **Jie Zhuang**, John S. Schwartz, Jaehoon Lee.\* 2022. The global significance of abiotic factors affecting nitrate removal in woodchip bioreactors. **Science of The Total Environment** 848, 157739. DOI:10.1016/j.scitotenv.2022.157739
11. Xijuan Chen, Liqiong Yang, Junjie Guo, Shuang Xu, Junzhen Di,\* **Jie Zhuang**.\* 2022. Interactive removal of bacterial and viral particles during transport through low-cost filtering materials. **Frontiers in Microbiology** 13, 970338. DOI:10.3389/fmicb.2022.970338
12. Huihui Sun, Yanchen Sun, Mingzhou Jin, Steven A. Ripp, Gary S. Sayler, **Jie Zhuang**.\* 2022. Domestic plant food loss and waste in the United States: environmental footprints and mitigation strategies. **Waste Management** 150, 202-207. DOI:10.1016/j.wasman.2022.07.006
13. Ruoyu Sun, Xianjun Liu, Dabing Li, **Jie Zhuang**, Shengrui Qi, Bo Meng,\* Mingda Liu.\* 2022. Optimization of China's Pig Production System to Reduce Environmental Impacts Based on a Data Envelopment and Life Cycle Analysis Model. **Resources, Conservation & Recycling** 185, 106483. DOI:10.1016/j.resconrec.2022.106483
14. Ninghui Xie, Tingting An, **Jie Zhuang**, Mark A. Radosevich, Sean Schaeffer, Shuangyi Li, Jingkuan Wang.\* 2022. High initial soil organic matter level combined with aboveground plant residues increased microbial carbon use efficiency but accelerated soil priming effect. **Biogeochemistry** 160, 1-15. DOI:10.1007/s10533-022-00936-6
15. Ning Duan, Lidong Li, Xiaolong Liang, Regan McDearis, Aubrey K. Fine, Zhibo Cheng, **Jie Zhuang**, Mark Radosevich, Sean M. Schaeffer.\* 2022. Composition of soil viral and bacterial communities after long-term tillage, fertilization, and cover cropping management. **Applied Soil Ecology** 177, 104510. DOI:10.1016/j.apsoil.2022.104510
16. Wenquan Dong, Kristina Armstrong, Mingzhou Jin,\* Sachin Nimbalkar, Wei Guo, **Jie Zhuang**, Joe Cresko. 2022. A framework to quantify mass flow and assess food loss and waste in the US food supply chain. **Communications Earth & Environment** 3(1), 1-11. DOI:10.1038/s43247-022-00414-9
17. Ning Duan, Lidong Li, Xiaolong Liang, Aubrey Fine, **Jie Zhuang**, Mark Radosevich, Sean S Schaeffer. 2022. Variation in bacterial community structure under long-term fertilization, tillage, and cover cropping in continuous cotton production. **Frontiers in Microbiology** 13, 847005. DOI:10.3389/fmicb.2022.847005
18. **Jie Zhuang**.\* Frank E. Löffler, Gary S. Sayler. 2022. Creating a research enterprise framework for transdisciplinary networking to address the food-energy-water nexus. **Engineering** 11, 95-100. DOI: 10.1016/j.eng.2021.08.017
19. Jing Chen, Liqiong Yang,\* Xijuan Chen, Steven A. Ripp, **Jie Zhuang**. 2022. Coupled effects of pore water velocity and soil heterogeneity on bacterial transport: intact vs. repacked soils. **Frontiers in Microbiology** 13, 730075. DOI: 10.3389/fmicb.2022.730075

# New Academic Program Proposal

## Bachelor of Science Degree in Environmental Engineering



THE UNIVERSITY OF  
TENNESSEE  
KNOXVILLE

Updated December 6, 2023

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## Section I: Overview

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### *Program Information*

<b>Institution:</b>	University of Tennessee Knoxville
<b>College:</b>	Tickle College of Engineering
<b>Department:</b>	Civil and Environmental Engineering
<b>Title of Degree:</b>	Bachelor of Science in Environmental Engineering
<b>Degree Designation:</b>	Bachelor of Science
<b>Formal Degree Abbreviation:</b>	BS ENVE
<b>CIP Code:</b>	14.1401
<b>CIP Code Title:</b>	Environmental/Environmental Health Engineering
<b>Proposed UT BOT Approval:</b>	February 2024
<b>Proposed THEC Approval:</b>	May 2024
<b>Proposed Implementation Date:</b>	August 2024
<b>Academic Program Liaisons:</b>	<p>Karen Etzkorn, Director of Academic Affairs            505 Summer Place / 1268B UT Tower            University of Tennessee System, 37902            Phone number: 865-974-2140            Email: <a href="mailto:etzkorn@tennessee.edu">etzkorn@tennessee.edu</a></p> <p>Chris Cox, Department Head            325 JD Tickle Engineering Building            851 Neyland Drive            Knoxville TN 37996-2313            Phone: 865-974-7700            Email: <a href="mailto:ccox9@utk.edu">ccox9@utk.edu</a></p>

*Documentation of Board Approval*



The University of Tennessee  
Board of Trustees

Resolution 002-2023  
Letter of Notification - Bachelor of Science  
in Environmental Engineering  
(University of Tennessee, Knoxville)

Resolved:

The Executive Committee, on behalf of the Board of Trustees, hereby approves the attached Letter of Notification pertaining to the proposed Bachelor of Science in Environmental Engineering and authorizes the submission of such Letter of Notification to the Tennessee Higher Education Commission.

Adopted this 20<sup>th</sup> day of January, 2023.

Certificate

I hereby certify that the foregoing Resolution was adopted by the Executive Committee of the Board of Trustees of The University of Tennessee on the date set forth above.

A handwritten signature in blue ink that reads "Cynthia C. Moore".

Cynthia C. Moore  
Secretary and Special Counsel

*System Letter of Support*



THE UNIVERSITY OF TENNESSEE SYSTEM

ACADEMIC AFFAIRS AND STUDENT SUCCESS

December 22, 2022

Dr. Julie Roberts, Chief Academic Officer  
Tennessee Higher Education Commission  
312 Rosa L Parks Ave. 9<sup>th</sup> Floor  
Nashville, TN 37243

Dear Dr. Roberts:

On behalf of UT Knoxville's Tickle College of Engineering, please accept the attached Letter of Notification (LON) for a proposed Bachelor of Science program in Environmental Engineering (CIP 14.1401). The BS ENVE program will cover fundamental topics such as fluid mechanics, environmental chemistry, microbiology, fate and transport of environmental pollutants, environmental systems engineering, and risk assessment, as well as applied topics including hydrology, water resources engineering, water, and waste treatment, air pollution control, solid and hazardous waste management, and energy systems. The University is well-positioned to support this degree program through current faculty resources, and has existing infrastructure on campus to support the program (e.g., existing environmental engineering research labs and equipment, a fully-equipped environmental teaching lab, a designated water resources teaching lab, two full-time staff technicians, and the Water Quality Core Facility). The proposed program will provide opportunities to expand its impact in thematic areas in which the Tickle College of Engineering (TCE) offers expertise and has the full support of the UT System.

We look forward to receiving an evaluation of the LON by THEC staff.

Sincerely,

Bernie Savarese, Ed.D.  
Acting Vice President of Academic Affairs and Student Success  
University of Tennessee System

CC: Donde Plowman  
John Zomchick  
Matthew Mench  
Chris Cox  
Heather Hartman  
Karen Etzkom

*Campus Letter of Support*



December 21, 2022

Dear President Boyd,

Please accept the attached application for a new BS degree program in Environmental Engineering in the Tickle College of Engineering at the University of Tennessee, Knoxville.

The proposed program will be housed in the existing Department of Civil and Environmental Engineering. The department has offered an MS Environmental Engineering degree program since 1970 and also offers environmental engineering coursework and specializations at the BS and PhD levels. Environmental Engineering is recognized as a distinct discipline by the ABET engineering accreditation board and the National Council of Examiners of Engineers and Surveyors (NCEES). There is no existing BS Environmental Engineering degree in the state of Tennessee, but similar programs in bordering states have enrollments totaling over 900 students. Likewise, many peer institutions have robust enrollments in BS Environmental Engineering programs. UTK student surveys indicate strong demand for the program and job market surveys and letters of support from specific employers show strong demand for environmental engineering graduates. The program can be successfully offered using current faculty, staff, and facility resources.

The curriculum for this new BS Environmental Engineering has been reviewed and approved by the department and college. It is currently under review by the appropriate campus-level bodies on the Knoxville campus and has the full support of campus administration. At this time, we request transmission to THEC for approval. Please contact me if you have any questions or need additional documentation.

Thank you in advance for your attention to this matter.

Sincerely,

John Zomchick  
Provost & Senior Vice Chancellor

CC: Donde Plowman  
Bernie Savarese  
Karen Etkorn  
Matthew Mench  
Chris D. Cox

Office of the Provost and Senior Vice Chancellor  
527 Andy Holt Tower, Knoxville, TN 37996-0152  
865-974-2445 865-974-4811 fax provost.utk.edu

Flagship Campus of the University of Tennessee System

## Section II: Background

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### *Background Concerning Academic Program Development*

The Department of Civil and Environmental Engineering (CEE) at The University of Tennessee offers a nationally ranked BS degree in Civil Engineering, an MS degree in Civil Engineering, and a Ph.D. degree in Civil Engineering. The BS degree in Civil Engineering (BS CE) requires that students be broadly educated in all six subdisciplines of Civil and Environmental Engineering before they choose specific specialty areas in two areas during the last academic year of their program. The six subdisciplines include (1) Structural, (2) Geotechnical, (3) Transportation, (4) Construction, (5) Environmental, and (6) Water Resource Engineering. Environmental Engineering and Water Resource Engineering are colloquially known as the “wet side” of the Civil Engineering discipline, while the other subdisciplines are referred to as the “dry side.” Under our current undergraduate curriculum, BS CE students take all six intro-level courses and then, in consultation with their advisor and faculty mentors, select second-level courses in at least two specialty areas, often in synergistic pairs (e.g., Structures/Geotechnical, Water Resources/Environmental).

As noted, the department offers MS degrees in both Civil Engineering and Environmental Engineering. The MS degree in Environmental Engineering (MS ENVE) was established in 1970, recognizing the need to educate and train engineers in specific skills related to protecting human health and the environment from the effects of pollution. Since its inception, the MS degree program has encompassed both the Environmental Engineering and Water Resources subdisciplines. Interested students can also earn a degree in Civil Engineering at the doctoral level with specializations in Environmental Engineering or Water Resources.

One of the challenges to recruiting undergraduate students who want to pursue Environmental or Water Resources Engineering (ENVE) disciplines is that the current BS CE program lacks sufficient opportunities to develop in-depth knowledge in those areas. This issue presents two concerns. First, many students interested in ENVE topics are less interested in enrolling in a degree program weighted so heavily in course requirements on the “dry side” topics, like structural engineering. As such, students interested in Environmental Engineering may choose different institutions outside of Tennessee, such as Alabama, Clemson, the University of Georgia, Georgia Tech, Missouri University of Science and Technology, or North Carolina State (See Table 1 for enrollment data). Additionally, UT students interested in Environmental Engineering may select different degree programs that do not fully align with their interests. For example, they may choose degree options in Biosystems Engineering, Chemical Engineering, or even a non-engineering degree like Environmental Science. We expect that offering a focused BS ENVE will increase enrollment and retention by better-placing students in a degree program that fits their interests and attracting students who otherwise leave the state to pursue ENVE programs at other institutions.

Overall, establishing a BS ENVE program at The University of Tennessee will significantly boost both our undergraduate and graduate programs of study by providing opportunities to grow student



enrollment. We have also recently filled a new faculty position allocated to the department to support the proposed BS ENVE program. The growth in students and visibility that comes from starting a new degree program can directly lead to improved US News rankings through growth in reputation. Second, a BS ENVE degree will produce graduates prepared to address numerous societal and environmental issues at the local, state, regional, and national levels.

The environmental challenges faced by our society have become increasingly complex during the last 50 years. For example, a recent report from the *National Academies*<sup>1</sup> identified the following grand challenges for environmental engineering:

- Create sustainable food, water, and energy
- Curb climate change and adapt to its impacts
- Design a future without pollution or waste
- Create efficient, healthy, resilient cities
- Foster informed decisions and actions

The *National Academies* study does not expect that environmental engineers will be able to solve these problems independently; instead, they will play a role in solving them by working in partnership with other STEM professionals, policymakers, and affected communities. The BS ENVE curriculum will provide more specialized skills to the area of study not included in the traditional BS CE curriculum, allowing graduates to contribute to these grand challenges.

### *Purpose and Nature of Academic Program*

The BS ENVE program will expand on the existing strengths of the departmental faculty and potentially offer opportunities to expand expertise in thematic areas in which the Tickle College of Engineering (TCE) offers expertise. The departmental faculty have approved a proposed curriculum for the BS ENVE degree, which will include fundamental topics such as fluid mechanics, environmental chemistry, microbiology, fate and transport of environmental pollutants, environmental systems engineering, and risk assessment, as well as applied topics such as hydrology, water resources engineering, water, and waste treatment, air pollution control, solid and hazardous waste management, and energy systems. The development of professional skills in communication, teamwork, ethics, public policy, and project management will also be integrated throughout the curriculum. The program will culminate in a capstone design project. This project will be delivered through a two-semester course sequence patterned after the CE 399S (1 credit hour) and CE 400 (3 credit hour) sequence in our BS CE program. The first course focuses on project scoping, community outreach and engagement, professional communication, and reflection, while detailed engineering design takes place during the second semester. This curriculum will satisfy the general and program-specific criteria of ABET and the Volunteer Core general education requirements. The

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<sup>1</sup> National Academies of Sciences, Engineering, and Medicine 2019. *Environmental Engineering for the 21st Century: Addressing Grand Challenges*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/25121>.

program will also prepare students to pass the Environmental Engineering Fundamentals of Engineering Exam administered by the National Council of Examiners for Engineering and Surveying.

We anticipate a potential program expansion to support specific regional needs and institutional strengths, including atmospheric science, watershed and river management, hydropower, and nuclear decommissioning and waste management (currently a minor in partnership with Nuclear Engineering). These distinct strengths could improve recruitment considerably compared to other programs while addressing the regional needs of the state.

The primary target population for the program includes traditional first-year college students and transfer students from community colleges. In the TCE in recent years, external transfer students have numbered fewer than 10% of new students coming to the college. Nevertheless, CEE considers transfer students a vital constituency and has developed transfer pathways for its BS CE program in partnership with other TN institutions. We would develop similar pathways for the new BS ENVE program. The program will be fully delivered on the Knoxville campus. Like other BS programs within the Tickle College of Engineering, student outcomes will satisfy both general and program-specific criteria of ABET. The criteria are listed below as general and program-specific criteria.

### *Alignment with State Master Plan and Institutional Mission*

#### *State Master Plan<sup>2</sup>*

An explicit goal of the 2020 update to THEC's State Master Plan is to "increase enrollment in majors leading to high-demand jobs." The proposed BS ENVE degree program supports this goal in several ways. There is a severe workforce shortage in civil engineering and construction. The THEC-TSAC report "Improving the Pipeline for Tennessee's Workforce: Academic Supply for Occupational Demand Report 2022"<sup>3</sup> lists Civil Engineering as one of the most in-demand STEM majors in Tennessee, with 1,110 unique job postings and 1,741 hires of civil engineers in 2020. Still, the supply of civil engineers cannot keep up with the demand, with all our graduates having jobs months before graduation. The recent federal infrastructure bill will only increase demand for Civil Engineers for the foreseeable future. How can the BS ENVE degree help this situation? Many civil engineers work to design and provide water supply, wastewater supply, and stormwater infrastructure. Our BS ENVE grads will also possess these skills. Moreover, our research shows that most students likely to enroll in the BS ENVE program will be unlikely to enroll in a traditional BS CE program. Therefore, by offering a BS ENVE, we will increase the total number of engineers able to deliver new and improved infrastructure to Tennessee and the nation.

<sup>2</sup> <https://www.tn.gov/content/dam/tn/thecc/bureau/research/other-research/master-plan/finalmp.pdf>

<sup>3</sup> <https://www.tn.gov/content/tn/thecc/research/supply-and-demand.html>

Another high-demand occupation listed in the THEC-TSAC report is “Environmental Scientists and Specialists, Including Health.”<sup>4</sup> A BS in Environmental Engineering is often among the preferred degrees for this kind of position. Finally, the 2019 Tennessee Department of Labor and Workforce Development report “The Demand for STEM Occupations in Tennessee”<sup>5</sup> reports that Environmental Engineers are expected to increase by 15.64% from 1151 in 2016 to 1331 in 2026. There are no existing BS Environmental Engineering degree programs in TN to meet this need.

In the State’s Postsecondary Education Master Plan (Postsecondary Attainment in the Decade of Decision 2015-2025)<sup>6</sup>, “Drive to 55” aims to increase the percentage of Tennesseans who hold postsecondary degrees. The plan requires increased degree production, and part of that plan can include offering degrees in the state that do not exist, thereby increasing retention of Tennesseans in in-state degree programs. Part of this drive is preparing students to succeed in STEM-oriented fields. The Drive to 55 focuses explicitly on identifying barriers to achievement for underrepresented students or other “focus populations.” Providing degree programs that align better with student interests could bridge that gap. For example, women and minorities are underrepresented in engineering, yet in environmental engineering programs at other institutions, women make up about 50% of the student body (Table 2). Environmental engineering could be a bridge to increase the success of underrepresented students at the college level. Our department’s history of successfully matriculating and graduating transfer students also enhances the accessibility of the program to lower-income and less-prepared students who often begin their college careers at community colleges.

### *The University of Tennessee Institutional Mission and Visions*

This program aligns well with the University of Tennessee’s strategic plan<sup>7</sup>. Specifically, the BS ENVE degree will: 1) *Enhance Educational excellence* by offering a new high-demand degree program that will increase enrollment, degrees awarded, and diversity in TCE. 2) *Expand research capacities* through the new female faculty member hired to support the program who brings a new research field (carbon storage and reuse) to UT and increases faculty diversity in TCE, and 3) *Foster outreach and engagement* by addressing grand challenges facing TN through our teaching, research, and outreach to the community.

The BS ENVE degree program also contributes to all five goals in UTK’s strategic vision<sup>8</sup>.

- Goal 1. CULTIVATING THE VOLUNTEER EXPERIENCE. The BS ENVE will provide access to a degree not currently available anywhere else in Tennessee, enhancing enrollment at

<sup>4</sup> Ibid.

<sup>5</sup> <https://www.jobs4tn.gov/admin/gsipub/htmlarea/uploads/LMI/Publications/STEMReport2019Updated.pdf>

<sup>6</sup> <https://www.tn.gov/content/dam/tn/thec/bureau/research/other-research/master-plan/MasterPlanSummary.pdf>

<sup>7</sup> [https://plan.tennessee.edu/wp-content/uploads/sites/38/2022/05/Strategic-Plan-Update-Final\\_5\\_19\\_22.pdf](https://plan.tennessee.edu/wp-content/uploads/sites/38/2022/05/Strategic-Plan-Update-Final_5_19_22.pdf)

<sup>8</sup> <https://plan.tennessee.edu/wp-content/uploads/sites/38/2022/05/strategic-vision-2021-UTK.pdf>



UTK by offering a new degree that addresses significant challenges affecting every Tennessean and people worldwide.

- Goal 2. CONDUCTING RESEARCH THAT MAKES LIFE & LIVES BETTER. We have hired one new faculty member to support the new degree program. Her carbon storage and reuse research has global implications in sustaining our way of life, mitigating climate change, and ensuring economic prosperity in the coming decades. Our department will continue its strong track record of undergraduate research by introducing BS ENVE students to research opportunities.
- Goal 3. ENSURING A CULTURE WHERE VOL IS A VERB. As shown later in Table 2, women are often drawn to environmental engineering as a field in which they are highly motivated to make a difference. Our program will provide this opportunity, thereby increasing the diversity of the TCE enrollment. Within the CEE department, we envision that this greater diversity will, over time, be transformational to our overall culture, thereby increasing the respectfulness and inclusiveness of our entire community.
- Goal 4. MAKING OURSELVES NIMBLE & ADAPTABLE. Environmental engineering has been interdisciplinary and collaborative since its emergence at the intersection between civil engineering and public health in the early 1900s. This spirit of collaboration continues through our proposed curriculum, which includes required technical courses from ten different units outside of CEE, all of whom will benefit from the increased enrollment in their courses. Furthermore, our faculty researchers have a strong track record of collaborative research.
- Goal 5. EMBODYING THE MODERN R1, LAND-GRANT UNIVERSITY. Tennesseans are rightfully proud of our state's natural beauty. At the same time, Tennesseans are looking forward to increased prosperity as our state seeks to continue its track record of drawing new industries to the state. Environmental Engineering serves to protect human health and our natural environment from hazardous byproducts associated with our way of life in ways that ensure economic growth and prosperity may continue. Our faculty and students seek to continue our strong engagement with the community to educate, empower, and work alongside them to benefit Tennessee and its citizens.

### *College and Departmental Mission and Vision*

Both the TCE and CEE are currently developing strategic plans that align with the UTK strategic vision. Therefore, demonstrating that the BS ENVE contributes to UTK's strategic vision ensures that it will also align with the college and department-level strategic plans. TCE has already demonstrated that the BS ENVE degree aligns with its strategic goals by funding a faculty line needed to develop and deliver the degree program.

### *Institutional Capacity to Deliver the Proposed Program*

The University is well-positioned to support this degree program through current resources. Several current members of the faculty will support the BS ENVE while they continue to support the BS CE program. These include two governor's chairs, the department head, six additional tenure-line faculty, and a PhD-level staff member who teaches two labs. In addition, the department has been approved to search for a full-time lecturer and the Goodrich Chair of Excellence, which represents two vacant lines that recently opened due to the faculty members' previous departure. Once these two open positions are filled, we anticipate that the current faculty will be sufficient to deliver the program. The faculty group described above represents a net increase of one faculty position above the historical size of the Environmental/Water Resources faculty. The new faculty member has already been hired, and the funds have been committed. Based on the above, the program's costs will be calculated based on a net addition of one faculty line. The department's MS in Environmental Engineering, established in 1970, demonstrates the long-term stability of educational programs in environmental engineering within the department and establishes name recognition for the major. There is also existing infrastructure on campus to support the program, including existing environmental engineering research labs and equipment, a fully equipped environmental teaching laboratory, a designated water resources teaching laboratory in the John D. Tickle building, two full-time staff technicians, and the Water Quality Core Facility. Additionally, campus research centers such as the TN Water Resources Research Center, the Institute for a Secure and Sustainable Environment, the Center for Environmental Biotechnology, the Baker Center for Public Policy, and the Bredesen Center for Interdisciplinary Research and Graduate Education are available to support interdisciplinary interests of faculty members and students.

Civil and Environmental Engineering (CEE) has one of the strongest records of collaboration in teaching, extracurricular student activities, and research on campus. We first outline several areas of existing collaboration with other academic units and then elaborate on how these collaborations will be enhanced by a BS ENVE program.

#### *Collaboration in Minors and Dual Degree Programs*

- CEE offers a minor in Environmental Engineering. Students in CE, Biosystems Engineering (BSE,) and Chemical and Biomolecular Engineering (CBE) commonly complete it.
- BS CE students frequently select the interdisciplinary undergraduate and graduate minors in Watersheds. The program is hosted in Biosystems Engineering, and CE and BSE faculty members have chaired the faculty watershed minor committee.
- CEE has partnered with Nuclear Engineering (lead department) on the Nuclear Decommissioning and Environmental Management minor.
- CEE strongly supports the new college-level Engineering for Sustainability minor started in 2022 by teaching EF 305 Engineering Approaches to Sustainability and managing the program's administration.

- CE students frequently minor in Business.
- CEE is a participating department in the Intercollegiate Graduate Minor in Statistics and Data Science.
- CEE is a participating department in the Intercollegiate Graduate Minor in Computational Sciences.
- CEE partners with the Haslam College of Business to offer two Dual degree programs (MS CE/MBA and MS ENV/MBA)

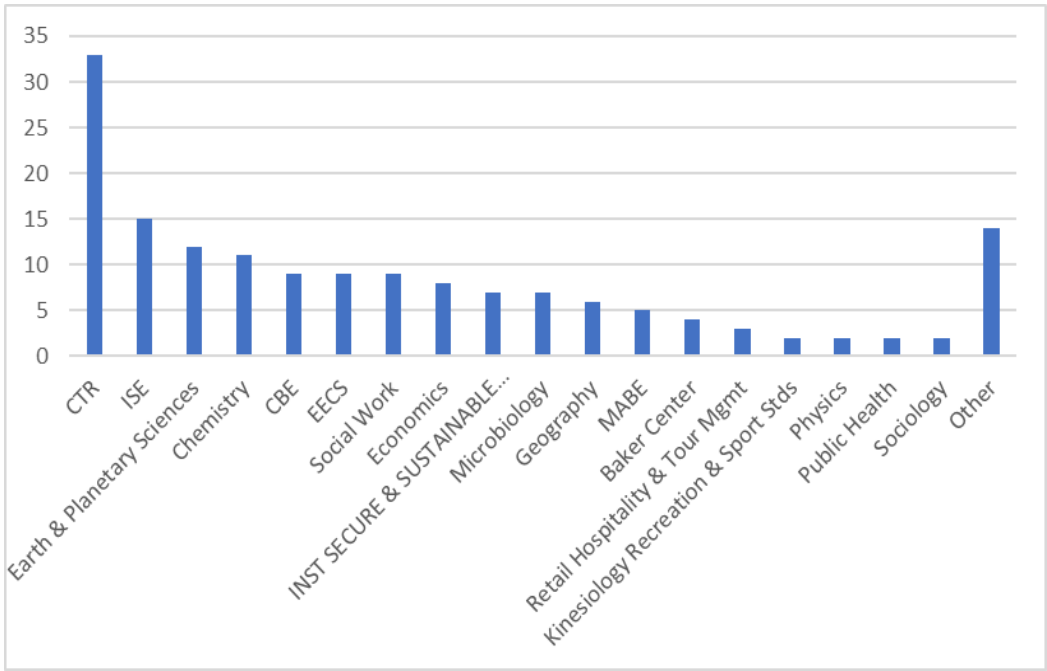
### *Collaborations in Extracurricular Activities*

- Hydrolunteers is an interdisciplinary student group that serves as the student chapter for the American Water Resources Association (AWRA) and the American Water Works Association/Water Environment Association. Students from CEE, BSE, LA, and EPS are among the members; a CEE faculty member serves as a faculty mentor.
- CEE students and faculty are well represented at the annual Watershed Symposium, organized by the watershed faculty associated with the watershed minors.
- The College of Architecture and Design is leading the formation of a Knoxville chapter of ACE, a mentoring program for high school students with a potential interest in Architecture, Construction, and Design. CEE and the Construction Science Program in BESS are additional partners in this effort.

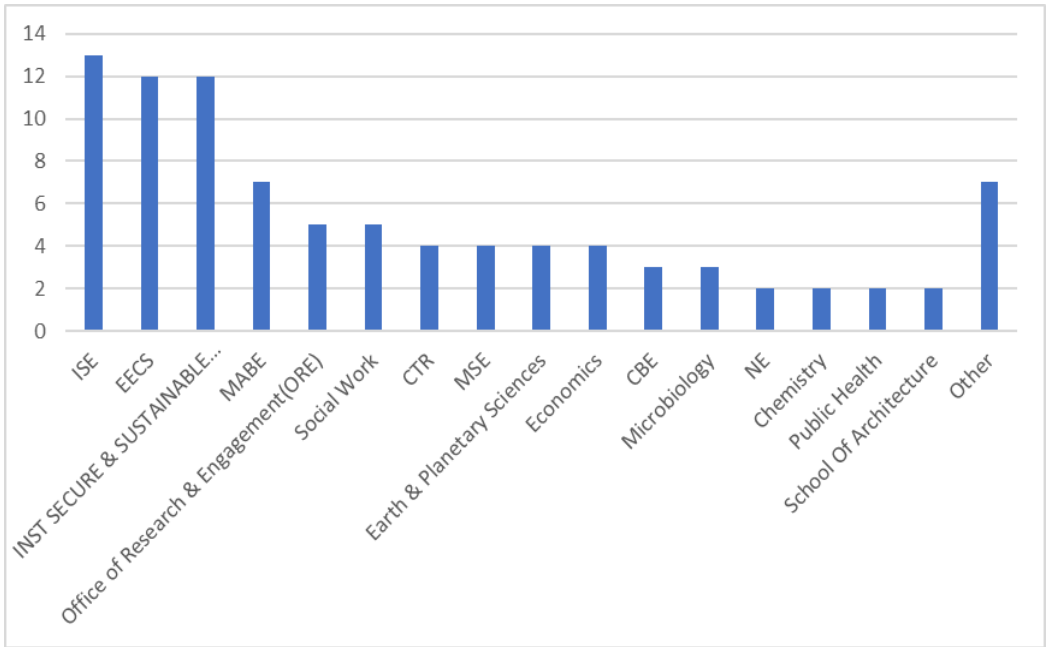
### *Collaboration in Research*

Multidisciplinary research is a distinguishing characteristic of the CEE department. It is active in various research centers and collaborates with numerous departments across campus. Research proposals led by CEE faculty with outside collaborators are shown in Figure 1, while collaborations with CEE faculty led by other units are shown in Figure 2. All told, over the six years, the number of funded collaborative research projects has remarkably averaged more than 10 per CEE tenure-line faculty member.

As we formulate the curriculum for a BS ENVE program, we intend to continue our stellar record of collaboration with others on campus. Future BS ENVE students will likely increase enrollments in the Nuclear Decommissioning and Environmental Management minor, the Watershed minor, and the Engineering for Sustainability minor, as well as increase enrollment in related classes. The inherently interdisciplinary nature of the environmental engineering discipline is reflected in the proposed curriculum for the BS ENVE degree, which includes required classes from MATH, CHEM, STAT, ME, EF, BSE, GEOL, and GEOG, in addition to general education courses. Enrollment of BS ENVE students in courses offered by other units efficiently utilizes resources outside of CEE, improves the interdisciplinary training of our students, and provides tuition income to colleges outside of TCE through the new UTK budget allocation model.



**Figure 1.** Number of research proposals led by CEE faculty with collaborators from researchers outside the department (2013-2018).



**Figure 2.** Research proposals led by researchers from other units with CEE collaborators.

### *Existing Programs Offered at TN Institutions*

There are currently no existing BS ENVE programs in the state of Tennessee.

Tennessee Technological University offers an Environmental Engineering concentration in its BS Civil Engineering degree program (CIP: 14.0801). Enrollment and graduation data for the last three years is as follows:

AY	Fall Enrollment	Graduates
2021-22	10	3
2022-23	23	5
2023-24 (preliminary)	22	n/a

The University of Memphis, offers an Environmental Engineering concentration in its BS Civil Engineering degree program (CIP: 14.0801).

The University of Tennessee, Chattanooga, offers a Environmental Engineering concentrations in their BS Civil Engineering (CIP: 14.0801) and BS Chemical Engineering (CIP: 14.0701) degree programs.

### *Accreditation*

#### *ABET General Criteria<sup>9</sup>*

The Accreditation Board of Engineering and Technology's General Criteria include the ability to:

1. Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. Communicate effectively with a range of audiences.
4. Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. Acquire and apply new knowledge as needed, using appropriate learning strategies.

<sup>9</sup> <https://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-engineering-programs-2022-2023/>

### *ABET Program Criteria*

The Accreditation Board of Engineering and Technology's Program Criteria include the following:

*The curriculum must include: a) Mathematics through differential equations, probability and statistics, calculus-based physics, chemistry (including stoichiometry, equilibrium, and kinetics), earth science, biological science, and fluid mechanics. b) Material and energy balances, fate and transport of substances in and between air, water, and soil phases; and advanced principles and practices relevant to the program objectives. c) Hands-on laboratory experiments, and analysis and interpretation of the resulting data in more than one major environmental engineering focus area, e.g., air, water, land, and environmental health. d) Design of environmental engineering systems that includes considerations of risk, uncertainty, sustainability, life-cycle principles, and environmental impacts. e) Concepts of professional practice and project management, and the roles and responsibilities of public institutions and private organizations pertaining to environmental policy and regulations.<sup>10</sup>*

We do not expect the BS ENVE program to affect our current BS CE program significantly but will complement it. There is an expressed interest by some current BS CE students to continue in that degree program while also taking courses in Environmental and Water Resource Engineering (these students prefer a general CE degree education), and we currently intend to maintain our six specialty areas. The proposed curriculum cross-lists several courses between the two curricula. We will also continue to offer the Environmental Engineering Minor to students not enrolled in the BS ENVE program.

The next ABET accreditation visit for the BS CE degree program will occur in Fall 2023. The BS ENVE degree program will not have any impact on that re-accreditation process. ABET requires students to graduate from the program prior to seeking accreditation. We project that the first students will graduate from the BS ENVE program in May 2027. Therefore, we will perform the ABET self-study for the BS ENVE program during the 2026-2027 academic year and schedule the accreditation visit for Fall semester 2027, anticipating that the program would receive full accreditation in Summer 2028. In subsequent years, the BS ENVE program would renew its accreditation on the same schedule as the other degree programs in the college, beginning with the 2029-2030 accreditation cycle.

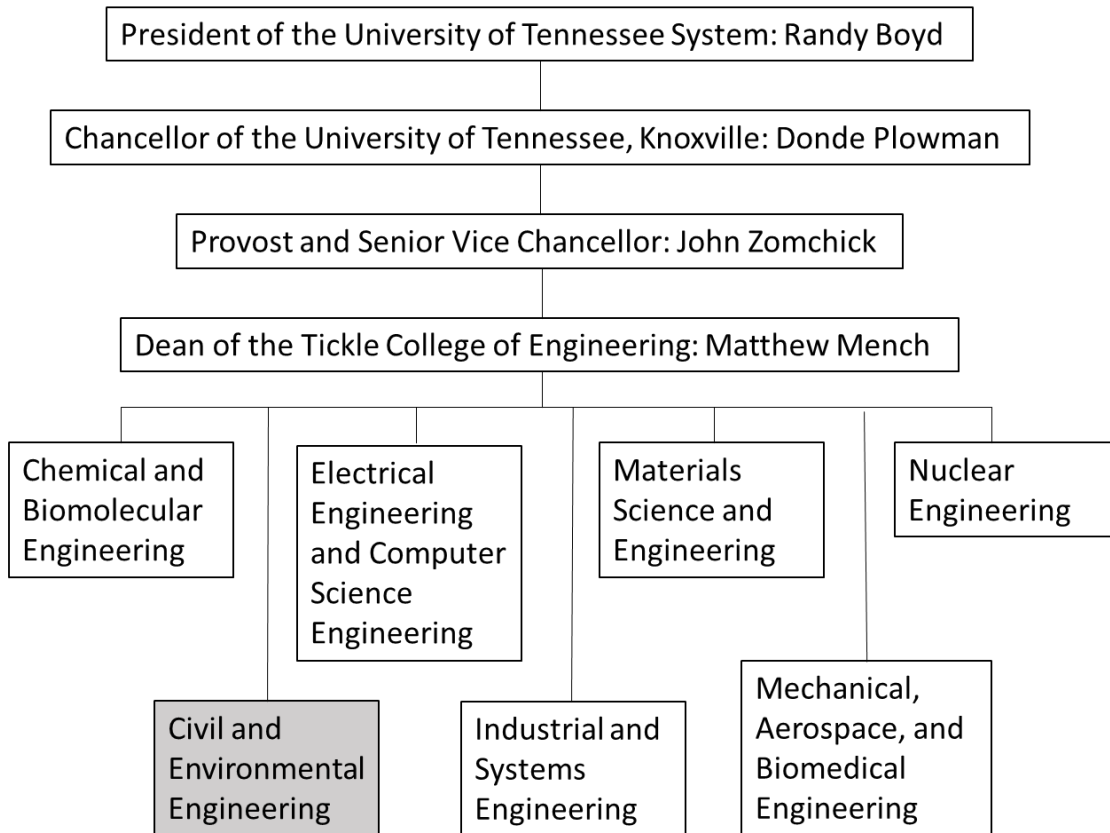
### *Administrative Structure*

The BS ENVE program will be administered through the existing academic structure of the University of Tennessee, Knoxville. The Department of Civil and Environmental Engineering in the Tickle College of Engineering will offer the degree. Dr. Chris Cox, the Civil and Environmental

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<sup>10</sup> Ibid.

Engineering Department Head, will direct the program. The department head reports to the Dean of the Tickle College of Engineering, Dr. Matthew Mench. The organizational structure is illustrated in Figure 3:



**Figure 3.** Simplified organizational chart. The Department of Civil and Environmental Engineering will administer the BS ENVE degree.

## Section III: Feasibility Study

### *Student Interest*

To assess student interest in a potential BS ENVE degree program, we examined BS ENVE enrollments at schools in states bordering Tennessee and at aspirational peer institutions. We also conducted separate surveys of first-year students enrolled in the Tickle College of Engineering and students currently enrolled in CEE. Enrollments in BS ENVE degree programs in surrounding states are summarized in Table 1. The data show significant regional student demand for this degree program and highlight the opportunity to recruit students from bordering states that do not have Environmental Engineering programs, including Arkansas, Kentucky, Mississippi, and Virginia.

**Table 1.**

*Enrollment in BS ENVE programs in states bordering Tennessee.*

State	Institution	BS Program Enrollment 2020*
Alabama	University of Alabama	89
Arkansas	None	0
Georgia	Georgia Tech	218
	Kennesaw State	101
	Mercer	33
	University of Georgia	163
Kentucky	None	0
Missouri	Missouri Science and Technology	115
Mississippi	None	0
North Carolina	North Carolina State	168
South Carolina	Clemson	81
Tennessee	None	0
Virginia	None	0

\*Online Profiles American Society for Engineering Education <http://profiles.asee.org/>

To determine the potential enrollment and demographics of students enrolling in a BS ENVE program, we examined enrollments in BS CE and BS ENVE degree programs at peer institutions. We define peer CEE programs as those ranked 17-30 by US News among public institutions (this included 18 institutions because of ties in ranking). Among these 18 peer institutions, only the



University of Maryland, the University of Virginia, Auburn, and the University of Massachusetts—Amherst do not offer BS ENVE programs. Three other institutions, Iowa, Iowa State, and Arizona State University have begun offering BS ENVE programs since 2015. Enrollment data for BS ENVE and BS CE programs at peer institutions are summarized in Table 2.

**Table 2.**

*Enrollments in BS CE and BS ENVE Programs at Peer Institutions.*

School	CE	ENVE	ENV/CE	CE %F	ENVE %F
North Carolina State University	464	168	36%	25%	51%
University of Florida	307	151	49%	29%	68%
Arizona State University	534	159	30%	25%	63%
Ohio State University	536	157	29%	21%	48%
University of California—Irvine	376	118	31%	32%	58%
Iowa State University*	523	23	4%	24%	43%
University at Buffalo—SUNY	428	120	28%	18%	55%
Colorado School of Mines	316	174	55%	37%	65%
Colorado State University	371	181	49%	25%	51%
Michigan State University	384	207	54%	22%	51%
Oregon State University	315	78	25%	24%	47%
Missouri University of Science & Technology	405	115	28%	24%	58%
University of Arizona	221	52	24%	24%	58%
University of Iowa	180	53	29%	22%	49%

*Note: CE %F and ENVE %F represent the percentage of enrollees who are female in CE and ENVE degree programs, respectively. \*New program began in 2021. Online Profiles American Society for Engineering Education <http://profiles.asee.org/>*

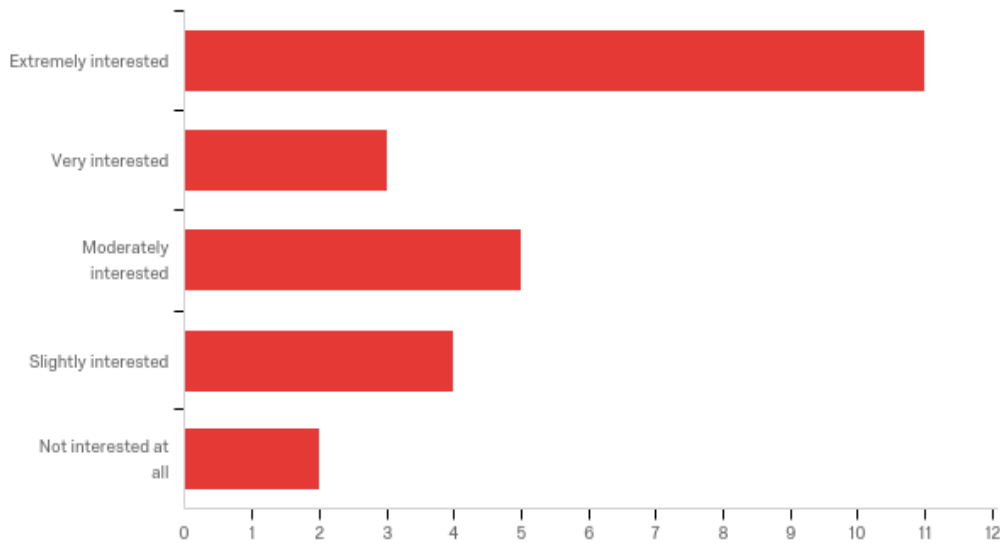
Across all peer institutions with BS ENVE degree programs, the enrollment in that program is about one-third of the corresponding BS CE program. Excluding the new program at Iowa State, BS ENVE enrollment ranged from 24% to 55% of BS CE enrollment. Female students (shown as F in Table 2) make up 56% of all students enrolled in BS ENVE programs (ranging from 43% to 65%) compared to an average of 25% of women in the corresponding BS CE program (ranging from 18% to 37%). Across all established peer programs, BS ENVE enrollment is sufficient for a viable degree program and is likely to attract more women than the BS CE program.

To assess interest in a BS ENVE program among students currently enrolled in the TCE, we surveyed two groups that would provide the initial cohort of students to populate the degree program.

1. Existing CEE students interested in Environmental or Water Resources Engineering

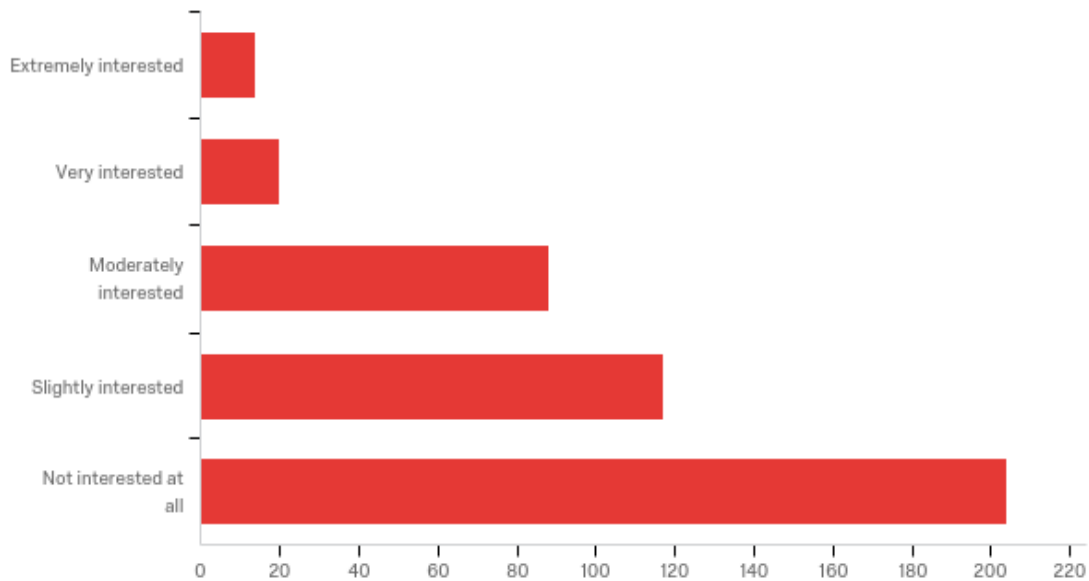
The first group surveyed was CEE students who have selected either Water Resources or Environmental Engineering as their specialty-area electives, usually chosen in their junior or senior year (Figure 3). These students have self-selected interests in those two subjects and would be likely candidates for the BS ENVE program. We excluded students who did not select specialty areas in Environmental Engineering or Water Resources since they are not likely interested in a stand-alone BS ENVE program. The survey was distributed to 12 students enrolled in Water Resources II in the Fall of 2018 and 18 in Environmental Engineering II in the Spring of 2019. Of those, we received 25 responses, an 83% response rate. Of the respondents, 60% decided to specialize in ENV or WR engineering before or when they entered the CEE department. When asked to gauge their interest in and BS ENVE degree relative to the BS CE, more than half (14/25) said they would be Extremely Interested or Very Interested in that degree program, and an additional 9/25 reported moderate or slight interest in the proposed program (Figure 4).

From Fall 2017 to Fall 2019, 53 students selected either Environmental Engineering or Water Resources as one of their specialty areas for 165 total BS CE graduates. This figure of 53 students, or roughly one-third of the CE graduates, represents the potential market from students already in our department for a BS ENVE. Of these, 18 students selected both specialty areas, while the others selected either Environmental Engineering or Water Resources and another specialty in CE. Sometimes scheduling conflicts make it difficult for students to choose the desired secondary specialty area, and they make this selection based on convenience. We believe these data indicate clear interest among existing Junior and Senior CE students for an ENVE BS program. At the same time, there will likely continue to be students who select these specialty areas while remaining in the BS CE degree program.



**Figure 4:** Q13 - Compared to a general Civil and Environmental Engineering degree, how interested would you be in a standalone Environmental Engineering BS program (not a concentration) that would allow you to focus on environmental and water resources training that would NOT include broader Civil Engineering disciplines in construction, geotechnical, structures and transportation?

To assess interest from students outside the department, we also surveyed first- and second-year students in the TCE Engineering Fundamentals courses. This process allowed us to identify students when they were choosing majors and gauge their awareness and interest in Environmental Engineering degree programs. The survey was distributed to 672 students in EF 151 and EF 152, and we received 496 responses (74% response rate). The questions were worded to evaluate students' overall level of interest in the TCE for a BS ENVE program if it did not require typical CE coursework (e.g., Structural Engineering or other "dry side" courses). The results are shown in Figure 5. This large cohort included all TCE majors, so many of them (e.g., electrical engineers) did not show any interest in an ENVE BS program. Forty-five freshmen (including ten who had declared an interest in CE) stated they would be *extremely interested* or *very interested* in a BS program. This number would likely be higher if all students had responded to the survey. In summary, a BS ENVE program could generate enough first-year student familiarity and interest to support itself as a viable program among current TCE students. On average, students across all Engineering majors (except declared CE students) indicated that they would be more interested in a BS ENVE program than the current BS CE program. We interpreted the data from the survey to mean that most student indicating that they were *extremely interested* or *very interested* in the BS ENVE program would in fact enroll in the program. The survey was one of the pieces of information, along with enrollment trends at peer institutions, that we used to arrive at a conservative estimate that at least 30 first-year students each year would chose to major in ENVE.



**Figure 5:** How interested would you be in enrolling in a stand-alone Environmental Engineering BS degree program that would allow you to focus on environmental and water resources training that would NOT include broader Civil Engineering disciplines in construction, geotechnical, structures and transportation?

#### *Students outside of TCE or UT*

Additionally, two sources of student populations for program enrollment are challenging to assess. However, these sources have the potential to attract additional prospective students. First, students outside TCE could be interested in a BS ENVE program. We did not conduct university-level surveys.

A more significant draw will be students recruited from across the state or region that would not have considered UT because it lacked a BS ENVE program. It is not easy to know how many students we can attract currently selecting other institutions. However, other BS ENVE programs in the region have large student enrollment (Table 1), indicating significant demand.

### *Local and Regional Need/Demand*

National demand for Environmental Engineers is strong. The US Bureau of Labor Statistics indicates that there were 52,300 Environmental Engineering Jobs in 2020, an increase of 1,900 during the last ten years. They further estimate that environmental engineering jobs will increase by another 4% over the next decade. The estimated annual salary for an environmental engineer is \$96,820 per year, which is slightly greater than that for civil engineers (\$88,050).<sup>11</sup>

As mentioned previously, environmental engineers often fill positions described as “Environmental Scientists and Specialists, Including Health,” which are identified by the state of Tennessee as high-demand occupations<sup>12</sup>. Likewise, Tennessee has also projected that Environmental Engineers are expected to increase by 15.64% from 1151 in 2016 to 1331 in 2026.<sup>13</sup> There are no existing BS Environmental Engineering degree programs in TN to meet this need.

In the sections below, we share results from our analysis of current regional job openings, a survey of local employers, and letters of support from local, regional, and national employers. These lines of evidence confirm that the workforce demand for environmental engineering graduates is strong, warranting the first such program in Tennessee.

### *Employer Demand*

To assess the regional job market for Environmental Engineers, we conducted two job searches for Environmental Engineering positions on LinkedIn with the following parameters:

- Experience Level: Entry Level
- Job Type: Full Time
- Locations:
  - Search 1: Tennessee
  - Search 2: Atlanta GA, Charlotte NC, Raleigh NC, Austin TX, Dallas TX, Houston TX
- Job Function: Analyst, Consulting, Research, Engineering, and Project Management
- Title: Environmental Engineer, Environmental Specialist, Civil Engineer
- Date: The searches were conducted on November 1, 2022

Search 1 focused on Tennessee and returned 64 jobs, while Search 2 focused on major metropolitan areas in the southeast region, returning 212 jobs. Each of these listings was screened to identify jobs for which a BS in Environmental Engineering fulfills the educational requirement, yielding more than

<sup>11</sup> <https://www.bls.gov/ooh/architecture-and-engineering/environmental-engineers.htm>

<sup>12</sup> Op. Cit. <https://www.tn.gov/content/tn/thec/research/supply-and-demand.html>

<sup>13</sup> Op. Cit. <https://www.jobs4tn.gov>

25 positions in Tennessee and 100 positions regionally. Screenshots from the two searches and a list of 30 example positions are listed in Appendix C. The search demonstrates a strong employment market for degree holders with a BS in Environmental Engineering in Tennessee and regionally.

Strong employment prospects for our MS ENVE graduates over many years provide additional evidence of employer demand for Environmental Engineers. Our graduates have gone to work for employers such as private consulting and industry, as well as utilities and government agencies (ORNL, TVA, NOAA, the Southeast Regional Climate Center, US Army Corp of Engineers, the USGS, and the Tennessee Department of Environment and Conservation).

One remaining question we addressed through a survey was employer preference between ENVE and CE at the undergraduate level. Some of our civil engineering graduates are hired to work in environmental engineering positions. We wanted to assess the extent to which a BS ENVE degree would expand employment opportunities for graduates compared to a BS CE degree and gain employer perspective on future needs. We sent surveys to 15 employers active in the region and known to hire environmental engineers, including a mixture of private and public-sector employers. Most employers selected for the survey hire heavily from UTK but may be less familiar with BS ENVE graduates since we do not have such a program. We received responses from 11 of the 15 employers. Results from the survey are summarized in Appendix D. Major takeaways from the employer survey include the following points:

- 1) There is a regular and steady demand for environmental engineers.
- 2) Currently, these employers hire mostly BS CEs to fill vacant positions.
- 3) Eight employers would prefer to hire a BS ENVE to fill these positions, while the other three would still prefer to hire employees with BS CEs.
- 4) Traditional CE topics, such as surveying and geotechnical engineering, are useful for much environmental engineering work and should at least be available to BS ENVE students as electives.
- 5) 6 of the 11 employer respondents foresee increased demand for environmental engineers.
- 6) 10 of the 11 employer respondents would similarly compensate employees holding a BS CE and BS ENVE.

Even considering that BS degree graduates from both Civil Engineering and Environmental Engineering programs may be viewed similarly by many employers, the BS ENVE degree represents tremendous value to employers by drawing more students to water and wastewater treatment and water resources. There is currently a tremendous shortage of graduates to fill entry-level positions in this industry. Without the availability of a BS ENVE degree, these students are likely to pursue other fields. The visibility of the BS ENVE degree will attract more students to a high-demand profession, thereby contributing a solution to workforce shortages in infrastructure engineering.

### *Community and Industry Partnerships*

The Department of Civil and Environmental Engineering has rich and long-standing relationships with the community and industry, which we will leverage to support the new degree program. These include local- and state-based **research sponsorship relationships** with the Great Smoky Mountain National Park, the Tennessee Department of Environment and Conservation, the Tennessee Department of Transportation, and several local industries. We partner with many consulting engineering companies, local utilities, state agencies, industries, and non-profit groups each year on capstone senior design projects. We anticipate expanding these partnerships to support the environmental engineering capstone design sequence. Local parent organizations, including the Knoxville Branch of the American Society of Civil Engineers, the Tennessee-Kentucky Water Environment Association, the Tennessee Section of the American Water Resources Association, and the Tennessee Society of Professional Engineers, support the department student chapters of professional organizations. Many local, regional, and national employers provide **internships, cooperative education, and full-time post-graduate employment opportunities**.

Letters of support from a sampling of employers demonstrating the high demand for graduates and willingness to support the program are provided in Appendix A.

## Section IV: Enrollment and Graduation Projections

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We estimate that each entering first-year class will have 30 BS ENVE students. This estimate is conservative based on the survey of current TCE first-year students and assuming new students from outside the TCE and UTK select this program. We also assume that, during the program's first year (Fall 2024), we will recruit 20 sophomores from the previous year's first-year class.

We developed an enrollment model based on UG data from the BS CE program from 2012 to 2022. In developing the model, we tracked the enrollment behavior of each student to gain deep and high-confidence insights into factors that govern enrollment on a year-by-year basis. We assumed that the trends observed in the BS CE program would be our best estimate of enrollment patterns in the BS ENVE degree. During this period, we identified the following trends that form the basis of the model:

- Each year, 30 new students will enter the program as first-year students.
- On average, the second-year class is 69%, as large as the first-year class from the previous year. The decrease in enrollment occurs due to the common practice of TCE students to switch majors in their first year and because some first-year students take more than one academic year to earn more than 30 credit hours.
- On average, the Junior class is 118%, as large as the Sophomore class from the previous year. The net increase occurs because of a net gain from transfer students (both internal to UTK and external) and a few students who have less than 30 credit hours after their first year but more than 60 credit hours after their second year, thereby never showing up as Sophomores in university data.
- The second and third assumptions are equivalent to the attrition of five students per year.
- On average, 60% of Seniors (defined as students having over 90 credit hours at the beginning of the fall semester) graduate by the end of that academic year. The remaining students require additional time to complete graduation requirements. We also identified some students that entered the BS CE degree program with more than 90 credit hours. These are typically second-degree students or students who did not complete their degrees when enrolled in a different major earlier in their academic careers. Together, these factors make the Senior class the largest of the four categories.
- We estimate the number of Seniors in any given by:  

$$\text{Seniors (previous year)} - \text{graduates (previous year)} + \text{juniors (previous year)}$$

Based on these assumptions, the BS enrollment during the program's first five years is projected as described in Table 3.



**Table 3.***Projected Enrollment in the BS ENVE Program During the First Five Years of The Program.*

Year	Academic	Freshmen	Sophomores	Juniors	Seniors	Projected Total Enrollment	Projected Attrition	Projected Graduates
1	2024-2025	30	20	10	0	50	5	0
2	2025-2026	30	21	24	10	75	5	0
3	2026-2027	30	21	25	24	100	5	14
4	2027-2028	30	21	25	35	111	5	21
5	2028-2029	30	21	25	39	115	5	23

By 2027, the projected BS ENVE enrollment will be approximately 1/3 the enrollment of our current BS CE program, which matches the average ratio of BS ENVE to BS CE students at peer institutions, suggesting that the enrollment projections are reasonable. We also project that 50% of the students will be women, based on the percent female enrollment at peer institutions.

## **Section V: Projected Costs to Deliver the Proposed Program**

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The Department of Civil and Environmental Engineering has offered an environmental and water resources-related curriculum for several decades. Therefore, most of the faculty and staff needed to support the program are already in place, as well as the laboratories and equipment. As a result, the projected costs to offer the degree program are modest.

### ***Faculty and Instructional Staff***

TCE approved one new faculty line to support the new BS ENVE degree program. The salary for this new faculty member is shown on the financial projection form, ranging from \$103,000 in year 1 and increasing to \$115,927 in year 5. That individual, an assistant professor, has already been hired, effective August 1, 2022. We have included their salary and benefits in the financial projection form because it is a new operating expense associated with the degree program. We currently have two open positions for a lecturer and Goodrich Chair, but these are historical positions and require no new resources. Additionally, the department has recently co-led a successful “It Takes a Volunteer” cluster hire initiative in Precision Health and Environment. This University-level cluster hiring initiative is independent of the BS ENVE degree program. However, there is one additional environmental engineering faculty hire associated with that cluster initiative, who will be available to teach and contribute to the BS ENVE degree program. After we fill the open positions, we will have sufficient faculty to offer the BS ENVE program. Salaries are calculated from the assistant professor’s 2022 base salaries of \$100,000, increasing by 3% per year. Faculty fringe benefit rates are estimated at 33%.

An additional one-time expense is start-up costs. We have shown the final two years of the startup budget for the new hire associated with the BS ENVE program in the Financial Projection Form. Additionally, startup expenses for \$182,675 in equipment purchases (described in detail below) are included.

### ***Non-Instructional Staff***

We project that an additional academic advisor will be needed to advise students within the program. The projected workload will be approximately 50%, with the other half of the position able to be assigned to other advising responsibilities either within the department or the college. The full-time salary for the position is estimated to be \$48,000, increasing by 3% per year. Staff fringe benefit rates are estimated at 33%.

## Graduate Assistants

Graduate assistants during the first five years of the program are as summarized in Table 4.

**Table 4.**

*Graduate assistant needs during the first five years of the program.*

Category	Year 1	Year 2	Year 3	Year 4	Year 5
GRAs supported by faculty startup funds	1	1			
GTAs supported by TCE		0.5	0.5	1	1
GRAs supported by external research grants		0.5	0.5	1	1
Total Graduate Assistants	1	2	1	2	2

One Graduate Research Assistant (50% effort, 20 hour per week appointment) will be funded by startup funds during year 1 and 2 of the program.

One new Graduate Teaching Assistant (GTA, 25% effort, 10 hours per week appointment will be needed to support teaching in the BS ENVE program in year 2 and year 3, and two GTA positions will be needed in years 4 and 5. Students selected to serve in GTAs also normally hold a 25% effort GRA position to bring their total support to 50%.

The TCE has approximately 211 Graduate Teaching Assistant (GTA) lines that it allocates to departments according to a formula that considers student-credit hours generated and full-time equivalent tenure-track faculty lines. The formula currently allocates approximately 25 GTA lines to CEE. We anticipate that the two additional GTA lines needed to support the program will be allocated through the TCE GTA allocation formula, due to an increase in the student-credit hours generated by the new degree program. Therefore, these GTA positions represent a reallocation, rather than new resources in the college. Nevertheless, we have included the costs associated with these GTA lines in the financial projection to demonstrate the financial soundness of the new degree program.

GTA are selected from among students nominated by CEE faculty members, with final selections and assignment of GTAs to specific classes being made by the department head based on the qualifications of nominated students to satisfy teaching needs. GTA responsibilities may include grading homework and lab reports, holding help sessions, providing teaching support in laboratories, and other forms of teaching support. GTAs are supervised by the faculty members teaching the course. Graduate assistant support costs include tuition support, a stipend of approximately \$24,000 per year, and health insurance. These costs are split between the GTA appointment (funded by the college) and the GRA appointment (funded by a research contract or startup).

Graduate student tuition is assumed to increase by 3% a year, and health insurance at 8% per year. We also assume that half of the graduate student tuition will be paid by research contracts.

### *Accreditation*

We will seek ABET accreditation for the program in the 2027-2028 academic year. We have budgeted \$6700 for the initial off-cycle accreditation visit, plus \$715 per year in accreditation maintenance costs beginning after accreditation is awarded in 2028. These costs were obtained from the ABET website.

### *Consultants*

New program approval requires a visit from an external evaluator. We have budgeted \$2500 honoraria for this purpose.

### *Equipment*

No new equipment is required to support the new academic program. However, equipment to support research will be purchased as part of the startup package for the new faculty line associated with the program. Startup-related equipment purchases are summarized below:

#### Year 1 \$103,935

Aligent hand-held FTIR: \$46,651

Three syringe pumps and controllers: \$57,284

#### Year 2 \$78,740

Two-phase acoustic separator: \$59,865

Hassler core holder: \$18,875

### *Information Technology*

No new information technology is needed to support the new academic program.

### *Library Resources*

No new library resources are required to support the new academic program.

### *Marketing*

We are including \$8,000 for a one-year initial marketing campaign to develop state-wide awareness of the new program.

### *Facilities*

Existing facilities are sufficient to support the new program.

### *Travel*

We have budgeted \$2000 in potential travel costs for the evaluation by the external consultant described above.

### *Other Resources*

No additional resources are required.

## Section VI: Projected Revenues for the Proposed Program

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### *Tuition*

Tuition income projections were based on the enrollment shown in Table 3. However, it should be noted that of the students listed in Table 3, we project approximately ten students per class will be students who would have previously enrolled in the BS CE program. The rest will be new students to the department.

We made additional assumptions to obtain the tuition revenue estimates in the TDEC Financial Projection forms. We assumed that students would enroll in both the Fall and Spring semesters and that one-third of graduating seniors would graduate in December (thus, enrolling in only one semester), which is consistent with past trends in the BS CE program. We assume that each student will enroll in nine hours of engineering courses per semester, generating differential tuition income at \$110 per student credit hour. We assume a 3% increase in tuition each year and that about 25% of the students will be out-of-state, consistent with recent trends in TCE (TCE out-of-state enrollment in first-year cohort 2019: 22% 2020: 26% 2021: 30% 2022: 36%).

### *Grants*

New faculty members are expected to conduct externally-funded research. By the end of year five, collectively, the new faculty member allocated to start this new degree program should be generating at least \$250K of research expenditures per year. Assuming an average effective F&A rate of 35% of direct costs on this research, this represents about \$90K per year in F&A. On the financial projection form, we have included funds from anticipated federal research grants that would cover the GRA portion of a split GRA/GTA appointments.

### *Other*

We are not anticipating other income sources during the program's first five years.

Our projection indicates that the BS ENVE program will generate excess income each year that can be reallocated to other University and TCE priorities.

## Section VII: Implementation Timeline

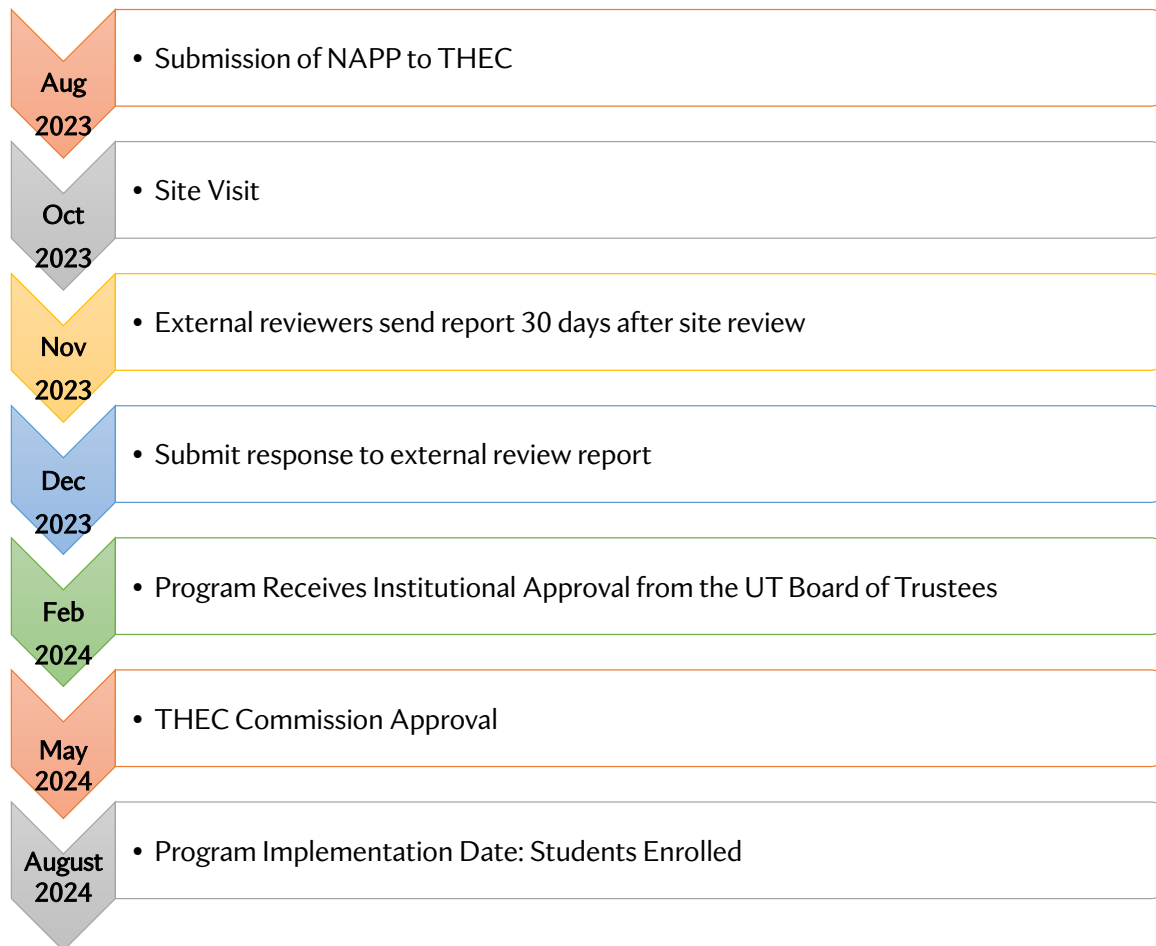


Figure 6: Implementation Timeline

### *Accreditation Considerations*

SACSCOC Accreditation:

The curriculum requires three new courses (ENVE 101, ENV 200, and ENVE 410)<sup>14</sup> consisting of 5 credit hours. The remaining 37 credit hours of courses in the curriculum taught by the CEE faculty are currently modified versions of courses already in the curriculum. Since the new content falls well below 25%, the university is not required to notify or seek approval from SACSCOC prior to beginning the program. The department's regular SACSCOC assessment procedures will be extended to the new degree program as the applicable courses are offered.

<sup>14</sup> ENVE101: Introduction to Environmental and Water Resources Engineering; ENVE200: Environmental Process Fundamentals; and ENVE410: Fate, Transport, and Risk Assessment

### Programmatic Accreditation:

A program is not eligible for ABET accreditation until it has at least one graduate. If the program has second-year students enrolled by Fall 2024 (possible because of the common first-year curriculum in the Tickle College of Engineering), it is reasonable for the first students to graduate from the program in May 2027. The first accreditation visit will be off-cycle from the other programs in the TCE. Under this scenario, the following accreditation timeline is anticipated:

- Fall 2024-Spring 2027: Gather and analyze assessment data and initiate continuous improvement process
- January 31, 2027: Submit Request for ABET Evaluation
- May 2027: First students graduate
- July 1, 2027: Submit ABET Self-Study Report
- September 2027 – December 2027: Onsite Accreditation Visit Occurs
- January – April 2028: Four months following visit, due process for correction of errors of fact, review of draft statement, institutional responses
- July 2028: Accreditation Decision
- August 2028: Formal Notice of Accreditation

Thereafter, the BS ENVE program will be evaluated for accreditation on the same cycle as all other programs in TCE, beginning with a self-study report and on-site visit in 2029.

### Applicable State Boards or Licensing

Engineering licensure in the state of Tennessee is administered by the Tennessee Board of Architectural and Engineering Examiners. From their website:

*Engineer Intern certification is the first step on the path to professional engineering registration. The educational requirements for engineer intern certification in the State of Tennessee are either an undergraduate degree in engineering that has been accredited by the Engineering Accreditation Commission (EAC) of the Accreditation Board for Engineering and Technology (ABET), or an undergraduate degree in engineering that has been determined to be substantially equivalent to an EAC/ABET-accredited degree.*

Therefore, ABET accreditation will be satisfy licensing requirements of the BS ENVE degree program.

The Tennessee Board of Architects and Engineers will allow students and graduates of the program to sit for licensing exams before the program is accredited with the proper disclaimer that the applicant would need to meet the statutory requirements at the time of application for licensure, which would include an ABET accredited bachelors or its equivalent. In this case, as student or graduate could sit for a licensing exam before the program was accredited, but could not apply for licensure before the program was accredited by ABET.

### ***UT Board of Trustees***



We plan to seek institutional approval for the BS ENVE program at the Winter UT Board of Trustees meeting on Feb. 29 – March 1, 2024.

*Tennessee Higher Education Commission*

We will seek THEC approval for the BS ENVE program at the Summer THEC Meeting in May 2024 pending approval by the UT BOT.

## Section VIII: Curriculum

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### *Program Goals/Objectives*

The proposed BS in Environmental Engineering will:

- Solve engineering problems and contribute to successful projects, with increasing technical and leadership responsibility
- Adapt to rapid changes in societal needs and engineering technology by leveraging existing and emerging engineering knowledge
- Exercise creative and resourceful critical thinking skills and an attitude of professional confidence
- Continually increase engineering proficiency, pursue graduate or other advanced education and professional licensure, and contribute to the profession and community with integrity

### *Student Learning Outcomes*

Student learning outcomes for accredited engineering programs are defined by ABET and are common for all engineering degree programs in the United States. Assessment of Student Learning Outcomes is a key component of the ABET accreditation process and is a key driver of continuous improvement of the program. In addition to Student Learning Objectives, ABET specifies Program Criteria for each academic discipline. The Program Criteria are specific content that must be included in the curricula, but program criteria are not assessed. ABET Student Learning Outcomes and Program Criteria are key drivers of our curriculum. Student Learning Outcomes are mapped to core ENVE courses in Table 5, and coverage of ABET Environmental Engineering Program Criteria topics are documented in Table 6.

In addition to the learning and assessment events documented in Table 5, there are additional learning events for student learning outcomes 6 and 7 in other courses in the curriculum. Learning opportunities for student outcome 6 (*an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions*) also occur in other laboratory courses in the curriculum, including EF 151 and 152 (Engineering Physics) and Chem 123 and 133 (General Chemistry Laboratory). Student learning outcome 7 (*an ability to acquire and apply new knowledge as needed, using appropriate learning strategies*) is foundational to university education and is embedded throughout the curriculum; Table 5 only indicates the assessment points within the ENVE disciplinary courses.

Table 5.

Student Learning Outcomes Mapped to Core Courses (T = Outcome Taught; A = Outcome Assessed)

Learning Outcome <i>Students will demonstrate...</i>	Engineering Approaches to Sustainability	Intro to Environmental and Water Resources	Environmental Process Fundamentals	Professional Development I	Professional Development II	Environmental Engineering I	Environmental Engineering II	Water Resources Engineering I	Water Resources Engineering II	Hydrology	Air Pollution Engineering and Control	Solid and Hazardous Waste Management	Fate, Transport and Risk Assessment	Water Resources Lab	Environmental Engineering Lab	Construction and Engineering Management	Senior Design I	Senior Design II
1. an ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.	T		T			T	T	A	T	T	T	T	A					
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.							T	T			T	T				T	A	A
3. an ability to communicate effectively with a range of audiences.				A	T									T	T	A	A	T
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.		T			A												T	T
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.						T	T		T					A	T		T	A
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.														T	A			
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.				A	A													A

Table 6.

Coverage of Topics Required by ABET Environmental Engineering Program Criteria

Topics Required by ABET Program Criteria	Courses in which Coverage Occurs
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Mathematics through differential equations, probability and statistics, calculus-based physics, chemistry (including stoichiometry, equilibrium, and kinetics), earth science, biological science, and fluid mechanics.	Calculus I, Calculus II, Calculus III, Differential Equations I, Probability and Statistics for Scientists and Engineers, Physics for Engineers I, Physics for Engineers II, Engineering Mechanics, General Chemistry I, General Chemistry I Lab, General Chemistry II, General Chemistry Lab II, Environmental Processes Fundamentals, Principles of Hydrogeology, Organismal and Ecological Biology, Water Resources Engineering I
Material and energy balances, fate and transport of substances in and between air, water, and soil phases; and advanced principles and practices relevant to the program objectives.	Environmental Process Fundamentals; Fate, Transport, and Risk Assessment; Biothermodynamics, Heat, and Mass Transfer; Environmental Engineering II, Water Resources Engineering II, Air Pollution Control and Engineering; Solid and Hazardous Waste Treatment.
Hands-on laboratory experiments, and analysis and interpretation of the resulting data in more than one major environmental engineering focus area, e.g., air, water, land, environmental health.	Environmental Engineering Laboratory; Water Resources Engineering Laboratory
Design of environmental engineering systems that includes considerations of risk, uncertainty, sustainability, life-cycle principles, and environmental impacts.	Environmental Engineering II, Water Resources Engineering II; Senior Design I; Senior Design II
Concepts of professional practice and project management, and the roles and responsibilities of public institutions and private organizations pertaining to environmental policy and regulations.	Professional Development I; Professional Development II, Construction Engineering and Management; Introduction to Environmental Engineering; Environmental Engineering I; Air Pollution Control and Engineering; Solid and Hazardous Waste Management

### *Academic Program Requirements*

The academic program requirements of the BS ENVE curriculum, excluding courses exclusively focused on satisfying Vol Core general education requirements, appear in Table 7. A course credit hour is generally a 50-minute block of structured instruction per week, except for laboratories in which one credit hour reflects roughly 2-3 hours of structured laboratory-based learning activities. The number of course credit hours also reflects the amount of learning content in the course.

**Table 7.**

#### *BS ENVE Program Curriculum*

Course Prefix, #, and Title	Course Catalog Description	Credit Hours	New or Existing
<b>Fundamental Courses: 41 Hours</b>			
BIO 150	Intended for science majors, an introduction to the major biological concepts emphasizing the organismal and ecological aspects of life. Organized along themes of evolution, structure and function, information flow, exchange and storage, pathways of energy and matter, and systems.	3	Existing
CHEM 122 General Chemistry I	A general course in theoretical and descriptive chemistry. Modern atomic theory, chemical bonding, molecular structures and geometries, stoichiometry, and quantitative aspects of solution chemistry, gas laws, and chemical energy.	3	Existing
CHEM 122 General Chemistry II	A general course in theoretical and descriptive chemistry. Intermolecular forces, kinetics, chemical equilibria, acid and base chemistry, thermodynamics, electrochemistry, and introduction to coordination chemistry.	3	Existing
COSC 111 Computation Thinking and the Art of Programming	An introduction to the thought processes of computer science and the art of programming. Topics include learning to think algorithmically, and solve problems efficiently, using a high-level programming language and a variety of software tools and technologies. Skills learned include designing programs to solve problems, developing the algorithms needed, using abstractions, data structures and encapsulation, writing code to implement algorithms, testing the code for errors, and documenting the process and the outcome. This course welcomes students with limited or no programming experience.	3	Existing

Course Prefix, #, and Title	Course Catalog Description	Credit Hours	New or Existing
EF 105 Computational Methods in Engineering Problem Solving	Introduction to computer applications used in engineering problem solving and communications. Introduction to programming concepts, including conditional statements and looping, and the development and implementation of logic flow diagrams.	1	Existing
EF 151 Physics of Engineers I	Calculus-based study of basic physics concepts, including vectors, kinematics, Newton's laws, forces, work-energy, and impulse-momentum. Introduction to team work. Introduction to the engineering disciplines. Examination of engineering principles and design issues. Oral and written presentation skills.	4	Existing
EF 152 Physics of Engineers II	Calculus-based study of basic physics concepts, including rotational dynamics, statics, oscillations, waves, fluids, heat and temperature, and first and second law of thermodynamics. Introduction to team work. Introduction to the engineering disciplines, examination of engineering principles and design issues. Oral and written presentation skills.	4	Existing
MATH 141 Calculus I	Single variable calculus especially for students of science, engineering, mathematics, and computer science. Differential calculus with applications.	4	Existing
MATH 142 Calculus II	Single variable calculus especially for students of science, engineering, mathematics, and computer science. Integral calculus with applications.	4	Existing
MATH 231 Differential Equations I	First course emphasizing solution techniques. Includes first-order equations and applications, theory of linear equations, equations with constant coefficients, Laplace transforms, and series solutions.	3	Existing
MATH 241 Calculus III	Calculus of functions in two or more dimensions. Includes solid analytic geometry, partial differentiation, multiple integration, and selected topics in vector calculus.	4	Existing
ME 202 Engineering Mechanics	Review of vector algebra. Statics of two-dimensional trusses and frames, including methods of joints and sections. Geometric properties of cross sections, including first and second moments and location of centroid. Inertial properties of rigid bodies, including moment of inertia and location of mass center.	2	Existing
STAT 251 Probability and Statistics for Scientists and Engineers	Data collection and descriptive statistics. Concepts of probability and probability distributions. Discrete and continuous distributions. Estimation of means, confidence intervals, and hypothesis tests for single mean and proportion. Simple regression and correlation. Process improvement, statistical process control, and 2-level experiments. Use of statistical computing software.	3	Existing

Required Core Classes: 30 Hours			
EF 305 Engineering Approaches to Sustainability	This course covers cross-cutting engineering approaches to analyze and solve current sustainability challenges. Students will learn some of the tools, protocols, and methods that are common to sustainability analysis, particularly focused on engineered systems.	3	Existing
ENVE 101 Introduction to Environmental and Water Resource Engineering	A series of case studies selected to illustrate the role of environmental and water resource engineers in addressing current environmental issues including population and urbanization, hydrologic cycle and water management, water and wastewater treatment, air pollution, solid waste management, industrial waste, sustainability, climate change and adaptation, and sustainability and employment opportunities in environmental engineering and water resources.	1	New
ENVE 200 Environmental Process Fundamentals	Principles of stoichiometry, mass balance, heat balance, chemical equilibrium, kinetics, and reactor design in the context of natural and engineered environmental systems.	3	New
ENVE 381 Environmental Engineering I	Introduction to drinking water treatment and distribution systems, wastewater treatment and collection systems, air pollution, solid/hazardous waste, and environmental regulations.	3	Existing
ENVE 391 Water Resources Engineering I	Introductory coverage of water resources engineering including fluid properties; conservation of mass, energy, and momentum; hydraulics (flow measurement, pressure pipe, and open channels); and hydrology (hydrologic cycle, groundwater flow, and rainfall-runoff estimation).	3	Existing
ENVE 410 Fate, Transport, and Risk Assessment	Interactions of pollutants with air, water, and soil media including partitioning, intermedia transport, and degradation. Risk assessment of pollutants to human health including exposure pathways and the role of epidemiology in determining dose-response relationships.	2	New
ENVE 456 Solid and Hazardous Waste Treatment	Magnitude and characteristics of solid and hazardous waste problems; collection systems; design of treatment and disposal systems; landfills, incineration, stabilization, composting, and remediation technologies; remedial investigations and feasibility studies; industrial solid and hazardous waste treatment; current and future regulations.	3	Existing
ENVE 474 Air Pollution Engineering and Control	Introduction to the fundamentals of air pollution, light scattering and visibility reduction, air quality laws and regulations, estimating concentrations from emission factors, theory and design of settling chambers, cyclone separators, wet collectors, fabric filters, electrostatic precipitator and control methods for gaseous air pollutants.	3	Existing

ENVE 481 Environmental Engineering II	Theory and design of drinking water treatment and distribution systems, and wastewater treatment and collection systems.	3	Existing
ENVE 494 Water Resources Engineering II	Advanced topics in water resources engineering with an emphasis on system analysis, modeling, and design. Topics include water supply and distribution, sanitary sewers, pump stations, hydrologic reservoir/stream flow routing, probability and risk/uncertainty analysis for flood control, and hydropower generation.	3	Existing
ENVE 495 Hydrology	The hydrologic cycle and key physical processes defined, i.e., precipitation, evaporation and transpiration, runoff, infiltration, and groundwater. Concepts introduced include unit hydrograph, statistics, design storms, and flow routing fundamentals. Tools for hydrological measurement, data acquisition, analysis, and interpretation; and applications for water resources management are discussed.	3	Existing
<b>Lab Requirements: 4 Hours</b>			
CHEM 123 General Chemistry I Laboratory	Experiments focusing on the topics discussed in CHEM 122* and covering the basic techniques of measuring and analyzing data from chemical reactions.	1	Existing
CHEM 133 General Chemistry II Laboratory	Experiments focusing on the topics discussed in CHEM 132* and covering intermolecular forces, properties of solutions, kinetics, equilibrium, acid-base reactions, thermodynamics, and other topics covered in general chemistry II.	1	Existing
ENVE 482 Environmental Engineering Laboratory	Laboratory methods and interpretation of results for physical, chemical, and biological analysis of water and wastewater.	1	Existing
ENVE 496 Water Resources Engineering Laboratory	Design and analysis of hydraulic and hydrologic experiments including laboratory exercises on basic fluid properties, hydrostatic pressure, flow behavior in porous media, pipe flow headlosses, open channel flow, fluid flow measurement in pressurized pipe and open channels, and pump analysis.	1	Existing
<b>Required Supporting Courses: 25 Hours</b>			
BSE 231 Biochemistry for Engineers	Fundamentals of biochemistry presented from an engineering point of view and applied to solve engineering-related problems. Topics to be covered include fundamental organic chemistry of amino acids, carbohydrates, lipids and other important biochemicals; the role and control of pH in biological solutions; fundamental biochemistry of proteins and enzymes; introduction to bioenergetics and metabolic pathways, and the replication, transcription, and translation of DNA.	3	Existing
BSE 321 Biothermodynamics, Heat,	Application of thermodynamics to biological systems; heat transfer with emphasis upon conduction and convection applications; introduction to diffusion mass transfer.	3	Existing



and Mass Transfer			
CE 340 Construction Engineering and Management I	Introduction to construction management concepts including developing an understanding of the goals and objectives of various construction stakeholders, delivery and procurement methods, types of construction contracts, planning, quality assurance and control, health and safety, estimating and scheduling.	3	Existing
GEOG 495 Special Topics in Geography (GIS)	Introduction to Geographical Information Systems and Applications in Engineering	3	New
ENGL 101 English Composition I	Intensive instruction in writing, focusing on analysis and argument. Strategies for reading critically, analyzing texts from diverse perspectives, developing substantive arguments through systematic revision, addressing specific audiences, integrating sources, and expressing ideas with clarity and correctness.	3	Existing
ENGL 102 English Composition II	Advancing concepts introduced in ENGL 101*. Intensive writing instruction focused on inquiry and research. Strategies for formulating and investigating questions, locating and evaluating information, using varied sources and research methods, developing positions on intercultural and interdisciplinary issues from diverse texts (print, digital, and multimedia), and presenting research using appropriate rhetorical conventions.	3	Existing
ENVE 205 Professional Development I	Introduction to civil and environmental engineering specialties, history, and achievements. Professional responsibility, communication, and organizations.	2	Existing
ENVE 305 Professional Development II	Legal and ethical responsibilities, continuous improvement, career planning, business and public policy concepts, and leadership.	2	Existing
GEOG 485 Principles of Hydrogeology	Physical principles of flow, flow equations, geologic controls, aquifer analysis, water well design/testing, and introduction to transport processes.	3	Existing
<b>Additional Requirements: 4 Hours</b>			
ENVE 399S Senior Design I	The course will introduce students to the concepts of design problem definition, effort scheduling and planning, and development of a scope of work for applications in the design phase of a typical environmental engineering project. Students will work to develop and initiate project design effort in preparation for Senior Design II. Pre-planning efforts (such as data collection, site investigations, client interactions, refinement of scope of work, etc.) will be performed per project needs. Additional	1	New

	lessons will focus on team cooperation, communication with clients, and other professional skills necessary for successful project management during the design phase.		
ENVE 400 Senior Design II	Open-ended, comprehensive project emphasizing team approach to design process. Includes engineering analysis and design, technical engineering report writing, and various design project components typical of those faced by practicing environmental engineers.	3	New

*Notes: In addition to the courses summarized in Table 7, students are required to take an additional 24 credit hours, as follows. Technical electives (6 credit hours required) are courses in science, technology, engineering or mathematics that contribute to the technical skills and knowledge of the student technical electives must be approved by the department. The Volunteer Core general education requirements of UTK require students to take courses in the following areas: Arts and Humanities (3 credit hours), Social Science (3 credit hours), Global Citizenship (6 credit hours), and Expanded Perspectives (6 credit hours). The expanded perspective requirements are satisfied by taking additional courses in Arts and Humanities, Social Sciences, and Global Citizenship.*

### Program of Study

The typical showcase plan of study for the BS ENVE program appears in Table 8. The curriculum requires 128 credit hours, as is typical for most baccalaureate engineering degree programs. Students seeking to complete the degree in four academic years, taking courses only in the Fall and Spring semesters, will need to take course loads averaging 16 credit hours per semester. Many students in the Tickle College of Engineering routinely graduate in four years.

**Table 8.**

*Sample Course Enrollment Schedule/ Plan of Study (when options are presented, the typical course is bolded and underlined).*

<b>Semester 1: Fall 1<sup>st</sup> YEAR</b>		
CRN/Course Abbreviation	Course Title	Credit Hours
<b>CHEM 122 and CHEM 123</b> or CHEM 128	<b>General Chemistry I and Lab</b> or Honors: General Chemistry I	4
EF 105	Computer Methods in Engineering Problem Solving	1
EF 142 or <b>EE 151</b> or EF 157	Introduction to Physics and Modeling for Engineers II or <b>Physics for Engineers I</b> or Honors: Physics for Engineers I	4
<b>ENGL 101</b> or ENGL 118 or ENGL 131 or ENGL 198	<b>English Composition I</b> or Honors English Composition I or Composition for Non-Native Speakers of English I or Chancellor's Honors Writing I	3
MATH 132 or <b>MATH 141</b> or MATH 147	Calculus 1B Infused with Precalculus or <b>Calculus I</b> or Honors: Calculus I	3 or <b>4</b>
Total Semester Credit Hours: 15 or <b>16</b>		
<b>Semester 2: Spring 1<sup>st</sup> YEAR</b>		
CRN/Course Abbreviation	Course Title	Credit Hours
<b>CHEM 132 and CHEM 133</b> or CHEM 138	<b>General Chemistry II and Lab</b> or Honors: General Chemistry II	4

<b>EF 152</b> or EF 158	<b>Physics for Engineers II</b> or Honors: Physics for Engineers II	4
<b>ENGL 102</b> or ENGL 132 or ENGL 290 or ENGL 298	<b>English Composition II</b> or Composition for Non-Native Speakers of English II or Intermediate Writing and Research or Chancellor's Honors Writing II	3
ENVE 101	Introduction to Environmental and Water Resources Engineering	1
<b>MATH 142</b> or MATH 148	<b>Calculus II</b> or Honors: Calculus II	4
Total Semester Credit Hours: 16		
<b><i>Semester 3: Fall 2<sup>nd</sup> YEAR</i></b>		
CRN/Course Abbreviation	Course Title	Credit Hours
<b>ECON 201</b> or ECON 207	<b>Introductory Economics: A Survey Course</b> or Honors: Introductory Economics	4
ENVE 200	Environmental Process Fundamentals	2
ENVE 205	Professional Development I	2
<b>MATH 231</b> or MATH 237	<b>Differential Equations</b> or Honors: Differential Equations	3
ME 202	Engineering Mechanics	2
(many choices)	Global Citizenship – US Elective	3
Total Semester Credit Hours: 16		
<b><i>Semester 4: Spring 2<sup>nd</sup> Year</i></b>		
CRN/Course Abbreviation	Course Title	Credit Hours
BIOL 102 or <b>BIOL 150</b>	Introduction to Biology: Biodiversity and Ecology or <b>Organismal and Ecological Biology</b>	4 or <b>3</b>
EF 305	Engineering Approaches to Sustainability	3
ENVE 391	Water Resources Engineering I	3
ENVE 496	Water Resources Engineering Lab	1

<b>MATH 241</b> or MATH 247	<b>Calculus III</b> or Honors: Calculus III	4
(many choices)	Global Citizenship – International Elective	3
Total Semester Credit Hours: <b>17</b> or 18		
<b><i>Semester 5: Fall 3<sup>d</sup> YEAR</i></b>		
CRN/Course Abbreviation	Course Title	Credit Hours
BSE 231	Biochemistry for Engineers	3
COSC 111	Computational Thinking and the Art of Programming	3
ENVE 305	Professional Development II	2
ENVE 381	Environmental Engineering I	3
GEOG 495	Special Topics in Geography (GIS)	3
GEOL 485	Principles of Hydrogeology	3
Total Semester Credit Hours: 17		
<b><i>Semester 6: Spring 3<sup>d</sup> YEAR</i></b>		
CRN/Course Abbreviation	Course Title	Credit Hours
BSE 321	Biothermodynamics, Heat, and Mass Transfer	3
<b>ENVE 481</b> or ENVE 487	<b>Environmental Engineering II</b> or Honors Environmental Engineering II	3
<b>ENVE 495</b> or ENVE 498	<b>Hydrology</b> or Honors: Hydrology	3
STAT 251	Probability and Statistics for Scientists and Engineers	3
(many choices)	Expanded Perspectives Elective	3
Total Semester Credit Hours: 15		
<b><i>Semester 7: Fall 4<sup>th</sup> YEAR</i></b>		
CRN/Course Abbreviation	Course Title	Credit Hours
ENVE 399S	Senior Design I	1

ENVE 410	Fate, Transport, and Risk Assessment	2
<b>ENVE 474</b> or ENVE 477	<b>Air Pollution Engineering and Control</b> or Honors: Air Pollution and Control	3
<b>ENVE 494</b> or ENVE497	<b>Water Resources Engineering II</b> or Honors: Environmental Engineering II	3
(many choices)	Arts and Humanities Elective	3
(many choices)	Technical Elective	3
Total Semester Credit Hours: 15		
<b><i>Semester 8: Spring 4<sup>th</sup> YEAR</i></b>		
CRN/Course Abbreviation	Course Title	Credit Hours
CE 341	Construction Engineering and Management I	3
ENVE 400	Senior Design II	3
ENVE 456 or ENVE 458	Solid and Hazardous Waste Management	3
ENVE 482	Environmental Engineering Lab	1
(many choices)	Expanded Perspective Electives	3
(many choices)	Technical Elective	3
Total Semester Credit Hours: 16		

### Suggested Technical Electives

Students who major in ENVE may commonly have interest in related fields such as sustainability, environmental health, and energy. Potential technical electives for students interested in these topics are listed as follows.

#### Sustainability

- Agricultural Leadership, Education, and Communications 485 – Global Sustainable Development goals
- Civil Engineering 311 – Smart Infrastructure and Sustainability Engineering
- Geology 206 – Sustainability Principles and Practices
- Geology 456–Global Climate Change

### Environmental Health

- Public Health 201 – Introduction to Public Health
- Public Health 202 – Introductory Epidemiology
- Public Health 420 – Environmental Public Health

### Energy

- Energy Science and Engineering 511 – Introduction to Energy Science and Technology
- Environmental and Soil Sciences 110 – Energy for the World
- Geography 346 – Energy, Governance, and Sustainability

### *Articulation and Transfer*

CEE currently participates in the Tennessee Transfer Pathway (TTP) program with other institutions in Tennessee for the BS Civil Engineering degree program. We intend to develop pathways for the BS ENVE program during the next renewal cycle. Below, we have outlined one such possible plan, that could be the starting point for developing a plan with our partner 2-year institutions. This plan assumes that students complete the following courses at 2-year institutions before coming to UTK (64 credit hours total):

Biology	3 credit hours
Chemistry:	8 credit hours
Computer solutions and programing:	4 credit hours
General Education:	18 credit hours
English:	6 credit hours
Engineering Physics:	8 credit hours
Math:	15 credit hours
Engineering Mechanics (Statics):	2 credit hours

Students may also transfer into the BS ENVE program without participating in the Tennessee Transfer Pathway program. For these students, all transfer credits are carefully evaluated and a custom degree plan for each student is developed. At present, several such students transfer to the BS Civil Engineering degree program through this mechanism. Tennessee Transfer Pathway and other transfer students will follow the course enrollment plan similar to the one outlined in Table 9 upon arriving at UTK.

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Transfer students may enter the BS ENVE degree program. Assuming a transfer student has completed approximately two years of applicable course work in general education, mathematics, science and basic engineering, typical course work for transfer students is shown in Table 9.



Table 9.

*Sample Course Enrollment Schedule/ Plan of Study for TRANSFER STUDENTS*

<b><i>Semester 1: Fall 1st YEAR at UTK</i></b>		
CRN/Course Abbreviation	Course Title	Credit Hours
BSE 231	Biochemistry for Engineers	3
ENVE 101	Introduction to Environmental and Water	1
ENVE 200	Environmental Process Fundamentals	3
ENVE 205	Professional Development I	2
ENVE 391	Water Resources Engineering I	3
ENVE 496	Water Resources Lab	1
GEOL 485	Hydrogeology	3
Total Semester Credit Hours: 16		
<b><i>Semester 2: Spring 1st YEAR at UTK</i></b>		
CRN/Course Abbreviation	Course Title	Credit Hours
BSE 321	Biothermodynamics, Heat, and Mass Transfer	3
CE 340	Construction Engineering I	3
EF 305	Engineering Approaches to Sustainability	3
ENVE 305	Professional Development II	2
ENVE 381	Environmental Engineering, I	3
ENVE 495	Principles of Hydrogeology	3
Total Semester Credit Hours: 17		
<b><i>Semester 3: Fall 2nd YEAR at UTK</i></b>		
CRN/Course Abbreviation	Course Title	Credit Hours
ENVE 399	Senior Design I	1
ENVE 410	Fate, Transport, and Risk Assessment	2
ENVE 456	Solid and Hazardous Waste Management	3
ENVE 474	Air Pollution Engineering and Control	3
ENVE 494	Water Resources II	3
GEOG 495	Special Topics in Geography (GIS)	3
Total Semester Credit Hours: 15		
<b><i>Semester 4: Spring 2nd YEAR at UTK</i></b>		
CRN/Course Abbreviation	Course Title	Credit Hours
ENVE 400	Senior Design II	3
ENVE 481	Environmental Engineering II	3
ENVE 482	Environmental Engineering Lab	1
STAT 251	Probability and Statistics for Scientists and	3
(many choices)	Tech elective	6
Total Semester Credit Hours: 16		

### *Assessment and Evaluation*

The BS ENVE degree program will undergo numerous ongoing evaluations as summarized in Table 10. These same evaluations are applicable to the BS CEE degree program, such that established assessment processes can be applied to both degree programs.

The ABET accreditation process runs on a six-year cycle and evaluates degree programs based on eight criteria including: 1) Students, 2) Program Educational Objectives, 3) Student Learning Outcomes, 4) Continuous Improvement, 5) Curriculum, 6) Faculty, 7) Facilities, and 8) Institutional Support.

The SACSCOC accreditation is a 10-year campus-level accreditation process that is founded on principles of student learning outcome assessment and continuous improvement.

The UTK Academic Program Review is a comprehensive external evaluation of all degree programs in the department and is based on a self-study followed by a site visit by the evaluation team.

*Course-level assessments of student learning outcomes.* Assessment of student learning outcomes occurs in the courses indicated in Table 5 by the course instructor at least once every two years. Student Learning Objectives are assessed for every student enrolled in the course using evaluation instruments (student work such as homework, exam problems, projects, lab reports, or presentations) evaluated using rubrics. Example rubrics are included in Appendix G. Data from course-level assessments are reported to the departmental assessment committee, who use the data in SACSCOC and ABET accreditation reviews.

*Course-level assessments of Volunteer Core learning outcomes.* Volunteer Core is the UTK general education program required of all graduates from the University of Tennessee, Knoxville. The CEE department teaches two courses that BS ENVE students will use to satisfy four Volunteer Core requirements as follows:

- CE/ENVE 205: (1) Written Communication and (2) Oral Communication
- CE/ENVE 399: (3) Applied Oral Communication and (4) Engaged Inquiry

Courses approved to satisfy Vol Core general education requirements are assessed by the UTK Vol Core committee every three years.

**Table 10.***Summary of Assessments relevant to the BS ENVE degree program.*

Type of Assessment and Evaluation	Frequency	Responsible Party	Reviewer
ABET Accreditation	ABET accreditation occurs every 6 years, but course-level learning outcomes are assessed at least every other year.	Course Instructor, Associate Department Head for Undergraduate Programs, and Department Head	ABET
SACSCOC Accreditation	SACSCOC accreditation occurs every 10 years, but course-level learning outcomes are assessed annually.	Course Instructor, Associate Department Head for Undergraduate Programs, and Department Head	SACSCOC
UTK Academic Program Review (APR)	UTK Academic Program Review occurs on a 10-year cycle with a mid-cycle review five years after the full review	Department Head	APR review team (typically 3 internal and 2 external reviewers)
Volunteer Core General Education Assessment	Every three years	Course instructors	Volunteer Core Assessment Committee

## Section IX: Students

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### *Academic Standards*

#### *Admissions*

The Tickle College of Engineering (TCE) admissions criteria are based on several performance indicators, including completion of core academic subjects, GPA scores on these subjects, and standardized test (SAT or ACT) scores. Students who may not meet the test-score criteria will be holistically reviewed for admission into TCE. Holistic admissions are conducted at the College level, with consultation of and input from the department.

A Success Prediction Indicator (SPI) number of 60 and a math ACT of 25 or a math SAT of 590 if taken after March 2016 (math SAT of 570 if taken before March 2016) are minimum standards used for admission to the college. The SPI is calculated by adding an individual's ACT mathematics score to 10 times their core high school GPA (based on a 4.0 scale). Core high school courses are defined on the UTK admission website.

Students who wish to pursue an engineering degree at UT but do not meet the college admission criterion may enroll as University Exploratory students and complete appropriate mathematics, science, and other courses before applying again for admission to the college.

Students denied entry under test-score criteria will be holistically reviewed for admission into TCE.

#### *Retention*

A student will be placed on Academic Probation after (1) their cumulative GPA falls below the minimum acceptable level of 2.0 for one semester or (2) their semester GPA falls below the minimum acceptable level of 2.0 two consecutive semesters of enrollment. During each semester a student is on Academic Probation, they must participate in a special directive advising and Academic Success Center programming to help them address concerns that are impacting their academic performance and to outline a plan for achieving academic success. While on Academic Probation, students must meet with an advisor prior to registering for all following semesters, which includes summer semester. This model of early intervention is designed to help students regroup and position themselves for academic success. Students on Academic Probation status during a semester will automatically be dismissed at the end of that semester if both:

- the cumulative GPA is below a 2.0, and
- the semester GPA is below a 2.0.

Students who begin their enrollment in UT in the Summer semester cannot be dismissed until at least the following Spring semester.

A student will no longer be on academic probation when their cumulative grade point average is 2.0 or higher and their semester grade point average is 2.0 or higher. This policy is in place in recognition of the University of Tennessee, Knoxville's minimum grade point average of 2.0 for graduation.

### *Graduation*

Students are required to maintain a cumulative grade point of at least 2.0 in all civil engineering (CE) and environmental engineering (ENVE) courses taken at the University of Tennessee, Knoxville, used to satisfy the graduation requirements. No more than four credit hours of CE and ENVE courses in which a C- or lower is the highest grade earned may be counted toward graduation.

### *Marketing and Recruitment*

The Tickle College of Engineering has a common first-year curriculum. There is significant interest for a BS ENVE degree among students currently enrolled in this curriculum. Therefore, our initial marketing and recruiting efforts will include an internally focused component through academic advising to recruit second-year students and an external component aimed at recruiting first year students. The internally focused effort to recruit second-year students will leverage:

- Posting on display screens and bulletin boards within the college
- College and departmental newsletters
- Informational sessions with Q&A
- Departmental Website
- One-on-one academic advising appointments to facilitate entry into the program.

The externally focused effort to recruit first-year students will be integrated into the normal TCE recruiting process. The BS ENVE program will also be integrated into the eVOL<sup>10</sup> summer engineering diversity program, TCE- and UTK-level on campus recruiting programs such as Breakfast of Champions, Big Orange Preview, and New Volunteer Admit Day. In addition, to raise awareness of the program during the program launch, we will highlight the program through social media posts and send mailers to Tennessee STEM teachers and high school guidance counselors.

To support these recruiting efforts, CEE will collaborate with the TCE Communication office to create a program brochure to be included in mailings to interested students and 3-minute introductory video informing students about the Environmental Engineering profession and degree program at UTK to post our website.

National awareness of the new program in the engineering academic community will be generated through advertisements in the *First Bell* daily news letter of the American Society of Engineering Educators and through department and college newsletters distributed nationally to department heads and deans.

## *Student Support Services*

### **Academic Advising**

Prior to enrolling for the first time at the university, all degree-seeking first-year students and transfer students are required to meet with an academic advisor. Readmitted students must also meet with an academic advisor prior to reenrolling. The following groups of students are required to meet with an advisor prior to registering for each term (fall and spring):

- All students with less than 30 hours at UT Knoxville.
- Students following exploratory tracks.
- Students identified as *off track* by uTrack.
- Students on Academic Probation (must also be advised prior to summer term).

All other students are required to consult with an advisor for a substantial conference during a designated semester each year. Students whose ID numbers end in an even digit are required to meet with an advisor during the Fall semester. Students whose ID numbers end in an odd digit are required to meet with an advisor during the Spring semester. All students are encouraged to consult with their advisors at any time.

All undergraduate students are advised by professional advisors in the Tickle College of Engineering. Professional Advisors report to the Director of Advising. Undergraduate students are assigned to professional advisors during orientation (onboarding). Advisors have advising loads of 300 students each. The UTK campus follows the Volunteer Experience Advising Model that includes curriculum, self-exploration, career exploration, and experience learning opportunities. A new academic advisor will be hired to support students in the BS ENVE program. The new advisor and the current advisor designated to the BS CE degree program will be cross trained so that both advisors will be able to assist students in either degree program. To assist freshman engineering students in selecting their major, the Engineering Fundamentals Program sponsors each semester the Freshman Engineering Fair in which all programs set up information booths with demonstrations. We will expand our current faculty and student participation in the fair to include information about the BS ENVE program.

### **Faculty Provided Career Guidance**

Faculty and students are assigned to a mentorship relationship to support student career advice. This mentorship is formalized through CE/ENVE 205 and CE/ENVE 305 Professional Development courses. Students and assigned mentors have opportunities to meet in one-on-one or small group settings to discuss career guidance, the CEE profession, or other professional development topics (e.g., licensure, undergraduate research). The faculty provide career advice to students, including helping students determine career goals and objectives.

Students also receive career guidance during formal classroom instruction in the program's Professional Development courses CE/ENVE 205 and CE/ENVE 305. Three class sessions in ENVE/CE 205 are devoted to familiarizing sophomore-level students with various sub-disciplines in both CE and ENVE. Topics in ENVE/CE 305 include self-awareness, resume and cover letter preparation, professional communication, interview skills, networking, ethics, professional licensure, life-long learning in relation to career planning, leadership, business principles, and public policy.

### **Internships and Post-Graduation Placements**

The university has two career offices to assist placement of engineering students. The Engineering Professional Practice Office<sup>15</sup> facilitates student placement in co-op or internship positions. Professional Practice offers workshops on Prep for Success, Promoting Yourself, and Interview Strategies. The Center for Career Development & Academic Exploration<sup>16</sup> facilitates placement in permanent post-graduation careers. It provides both career readiness workshops, that includes resume and interview assistance, and specific engineering career advice via engineering career consultants.<sup>17</sup>

Both the Office of Professional Practice and the Center for Career Development & Academic Exploration also sponsor numerous career fairs for engineering students and offers various online resources for locating both intern/co-op positions and positions when the student graduates. All undergraduate students are automatically added to a Canvas Civil and Environmental Engineering Undergraduate Resources class space that is integrated into their other course dashboards. The department and faculty often receive news of employment opportunities through networking with local, regional, and national companies and government. These opportunities are communicated to students through the Canvas page through announcements and archived there so that students can access them later.

### **Living-Learning Communities**

The Engage Living and Learning Community (Engage LLC) brings together first-year and upper-class engineering students in a residential environment to help students adjust to life as they enter their first year in college. The Engage LLC provides a supportive environment for first-year students who have been admitted to the College of Engineering where they can develop a sense of camaraderie with other engineering students. Living together allows students to share notes, work together in study groups, and participate in fun and educational outings. First-year Engage LLC students have access to faculty and upper-class community members who serve as mentors and plan activities to make the first-year experience successful and fun.

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<sup>15</sup> <http://www.coop.utk.edu/>

<sup>16</sup> <http://career.utk.edu/>

<sup>17</sup> <http://career.utk.edu/students/career-information-by-college/college-of-engineering/>

### **Additional Student Support Services**

Other student support services available to all UTK students include Academic Coaching, Student Disability Services, The Counseling Center, and Student Health Center.



## Section X: Instructional and Administrative Resources

### *Faculty Resources*

The Civil and Environmental Engineering department currently employs 24 instructional staff, and the undergraduate student-to-faculty ratio is 16:1. Thirteen of the 24 instructional staff will contribute to the proposed program as shown in Table 11.

### *Current Faculty*

Table 11 provides an overview of all current faculty who will contribute to the proposed BS ENVE program. Abbreviated *curricula vitae* for each faculty member listed in Table 11 is provided in Appendix E.

**Table 11.**

*Summary of Current Faculty Who Contribute to the Proposed Program*

Faculty Name	Faculty Department	Rank or Title	Highest Degree	Role in Program
Chris Cherry	Civil and Environmental Engineering	Professor and Associate Department Head for Undergraduate Programs	PhD	B, D
Chris Cox	Civil and Environmental Engineering	Condra Professor and Department Head	PhD	A, B, C, D
Adrian Gonzalez	Civil and Environmental Engineering	Lecturer	PhD	A
Joshua Fu	Civil and Environmental Engineering	Chancellor's Professor, John D. Tickle Professor, and James G. Gibson Professor	PhD	A, B, C
Jon Hathaway	Civil and Environmental Engineering	Associate Professor	PhD	A, B, C
Terry Hazen	Civil and Environmental Engineering	Governor's Chair Professor	PhD	B, C
Qiang He	Civil and Environmental Engineering	Professor	PhD	A, B, C
Anna Herring	Civil and Environmental Engineering	Assistant Professor	PhD	A, B, C
Haochen Li	Civil and Environmental Engineering	Assistant Professor	PhD	A, B, C
Frank Loeffler	Civil and Environmental Engineering	Governor's Chair Professor	PhD	A, B, C
Sarah Mobley	Civil and Environmental Engineering	Lecturer	PhD	A, B
Jenny Retherford	Civil and Environmental Engineering	Distinguished Lecturer	PhD	A, B

Faculty Name	Faculty Department	Rank or Title	Highest Degree	Role in Program
John Schwartz	Civil and Environmental Engineering	Professor	PhD	A, B, C

Note: As shown in the Table above contributions to the program are keyed as:

- A – Will teach in the program
- B – Will design curriculum for the program
- C – Will conduct related research
- D – Will advise students in the program

### *Anticipated Faculty*

**Table 12.**

#### *Anticipated Faculty and Instructional Staff*

Faculty Rank or Employment Classification	Part-Time or Full-Time	Anticipated Salary	Anticipated Start Date	Comments
Lecturer	Full-time	\$83,500	8/1/2024	Benjamin Fennell has been hired to fill this position
Goodrich Chair of Excellence	Full-Time	\$200,000	1/1/2024	This is an existing faculty line in CEE that is currently vacant.
Assistant Professor	Full-Time	\$103,000	8/1/2025	This position is part of the It Takes a Volunteer 2023-2025 Cluster Hiring Initiative associated with the Precision Health and Environment cluster. UTK and TCE resources for this position have already been allocated. This position is not part of our BS ENVE proposal, but this faculty member will participate in the program.

### *Administrative Support*

The Department of Civil and Environmental engineering has an excellent staff including five full-time office staff, two shop technicians, a 0.75 FTE IT support professional, and two technical support staff members in the environmental engineering area. No new staff positions are needed to support the BS ENVE degree program.

Students are advised by professional academic advisors in the TCE. The professional advisors are centrally administered by the TCE, but individual advisors are assigned to departments. To support the new BS ENVE degree program, an additional 50% FTE academic advisor will be needed. This will require hiring a new advisor with responsibilities shared between the BS ENVE program and another degree program in the TCE.

**Table 13.**

#### *Anticipated Non-Instructional Staff*

Job Title	Part-Time or Full-Time	Anticipated Salary	Anticipated Start Date	Comments
Academic Advisor	Full-time position but only 50% FTE is needed for the BS ENVE program	\$48,000	October 2023	About 50% of this individual's effort will be needed to support the BS ENVE degree program. The remainder of their effort will support other degree programs in the Tickle College of Engineering.

## Section XI: Resources

### *Equipment*

The department has a dedicated environmental teaching lab supplied with the equipment listed in Table 14. The lab is also stocked with typical laboratory glassware and supplies. Lab sections are typically 10-12 students, working in groups of two. Research equipment, such as a TOC analyzer, ion chromatography, gas chromatograph, digital titrator, and inductively coupled plasma optical emission spectrophotometer are also available to support teaching labs as needed. The department annually invests discretionary funds to keep the teaching labs well equipped and in good working order.

**Table 14.**

*Equipment available in environmental engineering teaching lab.*

Equipment and Instruments	Quantity
Analytical Balance	5
Benchtop pH/Ion Selective Electrode Meter	6
Chemical Oxygen Demand Heater Block	2
Chemical Oxygen Demand Reactor	2
Colony Counter	4
Conductivity Meter	5
Desiccator	5
Digital Turbidimeter	2
Dissolved Oxygen Meter	9
Drying Oven	2
Hot/Stir Plate	6
Incubator	3
Laboratory Dishwasher	1
Laboratory water purification system	2
Muffle Furnace	1
Portable pH/Ion Selective Electrode Meter Kit	1
Printing Turbidimeter	1
Six-place Jar Test Apparatus	5
Spectrophotometer	6
Stainless Steel Filter Holders	6
Tabletop Sterilizer	1
Top Loading Balance	3
UV/Vis Spectrophotometer	2
Vacuum Desiccator	1
Vacuum Pumps and Filtration Manifolds	4
Water Bath	2

The department has a dedicated water resources teaching lab supplied with the equipment listed in Table 15. The lab is also stocked with waders, water samplers, velocimeters, and surveying equipment for fieldwork. The department invests discretionary funds to keep the teaching labs well equipped and in good working order.

**Table 15.**

*Equipment available in the water resources teaching lab*

<b>Model</b>	<b>Equipment</b>	<b>Qty</b>	<b>Location</b>
<i>Tecequipment</i>	Open Channel Flume H12 (24' length, 0.5'x0.5')	1	JDT 200
<i>[-]</i>	Open Channel Flume (20' length, 1'x1.5')	1	JDT 200
<i>[-]</i>	Open Channel Flume (oval raceway for turbulence experiments)	1	JDT 200
<i>Turbine Technologies<sup>TM</sup></i>	Pump Curve Bench Tester;	1	JDT 200
<i>Hampden</i>	Pipe Friction/Minor Losses Bench Tester	1	JDT 200
<i>Hampden</i>	Hydrostatics Bench	1	JDT 200
<i>Ashcraft</i>	Bourdon Gauge Tester for gauge calibration	1	JDT 200
<i>Hampden</i>	Groundwater Seepage Demonstration Bench and Tank	1	JDT 200
<i>Sontek</i>	Acoustic Doppler Profiler; RiverSurveyor <sup>TM</sup>	1	JDT 200
<i>SonTek/YSI</i>	Acoustic Doppler Velocimeter 16-MHz MicroADV units	1	JDT 200
<i>SonTek/YSI</i>	Acoustic Doppler Velocimeter 16-MHz MicroADV units	2	JDT 200
<i>FlowMate 2000</i>	FlowMate Current Meter	2	JDT 200

### *Information Technology*

The Office of Information Technology (OIT) is responsible for managing the university's campus-wide computing infrastructure.

#### The University of Tennessee Campus Computer Labs

OIT's Computer Labs Services operates numerous labs across campus that provide students and faculty access to approximately 400 OIT computers with over 100 software packages, the bulk of which are available 24 hours. Hours of lab operation vary by lab. Technical help is available at any time via the Student Assistant, the OIT Help Desk or email. One of these OIT labs is located in 403 TIC, providing convenient access to BS ENVE students.

#### The UTK Network

The University of Tennessee-Knoxville's Office of Information Technology (OIT) is responsible for managing a complex network that spans the campus and remote sites throughout the state. OIT Network Services' responsibilities include the management of the local UTK network (both wired and wireless), a range of wide area connections, and Internet/Internet2 connectivity. In addition, the group manages various security devices such as firewalls, VPN (Virtual Private Network) access devices, IPS and IDS devices (Intrusion Prevention/Detection Systems). At its core, the UTK network supports speeds of 10 gigabits per second (Gbps) and greater. Buildings are dual connected

with at least 1 Gbps, with many featuring 10 Gbps connections to the core to accommodate applications that require very high bandwidth. Overall, the campus network can support approximately 36,000 100 Mbps connections, 28,000 Gigabit Ethernet connections and 8,600 Ten Gigabit Ethernet connections.

A state-of-the-art wireless network consisting of more than 4,500 wireless access points spans the entire campus. A major upgrade to the wireless infrastructure was completed in the summer of 2015 supporting 802.11a/g (54 Mbps), 802.11n (450 Mbps) and 802.11ac (1.3 Gbps). Multiple, redundant connections provide the UTK community with access to the Internet at an aggregate speed of more than 10 Gbps. Two core firewalls and a multitude of smaller, department-size firewalls are deployed and managed by Network Services. Secure remote access is facilitated through VPN access devices (appliances) that support both IPSec and SSL/VPN access.

### UTK Software

Many software applications are available to faculty, staff, and student at reduced or no additional cost via the following alternatives:

1. Downloads: Many packages are available for free at OIT's software distribution page, including the Microsoft Windows OS, Microsoft Office, various science and engineering packages including Maple, Mathematica, and MATLAB, statistics/analytics packages, and security software.
2. Personal and Departmental Purchases: UT faculty, staff, and students can purchase software for departmental and personal use at VOLTECH, a retail store located on campus. Students are eligible for one copy of Windows 10 for Education at no cost.
3. Apps@UT: The UTK Apps@UT system lets faculty, staff, and student run research software as if it were installed on the individual's own computer. Files can be saved on the local computer's disk drive and printed to a local printer. Apps@UT can be used from any Windows, Macintosh, or Linux computer. Maple, Mathematica, and MATLAB are the primary software packages available on Apps@UT that EE students would use.
4. Cloud-Based Software: Some UTK software executes on a vendor's own server and can be run from a browser or through a local client. Software available as a free service includes:
  - Qualtrics
  - MATLAB (also available on many other computers)
  - Office 365 ProPlus for faculty and staff
  - Office 365 ProPlus for students
  - Adobe Creative Cloud, Captivate, and Presenter

### UTK Storage Options

- T-Storage provides 1 GB of cloud-based central location for individuals and 200 GB for departments to store files and is available at no charge to all Knoxville faculty, staff, and students. T-Storage is certified for storing protected information (HIPAA, FERPA, etc.).
- OneDrive for Business offers faculty, staff, and students 1 TB (1000 GB) of Microsoft cloud storage. It is available at no charge as part of the UT/Microsoft contract. OneDrive for Business is available from anywhere with internet access.
- Google Drive for Mac, PC, Android and iOS device provides faculty, staff, and students a single place for up-to-date versions of files from anywhere with 1TB available for faculty, staff, and graduate students, and 100 GB for undergraduates.

### *Library Resources*

The environmental engineering collection in the UT Libraries is strong. The university libraries subscribe to all 55 of the main journals for environmental engineering selected by Web of Science for its Journal Citation Reports. Moreover, the libraries subscribe to more than a hundred electronic databases, of which 37 are categorized as useful for engineering students. These databases include Web of Science, Scopus, Compendex, AccessEngineering, and Knovel, and there are additional relevant databases in the Chemistry databases. The libraries purchase many ebooks for environmental engineering and there is a \$65,000 book budget for all the sciences and engineering. In addition to these funds, there are several engineering endowments and an approval book fund, which is used to buy books meeting predefined criteria such as publisher and cost. The engineering library is open to suggestions from faculty and students about what new materials to buy, as well.

### *Facilities*

The Department of Civil and Environmental Engineering (CEE) occupies significant space in four buildings: John D. Tickle Engineering Building (TIC), Perkins Hall (environmental laboratories), the Science and Engineering Research Facility (SERF) and the Auxiliary Services Building (ASB). The Department's space in ASB and SERF are principally designated for graduate research functions, although undergraduate researchers also use these facilities. Additionally, some of the instrumentation housed in SERF is used in support of the ENVE/CE 482 Environmental Engineering Laboratory.

***John D. Tickle Building (TIC).*** The John Tickle Building is a five-story, 110,000 square foot building, that opened in 2013. The department occupies the first four floors of the building. Resources within the Tickle Building that will support the BS ENVE program include four classrooms, conference rooms, the CEE administrative office, faculty and graduate student offices, a water resources lab, computer labs, a student lounge, the senior design lab, and the departmental shop.

**Offices** CEE faculty, staff and supported graduate students (TAs, RAs, and fellowship holders) are assigned office or desk space consistent with their positions and needs. Access to communications infrastructure, copy machines, printers, and other basic business equipment is provided in or around each person's office or desk. There is a reservation system available for reserving conference rooms and technology needs.

The Departmental office is in an accessible location on the third floor of TIC building (TIC 325). In addition to a copy machine and storage for records and office supplies, this area houses the department head, business manager, an accounting specialist, and three administrative assistants. There is a seating area for visitors, and sufficient room is provided for students to ask questions and conduct business with the appropriate person. Individual offices (TIC 429 and 430) are provided for the two professional advisors to facilitate private meetings with students. There is a meeting space (TIC 326) and shared office space that houses ad hoc meetings and small group student and faculty meetings. Recently, that space has been used to host our open office hours for student writing workshops.

Faculty offices are also in the TIC building except for two faculty members with joint appointments in Microbiology (they are in SERF). Faculty offices are provided with desks, filing cabinets, book shelves, computers, and seating for students and visitors. There are sufficient office spaces for all current faculty and new hires anticipated over the next few years.

Teaching assistants are provided offices on a priority basis in the available graduate student office spaces to provide a location for them to meet with students. Graduate teaching assistants are generally provided with a small cubicle and desktop or laptop computer.

**Classrooms:** The CEE and Industrial and Systems Engineering departments have priority access to four regular classrooms in TIC (rooms 402, 404, 434 and 405, with capacities of 46, 46, 56, and 100). In addition, TIC 410 is a distance education-enabled classroom with an on-campus capacity of 16. Rooms 402, 404, and 434 have mobile chair/desk combinations facilitating movement and collaboration. Each classroom is equipped with state-of-the-art enhanced technology delivery platforms (Cynap provided and maintained by the Office of Information Technology) driven by designated desktop computers (provided and maintained by the two departments). Each room also includes audio equipment and document cameras and ample whiteboards. Classrooms are air conditioned and have adequate lighting. Wireless internet access is available in all university classrooms. Overall, the current classroom facilities are excellent. Classes in the BS ENVE program can also be convened in other classrooms on campus as assigned by the University Registrar.

**Laboratories:** The following existing laboratories will be utilized in the BS ENVE degree program.

The hydraulics lab is in TIC 200 and includes equipment for laboratories (ENVE/CE 496 Water Resources Lab) in open channel flow demonstration, open channel flow measurement (weirs), closed conduit resistance, closed conduit flow measurement (orifice and Venturi meters),



centrifugal pump efficiency, and static pressure measurement. The laboratory has a designated instructional area equipped with whiteboard and projector for previewing applicable theory, procedures, and safety protocols.

The Environmental Engineering Laboratory (CE 482) is in Rooms 57 and 58 of Perkins Hall. A renovation of this space was completed in 2013. This laboratory is equipped with wet lab benches, fume hoods, balances, ovens, incubators, pH meters, conductivity meters, turbidity meters, spectrophotometers, jar test apparatus, fermentors, bench-scale activated sludge models and laboratory glassware.

TIC 309 is the Senior Design Lab. It is equipped with eight CAD workstations, a full-scale color plotter, assorted printers, worktables, flat drawing storage, and several project conference tables.

Also housed in TIC is a fully equipped woodworking/machine/welding shop. Shop capabilities include use of standard and specialized machine tools, such as a CNC mill and lathe, water jet cutter, vertical mill, drill press, grinders, saws, along with welding, cutting, and measuring devices. The shop facilities are used to support the teaching and research missions of the department and is staffed by two full-time technicians.

### *Other Resources*

#### *Evidence of Willingness to Partner*

Several entities have confirmed a willingness to partner with the proposed program. Each of the entities listed below has a signed letter of support; see Appendix A.

1. United Cleanup Oak Ridge LLC, Kenneth J. Rueter, President and Chief Executive Officer
2. Gresham Smith, Randall E. Gibson, Chief Strategy Officer
3. S&ME, Ken Barry and Gregory B. Page, Vice President and Principal Engineer
4. First Utility District of Knox County, Mark W. Mckinney, Capital Engineer Supervisor
5. Amentum National Security, Mark Whitney, President
6. 1992 HDR Engineering, Inc., Shane R. Womack, PE, Vice President, Office Principal
7. Tennessee Department of Environment and Conservation, Patrick J. Flood, Director
8. Tennessee Valley Authority, Tom Barnett, General Manager of River Management

## Appendix A: Evidence of Willingness to Partner



ORRCC-22-0732  
 December 8, 2022

Dr. Chris Cox, Department Head  
 Department of Civil and Environmental Engineering  
 John D. Tickle Engineering Building  
 The University of Tennessee  
 851 Neyland Drive, Suite 325  
 Knoxville, TN 37996

Dear Dr. Cox:

### Support for Bachelor of Science Degree Program in Environmental Engineering

Please accept this letter in support of the University of Tennessee's plan to develop a Bachelor of Science degree in Environmental Engineering.

UCOR is the prime cleanup contractor for the Department of Energy's Oak Ridge Office of Environmental Management, and our 2,000-strong workforce is tasked with the responsibility to safely manage environmental cleanup and risk reduction across the Oak Ridge Reservation. This \$8.2 billion cleanup over the next decade will include decontaminating, deactivating, demolishing, and disposing of waste, and remediating former nuclear and industrial facilities for future science and national security investments at the Oak Ridge National Laboratory, Y-12 National Security Complex, and the Heritage Center (formerly East Tennessee Technology Park).

UCOR is an economic engine for Tennessee: beyond our 2,000-strong workforce, an analysis by UT's Howard H. Baker Jr. Center for Public Policy determined that our environmental cleanup at the Oak Ridge Reservation has a \$1.3 billion annual economic impact in Tennessee and supports 7,022 full-time jobs. And UCOR's cleanup success at the Heritage Center has also enabled approximately \$500 million in planned investment at the Heritage Center, as well as making Oak Ridge the epicenter of the renaissance of the commercial nuclear industry.

As a corporate partner to the University of Tennessee, we understand that students in the BS Environmental Engineering program will have the option of completing the Nuclear Decommissioning and Environmental Management minor. Our industry would certainly be interested in hiring students with this background, which includes understanding of project management, construction management, and the radiological and environmental risks associated with materials and wastes used in nuclear-related industries. In addition, environmental engineering skills in waste management and multi-media fate and transport and risk assessment are applicable to many of our projects. There is a tremendous unfilled need for engineers with this background, both locally and nationally.

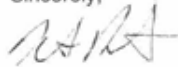
As part of our memorandum of understanding with the university, we would seek to recruit graduates from your program to fill internship, co-op, and entry-level positions in our organization. We would also seek to support your program through promotion of the minor to your students; advice on curriculum development; generation of relevant capstone design projects; and potential research support for faculty who specialize in this area.

Form-2 (8/22), Rev. 6

Dr. Chris Cox  
Page 2  
ORRCC-22-0732  
December 8, 2022

Please let us know how we can further support the development of your Environmental Engineering degree program.

Sincerely,



Kenneth J. Rueter  
President and Chief Executive Officer

KJR:SLD:JSA:vxI

c: J. S. Aylor  
H. T. Conner  
S. L. Dolynchuk  
File—DMC—NoRC

Form-2 (8/22), Rev. 6



8 December 2022

Dr. Chris Cox  
University of Tennessee Knoxville - Civil & Environmental Engineering  
427 John D. Tickle  
Knoxville, TN 37996-2313

Re: Tennessee Higher Education Commission  
BS Environmental Engineering Degree

Dear Dr. Cox:

I write this letter in support of the University of Tennessee's Tickle College of Engineering initiation of a new Environmental Engineering program.

Gresham Smith is a Nashville, TN based architecture, engineering, and planning firm with nearly a national footprint. With more than 1,100 employees, the firm is engaged with clients in aviation, healthcare, manufacturing, commercial development, transportation, and water/environment. Gresham Smith's annual revenue exceeds \$250 million.

As you are well aware, we consider the University an important industry partner as evidenced by my participation on advisory boards both for the Department of Civil and Environmental Engineering and for the Tickle College of Engineering.

Over the course of the past several years, the largest headwind to our company's growth has been the availability of talent. Given the dynamics in the AEC industry, we foresee this shortage of engineers to continue over a significant period, particularly in light of recent federal funding for infrastructure and green energy projects. In short, the need for infrastructure-related engineers in all experience ranges puts downward pressure on our ability to serve our clients at a time when their needs are increasing. In 2022, we have hired approximately 110 new engineers (including environmental professionals) and still have unmet recruitment needs.

Gresham Smith will stand to benefit from access to an increased pipeline of environmental engineering interns to help us meet the needs of our clients across the State of Tennessee, and the United States.

I would be pleased to address any questions that you may have.

Sincerely,

Randall E. Gibson, P.E.  
Chief Strategy Officer

222 Second Avenue South  
Suite 1400  
Nashville, TN 37201

GreshamSmith.com

*Genuine Ingenuity*



December 5, 2022

The University of Tennessee – Knoxville  
 Department of Civil and Environmental Engineering  
 325 John D. Tickle Engineering Building  
 851 Neyland Drive  
 Knoxville, Tennessee 37996-2313

Attention: Dr. Chris Cox, PhD, PE,  
 Department Head and Robert M. Condra Professor

Reference: Potential BS Degree Program in Environmental Engineering

Dear Dr. Cox:

Thank you for reaching out regarding the University of Tennessee – Knoxville (UTK) Department of Civil and Environmental Engineering's (DCEE) planning for a Bachelor of Science (BS) degree program in Environmental Engineering. This BS program is an interesting development with the potential to assist consulting firms like S&ME address future staffing needs.

Over the last 30 years, S&ME has hired many UTK DCEE graduates for roles in our geotechnical, construction services, civil, environmental, and water resources practices. We appreciate their grounding in civil engineering basics and ability to adapt to our market needs. However, while the need for agility is ever present, as engineering knowledge grows, so does the need for specialization. In the environmental engineering area, S&ME will need new graduates knowledgeable in site assessment, contaminate fate and transport (hydrogeology), solid waste management, stormwater management, vapor intrusion control, air pollution management, and environmental regulations while still having a grounding in traditional civil engineering skills such as surveying, drafting, surface water hydrology and hydraulics, and construction materials properties. Knowledge of the graphical language of engineering drawings and geographic information systems is important, but the ability to communicate in writing and verbally is critical. Students should have occasions in every class to practice communicating.

A BS degree program in Environmental Engineering at UTK DCEE will supply employers with qualified graduates having the specific and general knowledge to be immediately productive but also able to evolve as society's needs change. It will also attract students who may not have considered engineering in general, or civil engineering in particular, to the profession, helping to ease the looming talent shortage. We look forward to learning more about this new program as plans progress. Please let us know how we can be of any assistance.

Sincerely,

**S&ME, Inc.**

Ken Barry, PE, D. WRE  
 Technical Principal / Vice President

Gregory B. Page, PE  
 Principal Engineer

S&ME, Inc. | 6515 Nightingale Lane | Knoxville, TN 37909 | p.865.970.0003 | www.smeinc.com



Dr. Chris Cox  
 Head and Professor  
 Department of Civil and Environmental Engineering  
 325 John D. Tickle Engineering Building  
 851 Neyland Drive  
 The University of Tennessee  
 Knoxville, TN 37996

Dear Dr. Cox,

I am writing in support of the University of Tennessee's plan to develop a BS degree in Environmental Engineering. I graduated from UT with a BS in Civil Engineering (2001) and an MS in Environmental Engineering (2004). As such, I am very familiar with the content of your proposed BS Environmental Engineering degree. As a practicing engineer at First Utilities District (FUD) of Knox County, I can attest to the critical role environmental engineers play in providing people access to clean and dependable drinking water and in preserving water quality in our lakes, rivers, and aquifers. The ability to continue to provide these services is dependent upon a continual supply of well-trained engineers with specialized knowledge about environmental engineering.

My awareness of the importance of engineering education has motivated me over the past several years to volunteer my time to support the Civil Engineering 481 Water Resources II class, taught by Dr. John Schwartz and the Civil Engineering capstone design course taught by Dr. Jenny Retherford. To support these classes, I work with the instructors to develop real-world design projects to give practical experiences to students, give guest lectures, and mentor student teams. My understanding is that equivalent courses will be offered to students in the Environmental Engineering degree program and it is my intention to continue to support these classes in a similar manner in future years.

I anticipate that graduates from the proposed BS in Environmental Engineering program will have the knowledge and skills to make strong contributions to the water infrastructure industry. Graduates from an environmental degree program will be in high demand with water utilities such as FUD, regulatory agencies, and consulting engineers.

Please let us know how we can further support the development of your environmental engineering degree program.

Sincerely,

A handwritten signature in black ink, appearing to read "Mark W. McKinney".

Mark W. McKinney, PE  
 Capital Engineer Supervisor

122 Durwood Road Knoxville, TN 37922 | 865.966.9741 | 1stutility@fudknox.org





November 29, 2022

Dr. Chris Cox  
 Head and Professor  
 Department of Civil and Environmental Engineering  
 325 John D. Tickle Engineering Building  
 851 Neyland Drive  
 The University of Tennessee  
 Knoxville, TN 37996

Dear Dr. Cox,

I am writing in support of the University of Tennessee's plan to develop a BS degree in Environmental Engineering.

As the President of Amentum's National Security group, I oversee day-to-day operations, manage profit and loss, strategic initiatives, and business development activities for Amentum's work for clients such as the Department of Energy, National Nuclear Security Administration, and the U.S. Army Corps of Engineers across the United States and several other countries around the world. One of the primary capabilities of our organization is associated with managing environmental cleanup for these customers at sites such as the Oak Ridge Reservation (Tennessee), Savannah River Site (South Carolina), and Hanford Site (Washington) to name a few. Given the extremely large market for environmental cleanup that is estimated to range in the hundreds of billions of dollars both here domestically and across the world, having a pipeline of qualified students is imperative to support our company in the decades to come.

As a corporate partner to the University of Tennessee, we understand that students in the BS Environmental Engineering program will have the option of completing the Nuclear Decommissioning and Environmental Management minor. Our industry, and particularly our company, is interested in hiring students with this background, which includes understanding of project management, construction management, and the radiological and environmental risks associated with materials and wastes used in nuclear-related industries. In addition, environmental engineering skills in waste management and multi-media fate and transport, and risk assessment are applicable to many of our projects. There is a tremendous unfilled need for engineers with this background nationally.

As part of our memorandum of agreement with the university, we would seek to recruit graduates from your program to fill internship, co-op, and entry-level positions in our organization. We would also seek to support your program through promotion of the minor to your students, advice on curriculum development, generation of relevant capstone design projects, and potential research support for faculty who specialize in this area.

Please let us know how we can further support the development of your Environmental Engineering degree program.

Sincerely,

Mark Whitney  
 President, Amentum National Security

www.amentum.com  
 7799 Leesburg Pike, Suite 300 North, Falls Church, VA 22043





August 22<sup>nd</sup>, 2022

Dr. Chris Cox  
Head and Professor  
Department of Civil and Environmental Engineering  
325 John D. Tickle Engineering Building  
851 Neyland Drive  
The University of Tennessee  
Knoxville, TN 37996

Dear Dr. Cox,

I am writing on behalf of HDR Engineering, Inc. to support the University of Tennessee's plan to develop a BS degree in Environmental Engineering.

HDR is a top 5 rated engineering firm by Engineering News Record, with more than 11,000 employees in offices across the US and around the world. Engineers with strong backgrounds in environmental engineering and water resources lead projects related to water supply and distribution, wastewater collection and treatment, air quality management, site remediation, water resources management, and sustainable energy systems. These projects are distributed across the various markets sectors we serve, including Water, Waste, Energy, Transportation, and Industrial. Many of the projects serve to protect public health, manage natural resources, and protect the environment as a whole.

HDR hires over 200 entry-level engineers each year, including graduates of BS in Environmental Engineering programs. Environmental engineers are well-suited to fill many of these positions. Our demand for engineers with strong training in environmental engineering and water resources is projected to be strong for the foreseeable future.

We are excited about the prospect of a BS in Environmental Engineering degree program at the University of Tennessee. We would seek to recruit graduates from your program to fill entry-level positions in our offices in the Southeast and nationally. Moreover, we would gladly support other academic activities such as providing input on curriculum development and potentially working with you to develop capstone design projects based on real-world projects.

Please let us know how we can further support the development of your BS in Environmental Engineering degree program.

Sincerely,

Shane

Shane R. Womack, PE, Vice President, Office Principal, UT Knoxville BSCE Graduate, 1992

HDR Engineering, Inc.

hdrinc.com 1201 Market Street, Suite C, Chattanooga, TN 37402-2714  
(423) 414-3551





STATE OF TENNESSEE  
**DEPARTMENT OF ENVIRONMENT AND CONSERVATION**  
Division of Solid Waste Management  
William R. Snodgrass Tennessee Tower  
312 Rosa L. Parks Avenue, 14<sup>th</sup> Floor  
Nashville, Tennessee 37243

October 1, 2019

Dr. Chris Cox, Department Head  
Department of Civil and Environmental Engineering  
525 John D. Tickle Building  
University of Tennessee -- Knoxville  
Knoxville, TN 37996

Subject: Establishment of Environmental Engineering Program  
University of Tennessee – Knoxville

Dear Dr. Cox:

I understand that the Civil and Environmental Engineering Department at the University of Tennessee is making plans to establish a Bachelor's degree in Environmental Engineering. Environmental engineers play a vital role in protecting public health and preserving environmental resources across the state of Tennessee in areas such as safe drinking water, sanitation, solid waste management, environmental remediation, air quality, water resources management, groundwater, and numerous others.

Environmental engineers are employed in public utilities, manufacturing, consulting engineering firms, and state and federal agencies, including my own, the Tennessee Department of Environment and Conservation. This degree program will play a vital role in workforce development in Tennessee, especially since there are currently no undergraduate environmental engineering programs offered by any of Tennessee's colleges or universities. I am also pleased to learn that the degree program you are envisioning will prepare graduates to contribute solutions to some of the most important issues facing Tennessee and the nation, including sustainable energy and water systems, smart and resilient communities, and informed community-driven decision making.

I wholeheartedly support the development of an Environmental Engineering Program at the University of Tennessee – Knoxville. Please let me know how I may offer support for your plans to develop this degree program. Thank you.

Sincerely,

A handwritten signature in black ink that reads 'Patrick J. Flood'.

Patrick J. Flood, P.E.  
Director



Tennessee Valley Authority, 400 West Summit Hill Drive, Knoxville, Tennessee 37902

September 19, 2019

Dr. Chris Cox  
 Department Head, Civil and  
 Environmental Engineering  
 University of Tennessee  
 325 John D. Tickle Building  
 851 Neyland Drive  
 Knoxville, Tennessee 37902

Dear Dr. Cox:

Thank you for soliciting TVA's input on the proposed creation of an Environmental Engineering bachelor's degree at the University of Tennessee. As you know, TVA hires many students from UT's current civil engineering program. These students have gone on to successful careers for TVA, in roles as diverse as river management, bridge engineering, and geotechnical engineering and structures.

It is important to note that each of these career paths at TVA are fairly specialized tracks. To illustrate, let me use the group I lead as an example. Within River Management, we depend on a deep set of water resources engineering and policy skills. We depend on staff to make extremely complex decisions that affect the lives of millions of people. These decisions are typically supported by very complex statistical and modelling techniques that often cannot be performed by a new graduate with a generalist civil engineering background. For that reason, we prefer to hire M.S. level graduates into our group. Even so, it often requires a year or two of skills acquisition for that new hire to make a significant contribution.

Your effort to create an undergraduate program that would focus more heavily on the water resources, environmental, and policy aspects of engineering would allow graduates to be more immediately beneficial to TVA.

Sincerely,

Tom Barnett, PE  
 General Manager  
 River Management

## Appendix B: THEC Financial Projection Form

Financial Projections Form						
<b>Institution</b>	University of Tennessee Knoxville					
<b>Program Name</b>	Bachelor of Science in Environmental Engineering					
Projected One-Time Expenditures						
Category	Planning	Year 1	Year 2	Year 3	Year 4	Year 5
Faculty & Instructional Staff						
Non-Instructional Staff						
Graduate Assistants						
Accreditation				\$ 6,700		
Consultants	\$ 2,500					
Equipment		\$ 103,935	\$ 78,740			
Information Technology						
Library resources						
Marketing		\$ 8,000				
Facilities						
Travel	\$ 2,000					
Other						
<b>Total One-Time Expenditures</b>	<b>\$ 4,500</b>	<b>\$ 111,935</b>	<b>\$ 78,740</b>	<b>\$ 6,700</b>	<b>\$ -</b>	<b>\$ -</b>
Projected Recurring Expenditures						
Category	Planning	Year 1	Year 2	Year 3	Year 4	Year 5
Faculty & Instructional Staff		\$ 136,990	\$ 141,100	\$ 145,333	\$ 149,693	\$ 154,183
Non-Instructional Staff		\$ 31,920	\$ 32,878	\$ 33,864	\$ 34,880	\$ 35,926
Graduate Assistants		\$ 44,686	\$ 87,979	\$ 46,229	\$ 90,720	\$ 92,171
Accreditation					\$ 715	\$ 715
Consultants						
Equipment						
Information Technology						
Library						
Marketing						
Facilities						
Travel						
Other						
<b>Total Recurring Expenditures</b>	<b>\$0</b>	<b>\$213,596</b>	<b>\$261,956</b>	<b>\$225,426</b>	<b>\$276,007</b>	<b>\$282,995</b>
<b>Grand Total (One-Time and Recurring)</b>	<b>\$4,500</b>	<b>\$325,531</b>	<b>\$340,696</b>	<b>\$232,126</b>	<b>\$276,007</b>	<b>\$282,995</b>
Projected Revenue						
Category	Planning	Year 1	Year 2	Year 3	Year 4	Year 5
Tuition		\$ 913,357	\$ 1,394,363	\$ 1,844,895	\$ 2,070,289	\$ 2,175,933
Grants			\$ 22,343	\$ 22,450	\$ 43,565	\$ 43,991
Other						
<b>Total Revenues</b>	<b>\$ -</b>	<b>\$ 913,357</b>	<b>\$ 1,416,706</b>	<b>\$ 1,867,345</b>	<b>\$ 2,113,854</b>	<b>\$ 2,219,924</b>

## Appendix C: Results from Online LinkedIn Job Search

### Search 1: Tennessee

The screenshot shows a LinkedIn search interface for 'environmental engineering jobs' in Tennessee, United States. The search results are as follows:

Job Title	Company	Location	Connections	Applicants	Posted
Civil Project Engineer	Thomas & Hutton	Smyrna, TN (On-site)	2 connections work here	2 applicants	3 weeks ago
Civil Engineer - Structural Design	The Pictsweet Company	Bells, TN	2 company alumni work here	0 applicants	1 week ago
Traffic Engineer	WSP USA	Nashville, TN (Hybrid)	Actively recruiting	7 applicants	1 week ago
Geotechnical Engineer	Universal Engineering Sciences	Memphis, TN (On-site)	3 connections work here	0 applicants	1 month ago
Civil Engineer Aviation	Kimley-Horn	Nashville, TN	7 connections work here	0 applicants	1 month ago

### Search 2: Major Regional Metropolitan Areas

The screenshot shows a LinkedIn search results page for 'environmental engineering jobs in United States'. The search bar at the top contains the text 'environmental engineering jo...' and 'United States'. Below the search bar, there are filters for 'Jobs', 'Entry level 1', 'Full-time 1', 'Location 6', 'Job Function 5', 'Title 3', 'Date Posted', and 'All filters'. The results list five job postings:

- Environmental Engineer** at **CPS, Inc.**, Atlanta, GA (On-site). 1 alum works here. Promoted. Easy Apply.
- Staff Environmental/Civil Engineer (Entry Level)** at **ERM**, Charlotte, NC (Hybrid). 8 company alumni work here. Promoted. 1 applicant.
- Graduate Water Resources Engineer** at **WSP USA**, Dallas, TX. 148 alumni work here. Promoted. 17 applicants.
- Critical Environments Operating Engineer** at **JLL**, Austin, TX. Medical, Vision, Dental, 401(k). 1 company alumnus works here. Promoted. 1 applicant.
- Environmental Engineer** at **North Carolina State University**, Raleigh, NC (On-site). 109 alumni work here. 1 month ago. 1 applicant.

## Summary of 30 Positions Identified During Online Job Search

Employer	Job Title	Location	Education Requirement	Link
Leidos	Environmental Engineer	Oak Ridge, TN	Bachelor's degree in environmental/civil/engineering or related science degree	<a href="https://www.linkedin.com/jobs/view/3305771865/">https://www.linkedin.com/jobs/view/3305771865/</a>
LJA Engineering, Inc	Graduate Engineer - Water/Wastewater	Knoxville, TN	Bachelor of Science, Civil or Environmental Engineering is required.	<a href="https://www.linkedin.com/jobs/view/3313561147/">https://www.linkedin.com/jobs/view/3313561147/</a>
CDM Smith	Environmental Engineer 1	Nashville, TN	Bachelor's degree in Civil, Environmental, or Chemical Engineering or related discipline.	<a href="https://www.linkedin.com/jobs/view/3334619792/">https://www.linkedin.com/jobs/view/3334619792/</a>
Thomas & Hutton	Project Manager - Water Wastewater Engineer	Smyrna, TN	Bachelor's degree in Civil Engineering, Environmental Engineering	<a href="https://www.linkedin.com/jobs/view/3324487714/">https://www.linkedin.com/jobs/view/3324487714/</a>
S&ME	Civil Engineering Staff Professional	Knoxville, TN	A bachelor's degree in Civil or Environmental Engineering.	<a href="https://www.linkedin.com/jobs/view/3250373971/">https://www.linkedin.com/jobs/view/3250373971/</a>
S&ME	Civil Engineering Staff Professional	Nashville, TN	A bachelor's degree in Civil or Environmental Engineering.	<a href="https://www.linkedin.com/jobs/view/3153298663/">https://www.linkedin.com/jobs/view/3153298663/</a>
Tetrattech	Junior Environmental Scientist/Engineer	Nashville, TN	Degreed individual in the sciences (biology, ecology, geology, hydrogeology, etc.), architecture, or engineering	<a href="https://www.linkedin.com/jobs/view/3281929552/">https://www.linkedin.com/jobs/view/3281929552/</a>

Liberty Personnel Services	Junior Civil Engineer	Nashville, TN	BS in Civil or Environmental Engineering	<a href="https://www.linkedin.com/jobs/view/3307183299/">https://www.linkedin.com/jobs/view/3307183299/</a>
Actalent	Project Environmental Engineer	Brentwood, TN	Bachelor's degree in Construction Engineering, Civil Engineering, Environmental Engineering, or Geotechnical Engineering required.	<a href="https://www.linkedin.com/jobs/view/3339849761/">https://www.linkedin.com/jobs/view/3339849761/</a>
ERM	Staff Environmental Engineer/Geologist/Scientist	Nashville, TN	BS in environmental, civil, or chemical engineering; geology; hydrogeology; or related discipline;	<a href="https://www.linkedin.com/jobs/view/3330559539/">https://www.linkedin.com/jobs/view/3330559539/</a>
CPS, Inc	Environmental Engineer	Atlanta, GA	BS in Environmental Science, Engineering, Chemistry, or another science-related field	<a href="https://www.linkedin.com/jobs/view/3224222450/">https://www.linkedin.com/jobs/view/3224222450/</a>
ERM	Staff Environmental/Civil Engineer (Entry Level)	Charlotte, NC	Bachelor's degree in Civil, Environmental, or Chemical Engineering.	<a href="https://www.linkedin.com/jobs/view/3330561732/">https://www.linkedin.com/jobs/view/3330561732/</a>
WSP USA	Graduate Water Resources Engineer	Dallas, TX	Bachelor's Degree in Civil or Environmental Engineering, with a focus on Water Resources or a closely related discipline.	<a href="https://www.linkedin.com/jobs/view/3289793004/">https://www.linkedin.com/jobs/view/3289793004/</a>
North Carolina State University	Environmental Engineer	Raleigh, NC	Bachelor's Degree in the Engineering discipline related to the area of assignment	<a href="https://www.linkedin.com/jobs/view/3332431405/">https://www.linkedin.com/jobs/view/3332431405/</a>

Terracon	Staff Environmental Compliance Engineer	Charlotte, NC	Bachelor's degree in Chemical Engineering, Environmental Engineering, or other environmental related discipline (Master's degree preferred),	<a href="https://www.linkedin.com/jobs/view/3295663375/">https://www.linkedin.com/jobs/view/3295663375/</a>
McGill and Associates	Water / Wastewater Engineer	Raleigh, NC	Bachelor's Degree in Civil or Environmental Engineering or a related field	<a href="https://www.linkedin.com/jobs/view/3310206188/">https://www.linkedin.com/jobs/view/3310206188/</a>
STV	Water Resources Engineer	Charlotte, NC	Bachelor's degree in Engineering and a master's degree in Engineering is a plus (Civil, Biological, Agricultural, or another related discipline)	<a href="https://www.linkedin.com/jobs/view/3325914605/">https://www.linkedin.com/jobs/view/3325914605/</a>
AECOM	Environmental Engineers All Levels	Dallas, TX	BA/BS degree in environmental, engineering, or other relevant discipline	<a href="https://www.linkedin.com/jobs/view/3334609573/">https://www.linkedin.com/jobs/view/3334609573/</a>
Chord Energy	Environmental Engineer Advisor	Houston, TX	Bachelor's degree in environmental science, engineering, or a related degree	<a href="https://www.linkedin.com/jobs/view/3305283575/">https://www.linkedin.com/jobs/view/3305283575/</a>
Chord Energy	Environmental Engineer	Houston, TX	Bachelor's degree in environmental science, engineering, or a related degree	<a href="https://www.linkedin.com/jobs/view/3304959287/">https://www.linkedin.com/jobs/view/3304959287/</a>
Westwood Professional Services	Civil Graduate Engineer	Dallas, TX	Bachelor's Degree in Civil or Environmental Engineering	<a href="https://www.linkedin.com/jobs/view/3323712518/">https://www.linkedin.com/jobs/view/3323712518/</a>



CHA Consulting	Early Career Environmental Engineer	Atlanta, GA	Bachelor's degree in Environmental Engineering is required.	<a href="https://www.linkedin.com/jobs/view/3257605305/">https://www.linkedin.com/jobs/view/3257605305/</a>
AECOM	Environmental Engineers All Levels	Austin, TX	BA/BS degree in environmental, engineering, or other relevant discipline	<a href="https://www.linkedin.com/jobs/view/3312986883/">https://www.linkedin.com/jobs/view/3312986883/</a>
TRC Companies	Environmental Engineer	Austin, TX	Bachelor's Degree in engineering (environmental, civil, chemical, or agricultural) from an accredited university	<a href="https://www.linkedin.com/jobs/view/3153764888/">https://www.linkedin.com/jobs/view/3153764888/</a>
CyberCoders	Project Engineer - Land Development	Raleigh, NC	BS in Civil or Environmental Engineering	<a href="https://www.linkedin.com/jobs/view/3303259898/">https://www.linkedin.com/jobs/view/3303259898/</a>
ERM	Staff Environmental/Civil Engineer (Entry Level)	Atlanta, GA	Bachelor's degree in Civil, Environmental, or Chemical Engineering.	<a href="https://www.linkedin.com/jobs/view/3330560698/">https://www.linkedin.com/jobs/view/3330560698/</a>
Baxter & Woodman	Water / Wastewater Engineer	Houston, TX	Bachelor of Science Degree from an accredited university in Civil Engineering, Environmental Engineering, Mechanical Engineering, or a related field.	<a href="https://www.linkedin.com/jobs/view/3339083598/">https://www.linkedin.com/jobs/view/3339083598/</a>
AECOM	Environmental Engineers All Levels	Houston, TX	BA/BS degree in environmental, engineering, or other relevant disciplines	<a href="https://www.linkedin.com/jobs/view/3312992110/">https://www.linkedin.com/jobs/view/3312992110/</a>

Aqua	Project Engineer	Houston, TX	Bachelor's degree in Mechanical, Civil, or Environmental Engineering	<a href="https://www.linkedin.com/jobs/view/3325850328/">https://www.linkedin.com/jobs/view/3325850328/</a>
Garver	Project Engineer	Atlanta, GA	Bachelor's degree in civil, biological, or environmental engineering from an ABET-accredited program Registered as an Engineer Intern (EI)	<a href="https://www.linkedin.com/jobs/view/3324950656/">https://www.linkedin.com/jobs/view/3324950656/</a>

## Appendix D: Summary of Employer Survey Response

<p><b>In the last five years, how many entry-level engineering positions did your firm (or branch office) hire that included environmental engineering in the job description?</b></p> <ul style="list-style-type: none"> <li>● 2 to 5: 4 respondents</li> <li>● 6 to 13: 6 respondents</li> <li>● About 100: 1 respondent</li> </ul>
<p><b>About what proportion of those were filled by a candidate with a civil engineering BS degree vs. environmental?</b></p> <ul style="list-style-type: none"> <li>● Predominantly civil: 7 respondents</li> <li>● About 50/50: 2 respondents</li> <li>● Only hire Environmental Engineers with graduate degrees: 1 respondent</li> <li>● Don't know: 1 respondent</li> </ul>
<p><b>Consider two job candidates for a position in your organization that carries the nominal job title of "Environmental Engineer." One candidate holds a BS in Environmental Engineering, and another holds a BS in Civil Engineering. Other than their degree, the two candidates are equally qualified. Please select the statement that most closely reflects your opinion:</b></p> <ul style="list-style-type: none"> <li>● Our organization would prefer the depth of knowledge of a candidate holding the Environmental Engineering degree: 7 respondents</li> <li>● Our organization would prefer the breadth and versatility of the candidate holding the Civil Engineering degree: 3 respondents</li> <li>● Our organization only hires people holding an MS degree in Environmental Engineering for such positions: 1 respondent</li> </ul>
<p><b>Thinking 5-10 years into the future, do you think you will have more, less, or about the same level of interest in hiring a student with a BS ENVE degree?</b></p> <ul style="list-style-type: none"> <li>● More: 6 respondents</li> <li>● Less: 0 respondents</li> <li>● About the same: 5 respondents</li> </ul>
<p><b>Would you compensate a BS ENVE graduate higher, lower, or about the same as a BS CEE graduate?</b></p> <ul style="list-style-type: none"> <li>● More: 1 respondent</li> <li>● Less: 0 respondents</li> <li>● About the same: 10 respondents</li> </ul>
<p><b>Do you have any additional comments?</b></p> <ul style="list-style-type: none"> <li>● River management focus area would be great</li> <li>● My environmental engineering training served me well, so I favor such a B.S. Degree. Keep in mind that much "environmental work" requires a strong background in Civil Engineering. For example, landfill design is considered environmental but is mostly civil.</li> <li>● While we almost exclusively hire MS and Ph.D. level engineers, we very much value the BS in ENVE, especially in Tennessee, where PE registration requires a BS in engineering.</li> </ul>

- Not at this time
- The preference stated above for Environmental would be slight and a function of the exact position. In some cases, a generalist is preferred.
- Our Division typically hires most of its engineers into either the Solid Waste Program or the Hazardous Waste Program. Traditional Civil Engineering programs would benefit candidates in the Solid Waste Program; an Environmental Engineering program might give a slight benefit to candidates in the Hazardous Waste Program (depending on course content). I would also be VERY concerned about an Environmental Engineering graduate being able to obtain their PE; it would be an easier path for a traditional Civil Engineering graduate.
- I like the idea of a student coming into the workplace better understanding what we do in the water and wastewater industry.
- First, the question that compares the two candidates is not as black and white as asked. There are instances where an Environmental would be a preference over a Civil, but that is not delineated in the question. For example, the preference would be an environmental engineer in a technical services field that deals with environmental programs. However, in general, project management may be Civil, but the answers to the question make you go one way or the other. Also, an Environmental could step into the role of a project manager so that they would be versatile. Second, while Civil students get a well-rounded education, there is a need for what I would term a process engineer. An environmental engineer who has studied more about water and wastewater processes could benefit Plant Operations. They would be technically minded and related to process and could help us troubleshoot process upsets, go back in time, and examine why upsets occurred. They would also need soft skills to communicate and work with a more blue collared workforce in the treatment plant Operator world.
- My Environmental Department head is a relatively young engineer named Matt Bruck. Matt can provide additional information about what consultants in environmental engineering would value.
- TVA River Management would certainly be in favor of hiring graduates who have had more focus on water resources studies
- Great for employers who are big enough to hire ENV BS and CE BS and separate their duties into two categories, but not the best option for a smaller employer who is looking to have the breadth of capabilities or the employee who isn't exactly sure what they want to be when they grow up because too limited in knowledge and skills.

## Appendix E: Faculty Curricula Vitae

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### Dr. Christopher R. Cherry

1. Name: Dr. Christopher R. Cherry
2. Education
  - PhD. Civil and Environmental Engineering-Transportation, University of California, Berkeley, Berkeley, CA, Ph.D, 2007
  - MS Civil Engineering-Transportation University of Arizona, Tucson, AZ, 2003
  - BS Civil Engineering University of Arizona, Tucson, AZ, 2000
3. Academic experience
  - University of Tennessee, Professor, 2018-Present, Full time
    - Associate Department Head of Undergraduate Studies (2019-Present)
  - University of Tennessee, Associate Professor, 2013-2018, Full time
  - University of Tennessee, Assistant Professor, 2007-2013, Full time
4. Non-academic experience
  - Engineering Designer, MMLA. Tucson, AZ, 2000-2001, Full time
  - Construction Engineering Intern, Exxon/Mobil, New Orleans, LA Summer 2000, Full time
  - Land Surveyor, S and S Surveys, Inc. Tucson, AZ, Summer 1999, Full time
  - Land Surveyor, Kelley/Wise Engineering, Prescott, AZ, Summers 1997/1998, Full time
5. Certifications or professional registrations
  - Professional Engineer in Tennessee, 117925
6. Current membership in professional organizations
  - Transportation Research Board, Member, 2003-Present
  - Women's Transportation Seminar, Member, 2015-Present
7. Honors and awards
  - UTK CEE Scholarship Recognition Award 2022.
  - CEE Service Recognition Award 2021
  - TCE Charles E Ferris Faculty Award 2015 & 2020
  - UTK Center for Transportation Research Fellow, 2014
  - UTK TCE Professional Promise in Research Award 2014
  - UT Environmental Leadership Award 2010 & 2015
8. Service activities (within and outside of the institution)
  - Associate Editor, *Transportation Research Part D* and *The International Journal of Sustainable Transportation*.
  - City of Knoxville Vision Zero Task Force, 2021-Present
  - Society of Automotive Engineers (SAE) Micromobility Committee, Founding Chair, 2018-Present
  - Transportation Research Board (TRB) Joint Subcommittee on Micromobility Vehicles, Chair, (2011-2022).
  - FHWA E-bikes on Public Lands Committee, Member, 2021-Present

- UN Environment Program (UNEP) Electric Two Wheeler Working Group, 2021-Present
- UTK Honors Reimagining Committee, Member, 2022
- Tenure and Promotion External Reviewer (seven faculty members since 2018)
- Light Electric Vehicle Education and Research (LEVER) Institute, Director, 2014-2023

9. Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Ziedan, A., N.R. Shah, Y. Wen, C. Brakewood, C.R. Cherry (2021) *Complement or Compete? The Effects of Shared Electric Scooters on Bus Ridership*. Transport Research Part D. 101. 103098.
- Yang, H. J Huo, Y Bao, X Li, L Yang, CR Cherry (2021) *Impact of e-scooter sharing on bike sharing in Chicago*. Transportation Research Part A.154, 23-36
- Azad, M. J., C. Cherry, D. Abdelqader, L. Taboada (2021) *Walk-to-transit demand estimation methods applied at the parcel level to improve pedestrian infrastructure investment*. Journal of Transport and Geography.
- Shah, N., S. Aryal, Y. Wen, C. Cherry (2021) *Comparison of motor vehicle-involved e-scooter and bicycle crashes using standardized crash typology*. Journal of Safety Research, 77. 217-228
- McQueen, M., MacArthur, J., & Cherry, C. (2020). *The E-Bike Potential: Estimating regional e-bike impacts on greenhouse gas emissions*. Transportation Research Part D: Transport and Environment, 87, 102482.
- Hezaveh, A.M., C. Cherry (2018) *Neighborhood-Level Factors Affecting Seat Belt Use*. Accident Analysis and Prevention. 122, pg 153-161.

10. Briefly list the most recent professional development activities

- Regularly review articles in a variety of professional journals and conferences.
- Regularly attend and chair sessions at professional conferences.

## Dr. Chris Cox

1. Name: Dr. Chris Cox
2. Education
  - Ph.D., Environmental Engineering, Penn State University, 1992
  - M.S., Environmental Engineering, University of Missouri, 1984
  - B.S., Chemical Engineering, University of Missouri, 1983
3. Academic experience
  - University of Tennessee, Knoxville, Department Head, 2015-present
  - University of Tennessee, Knoxville, Professor, 2007-present
  - University of Tennessee, Knoxville, Institute for a Secure and Sustainable Environment, Director, 2011-2015
  - University of Tennessee, Knoxville, Associate Department Head, 2008-2015
  - University of Tennessee, Knoxville, Associate Professor, 1997-2007
  - University of Tennessee, Knoxville, Assistant Professor, 1992-1997
  - University of Tennessee, Knoxville, Instructor (full time), 1991-1992
4. Non-academic experience
  - Smith and Loveless, Lenexa, KS, Industrial Process Engineer, 1985-1987, full time
5. Certifications or professional registrations
  - Professional Engineer, Tennessee #105764
6. Current membership in professional organizations
  - American Society of Civil Engineers
  - Tennessee Society of Professional Engineers
  - Water Environment Federation
  - American Society of Engineering Educators
  - Association of Environmental Engineering and Science Professors
7. Honors and awards
  - ASCE, Tennessee Section, Peter G. Hoadley Award for Outstanding Engineering Educator, 2020.
  - ASCE, Knoxville Branch, Educator of the Year Award, 2020.
  - UTK, Department of Civil and Environmental Engineering Outstanding Service Award, 2002, 2010, 2012, 2014.
  - UTK, College of Engineering, Outstanding Advising Award, 2011
  - UTK, Chancellor's Teaching Award, 2009
  - UTK, College of Engineering Research Fellow Award, 2006, 2008
  - UTK, College of Engineering, Allen Hoshall Faculty Award, 2005
  - UTK College of Engineering, Leon and Nancy Cole Superior Teaching Award, 1998
8. Service activities (within and outside of the institution)
  - Department of Chemical and Biomolecular Engineering Department Head Search Committee, Chair, 2022-2023
  - Department of Mechanical Aerospace and Biomedical Mid-Cycle Academic Program Review Committee, 2021

- Continuity of Research Operations Team during COVID-19 pandemic, 2020-2021
- Department of Ecology and Evolutionary Biology Academic Program Review Committee, 2020
- UTIA-UTK Academic Affairs and Shared Governance Working Group, 2020
- UTIA-UTK Reunification Committee, 2019
- Research Misconduct Inquiry Panel, Chair, 2016-2018
- East Tennessee Clean Fuels Coalition, Advisory Board Member, 2013-present
- Tennessee Society of Professional Engineers, Knoxville Chapter, MATHCOUNTS Coordinator, 2013-present.

9. Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Cao, L., C.D. Cox, Q. He (2021) “Patterns of syntrophic interactions in methanogenic conversion of propionate.” *Applied Microbiology and Biotechnology* 105 (23), 8937-8949.
- Keating, S.M. et al (more than 100 authors). 2020. SBML Level 3: an extensible format for the exchange and reuse of biological models. *Molecular Systems Biology* 16:8.

10. Briefly list the most recent professional development activities

- Annual Participation in ASCE Department Heads Meeting 2015-2023
- Attend Monthly UTK Department Heads Forum
- Association of Environmental Engineering and Science Professors Conference, 2022
- Virtual 2021 World Environmental & Water Resources Congress, 2021



## Dr. Joshua S. Fu

1. Name: Dr. Joshua S. Fu
2. Education
  - Ph.D., Civil Engineering (Concentration: Environmental Systems), North Carolina State University
  - M.S., Environmental Engineering, University of California at Los Angeles
  - B.S., Environmental Engineering, National Cheng Kung University
3. Academic experience
  - Chancellor's Professor, the University of Tennessee, 2022-present
  - James G. Gibson Professor in Climate Change, the University of Tennessee, 2021-present
  - John D. Tickle Professor of Engineering, the University of Tennessee, Knoxville, TN, 2017-present
  - Professor, Department of Civil and Environmental Engineering, the University of Tennessee, Knoxville, TN, 2014-present
  - Joint Appointment Professor, Climate Change Science Institute, Oak Ridge National Laboratory, Oak Ridge, TN, 2012-present
  - Inaugural Professor, Bredesen Center, Energy Science and Engineering, the University of Tennessee, Knoxville, TN, 2010-present
  - Associate Professor, Department of Civil and Environmental Engineering, the University of Tennessee, Knoxville, TN, 2009-2014
  - Extended Senior Research Staff, Computational Earth Science Group, Computer Science and Mathematics Division, Oak Ridge National Laboratory, Oak Ridge, TN, 2009-2012
  - Research Assistant and Associate Professor, the University of Tennessee, Knoxville, TN, 2000-2009
4. Non-academic experience
  - Senior Scientific Applications Analyst and Software Engineer, Lockheed Martin Information Services in the U.S. EPA National Supercomputing Center, 1998-2000
5. Certifications or professional registrations
  - Board Certified Environmental Engineering Member, American Academy of Environmental Engineers & Scientists, 2020-present
6. Current membership in professional organizations
  - Air and Waste Management Association, Fellow, 2021
  - American Academy of Environmental Engineers and Scientists
  - American Geophysical Union
  - Association of Environmental Engineering and Science Professors
  - American Society for Engineering Education
  - American Association for the Advancement of Science, Fellow, 2020
7. Honors and awards
  - Chancellor's Professor, the University of Tennessee, 2022

- Research & Creative Achievement Award, Office of Chancellor, UTK, 2022
  - Fellow, Air & Waste Management Association, 2021
  - The Environmental Management or Policy Research and Study Related to Air Quality Scholarship Award (PhD student), Air & Waste Management Association, 2021
  - James G. Gibson Endowed Professorship, Tickle College of Engineering, University of Tennessee, 2021
  - Research Achievement Award, Tickle College of Engineering, University of Tennessee, 2021
  - Fellow, American Association for the Advancement of Science (AAAS), 2020
  - Board Certified Environmental Engineering Member (BCEEM), American Academy of Environmental Engineers & Scientists, 2020
  - Atmospheric Sciences Chair Professor, National Central University, Taoyuan, Taiwan, 2020-2024
  - Lyman A. Ripperton Environmental Educator Award, Air and Waste Management Association, 2018
  - The Albert Nelson Marquis Lifetime Achievement Award, Marquis Who's Who, 2018
  - Who's Who in the World, 2017-present
  - John D. Tickle Professorship, Tickle College of Engineering, The University of Tennessee, 2017-present
  - The Best Ph.D. Student Paper Award, Air and Waste Management Association, 2016
  - Most Cited Article Award, Atmospheric Environment, Elsevier Limited., 2013
  - Significant Event Award, Oak Ridge National Laboratory; for accomplishments on the Arctic Black Carbon program, 2013
  - Chancellor Award for Professional Promise in Research and Creative Achievement, The University of Tennessee, 2012
  - Research Fellow Award, College of Engineering, The University of Tennessee (UTK), 2010, 2013
  - Computerworld Honors Laureate, 2012
  - Who's Who in America, 2007-present
  - Honorary Professorship, Chinese Research Academy of Environmental Sciences, China, 2005
  - Honorary Member, Chi Epsilon Society, 1995
8. Service activities (within and outside of the institution)
- Vice-Chair, Science Leadership Committee, WMO Measurement-Model Fusion for Global Total Atmospheric Deposition Initiative, 2019-present
  - Member, Expert Group, WMO Measurement-Model Fusion for Global Total Atmospheric Deposition Project, 2019-present
  - Member, Advanced R&D Advisory Committee for President Office, Industrial Technology Research Institute, Taiwan, 2019-2024
  - Member, Expert Group, Arctic Council AMAP Short-lived Climate Pollutants, 2017-present

- Member, State Air Pollution Control Board, State of Tennessee Department of Environmental Conservation, 2017-2026
  - Chair of Climate Impacts, Air & Waste Management Association, 2016-2024
  - Member, The American Association for the Advancement of Science, 2012-present
  - Member, Review Committee, Status of Air Quality in the East Asia, East Asia Nations Task Force on Research Coordination of the Scientific Advisory Committee of the Acid Deposition Monitoring Network in East Asia (EANET), 2012-2015
  - Member, UN ECE Task Force Hemispheric Transport of Air Pollution, Co-author of HTAP Phase I and II Report, 2007-present
  - Member, American Geophysical Union, 2004-present
  - Member, Expert Panel, EPA Air Quality Management Manual, 2003-2010
  - Member, Air & Waste Management Association, 2000
9. Most important publications in the last 5 years.
- WMO GAW Report No. 250, Global Atmosphere Watch Expert Meeting on Measurement-Model Fusion for Global Total Atmospheric Deposition. Geneva, Switzerland, 26-27 February 2019. Contributing author. This report is to make a research direction and provide the first measurement-model map of the atmospheric deposition for science, industrial and policy communities.  
[https://library.wmo.int/doc\\_num.php?explnum\\_id=10315](https://library.wmo.int/doc_num.php?explnum_id=10315)
  - National recognition: Highly active researcher: Google Scholar H-Index 54 (in 2023). Web of Science H-Index 44.
  - Google Scholar: <https://scholar.google.com/citations?user=V1OYFOOAAAAJ&hl=en>  
Scopus: <https://www.scopus.com/authid/detail.uri?authorId=57209473462>

## Dr. Adrian Gonzalez

1. Name: Adrian M. Gonzalez, Ph.D.
2. Education:
  - Ph.D., University of Tennessee, Knoxville, Civil Engineering, 2018
  - M.S., Manhattan College, Riverdale, N.Y., Environmental Science & Engineering, 1992
  - B.A., Pomona College, Claremont, CA, Chemistry, 1987
3. Academic Experience:
  - University of Tennessee, Knoxville, Instructor, 2020-present
  - University of Tennessee, Knoxville, Research Associate Laboratory Manager, 2018-present
  - University of Tennessee, Knoxville, Ph.D. candidate, 2013-2018, full time
  - Manhattan College, Post-Masters Research Associate, 1990-1993, full time
4. Non-academic experience:
  - Environmental Scientist / Research Fellow, U.S. Food and Drug Administration, 2012-2013
  - Environmental Scientist / Project Associate, Black & Veatch Special Projects Corp., 2003-2011
  - Environmental Scientist / Project Associate, Jacobs Engineering, 2001-2003
  - Environmental Scientist / Project Associate, IT Corporation (, 2003-2011
  - Environmental Scientist / Project Associate, Black & Veatch Special Projects Corp., 2003-2011
  - Formulations analysis chemist, American Cyanamid Company, 1987-1990
5. Certifications or professional registrations:
  - Engineer-in-Training (EIT) license, January 2009 (State of Georgia, license no. EIT023710)
  - Professional Certification in Watershed Management, Michigan State University; December 2004
  - EPA Watershed Academy Certification, U.S. Environmental Protection Agency; May 2004
  - Qualified Environmental Professional (QEP) Certification, July 2001 (#07010021)
6. Current membership in professional organizations:
  - National Environmental Laboratory Accreditation Program (TNI), 2018-current
  - Society of Environmental Toxicology and Chemistry (SETAC), 1991-current
  - MENSA - North America Mensa, 2015-current
7. Honors and awards:
  - Civil and Environmental Engineering (CEE) department service award, 2022

8. Service activities:

- Science fair judge and organizer, spanning elementary age through college age, 2005-current

9. Principal publications of the last five years – N/A

10. Professional development in the last five years:

- Technical Expert, associate member of the Chemistry Expert Committee, TNI, 2020-current
- National Environmental Measurement Conference (NEMC) presenter: 2018 (New Orleans, LA); 2019 (Jacksonville, FL); 2020 (Virtual Conference); 2021 (Virtual Conference)
- Invited panelist, TNI technical expert, Field Sampling and Measurement Conclave, 2023
- Journal article reviewer, Science of the Total Environment, 2020-current

## Dr. Haochen Li

1. Name: Dr. Haochen Li

2. Education

- Ph.D., Environmental Engineering, University of Florida, Gainesville, FL, 2019
- M.S., Mechanical Engineering, University of Florida, Gainesville, FL, 2019
- M.S., Civil Engineering, University of Florida, Gainesville, FL, 2015
- B.S., Coastal Engineering, Hohai University, Nanjing, China, 2013

3. Academic experience

- University of Tennessee, Assistant Professor, 2022- Present, Full time
- University of Florida, Affiliated Assistant Professor, 2022- Present, Full time
- University of Florida, Lecturer, January 2018- May 2018, Full time
- University of Florida, Research Assistant, 2015-2019, Full time
- University of Florida, Teaching Assistant, 2015-2019, Full time

4. Non-academic experience

- Internship, St. Johns River Water Management District, January 2015- May 2015, Part time

6. Current membership in professional organizations

- American Society of Civil Engineers – Member
- American Geophysical Union – Member
- Transportation Research Board (TRB) – Member

7. Honors and awards

- Rudolph Hering Medal, ASCE, 2023
- Editor Choice, Journal of Environmental Engineering ASCE, 2021
- Editor Choice, Journal of Environmental Engineering ASCE, 2020
- Graduate School Fellowship, University of Florida, 2015
- Academic Achievement Award, University of Florida, 2013

8. Service activities (within and outside of the institution)

- Member, ASCE/EWRI Computational Fluid Dynamics Committee, 2019 - Present
- Reviewer for Water Research, International Journal of Multiphase Flow, Powder Technology, Journal of Environmental Engineering, Environmental Science and Pollution Research, and npj Clean Water, and Micromachines.

9. Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Li, H., & Sansalone, J. (2022). Implementing machine learning to optimize the cost-benefit of urban water clarifier geometrics. *Water Research*, 220, 118685. <https://doi.org/10.1016/J.WATRES.2022.118685>
- Li, H., & Sansalone, J. (2022). A CFD-ML augmented alternative to residence time for clarification basin scaling and design. *Water Research*, 209, 117965. <https://doi.org/10.1016/J.WATRES.2021.117965>
- Li, H., & Sansalone, J. (2022). Interrogating common clarification models for unit operation systems with dynamic similitude. *Water Research*, 215, 118265.

<https://doi.org/10.1016/J.WATRES.2022.118265>

- Li, H., & Sansalone, J. (2022). InterAdsFoam: An Open-Source CFD Model for Granular Media-Adsorption Systems with Dynamic Reaction Zones Subject to Uncontrolled Urban Water Fluxes. *Journal of Environmental Engineering*, 148(9), 04022049. [https://doi.org/10.1061/\(ASCE\)EE.1943-7870.0002027](https://doi.org/10.1061/(ASCE)EE.1943-7870.0002027)
- Li, H., Balachandar, S., & Sansalone, J. (2021). Discordance of Tracer Transport and Particulate Matter Fate in a Baffled Clarification System. *Journal of Fluids Engineering*, 143(5), 051202. <https://doi.org/10.1115/1.4049690>
- Li, H., Balachandar, S., & Sansalone, J. (2021). Large-eddy simulation of flow turbulence in clarification systems. *Acta Mechanica*, 232(4), 1389–1412. <https://doi.org/10.1007/s00707-020-02914-1>

10. Briefly list the most recent professional development activities

- Applications of AI in Engineering, University of Florida, 2022
- Accelerated Data Science with RAPIDS, Nvidia Deep Learning Institute, 2021
- Fundamentals of Accelerated Computing with CUDA Python, Nvidia Workshop, 2021
- The #1 AI conference for innovators, technologists, and creatives, Nvidia GTC, 2021
- Fundamentals of Deep Learning for Computer Vision, Nvidia Deep Learning Institute, 2020

## Dr. Jon Hathaway

1. Name: Dr. Jon Hathaway

2. Education

- Ph.D., Bio. and Ag. Engineering, North Carolina State University, 2010
- M.S., Bio. and Ag. Engineering, North Carolina State University, 2005
- B.S., Environmental Engineering, North Carolina State University, 2002

3. Academic experience

- University of Tennessee, Knoxville, Associate Professor, 2019-present
- University of Tennessee, Knoxville, Assistant Professor, 2013-2019

4. Non-academic experience

- Biohabitats Inc., Water Resources Engineer, 2001-2013

5. Certifications or professional registrations

- Professional Engineer, North Carolina

6. Current membership in professional organizations

- ASCE, Member, 2013-present

7. Honors and awards

- Research Recognition Award - Department of Civil and Environmental Engineering - University of Tennessee (2022)
- Best Paper Award - Omega (2021)
- Best Case Study Award - ASCE Journal of Sustainable Water in the Built Environment (2020)
- Outstanding Faculty Award - Phi Eta Sigma National Honor Society - University of Tennessee Chapter (2019)
- Faculty Environmental Leadership Award - Office of Sustainability and Committee on the Campus Environment - University of Tennessee (2019)

8. Service activities (within and outside of the institution)

- Associate Editor, *Journal of Environmental Engineering*
- Secretary, ASCE-EWRI Urban Water Resources Research Council
- Treasurer, IWA-IAHR Joint Committee on Urban Drainage
- Faculty Senate, University of Tennessee
- Stormwater Advisory Council, University of Tennessee
- External Advisory Board, Dept. of Bio. and Ag. Engineering, North Carolina State University

9. Briefly list the most important publications and presentations from the past five years - title, co-authors if any, where published and/or presented, date of publication or presentation

- Weathers, M.W., J.M. Hathaway, R.A. Tirpak, and A. Khojandi. (2023). "Evaluating the Impact of Climate Change on Future Bioretention Performance Across the Contiguous United States." *Journal of Hydrology*. DOI: 10.1016/j.jhydrol.2022.128771
- Howard, M.H., J.M. Hathaway, R.A. Tirpak, W.A. Lisenbee, S.Sims. (2022). "Quantifying urban tree canopy interception in the southeastern United States." *Urban Forestry and Urban Greening*. DOI: 10.1016/j.ufug.2022.127741



- Lisenbee, W.A., J.M. Hathaway, M.J. Burns, T.D. Fletcher. (2021) “Modeling bioretention stormwater systems: current models and future research needs.” *Environmental Modeling and Software*. 144: 105146.
- Barah, M., A. Khojandi, X. Li., J.M. Hathaway, and O. Omitaomu. (2020). “Optimizing green infrastructure placement under precipitation uncertainty.” *Omega*. doi:10.1016/j.omega.2020.102196
- Lisenbee, W.A., J.M. Hathaway, M. Youssef, L. Negm, and R.J. Winston. (2020). “Enhanced Bioretention Cell Modeling with DRAINMOD-Urban: Moving from Water Balances to Hydrograph Production.” *Journal of Hydrology*. 582: 124491

10. Briefly list the most recent professional development activities

- Regularly review articles in a variety of professional journals and conferences.
- Regularly attend and moderate sessions at professional conferences.

## Dr. Terry Hazen

1. Name: Dr. Terry C. Hazen
2. Education
  - Ph.D., Microbial Ecology, Wake Forest University, 1978
  - M.S., Interdepartmental Biology, Michigan State University, 1974
  - B.S. with Honor, Interdepartmental Biology, Michigan State University, 1973
3. Academic experience
  - University of Tennessee, Governor's Chair Professor, 2011-present
  - University of Tennessee, Knoxville, Methane Center, Director, 2018-present
  - University of Tennessee, Knoxville, Institute for a Secure and Sustainable Environment, Director, 2015-2018
  - Professor, University of Puerto Rico, Río Piedras, Puerto Rico, 1985-8.
  - Associate Professor, University of Puerto Rico, Río Piedras, Puerto Rico, 1982-5.
  - Assistant Professor, University of Puerto Rico, Río Piedras 1979-82.
  - Graduate Student Advisor 1982-4.
  - Interim Chairman of the Department of Biology 1984-5.
  - Research Associate, Wake Forest University, Winston-Salem, North Carolina, 1978-9.
  - Teaching Assistant, Wake Forest University, Winston-Salem, North Carolina, 1975-8
  - Research Technician, Savannah River Ecology Laboratory, Aiken, SC, 1974-5
4. Non-academic experience
  - Faculty Fellow, Oak Ridge National Laboratory, Biosciences Division, 2011-present
  - Pacific Northwest National Laboratory's Promotion Advisory Committee, 2012-present
  - Senior Scientist, Earth Sciences Division, Lawrence Berkeley National Laboratory, University of California, 2003-2011.
  - Program Director, Deepwater Horizon Oil Spill Systems Biology, Energy Biosciences Institute, UCB-BP-LBNL-UIUC. 2010-2011.
  - Program Director, Microbial Enhanced Hydrocarbon Recovery, Energy Biosciences Institute, UCB-BP-LBNL-UIUC. 2009-2011.
  - Director, Microbial Communities Division, Joint BioEnergy Institute, Lawrence Berkeley National Laboratory. 2007-2011
  - Co-Director, Virtual Institute for Microbial Stress and Survival, Lawrence Berkeley National Laboratory. 2002-2011.
  - Head, Center for Environmental Biotechnology, Lawrence Berkeley National Laboratory, University of California, 1999-2011.
  - Head, Ecology Department (Microbial Ecology & Environmental Engineering Department), Lawrence Berkeley National Laboratory, Univ of California, 1998-2011
  - Lead, Environmental Remediation Technology Program, Lawrence Berkeley National Laboratory, University of California, 1998-2003.
  - Director, Bioremediation Education Science and Technology (BEST) Program, 1999-2001.

- Member Scientific Advisory Committee Oklahoma EPSCOR in Bioenergy, 2009-2013.
  - Chair, Institutional Biosafety Committee, Lawrence Berkeley National Laboratory, 2009-2011.
  - Member Lead-Lab Council, Subsurface Contaminant Focus Area, USDOE Environmental Management, 1999-2002.
  - Chairman, Field Research Review Panel, USDOE Natural and Accelerated Bioremediation Program, 1999-2007.
  - Member, USDOE EM Strategic Laboratory Council, 1998-2003.
  - Member, California Environmental Business Council, 1998-2000.
  - Environmental Remediation Technology Department, Head, Lawrence Berkeley National Laboratory, University of California, 1998-1998.
  - Staff Scientist, Earth Sciences Division, Lawrence Berkeley National Laboratory, University of California, 1998-2003.
  - Environmental Biotechnology Section Manager, Savannah River Technology Center, Westinghouse Savannah River Company, 1996-1998.
  - Biotechnology Group Manager, Savannah River Technology Center, Westinghouse Savannah River Company, 1995-1996.
  - Biotechnology Group Leader, Westinghouse Savannah River Company, Savannah River Technology Center, 1993-1995.
  - Member USDOE Biotechnology Interlaboratory Council, 1994-1998, 1999-2005
  - Fellow Scientist, Westinghouse Savannah River Company, Savannah River Technology Center, 1993-1998.
  - Principal Scientist, Westinghouse Savannah River Company, Savannah River Laboratory, 1989-1993.
  - Scientist, E. I. DuPont de Nemours, and Company, Savannah River Laboratory, 1987-1989.
  - Chairman, USDOE Ad-Hoc Panel on Bioremediation, In Situ Integrated Program, Office of Technology Development, 1989-1994.
5. Certifications or professional registrations (none)
6. Current membership in professional organizations
- Sigma Xi, UTK/ORNL president
  - American Association for the Advancement of Science, Fellow 2013
  - American Academy of Microbiology, Fellow 1991
  - American Society for Microbiology
  - American Chemical Society
  - American Society of Engineering Educators
  - Association of Environmental Engineering and Science Professors
7. Honors and awards
- Civil & Environmental Engineering, Tickle College of Engineering, The University Tennessee, 2% highest citation rate in the world 2023.
  - Tickle College of Engineering 2021 Special Service Award.
  - **American Society for Microbiology 2021 ASM Award for Environmental Research.**

- 2018 Highly Cited Author, Web of Science November 28, 2018.
  - The University of Tennessee, Service Excellence and Leadership Award, Laboratory Safety Visionary 2016
  - Environmental Science & Technology 2011 Best Paper Award. May 8, 2012
  - Biology Faculty of 1000 2008-2011
  - DOE BER Distinguished Scientist Award 2005-2010
  - R&D 100 Award 1996.
  - Federal Laboratory Consortium Award for Excellence in Technology Transfer for 1996.
  - R&D 100 Award 1995.
  - First Prize 1983 Science Writing Award Puerto Rico Institute of Culture.
8. Service activities (within and outside of the institution)
- Chair, University of Tennessee Laboratory Safety Committee, 2014-present.
  - Member Advisory Board “Program for Excellence and Equity in Research” (PEER) NIH-IMSD program 2014-2015, Member CEE Head Search Committee 2014-2015, Member CEE Goodrich Chair Search Committee 2011-2013, Member CEE Water Resources Search Committee 2012-2013. Member EPS Isotope Geochemist Search Committee 2012-2013. Member College of Engineering Awards Committee 2013, 2014, 2016, Search Committee Associate Vice Chancellor for Research and Development UT, 2017, Beckman Scholars Program application Committee UT, 2017, Member Provost Search Committee 2017-2018, Member Search Committee Vice Chancellor for Research 2018-2019.
9. Most important publications in the last 5 years.
- **Hazen T. C.** 2020. Lessons from the 2010 *Deepwater Horizon* Accident in the Gulf of Mexico. In: Wilkes H. (eds) *Hydrocarbons, Oils and Lipids: Diversity, Origin, Chemistry and Fate*. Handbook of Hydrocarbon and Lipid Microbiology. Springer, Cham. [https://doi.org/10.1007/978-3-319-90569-3\\_31](https://doi.org/10.1007/978-3-319-90569-3_31).
  - **Hazen, T. C.** 2018. In Situ: Groundwater Bioremediation. Handbook of Hydrocarbon and Lipid Microbiology Series. Consequences of Microbial Interaction with Hydrocarbons, Oils, and Lipids: Biodegradation and Bioremediation. Springer, Cham. 1-18. [https://doi.org/10.1007/978-3-319-44535-9\\_11](https://doi.org/10.1007/978-3-319-44535-9_11)

## Dr. Qiang He

### Name

Qiang He, Professor of Environmental Engineering

### Education

- Ph.D., Environmental Engineering, University of Illinois, 2000-2003
- M.S., Biological and Agricultural Engineering, Kansas State University, 1998-2000
- B.S., Biochemical Engineering, East China University of Science and Technology, Shanghai, China, 1989-1993

### Academic Experience

- University of Tennessee, Professor, 2019- present, Full time
- University of Tennessee, Associate Professor, 2013- 2019, Full time
- University of Tennessee, Assistant Professor, 2007-2013, Full time
- Temple University, Philadelphia, PA, Assistant Professor, 2005-2007, Full time
- Oak Ridge National Laboratory, Research Fellow, 2003-2005, Full time

### Non-academic Experience

- None

### Certifications of Professional Registrations

- None

### Current Membership in Professional Organizations

- American Society for Microbiology (23 years) – Member
- Association of Environmental Engineering and Science Professors (18 years) – Member

### Honors and Awards

- Chancellor's Award—Success in Multidisciplinary Research for “Healthy Environment”, 2021
- Scholar Recognition Award, Dept. of Civil and Environmental Engineering, 2021
- Best Paper Award, Journal of “*Building and Environment*”, for the article titled “Segmenting areas of potential contamination for adaptive robotic disinfection in built environments”, 2020
- Teaching Fellow Award, College of Engineering, 2017
- Teaching Recognition Award, Dept. of Civil and Environmental Engineering, 2013
- Scholar Recognition Award, Dept. of Civil and Environmental Engineering, 2011

### Service Activities

- State of Tennessee Nutrient Strategy Task Force, member, 2019-present
- Town of Farragut Stormwater Management Advisory committee, member, 2008-

2009/2021-present

- Association of Environmental Engineering and Science Professors (AEESP)—Environmental Engineering Program Leaders (EEPL) committee, 2022-present
- The Overseas Chinese Society for Microbiology—Board of Directors, 2018-present
- University of Tennessee High Hazard Chemical Committee, 2022-present
- University of Tennessee Faculty Senate, 2015-2022
- University of Tennessee Institutional Compliance Committee, member, 2021-2022
- University of Tennessee Faculty Senate Tickle College of Engineering Caucus Chair, 2020-2022
- University of Tennessee Faculty Senate Research Council Chair, 2017-2018
- University of Tennessee Faculty Senate Executive Committee, 2017-2018
- University of Tennessee Tickle College of Engineering Tenure and Promotion Committee, 2020-present
- Associate Editor, BMC Microbiology, 2014-Present

#### **Principal Publications of the Last Five Years**

- Chen, S.; Wang, Y.; Cheng, H.; Hazen, T.C.; He, C.; **He, Q.** 2022. Identification of propionate-degrading microbial populations in methanogenic processes for waste treatment: *Methanosaeta* and *Methanoculleus*. *Environ. Eng. Sci.* 39(3): 202-211.
- Swanson, C.S.; Dhand, R.; Cao, L.; Ferris, J.; Elder, C.S.; **He, Q.** 2022. Microbiome-based source identification of microbial contamination in nebulizers used by inpatients. *J. Hosp. Infect.* 122: 157-161.
- Cao, L.; Cox, C.D.; **He, Q.** 2021. Patterns of syntrophic interactions in methanogenic conversion of propionate. *Appl. Microbiol. Biotechnol.* 105(23): 8937-8949.
- Cao, L.; Yang, L.; Swanson, C.S.; Li, S.; **He, Q.** 2021. Comparative analysis of impact of human occupancy on indoor microbiomes. *Front. Environ. Sci. Eng.* 15(5): 89.
- Li, S.; Yang, Z.; Hu, D.; Cao, L.; **He, Q.** 2021. Understanding building-occupant-microbiome interactions toward healthy built environments: a review. *Front. Environ. Sci. Eng.* 15(4): 65.
- Li, S.; Xu, Y.; Cai, J.; Hu, D.; **He, Q.** 2021. Integrated environment-occupant-pathogen information modeling to assess and communicate room-level outbreak risks of infectious diseases. *Build. Environ.* 187: 107394.
- Hu, D.; Zhong, H.; Li, S.; Tan, J.; **He, Q.** 2020. Segmenting areas of potential contamination for adaptive robotic disinfection in built environments. *Build. Environ.* 184: 107226.
- Wang, Y.; Nie, Q.; Huang, B.; Cheng, H.; Wang, L.; **He, Q.** 2020. Removal of ciprofloxacin as an emerging pollutant: A novel application for bauxite residue reuse. *J. Clean. Prod.* 253: 120049.
- Yang, T.; Wang, Y.; Sheng, L.; He, C.; Sun, W.; **He, Q.** 2020. Enhancing Cd(II) sorption by red mud with heat treatment: Performance and mechanisms of sorption. *J. Environ. Manage.* 255: 109866.

#### **Professional Development in the Last Five Years**

Attended multiple conferences and workshops on a yearly basis.

## Dr. Anna Herring

1. Name: Dr. Anna Herring
2. Education
  - Ph.D., Environmental Engineering, Oregon State University, 2015
  - M.S., Environmental Engineering, Oregon State University, 2013
  - B.S., Environmental Engineering, University of Colorado, 2010
3. Academic experience
  - University of Tennessee, Knoxville, Assistant Professor, 2022-present
  - Australian National University, Visitor, 2021-2022
  - Australian National University, Discovery Early Career Research Fellow, 2018-2021
  - Australian National University, Postdoctoral Research Associate, 2015-2018
4. Non-academic experience
  - Geomega Environmental Consulting, Technical Intern, 2007-2010
5. Certifications or professional registrations
  - NCEES Engineer in Training, 2010
6. Current membership in professional organizations
  - ASEE, Member, 2022-present
  - International Society of Porous Media, 2014-present
7. Honors and awards
  - Editors' Citation for Excellence in Refereeing for Water Resources Research, 2021
8. Service activities (within and outside of the institution)
  - Committee Member, InterPore Diversity, Equity, and Inclusion Committee, 2022-present
  - Referee for Australian Research Council
  - PhD Committee Member, ANU
  - Local Organizing Committee for the International Conference on Tomography of Materials & Structures 2019; Cairns, Australia; 22-26 July 2019
  - Local Organizing Committee for the Elizabeth and Frederick White Conference 2018: Frontiers in Gas-Solid Processes from the Atomic Scale to the Parsec; Canberra, ACT, Australia; 5 - 7 Sept 2018
9. Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation
  - R. Huang, A.L. Herring, A. Sheppard, "Investigation of supercritical CO<sub>2</sub> mass transfer in porous media using X-ray micro-computed tomography", *Adv. Water Resour.*, vol. 171, 2023.
  - A.L. Herring, C. Sun, R. T. Armstrong, Z. Li, J. E. McClure, M. Saadatfar. "Evolution of Bentheimer Sandstone Wettability During Cyclic scCO<sub>2</sub>-Brine Injections", *Water Resources Research*, vol. 57, no. 11, 2021.
  - A.L. Herring, P.L. King, M. Saadatfar, F. Mahdini, A.M. Kemis Yahyah, E. Andò. "3D microstructure controls on mineral carbonation", *J. CO<sub>2</sub> Utilization*, vol. 47, 2021.
  - C. Sun, J.E. McClure, P. Mostaghimi, A.L. Herring, D.E. Meisenheimer, D. Wildenschild, S. Berg, R.T. Armstrong. "Characterization of wetting using topological principles", *J. Colloid*

*Interface Sci.*, vol. 578, pp. 106-115, 2020.

- A.L. Herring, V. Robins, and A.P. Sheppard. “Topological Persistence for Relating Microstructure and Capillary Fluid Trapping in Sandstones”, *Water Resources Research*, vol. 55, no. 1, pp. 555-573, 2019.

10. Briefly list the most recent professional development activities

- Regularly review articles in > 15 peer-reviewed journals.
- Regularly attend and chair sessions at professional conferences.
- Minisymposium organizer: InterPore 2023 MS01 Porous Media for a Green World: Energy & Climate
- Guest Associate Editor for *Frontiers in Water: Water and Critical Zone*, Special Topic “Pore-scale Microstructure, Mechanisms, and Models for Subsurface Flow and Transport”



## Dr. Frank Loeffler

### Professional Preparation

- University of Hohenheim, Germany Biology, Agricultural Sciences B.S., 1986
- University of Hohenheim, Germany Microbiology, Biochemistry M.S., 1990
- Technical Univ. Harburg/Hohenheim Technical Biochemistry/Microbiology Ph.D., 1994  
Michigan State University, Microbial Ecology, Postdoc, 1994-1999

### Appointments

- Adjunct Professor, Department of Biosystems Engineering and Soil Science since 2/2017
- Director, Center for Environmental Biotechnology, University of Tennessee since 7/2016
- Governor's Chair Professor, University of Tennessee & Oak Ridge National Lab since 5/2010
- Carlton Wilder Professor, CEE, Georgia Tech, 2/2010-4/2010
- Carlton Wilder Assoc. Prof., CEE, Georgia Tech, joint appt. School of Biology, 9/2006-1/2010
- Associate Professor, CEE, Georgia Tech, 4/2004-8/2006
- Assistant Professor, CEE, Georgia Tech, 4/1999-3/2004

### Select Publications (*of ~200 peer-reviewed publications*)

1. Zhang, L., Y. Yin, Y. Sun, X. Liang, D.E. Graham, E.M. Pierce, **F.E. Löffler**, and B. Gu. 2023. Inhibition of methylmercury and methane formation by nitrous oxide in Arctic tundra soil microcosms. *Environ. Sci. Technol.* 57:5655-5665.
2. Zhuang, J., **F.E. Löffler**, and G.S. Saylor. 2022. Creating a research enterprise framework for global transdisciplinary networking to address at food-energy-water nexus. *Engineering.* 11:95-100.
3. Murdoch, R.W., G. Chen, F. Kara Murdoch, E.E. Mack, M.I. Villalobos Solis, R.L. Hettich, and **F.E. Löffler**. 2021. Identification and widespread environmental distribution of a gene cassette implicated in anaerobic dichloromethane degradation. *Glob. Change Biol.* 28: 2396-2412.
4. Karthikeyan, S., L.H. Orellana, E.R. Johnston, J.K. Hatt, **F.E. Löffler**, H. Ayala-del-Rio, G. Gonzalez, and K.T. Konstantinidis. 2021. Metagenomic characterization of soil microbial communities in the Luquillo experimental forest (Puerto Rico) and implications for nitrogen cycling. *Appl. Environ. Microbiol.* 87:e00546-21.
5. Shan, J., R.A. Sanford, J. Chee-Sanford, S. Khan Ooi, **F.E. Löffler**, K.T. Konstantinidis, W.H. Yang. 2021. Beyond denitrification: the role of microbial diversity in controlling nitrous oxide reduction and soil nitrous oxide emissions. *Glob. Change Biol.* 00:1-15.
6. Sanford, R.A., K.G. Lloyd, K.T. Konstantinidis, and **F.E. Löffler**. 2021. Microbial taxonomy run amok. *Trends Microbiol.* 29:394-404.

7. Zhuang, J., H. Sun, G. Saylor, G. Yu, B. Fu, M. Jin, V.H. Dale, K.L. Kline, and **F.E. Löffler**. 2021. Food-Energy-Water crises in the United States and China: Commonalities and asynchronous experiences support integration of global efforts. *Environ. Sci. Technol.* 55:1446-1455.
8. Murray, A.E., et al., 2020. Roadmap for naming uncultivated Archaea and Bacteria. *Nat Microbiol.* 5:987-994.
9. Karthikeyan, S., L.H. Orellana, E.R. Johnston, J.K. Hatt, **F.E. Löffler**, H. Ayala-del-Rio, G. Gonzalez, and K.T. Konstantinidis. 2020. Metagenomic characterization of soil microbial communities in the Luquillo experimental forest (Puerto Rico) and implications for nitrogen cycling. *Appl. Environ. Microbiol.* 87:e00546-21.
10. Kaya, D., B.V. Kjellerup, K. Chourey, R.L. Hettich, D.M. Taggart, **F.E. Löffler**. 2019. Impact of fixed nitrogen availability on *Dehalococcoides mccartyi* reductive dechlorination activity. *Environ. Sci. Technol.* 53:14548-14558.

### Select Professional Awards

- 2021 Tickle College of Engineering, University of Tennessee, Knoxville, Special Service Award
- 2016 Fellowship, American Academy of Microbiology
- 2015 ESTCP, Project-of-the-Year Award for Environmental Restoration (as Co-PI)
- 2015 American Society for Microbiology Divisions N, Q, R Lecturer
- 2009 Shimizu Visiting Professorship, Environmental Science & Eng. Program, Stanford University
- 2008 ITRC Bioremediation of DNAPL Team of the Year Award
- 2004 SERDP, Cleanup Project of the Year Award
- 2001 National Science Foundation CAREER Award

### Scientific, Technical & Management Performance

Dr. Löffler conducts project management and research coordination, as well as performance planning and evaluation for a group of ~15 postdoctoral associates, visiting faculty, graduate students, technicians, and administrative assistants. He directs microbiological-chemical laboratories at UT and at ORNL, implements laboratory safety procedures, and provides ethical conduct training. Dr. Löffler has served/serves as principal investigator on NSF, DOE, DOD, EPA, NIH and industry grants and contracts. He has an established track record for assembling and leading successful transdisciplinary research teams. Dr. Löffler maintains a high standard of scholarly achievements with innovative, cutting edge contributions to science and engineering. Since 1994, he has collaborated with more than 150 scientists and engineers. He publishes in priority journals, authored more than 200 peer-reviewed publications, has a Google Scholar h-index of 67, and his work receives about 1,500 citation per year. Dr. Löffler has supervised 21 postdoctoral fellows (2 current), graduated 16 graduate students (5 current), and mentored 58 undergraduate students (4 current) since 2000 (67% female, 29% underrepresented minorities). All graduates pursue successful professional careers in academia, government, or industry.

## Dr. Sarah Mobley, P.E. (AK)

1. Name: Dr. Sarah Mobley, P.E. (AK)
2. Education
  - Ph.D., Structural Engineering, University of South Florida, Tampa. August 2019
  - M.S., Geotechnical Engineering, University of South Florida, Tampa. April 2017
  - B.S., Civil Engineering - University of Alaska, Anchorage. May 2010
3. Academic experience
  - University of Tennessee, Knoxville, Lecturer, 2019-present
  - University of South Florida, Instructor (part time), 2017-2019
4. Non-academic experience
  - Project Engineer, Department of Natural Resources, Division of State Parks, Design and Construction Section, Anchorage, AK (2005-2015)
5. Certificates or Professional Registration
  - Registered Professional Engineer, State of Alaska #AELC14416 (2014-present)
6. Current membership in professional organizations
  - American Society for Engineering Education, Member
  - American Society of Civil Engineers, Member
  - Deep Foundation Institute, Member
  - Society of Women Engineers -Member
7. Honors and awards
  - 2022 UTK Dept. of Civil and Environmental Engineering Extraordinary Service Award
  - 2021 UTK Dept. of Civil and Environmental Engineering Excellence in Teaching Award
  - Association of Drilled Shaft Contractors, 2018 Women's Association Teri Dress Scholarship Winner
8. Service activities (within and outside of the institution)
  - Laboratory Safety Advocate (2020-present)
  - UTK Faculty Senate (2021-present)
  - Society of Women Engineers Faculty Advisor (2022-present)
10. Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation
  - DFI/EFFC Joint committee on Support Fluid Regulation (2022) Royal Society- London, UK
  - Mullins, A. G., Mobley, S. J. and Costello, K. M. (2022) "Method to Instantaneously Determine Concrete Strength while Coring or Drilling," US Patent No. 11,268,88 B1.
  - Retherford, J., **Mobley, S.**, & Wyckoff, K. (2020), *Improved Metric for Identifying Female Faculty Representation in Engineering Departments* Paper presented at 2020 ASEE Virtual Annual Conference Content Access, Virtual On line . 10.18260/1-2–34788
  - **Mobley, S.**, Costello, K., & Mullins, G. (2018) *The effect of slurry type on drilled shaft cover quality*, DFI Journal - The Journal of the Deep Foundations Institute, 11:2-3, 91-100, DOI: [10.1080/19375247.2018.1468522](https://doi.org/10.1080/19375247.2018.1468522)

10. Briefly list the most recent professional development activities

- Regularly review articles in a variety of professional journals and competitions

## Dr. Jennifer Q. Retherford

1. Name: Jennifer Retherford
2. Education
  - Ph.D., Civil Engineering, Vanderbilt University, 2012
  - M.S., Civil Engineering, Vanderbilt University, 2007
  - B.S., Civil Engineering, University of Nebraska Omaha, 2003
3. Academic Experience
  - University of Tennessee, Knoxville, Distinguished Lecturer, 2012-present
4. Non-Academic Experience
  - AMEC Earth & Environmental, Design Engineer, responsible for geo-structural design and analysis, 2009-2012.
  - Stanley D. Lindsey, Design Engineer, responsible for structural analysis and design for commercial buildings; 2005-2009
5. Professional Registration
  - P.E. license (TN-112035) 2008
  - Structural I Exam (TN) 2008
  - LEED Accredited Professional; certified 2004; Credentialed BD+C 2011-13; current status: Legacy Professional
6. Current Professional Organization Membership
  - American Society of Civil Engineers (ASCE), Member
  - American Society for Engineering Education (ASEE), Member
  - American Institute of Steel Construction (AISC), Member
  - Water Environmental Federation (WEF), Member
7. Honors and Awards
  - Outstanding Outreach and Engagement. Tickle College of Engineering, 2020.
  - Tennessean “People of the Year”, Dec. 2019
  - Nominee for University of Tennessee President’s “Connect” Award (earned Citation of Merit), Dec. 2019
8. Service Activities
  - ASCE Committee on Student Conferences and Competitions, Member, 2019-2021, Corresponding Member 2021 - present
  - ASCE Committee on Scholarships, Member, 2019-2022
  - ASEE Civil Engineering Division, serving Division Leadership since 2019
  - ASCE Knoxville, Past President in 2022
  - ASCE ExCEEEd Teaching Workshop, Several Roles since 2014
9. Publications (\*: Presenter)
  - Retherford, Jennifer Q.\*, Sarah Mobley, Brad McCoy, Aaron Hill. Student Perceptions of Project-Based Learning as Applicable to the Formation of Trusted Professionals. ASEE Annual Conference. 2022
  - Retherford, Jennifer Q.\*, Sarah Mobley, and Kristen Wyckoff. Lessons Learned in a Mixed-Mode Teaching Experience. ASEE Annual Conference. 2021.

- Retherford, J.Q.\*, Beth Hartmann, Rania Hammoud, and George Hunt. Civil Engineering Capstone Inventory: Standards of Practice & The ASCE Body of Knowledge. ASEE Annual Conference. 2020.
- Retherford, J.Q.\*, Sarah Mobley, and Kristen Wyckoff. Improved Metric for Identifying Female Faculty Representation in Engineering Departments. ASEE Annual Conference. 2020.
- McCord, Rachel\*, David Keffer, Chris Wetteland, Travis Griffin, and J. Q. Retherford. NSF S-STEM: Transfer Success Co-Design for Engineering Disciplines (TranSCEnD). NSF Program Division, Poster Session. ASEE Annual Conference. 2019.

#### Invited Presentations

- Jennifer Retherford, Cameron Bushnell, Rachelle Beckner. Lessons Learned: How to Sustain Communication Instruction in Engineering Courses. NSF RED Consortium Meeting, September 2022.
- Liberating Structures: Workshop for Invoking Change in RMWEA. Rocky Mountain WEA Summer Planning Meeting, Colorado, July 2022.
- Invited Panelists: Jenny Retherford, Elizabeth Meier, Sarah Brownell. Finding and Maintaining Remote Client Partnerships. Capstone Conference, June 2022.
- Invited Panelists: Cassie Bowman, Jenny Retherford, Shraddha Sangelkar. Community Engagement and Service. Capstone Conference, June 2022.
- Liberating Structures: Concepts & Applications for WEF MA Leaders. WEFMAX: WEF Member Association Exchange, Hawaii, April 2022.
- Kennicutt, Alison, Vicki May, Jenny Retherford, and Kelly Salyards. ASCE ExCEEEd Community Exchange: Projects, Labs, and Experiential Learning in an Online Environment, August 2020.
- Henschen, Jacob, Alison Kennicutt, Tara Kulkami, and Jenny Retherford. ASCE ExCEEEd Community Exchange: Debrief the Semester: Lessons learned from the term, November 2020.

#### 10. Professional Development

- Annual attendance at ASEE
- Active member of ASCE Knoxville, attend monthly branch meetings frequently, participate in leadership meetings.

## Dr. John Schwartz

1. Name: Dr. John Schwartz

2. Education

- Ph.D., Environmental Engineering, University of Illinois -Urbana/Champaign, 2002
- M.S., Fisheries Science, Oregon State University, 1991
- B.S., Civil Engineering, University of Missouri – Columbia, 1982

3. Academic experience

- University of Tennessee, Knoxville, Professor and Director of the Tennessee Water Resources Research Center, 2019-present.
- University of Tennessee, Knoxville, Professor and Associate Department Head for Undergraduate Studies, 2015-2019.
- University of Tennessee, Knoxville, Associate Professor; 2009-2015.
- University of Tennessee, Knoxville, Assistant Professor; 2003-2009.
- University of Illinois at Urbana-Champaign, Post-Doctoral Researcher; 2002-2003.

4. Non-academic experience

- HGE, Inc.; Coos Bay, Oregon; Project Engineer/Manager, 1992-1998.
- Parametrix Inc.; Portland, Oregon; Environmental Engineer, 1991-1992.
- U.S. Environmental Protection Agency, Region VI Water Quality Division, NPDES Compliance; Dallas, Texas. Environmental Engineer, 1986-1987.
- U.S. Peace Corps; Kenya Ministry of Water Development, South Nyanza District Office; Homa Bay, Kenya. Project Engineer, 1983-1985.

5. Certifications or professional registrations

- Professional Engineer, Tennessee (# 114290); Oregon (# 16081).

6. Current membership in professional organizations

- American Society of Civil Engineers, Member, 1983-present.
- American Ecological Engineering Society, Member; 2005-present.
- American Geophysical Union, Member; 2002-present.

7. Honors and awards: Research

- University of Tennessee - Knoxville, Tickle College of Engineering *Research Achievement Awards* – 2015 and 2008.
- University of Tennessee – Knoxville, College of Engineering; *2012 Moses E. and Mayme Brooks Distinguished Professor Award*.
- University of Tennessee – Knoxville, College of Engineering; *2009 Charles E. Ferris Faculty Award*.
- University of Tennessee - Knoxville, Department of Civil and Environmental Engineering *Research Recognition Awards*. 2012, 2011, 2010, and 2007.
- ASCE Environmental & Water Resources Institute. *Outstanding Service Award*, May 2009.

Teaching

- April 2022: UT Dept. of Civil and Environmental Engineering *2022 Teaching Recognition Award*.
- April 2018: UT Dept. of Civil and Environmental Engineering *2018 Outstanding Teaching Award*.
- April 2013: UT Dept. of Civil and Environmental Engineering *2013 Outstanding Teaching Award*.

- April 2012: UT College of Engineering *2012 Moses E. and Mayme Brooks Distinguished Professor Award*. Distinguished record of teaching effectiveness and gains distinction in engineering practice.

- April 2006: UT Dept. of Civil and Environmental Engineering *2006 Teaching Recognition Award*.

8. Service activities (within and outside of the institution)

- Member, ASCE-EWRI River Restoration Committee; and the Urban Water Resources Research Council.
- Chair, ASCE-EWRI River Restoration Committee TC Stream Compensatory Mitigations Tool Reviews.
- Chair, ASCE-EWRI River Restoration Committee TC Stream Restoration Certification.
- Member, City of Knoxville; Environmental Appeals Board.
- Member, Search Committee for Water Center Director at Tennessee tech University.
- Director of the Tennessee Water Resources Research Center.
- Member; Organizer for the annual Tennessee Water Resources Symposium.

9. Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation

- Schwartz, J.S., A. Veeneman, M.A. Kulp, and J. Renfro. 2022. Throughfall deposition chemistry in the Great Smoky Mountains National Park: Landscape and seasonal effects. *Water, Air, and Soil Pollution* 233:107. DOI: 10.1007/S11270-022-05575-z.
- Lee, J., Y. Fan, M. Essington, S. Jagadamma, J. Zhuang, and J.S. Schwartz. 2022. Global significance of abiotic factors effect on nitrate removal in woodchip bioreactors. *Science of the Total Environment* 848: 157739. doi: 10.1016/j.scitotenv.2022.157739.
- Mahalder B., Schwartz, J.S., Palomino, A.M., & Zirkle, J. 2021. Scour hole development in natural cohesive bed sediment around cylinder-shaped piers subjected to varying sequential flow events. *Water* 13(22), 3289; doi:10.3390/w13223289.
- Mahalder, B. Schwartz J.S. Thompson-Wynn, T.M., Palomino, A.M and Zirkle, J. 2021. Comparison of erodibility parameters for cohesive streambank soils between an in-situ jet test device and laboratory conduit flume. *Journal of Hydraulic Engineering* doi: 10.1061/(ASCE)HY.1943-7900.0001938.
- Tullos D., Baker D., Curran J., Schwar M., and Schwartz J. 2020. Enhancing resilience of river restoration design in systems undergoing change. *Journal of Hydraulic Engineering* DOI: 10.1061/(ASCE)HY.1943-7900.0001853.
- Thompson, J., J.S. Schwartz, and J.M. Hathaway, and. 2020. Performance evaluation of a regenerative stormwater conveyance system: A case study in Knoxville, Tennessee. *ASCE Journal of Environmental Engineering*. 147(7) 05020004.

10. Briefly list the most recent professional development activities

- Regularly review articles in a variety of professional journals and conferences.
- Regularly attend and moderate sessions at professional conferences.



## Appendix F: Course Syllabi

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Syllabi from the following courses are found on the following pages. Each course is a required core course in the BS ENVE curriculum and taught by CEE faculty. In most cases, the syllabus is from the most recent offering of the course and may carry a CE prefix (instead of ENVE) or may carry a different course number. The changes to syllabi from existing courses are highlighted.

1. EF 305 Engineering Approaches to Sustainability.
2. ENVE 101 Introduction to Environmental and Water Resources Engineering Fundamentals (new course, so a skeleton syllabus is provided)
3. ENVE 200 Environmental Process Fundamentals (new course, so a skeleton syllabus is provided)
4. ENVE/CE 205 Professional Development I
5. ENVE/CE 305 Professional Development II
6. ENVE/CE 381 Environmental Engineering I
7. ENVE/CE 391 Water Resources Engineering I
8. ENVE 399 Senior Design I (this course will be patterned after CE 399S; a modified syllabus from CE 399S is provided)
9. ENVE 400 Senior Design II (this course will be patterned after CE 400; a modified syllabus from CE 400 is provided)
10. ENVE 410 Fate, Transport and Risk Assessment (new course, so a skeleton syllabus is provided)
11. ENVE 456/558 Solid and Hazardous Waste Management
12. ENVE 474/574 Air Pollution Engineering and Control
13. ENVE/CE 481 Environmental Engineering II
14. ENVE/CE 482 Environmental Engineering Lab
15. ENVE/CE 494 Water Resources Engineering II
16. ENVE/CE 496 Water Resources Lab
17. ENVE/CE 495 Hydrology

## EF 305: Engineering Approaches to Sustainability, Spring 2023 University of Tennessee, Knoxville

**Course Section:** 001

**Meeting:** MWF 01:50 PM – 02:40 PM, ZEC 263

**Course Credit Hours:** 3

### **Faculty Contact Information:**

lecturer: **Anna Herring, Chris Cox, Chris Cherry**

email: [aherri18@utk.edu](mailto:aherri18@utk.edu), [ccox9@utk.edu](mailto:ccox9@utk.edu), [cherry@utk.edu](mailto:cherry@utk.edu)

office: 316 / 325 / 321 John D. Tickle Building

office hours: In person: M/W 11:30-12:30

Virtually: [by appointment](#)

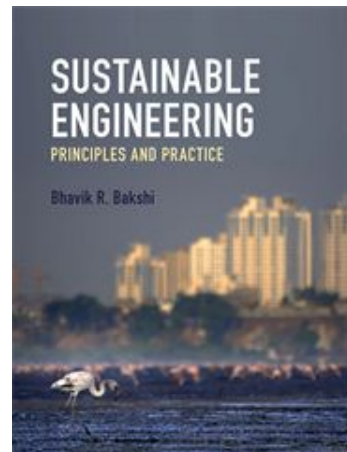
**Course Description:** This course covers cross-cutting engineering approaches to analyze and solve current sustainability challenges. Students will learn some of the tools, protocols, and methods that are common to sustainability analysis, particularly focused on engineered systems.

*Pre-reqs: MATH 231 or MATH 237*

**Text:** “Sustainable Engineering Principles and Practice” by Bhavik R. Bakshi

### **Student Learning Objectives:**

- Recognize and differentiate major environmental, social, and economic impacts of products/processes/systems
- Evaluate underlying assumptions and scope of quantitative sustainability analyses
- Apply quantitative analyses (footprint analysis, material and energy flows, LCA) to evaluate multi-dimensional sustainability aspects of products/processes/systems
- Effectively communicate (via verbal and written methods) complex sustainability topics and analytical results



**Learning Environment:** Lectures will cover fundamentals and quantitative approaches to analyze dimensions of sustainability; weekly readings will support group discussions.

### **Course Communications:**

- Course updates/announcements will be made via Canvas.
- Individual questions: Office hours, before or after or class; otherwise, email. I aim to respond to emails within 24 hours on weekdays.

<b>Grading:</b>	Homework	25%
	Discussion Participation	10%
	LCA Project	15%
	Midterm Exam	25%
	Final Exam	<u>25%</u>
		100%

Rubrics for homework are included on Canvas (where applicable).

Weekly homework assignments will be available after class on Wednesday, and discussion summaries will be assigned on Fridays after class discussion. Both assignments will be due at the beginning of class (1:50 PM) on the following Wednesday. Late assignments will be accepted for 50% credit up to the following Friday; and otherwise not accepted (unless cleared with the lecturer in advance, or in extraordinary circumstances).

Final grades will be awarded according to the scale below. The numerical cutoffs for a given grade may be adjusted downward, depending on the overall class performance.

A	= [93-100]
A-	= [90-93)
B+	= [87-90)
B	= [83-87)
B-	= [80-83)
C+	= [77-80)
C	= [73-77)
D	= [60-73)
F	= <60

### Course Schedule:

A tentative schedule with topics and assignment available/due dates is posted [online](#). These dates may change, but any adjustments to assessment due dates/times and any major deviations in course content will be advertised in class and on Canvas.

*The instructor reserves the right to revise, alter or amend this syllabus as necessary. Students will be notified via Canvas/email of any such changes.*

### Key Campus Resources for Students:

- [Center for Career Development and Academic Exploration](#) (Career counseling and resources; Handshake job search system)
- [Course Catalogs](#) (Listing of academic programs, courses, and policies)
- [Hilltopics](#) (Campus and academic policies, procedures and standards of conduct)
- [OIT HelpDesk \(865\) 974-9900](#)
- [Schedule of Classes/Timetable](#)
- [Student Health Center](#) (visit the site for a list of services)
- [Academic Success Center](#) (Academic support resources)

- [Undergraduate Academic Advising](#) (Advising resources, course requirements, and major guides)
- [University Libraries](#) (Access to library resources, databases, course reserves, and services)

## [ENVE 101 Introduction to Environmental and Water Resources Engineering: Fall 2024 University of Tennessee, Knoxville](#)

**Meeting Time and Place:** to be determined (one 50-minute session per week)

**Course Credit Hours:** 1

### **Faculty Contact Information (new course, faculty member TBD)**

Instructor:

Email:

Office:

Office Hours:

### **Course Description/Information:**

A series of case studies selected to illustrate the role of environmental and water resource engineers in addressing current environmental issues including population and urbanization, hydrologic cycle and water management, water and wastewater treatment, air pollution, solid waste management, industrial waste, sustainability, climate change and adaptation, and sustainability and employment opportunities in environmental engineering and water resources.

*Corequisite: Chem 122 or 128; EF 141 or EF 151 or EF 157*

**Prerequisites:** none (corequisite listed above)

**Textbooks:** none

### **Specific Student Learning Outcomes:**

- Discuss the role of environmental engineering in addressing issues such management of the hydrologic cycle, water and waste treatment, solid and industrial waste management, and air pollution and how these issues impact human health and well-being.
- Summarize how environmental and water resources engineers will contribute to areas at the frontier of the profession including climate change mitigation and adaptation, and urbanization and sustainable communities.
- Explain how fundamental scientific principles, engineering concepts, and mathematics are applied to environmental engineering problem-solving and project execution.
- Understand how environmental and water resources engineers collaborate with other professions to achieve common goals.
- Learn of career opportunities for environmental engineers in consulting engineering, utilities, government, and industry.
- Reflect on whether a BS degree in environmental engineering will help you progress toward your own personal career and professional interests and goals.

**Learning Environment:**

ENVE 101 is a seminar-style course, with weekly reading assignments, classroom discussions, and written discussion assignments.

**Course Communications:**

Course materials, assignments, and communications will be administered through the UTK Canvas classroom content management system.

**Grading:**

- Grading will be based on written responses to weekly discussion questions related to the topic.

**Grading Scale:**

Final grades will be no lower than that shown in the scale below. The numerical cutoffs for a given grade may, at the instructor's discretion, be adjusted downward, depending on the overall class performance.

A = 93-100

A- = 90-93

B+ = 87-90

B = 83-87

B- = 80-83

C+ = 77-80

C = 73-77

D = 60-73

F = <60

**Major Assignments and Exams**

- Homework: discussion questions will be assigned weekly and will reflect concepts covered in the reading and weekly discussion.

**Key Campus Resources for Students:**

- [Center for Career Development and Academic Exploration](#) (Career counseling and resources; Handshake job search system)
- [Course Catalogs](#) (Listing of academic programs, courses, and policies)
- [Hilltopics](#) (Campus and academic policies, procedures and standards of conduct)
- [OIT HelpDesk](#) (865) 974-9900
- [Schedule of Classes/Timetable](#)
- [Student Health Center](#) (visit the site for a list of services)
- [Academic Success Center](#) (Academic support resources)
- [Undergraduate Academic Advising](#) (Advising resources, course requirements, and major guides)
- [University Libraries](#) (Access to library resources, databases, course reserves, and services)

**Course Schedule:**

<b>Week</b>	<b>Presenter</b>	<b>Topic</b>
1	Chris Cox	Introduction
2	Chris Cox	From Source to Solutions: An Introduction to Environmental Engineering Through the Lens of Microplastics
3	Joshua Fu	Atmospheric modeling of air pollution and climate change
4	Jon Hathaway	Green Stormwater Infrastructure
5	Terry Hazen	Bioremediation Engineering
6	Qiang He	Drinking Water Microbiology
7	Anna Herring	Climate Change Mitigation through Carbon Sequestration
8	Haochen Li	Water infrastructure design through advanced hydrodynamic analysis
9	Frank Loeffler	Biological Remediation of Chlorinated Organics
10	John Schwartz	Urban Stream Restoration
11	Employer: Consulting Engineering	Career Opportunities in Consulting Engineering with Q&A
12	Employer: Utility	Career Opportunities in the Public Utilities Sector with Q&A
13	Employer: State/Federal Agency	Career Opportunities at Government Agencies with Q&A
14	Employer: Company	Career Opportunities in Corporations with Q&A

## ENVE 200 Environmental Process Fundamentals

### Fall 2024 | University of Tennessee, Knoxville

**Meeting Time and Place:** to be determined (two 50-minute sessions per week)

**Course Credit Hours:** 2

#### **Faculty Contact Information (new course, faculty member TBD)**

Instructor:

Email:

Office:

Office Hours:

#### **Course Description/Information:**

Principles of stoichiometry, mass balance, heat balance, chemical equilibrium, kinetics, and reactor design in the context of natural and engineered environmental systems.

*Prerequisites: Chem 132 or 138; EF 152 or 158*

*Corequisite: Math 231 or 237*

**Prerequisites:** *Chem 132 or 138; EF 152 or 158*

**Textbooks:** *Fundamentals of Environmental Engineering*, First Edition, by Danny Reible, Taylor and Francis, 2019.

#### **ABET Student Learning Outcomes:**

In ENVE 200, students will demonstrate an ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.

#### **Specific Student Learning Outcomes:**

- Students will be able to apply the mass and energy balance concept to environmental systems.
- Students will be able to apply thermal, chemical, phase, and sorption equilibrium concepts to formulate and solve mass balances subject to equilibrium conditions
- Students will be able to apply zero-, first-, and second-order chemical kinetics and biokinetics to formulate and solve mass balances under rate limited conditions in ideal complete-mix and plug-flow reactors.
- Students will be able to utilize analytical solutions, spreadsheets, MATLAB solvers, and other numerical approaches to solving non-steady state mass balances in environmental systems.



**Learning Environment:**

ENVE 200 is a lecture-based course, with weekly homework assignments which provide opportunities for students to apply the concepts learned during the lecture. Homework problems will include solutions using pencil-and-paper, spreadsheets, MATLAB and other software approaches.

**Course Communications:**

Course materials, assignments, and communications will be administered through the UTK Canvas classroom content management system.

**Texts/Resources/Materials:**

Required text: *Fundamentals of Environmental Engineering*, First Edition, by Danny Reible, Taylor and Francis, 2019.

**Grading:**

- Homework: 20%
- Weekly Concept Quizzes: 10%
- Midterm Exam: 35%
- Final Exam: 35%

**Major Assignments and Exams**

- Homework: homework problems will be assigned weekly and will reflect concepts covered during lecture.
- Weekly Concept Quizzes will be weekly closed-book 10-minute quizzes administered through Canvas during the first class meeting of the week. They will be qualitative and test concepts from the previous week.
- The mid-term and final exams will be open-book open-note tests in which the student learning outcomes are assessed. The scope of the problems will be amenable to paper-and-pencil solutions.

**Course Schedule:**

Week	Topics	Assignments
Week 1	Introduction to Environmental Engineering Calculations. <ul style="list-style-type: none"> <li>• System of Units and Nomenclature</li> <li>• Dimensional Analysis</li> </ul>	
Week 2	Steady-state Mass Balances <ul style="list-style-type: none"> <li>• Example: Chemical Dosages</li> <li>• Example: Mixing in Rivers</li> <li>• Example: Removal Efficiency</li> </ul>	Homework 1 Due Quiz 1 Due
Week 3	Steady-state Energy Balances <ul style="list-style-type: none"> <li>• First-law of Thermodynamics</li> <li>• Example: Temperatures of mixtures</li> </ul>	Homework 2 Due Quiz 2 Due

Week	Topics	Assignments
	<ul style="list-style-type: none"> <li>Heat capacity</li> <li>Example: Evaporative cooling</li> </ul>	
Week 4	Steady-state Mass Balances with Reactions <ul style="list-style-type: none"> <li>Example: Combustion Reactions</li> <li>Example: Softening</li> </ul>	Homework 3 Due Quiz 3 Due Project Module 1 Assigned
Week 5	Chemical Equilibria <ul style="list-style-type: none"> <li>Example: Groundwater Composition</li> <li>Example: Metals Solubility</li> </ul>	Homework 4 Due Quiz 4 Due
Week 6	Phase Equilibria <ul style="list-style-type: none"> <li>Henry's Law</li> <li>Example: Oxygen solubility</li> <li>Raoult's Law</li> <li>Example: Oil Spills</li> </ul>	Homework 5 Due Quiz 5 Due Project Module II Assigned
Week 7	Sorption <ul style="list-style-type: none"> <li>Partitioning Coefficient</li> <li>Isotherms</li> <li>Example: sorption by soil</li> <li>Example: Activated Carbon</li> </ul>	Homework 6 Due Quiz 6 Due
Week 8	Review and Midterm Exam	Mid-Term Exam Due (Covers HW and Quizzes 1-6)
Week 9	Steady-state systems in equilibria <ul style="list-style-type: none"> <li>Example: Co-current vs. Counter-current Stripping</li> <li>Simple soil washing systems</li> <li>Simple scrubber systems</li> </ul>	Homework 7 Quiz 7
Week 10	Simple Reaction Rate Laws <ul style="list-style-type: none"> <li>Zero, First, Second order</li> <li>Enzyme Kinetics</li> <li>Analyzing Rate Data</li> <li>Effect of Temperature</li> </ul>	Homework 8 Due Quiz 8 Due Project Module III Assigned
Week 11	Reactions in Simple Model Reactors <ul style="list-style-type: none"> <li>CMFR</li> <li>PFR</li> <li>Example: Chlorine Decay in Water Storage Tank or Pipe</li> <li>Example: Disinfection</li> </ul>	Homework 9 Due Quiz 9 Due
Week 12	Non-steady State Systems <ul style="list-style-type: none"> <li>Batch reactors</li> <li>Example: Flow Equalization System</li> <li>Example: Stormwater Retention Basin</li> </ul>	Homework 10 Due Quiz 10 Due
Week 13	Approaches to Solving Differential Equations in Non-steady State Systems <ul style="list-style-type: none"> <li>Analytical Solutions</li> <li>Spreadsheets</li> <li>Matlab</li> <li>Python</li> </ul>	Quiz 11 Due

Week	Topics	Assignments
Week 14	More approaches to Modeling <ul style="list-style-type: none"> <li>• More examples</li> </ul>	Homework 11 Due Quiz 12 Due Final Project Due
Finals	Final Exam	Final Exam

*The instructor reserves the right to revise, alter or amend this syllabus as necessary. Students will be notified in writing / email of any such changes.*

## [CE/ENVE 205 – Professional Development I](#)

Credits and Contact Hours: 2 credit hours and 30 contact hours (2 - 50 minute lectures weekly for 15 weeks)

Instructor's or Course Coordinator's Name: Dr. Jennifer Q. Retherford; 315 John D. Tickle Building; 865-974- 2682; [jretherf@utk.edu](mailto:jretherf@utk.edu)

### Textbook and Other Supplemental Material

- a) Text book: Irish, Robert and Peter Weiss. Engineering Communication, 2<sup>nd</sup> Edition, Oxford University. ISBN-13: 978-0195446920
- b) Supplemental materials: ASCE Press. Publishing in ASCE Journals: A Guide for Authors. <https://doi.org/10.1061/9780784479018>

### Specific Course Information

- a) Catalog Description: This course will introduce students to the fundamental concepts of written and oral communication for technical engineering applications. Engineering conceptual problems, historical context, and current events in the realm of civil and environmental engineering will comprise the subject matter which students will address through technical communication exercises.
- b) Prerequisites<sup>18</sup>: [RE] EF 151: Physics for Engineers I (or EF 157: Honors Physics)
- c) Corequisites: None
- d) Required for ENVE majors

### Specific Goals for the Course

- a. Specific outcomes of instruction
  - i. Write a technical engineering report.
  - ii. Prepare a technical engineering oral presentation.
  - iii. Recognize major events in the history of civil and environmental engineering.
- b. Student Outcomes listed in Criterion 3 addressed by the course. (“X” denotes contributes to Outcome, “A” denotes assessed for Outcome):

### Topics Covered

Writing Topics: Readability & Plagiarism, Defining Technical Writing, Identifying Technical References, Effective Document Organization, Assessment & Review Processes, Generating Flow

<sup>18</sup> Note: RE refers to “registrar enforced” pre/corequisite, DE refers to “department enforced”

and Refinement of Writing, Technical Correspondence Practice (email, letters). Oral Communication: Traits of Technical Presentation, Oral Communication Principles & Best Practices. Introduction to CEE Disciplines.

**Grading:**

**TABLE 3: Assignment Point Value Summary**

Assignment	Point Value	Composite Value
Written Assignment 01 (WA01)	10	30
Revised WA01	15	
Letter to Reviewer	5	
Peer Review	Complete/Incomplete*	
Presentation 01	5	5
Written Assignment 02 (WA02)	15	40
Revised WA02	20	
Independent Written Assignment	5	
Presentation 02	10	10
Independent Study & Effort	4.5**	15
In-Class Learning Activities	10.5	
Professional Correspondence	Complete/Incomplete**	

(\*): Penalty of (5) points will be applied to “Revised WA01” for an incomplete “Peer Review”.

(\*\*): The “Independent Study & Effort” score will be forfeited for an incomplete “Professional Correspondence” effort.

**Prerequisites:** EF 151: Physics for Engineers I (or EF 157: Honors Physics)

## CE/ENVE 305 Professional Development II

### Spring 2023

<b>Course Instructor:</b>	Dr. Chris Cox 325 John D. Tickle Building 865-974-7700 <a href="mailto:ccox9@utk.edu">ccox9@utk.edu</a>
<b>Course Description:</b>	This course is designed to introduce students to legal and ethical responsibilities, enhance career planning, introduce business, sustainability, and public policy concepts, and improve leadership skills.
<b>Prerequisite:</b>	CE/ENVE 205
<b>Course Credit:</b>	2 credit hours
<b>Grading:</b>	Formal Written Assignments: 20% Informal Assignments: 20% Ethics Project: 20% Sustainability Project: 10% Final Exam: 30%
<b>Attendance:</b>	Professional Development II is a development course and active participation is expected. Attendance is required for this course; however, you NOT attend class if you have symptoms of illness. To accommodate potential absences, attendance for this class will be included as a portion of the informal assignments. If you are you are unable to attend class, you should still attempt to complete the assignment online. Contact Dr. Cox and Matthew Tipton (copy both on email) to make alternative plans so that you do not lose credit and to be excused from attendance.
<b>Participation:</b>	Class discussion aimed at encouraging reflection and developing critical thinking skills is the primary instructional methodology of course. All students are encouraged to participate and ask questions. To allow opportunity for all students to participate, each student should wait to be called on to contribute, and limit contributions and questions to three per class section.
<b>Discussion:</b>	Given current climates, there is a chance that some conversations in this course will be difficult. All students are expected to remain respectful and avoid using derogatory, hateful, racist language (etc.). This is not to say that you cannot disagree, but please do so respectfully.
<b>Final Exam:</b>	The final exam will be administered through Canvas in an in-person venue. Topics to be covered will be emphasized in the discussion summary.

**Course Schedule:**

<b>Day of Week</b>	<b>Date</b>	<b>Topic</b>	<b>Learning Objectives</b>
W	1/25	Introduction	Develop awareness of the important power-skills and attitudes employers desire
F	1/27	Center for Career Development	Learn about services available at the Center for Career Development. Prepare a resume and cover letter to effectively communicate skills, qualifications, and experience
W	2/1	Center for Career Development	Strategies for the job search
F	2/3	Self-Awareness and Company Research	Determine your personal values, strengths, and weaknesses as they relate to career planning in engineering. Identify how value and preference alignment to your employers can affect career satisfaction
W	2/8	Career Attitudes and Skills. Interview Questions.	Associate attitudes and skills with what employers are looking for, and how interview questions are designed to assess these. Prepare to provide strong answers to potential future interview questions
F	2/10	Mock Interviews	Illustrate and improve interview skills through simulation and peer feedback
W	2/15	Mentors	Identify the varied roles mentors play and the value of having a mentor network.
F	2/17	Ethics- Introduction	Understand the basis of ethical thinking and identify the need for ethics in a professional context
W	2/22	Ethics- Application to the CE Profession	Interpret NCEES Model Rules for Professional Conduct Section 240.15 and the ASCE Code of Ethics
F	2/24	Ethics- Application to the CE Profession	Apply NCEES and ASCE ethics to make ethical decisions in situations that could arise in civil engineering practice
W	3/1	Ethics Projects	Form groups and select from various case studies that will form the basis of the ethics project.
F	3/3	Diversity, Equity and Inclusion	Understand the importance of including consideration of diverse perspectives, cultural backgrounds, knowledge, and experience in the formulation and design of infrastructure.
W	3/8	Introduction to Sustainability	Articulate the ASCE definition of sustainability. Summarize the triple bottom line (TBL). Identify aspects of a Civil or Environmental Engineering project that affect each element of the TBL. Identify the

			internalized and externalized cost of a project, service, or product.
F	3/10	Sustainability Example	Apply sustainability principles to an engineering system.
W	3/22	Sustainability Project Using Envision	The sustainability project for the semester will be assigned and described.
F	3/24	Introduction to public policy	Break down the meaning of public policy, how it is formed, and how it impacts the civil and environmental engineering profession
W	3/29	Ethics Project Presentations	Demonstrate your ability to make effective oral presentations with appropriate and engaging visual aids
F	3/31	Ethics Project Presentations	Demonstrate your ability to make effective oral presentations with appropriate and engaging visual aids
W	4/5	Public Policy: Financing Environmental Policy	Understand the challenges and creative solutions in financing engineering infrastructure. Examine US Environmental Policy as an example of public policy.
W	4/12	Public Policy: Licensure	Express the reasons for professional licensure and who must be licensed, how to become a professional engineer, and the role of continuing education in maintaining licensure
F	4/14	Public Policy: Professional Preparation	Summarize the various professional organizations (ASCE, NSPE, NCEES, ABET, State legislatures, licensing boards) shape the content of the Civil Engineering and Environmental Engineering Undergraduate degree.
W	4/19	Graduate School	Identify the advantages of attending graduate school
F	4/21	Professional Attitudes and Leadership	Describe selected professional attitudes and why they are important in Civil and Environmental Engineering. of effective leaders. Illustrate how these characteristics, skills, and attitudes can be used to lead without designated authority
W	4/26	Professional Attitude: Flexibility	Identify accelerated societal and technological trends impacting the profession. Identify the need for life-long learning
F	4/28	Business Types	Analyze the different models for forming a business and the relative advantages and disadvantages of each
W	5/3	Business Principles	Apply terms in the context of a small consulting firm (revenue, profits, direct and indirect costs, overhead rate, direct labor costs, total labor costs, labor utilization rate,



			effective labor multiplier, break even multiplier, billable vs. non-billable hours, assets, liabilities, and equity).
F	5/5	Business Principles	Apply terms in the context of a small consulting firm (revenue, profits, direct and indirect costs, overhead rate, direct labor costs, total labor costs, labor utilization rate, effective labor multiplier, break even multiplier, billable vs. non-billable hours, assets, liabilities, and equity).
T	5/16	<b>Final Exam (10:30 - 12:45) 405 Tickle</b>	

## Environmental Engineering (ENVE) 381

### Environmental Engineering I

### Civil Engineering (CE) 381 - Environmental Engineering I

**Meeting Time:** 10:20am-11:10am MWF in TIC 404

**Course Dates:** 01/23/2023 – 05/09/2023

**Instructor:** Dr. Clifford Swanson

Email: cswanso6@tennessee.edu (please include ENVE/CE381 in the subject line)

Office: TIC 431

Office Hours: I will not be holding official office hours but instead will have an open-door policy. If you need to meet with me you could stop by my office so long as I am there and not meeting with someone else, or we could set up a time to meet via email.

**Text:** Introduction to Environmental Engineering by Mackenzie Davis and David Cornwell (ISBN: 007742607X) accessed through canvas (Vital Source)

**Course Goals:**

1. Utilize environmental chemistry and mass balances to solve environmental engineering problems
2. Understand the importance of drinking water safety, drinking water regulations, and common treatment technologies
3. Understand wastewater regulations and treatment technologies
4. Understand air pollution, solid waste, and hazardous waste

**Prerequisites:** ENVE 391 or CE 391, and CHEM 132 and CHEM 133

**Grading:**

- **Final Grade Breakdown:**

Homework:	15%
Quizzes:	15%
Exam 1:	15%
Exam 2:	15%
Exam 3:	15%
<u>Final Exam/Project:</u>	<u>25%</u>
Total:	100%

- **Course Attendance:**

Attendance is not required for this course; lecture notes and homework solutions will be posted online. Example and derivations will be worked through in class and posted after the fact on Canvas. While attendance is not required, participation in examples within class will allow students to accumulate extra credit points, described later.

- **Homework:**

Homework will be assigned on a weekly basis where a week will be given to complete the homework. Homework will be assigned on Mondays and due the following Monday. The purpose of each homework assignment is to learn how to solve realistic problems related to environmental engineering.

Solutions to homework will be posted after the class period that homework was due. Because of this there will not be late work accepted for homework. If you are having problems with the homework, it is better to turn something in that is not correct than nothing at all, again the purpose of homework is to give you experience with these problems so most of the credit will come from the homework being attempted.

Homework will be done in groups of 2-3 people, where you will be picking your groups for the whole semester. Each homework will require one submission that has the name of all group members. In addition to this submission all group members will be required to also submit a short statement explaining what each group member had done for this homework. The purpose of this is to ensure that all group members are contributing to the homework. If one group member is not contributing evenly, as determined by the statements from both group members, then their grade will be adjusted accordingly to reflect the effort they put in. If there is any issues within a group feel free to contact me to discuss this so that a solution can be figured out for it. If this is not turned in by a group member then they will not receive a grade for their homework assignment.

- **Quizzes:**

There will be weekly conceptual quizzes which will focus on quizzing you over concepts covered during that week of lecture. These quizzes will occur about every week, except for weeks we have exams. They should be shorter quizzes with just a few conceptual questions. These quizzes will be posted online on Canvas after class on Friday and you will have 15 minutes to complete it prior to class on Monday. These quizzes are expected to be taken alone as they are also used to help assess what material needs to be better covered.

- **Course Exams (Mid Terms):**

There will be three midterm exams, which will correspond to the first three sections of this course (as described by the course goals). These exams will take the whole class period. You will be allowed a cheat sheet front and back, where you can put anything onto it. This sheet will be turned in with your exam. You will also be given a sheet of relevant equations and values for that exam, such as physical and chemical constants. You will not be allowed to use phones, cellphones, or any other communication electronics.

- **Final Exam:**

The tentative final exam period is Friday May 12th from 3:30 to 6:00 (Could change)

**Course Schedule:** This course will follow the schedule below. This schedule is a tentative schedule and is subject to change based on the pace of the course.

Week	Monday	Wednesday	Friday
Jan. 23-27	Syllabus and Introduction to Environmental Engineering	Environmental Chemistry	Environmental Chemistry
Jan. 30-Feb. 3:	Environmental Chemistry	Environmental Chemistry	Mass Balances
Feb. 6-10:	Mass Balance	Mass Balances	Mass Balances
Feb. 13-17:	Mass Balances	Mass Balances	Risk Assessment
Feb. 20-24:	Drinking Water Standards/ Introduction	Exam Review	<b>Exam 1</b>
Feb. 27-March 3:	Coagulation/ Flocculation	Coagulation/ Flocculation	Coagulation/ Flocculation
March 6-10:	Water Softening	Water Softening	Water Softening
March 13-17:	<b>Spring Break</b>	<b>Spring Break</b>	<b>Spring Break</b>
March 20-24:	Sedimentation	Sedimentation/Filtration	Disinfection
March 27-31:	COD/BOD	Exam Review	<b>Exam 2</b>
April 3-7:	Wastewater Characteristics/ Pretreatment	Primary Treatment/ Wastewater microbiology	<b>Spring Recess</b>
April 10-14:	Secondary Treatment (Sludge)	Secondary Treatment (Sludge)	Secondary Treatment (Sludge)
April 17-21:	Secondary Treatment (Sludge)	Tertiary Treatment	Tertiary Treatment
April 24-28:	Sludge Treatment	Sludge Treatment	Exam Review
May 1-5:	<b>Exam 3</b>	Solid Waste	Solid Waste
May 8-12:	Air Pollution	<b>Study Day</b>	Final Exam Period

[Water Resources Engineering I](#)  
[Environmental Engineering \(ENVE\) 391](#)  
[Civil Engineering \(CE\) 391](#)

Spring 2023 course outline

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<b>DESCRIPTION:</b>	Course covers basic concepts in Civil and Environmental Engineering hydraulics and hydrology with an emphasis on water resource engineering applications. Hydraulics will include: fluid properties; flow measurement; fluid statics; basic conservation laws and properties of incompressible fluids (continuity, energy, and momentum equations); pipe flow and pump/turbine systems; and open channel flow. Hydrology will include: basic hydrological and watershed processes; water budgets; rainfall-runoff models; groundwater flow and well performance; and water resource system characteristics.
<b>PREREQUISITES:</b>	Differential and integral calculus (Math 231), basic mechanics and dynamics (EF 152). Knowledge of PC usage and word processing, spreadsheet, and graphing software are expected. You will need to use CANVAS and Mastering Engineering, so check them regularly.
<b>CREDIT:</b>	3 semester hours (lecture only).
<b>SCHEDULE:</b>	Lecture: MWF 10:20 AM - 11:10 AM; Location: JDT(TIC) 405
<b>INSTRUCTOR:</b>	<b>Dr. Jon M. Hathaway, PE</b> The University of Tennessee Department of Civil & Environmental Engineering 415 John D. Tickle Building, Knoxville, TN 37996 E-mail: <a href="mailto:hathaway@utk.edu">hathaway@utk.edu</a> Phone: (865) 974-6058 Website: <a href="http://hathaway.utk.edu">http://hathaway.utk.edu</a>
<b>OFFICE HOURS:</b>	by appointment, please email Victoria or I to schedule
<b>TEXTS</b>	
<b>Text Required:</b>	<u><a href="#">Fluid Mechanics</a></u> , 2018, Second edition; by R. C. Hibbeler; Pearson, Hoboken, NJ.  *** <u><a href="#">Mastering Engineering</a></u> to accompany Fluid Mechanics/Hibbeler
<b>Library Resources:</b>	<u><a href="#">Introduction to Hydrology</a></u> , 2003 Fifth edition; by W. Viessman and G.L. Lewis; Prentice Hall, Pearson Education, Inc., Upper Saddle River, NJ.

**EVALUATION:** Your overall grade will be determined by your performance on the student learning tasks summarized below.

- (20%) Homework
- (20%) Exams 1 and 5 (10% each)
- (45%) Exams 2, 3, and 4 (15% each)
- (15%) Final Exam

Note: Each Learning Task is important and contributes to your overall grade, so do not skip, say, homework assignments or quizzes, and hope to compensate for the slack with Exams.

**HOMEWORK:** Homework will be assigned primarily through *MasteringEngineering* – an online tutorial homework program ([www.masteringengineering.com](http://www.masteringengineering.com)) accompanying the course textbook. Grading emphasis for homework is on the problem-solving approach and demonstrated understanding of the concepts. *MasteringEngineering* automatically grades homeworks so you are able to view your score immediately after completion. **A small number of traditional written homeworks will also be assigned which can be uploaded to CANVAS.**

**EXAMS:** Exams will consist of five exams and a final comprehensive exam (see attached exam guidelines) and will consist of short answer covering key concepts, simple problems, discussions, and longer more challenging problems. Exams may be closed or open book at the discretion of the instructor.

- Familiarity with definitions, classification schemes, and common terminology used in hydraulics and hydrology as practiced by civil engineers.
- Understanding of basic fluid properties and how to obtain or measure their values.
- Appreciation of and an ability to work with common mathematical models for hydraulic and hydrologic applications, including basic principles, assumptions, and simplifications.
- Appreciation for the requirements and limitations of flow measurements of water resource systems in closed-conduit pipe, open channels, and drainage basins.
- Further development of computer skills, especially with regard to the graphical plotting of measured data.
- Understanding of water resources engineering and the variety of applications to which its basic principles and associated mathematical relationships can be applied in practice.

*Water Resources Engineering I – Spring 2023 LECTURE SCHEDULE*

Date	Lec.	Topics	Chapter	Readings	
January	23	1	Course Introduction, Introduction to water resources & hydrology; basic units & dimensions.	1 1*	1.1-1.5 1.1-1.5*
	25	2	Hydrology: Introduction; drainage basins; hydrological measurements; precipitation	2* & 4*	2.1-2.6*, 4.1-4.5*, 4.8*
	27	3	Hydrological Processes: Interception; depression storage; evaporation; evapotranspiration; Infiltration	5* - 7*	5.1-5.3,* 6.1-6.2*, 7.1-7.4*
	30	4	Hydrology: Surface runoff (NRCS Curve Number); hydrographs; rational method	7* - 9*	7.9*, 8.2*, 9.1-9.3*
February	1	5	Groundwater: Concepts and Flow	10*	10.1-10.3*
	3	-	Hydrology: work problems / Review	--	--
	6	6	Fluid Properties: Basic characterization & units	1	1.6, 1.9
	8	-	<b>Exam 1</b>	--	--
	10	7	Fluid Properties: Viscosity, ideal fluid, drag	1, 11	1.7-1.8, 11.8
	13	8	Fluid Properties: Pressure & pressure variation	2	2.1 - 2.4, 2.6
	15	9	Fluid Statics: Plane surfaces	2	2.7
	17	10	Fluid Statics: Curved surfaces	2	2.10
	20	11	Fluid Statics: Buoyancy	2	2.11
	22	-	Fluid Statics: work problems / Review	--	--
	24	-	<b>EXAM 2</b>	--	--
	27	12	Basics of Fluid Flow; Control volume approach	3 & 4	3.1-3.3, 4.1, 4.3- 4.4
March	1	13	Energy in Steady Flow: Bernoulli	5	5.1-5.3
	3	14	Energy in Steady Flow: Energy Equation	5	5.5
	6	15	Energy in Steady Flow: HGL and EGL	5	5.4
	8	16	Momentum and Forces in Fluid Flow	6	6.1-6.2
	10	16	Momentum and Forces in Fluid Flow	6	6.1-6.2
	13-17	-	<b>NO CLASS – Spring Break</b>	--	--
	20	-	Energy/Momentum Concepts: work problems / Review	--	--
	22	-	<b>EXAM 3</b>	--	--
	24	17	Pipe Flow: Laminar/turbulent flow theory	9 & 10	9.5, 10.1, 9.6-9.8
	27	18	Pipe Flow: Single pipe friction loss	10	10.1, 10.3
April	29	19	Pipe Flow: Minor losses	10	10.2
	31	20	Pipe Flow: Pipelines with pumps/turbines	10	10.3-10.4
	3	21	Pipe Flow: Pipes in series and in parallel	10	10.4
	5	22	Pressure Pipe Flow: Flow measurements	10	5.3, 10.5
	7	-	Spring Recess		
	10	23	Dimensional analysis and Similitude	8	8.1-8.5
	12	24	Hydraulic Machinery – Pumps	14	14.1-14.4, 14.6, 14.8
	14	25	Hydraulic Machinery – Pumps	14	14.7, 14.9
	17	25+	System Curves + Pump Curves	--	--
	19	-	Pressure pipe flow/pumps: work problems / Review	--	--
	21	-	<b>EXAM 4</b>	--	--
	24	26	Open Channel Flow: Uniform flow	12	12.1-12.2, 12.6
	26	27	Open Channel Flow: Specific energy	12	12.3
	28	28	Open Channel Flow: Critical depth	12	12.4-12.5
May	1	29	Open Channel Flow: Hydraulic jump; weirs, flow measurement	12	12.8-12.9
	3	-	<b>EXAM 5</b>	--	--
	5	-	Final Exam Review	--	--
	8	-	TBD		
May	12	-	<b>FINAL EXAM</b> (comprehensive)	--	--

**UNIVERSITY of TENNESSEE**  
**Department of Civil and Environmental Engineering**  
**ENVE 399: Senior Design Project**

**GENERAL INFORMATION**

<b>Instructor</b>	To be determined
<b>Course Description</b>	This course will introduce students to the concepts of design problem definition, effort scheduling and planning, and development of a preliminary technical package for a typical environmental engineering project. Students will work to develop and initiate project design effort in preparation for the Senior Design Project II course. Pre-planning efforts (such as data collection, site investigations, client interactions, refinement of scope of work, etc.) will be performed per project needs. Additional lessons will focus on team cooperation, communication with clients, and other professional skills necessary for successful project management during the design phase.
<b>Class Hours</b>	W 1:25 – 2:15 pm.
<b>Classroom</b>	JDT 405
<b>Web Page Address</b>	Course Documents will be posted on Canvas; access via UT Home Page
<b>Course Credit</b>	1 Semester Hours
<b>Prerequisites</b>	ENVE 205. Senior standing and must be taken during the term immediately prior to ENVE 400.
<b>Goals of Instruction</b>	The goals of this course are to: <ul style="list-style-type: none"> <li>▪ Clearly <b>present</b> the fundamental components of engineering deliverables.</li> <li>▪ <b>Present</b> professional skills recommendations and concepts.</li> <li>▪ <b>Demonstrate</b> a traditional environmental engineering workplace environment.</li> <li>▪ <b>Integrate</b> the NAE Grand Challenges into environmental engineering design projects.</li> </ul>



**Course Objectives**

Upon completion of the course, students should attain these objectives:

1. **Produce** an engineering technical report and supporting drawings for a environmental engineering project by **applying (\*\*)** appropriate engineering design process and **collaborating (\*\*)** on an engineering design team.
2. **Summarize** the engineering work necessary for an environmental design project, specifically including relationships between the work and the Grand Challenges.
3. **Engage** in meetings with project constituents and with non-technical audiences (such as local citizens) multiple times within the term.
4. **(\*) Apply** standards of professional applied oral communication to environmental engineering opportunities, demonstrating the ability to express design effort and decisions to a variety of audiences, aware of cultural communication practices, ethical responsibilities, professional expectations for client-engineer subject-matter, informed by engineering codes and standards of practice.

(\*): Course objectives supporting Applied Oral Communication (AOC) course designation.

(\*\*): Course objectives supporting the Engaged Inquiry (EI) course designation

**Attendance Policy**

Senior Design is a challenging course. **Your attendance is required.**

**Grading**

Grades will be based on the following:

Category	VolCore*	Task	Value
Project Deliverables	EI	Preliminary Design Report	25%
	EI	Schematic Report & Drawings	15%
Presentations & Discussions	AOC	Client Interactions (2 Observations)	10% (equally weighted)
	AOC	Project Forums (2 Observations)	10% (equally weighted)
	AOC	Project Video	15%
Reflective Exercises		(3) Reflective Narratives	15% (equally weighted)
		Sharing Day Reflective Presentation	5%
	AOC	Showcase Reflective Presentation	5%

Grades will be calculated according to the following scale (rounding to the hundredths place on the final, total grade). There will be no curve.

**Due Date Policy**

There is a firm deadline for a number of submittals throughout the semester. Guidelines for extensions of these deadlines are unique to each submittal and details are provided as necessary.

**Final Presentation &  
Client Interactions**

**Attendance at the Final Presentation Event is mandatory for all students. Expectations will be clarified throughout the term for additional mandatory client interactions throughout the term.**

**Tentative Schedule**

Week	Topic	Activities & Deadlines	Graded Value
1	Introductions, Course Information	Team Assignments	
2	Hosting a Purposeful Meeting <sup>1</sup>	Kick Off Meeting prior to Mon., week 5.	5% Total Grade
3	Templates, Formats, and Standards of Style		
4	Engineering Deliverables I: Reports		
5	Team Dynamics	Preliminary Drawings due within week 12.	25% Total Grade
6	NAE Grand Challenges	Reflection Narrative 1 due prior to Mon., week 8	5% Total Grade
7	Non-technical Audiences <sup>2</sup>		
8	Time Management & Keeping	Forum I to occur prior to Mon., week 10.	5% Total Grade
9	Engineering Drawings		
10	Asking the Right Question	Progress Meeting prior to Mon., week 15.	5% Total Grade
11	<b>Spring Break - No Classes</b>	Reflection Narrative 2 due prior to Mon., week 13	5% Total Grade
12	ASCE Body of Knowledge	Forum II to occur prior to Mon., week 14.	5% Total Grade
13	Engineering Deliverables III: Calcs.	Reflection Narrative 3 due prior to Mon., week 15	5% Total Grade
14	Sharing Day		5% Total Grade
15	GCSEE* <sup>3</sup>	Video due Study Day, 3:00 pm	15% Total Grade
16	Stewardship in CEE & Reflection	Schematic Package dues within week 17	15% Total Grade
17	<b>Study Day</b>		
18	Poster Showcase Event	Attendance Mandatory	5% Total Grade

## CE400 – Senior Design Project II

1. Course Number and Name: CE 400 - Senior Design Project II
2. Credits and Contact Hours: 3 credit hours and 45 contact hours (2 - 120 minute lectures weekly for 15 weeks)
3. Instructor's or Course Coordinator's Name: Dr. Jennifer Q. Retherford
4. Textbook and Other Supplemental Material
  - a. Textbook: None
  - b. Supplemental materials: Various codes and guidelines for safe, compliant engineering design
5. Specific Course Information
  - a. Catalog Description: This course will allow students to apply the environmental engineering design process. A comprehensive project introduces students to problem formulations, site planning, project management, engineering design, construction documents, and various project components typical to environmental engineering projects. As students exit ENVE 399, they have a firm understanding of the needs of their design project; in ENVE 400, students finalize the engineering analysis and design efforts to satisfy the needs. Ultimately, the work concludes with the communication of the design work to the client through presentations and formal engineering documentation.
  - b. Prerequisites: None; recommended to be taken in term of graduation
  - c. Corequisites: None
  - d. Required for CE majors
6. Specific Goals for the Course
  - a. Specific outcomes of instruction
    - i. Demonstrate an understanding of a typical, multidisciplinary, environmental engineering (ENVE) design process.
    - ii. Identify, examine, and interpret planning and engineering documents.
    - iii. Compile contract documents for schematic design and design development phases of engineering design.
    - iv. Perform standard environmental engineering calculations.
    - v. Summarize the engineering work performed for a completed design project.
    - vi. Attend continuing education activities outside of traditional coursework.
  - b. Student Outcomes are listed in Criterion 3 addressed by the course. ("X" denotes contributes to Outcome, "A" denotes assessed for Outcome):

## 7. Topics Covered

Design phases and the design process, site safety, the feedback process, design development phases and refining technical writing, time management, developing content for a specified audience, preparing 50% Design Development materials, concluding the design development phase and finalizing design decisions, credibility and competency in technical work, developing an exhibit of services rendered, re-centering during busy times (personal time management), expectations for final contract documents, refining contract documents, career planning, preparing for final meetings, finalizing deliverables to satisfy final project expectations.

## 8. Grading

Category	Task	Value
Technical	50% Design Development (DD) Package	25
	100% Design Development (DD) Package	15
	95% Contract Documents (CD) Package	30
Professional	Class Engagement Activities	10
	Client & Mentor Meetings (2 Observations)	10 (equally weighted)
	UTKs [Continuing Education]	10
	<b>TOTAL POINTS POSSIBLE</b>	<b>100</b>

## ENVE 410 Fate, Transport, and Risk Assessment Fall 2025 University of Tennessee, Knoxville

Meeting Time and Place: to be determined (two 50-minute sessions per week)

Course Credit Hours: 2

### Faculty Contact Information (new course, faculty member TBD)

Instructor:

Email:

Office:

Office Hours:

### Course Description/Information:

Interactions of pollutants with air, water, and soil media including partitioning, intermedia transport, and degradation. Risk assessment of pollutants to human health including exposure pathways and the role of epidemiology in determining dose-response relationships.

*Prerequisites: BSE 321*

### ABET Student Learning Outcomes:

In ENVE 410, students will demonstrate an ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.

### Specific Student Learning Outcomes:

- Students will be able to explain how the physical and chemical properties of various chemical pollutants affect their fate and transport in the environment.
- Students will be able to explain how characteristics of the natural environment affect the fate and transport of chemical pollutants in the environment.
- Students will be able to calculate the equilibrium partitioning of chemicals in water, air, soil, and biota using both chemical concentrations and fugacities.
- Students will be able to use the fugacity approach to calculate the steady-state transport rates of chemicals between air, water, and soil.
- Students will be able to calculate human exposure to chemicals in the environment and estimate risk to human health.

### Learning Environment:

ENVE 410 is a lecture-based course, with weakly homework assignments which provide opportunities for students to apply the concepts learned during the lecture. Homework problems will include solutions using pencil-and-paper, spreadsheets, and specialty software.

### Texts/Resources/Materials:

Required text: *Multimedia Environmental Models: The Fugacity Approach*, 3<sup>rd</sup> Edition. J. Mark Parnis and Donald Mackay. CRC Press, 2021.

## Grading:

- Homework: 10%
- Weekly Concept Quizzes: 10%
- Comprehensive Project: 30%
- Midterm Exam: 25%
- Final Exam: 25%

## Course Schedule:

Week	Topics	Assignments
Week 1	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Review of Mass Balance Concepts</li> <li>• Equilibrium, Steady State, and Non-Steady State</li> </ul>	
Week 2	Water – Air Phase Equilibrium <ul style="list-style-type: none"> <li>• Water Solubility and Vapor Pressure</li> <li>• Henry’s Law</li> <li>• Concentration-Based Calculations</li> <li>• Introduction to Fugacity</li> <li>• Fugacity-Based Calculations</li> </ul>	Homework 1 Due Quiz 1 Due
Week 3	Water – Soil (and Sediment) Equilibrium <ul style="list-style-type: none"> <li>• Octanol-Water Partitioning Coefficient</li> <li>• Soil-Water Partitioning Coefficient</li> <li>• Concentration-Based Calculations</li> <li>• Fugacity-Based Calculations</li> </ul>	Homework 2 Due Quiz 2 Due
Week 4	Multiphase Equilibrium Calculations <ul style="list-style-type: none"> <li>• Concentration-Based Calculations</li> <li>• Fugacity-Based Calculations</li> <li>• Evaluative Unit Worlds</li> <li>• Level 1 Models</li> </ul>	Homework 3 Due Quiz 3 Due Project Module 1 Assigned
Week 5	Advection and Reaction Processes I <ul style="list-style-type: none"> <li>• Advection Processes in the Environment</li> <li>• Fugacity Notation for Advection</li> <li>• Reactions: Photolysis, Biodegradation, Hydrolysis</li> </ul>	Homework 4 Due Quiz 4 Due
Week 6	Advection and Reaction Processes II <ul style="list-style-type: none"> <li>• Estimating Rates</li> <li>• Fugacity Notation for Reactions</li> <li>• Level II Models</li> </ul>	Homework 5 Due Quiz 5 Due Project Module II Assigned
Week 7	Diffusive Transport <ul style="list-style-type: none"> <li>• Molecular Diffusion</li> <li>• Turbulent Diffusion</li> <li>• Mass Transport Coefficients</li> <li>• Fugacity Notation</li> </ul>	Homework 6 Due Quiz 6 Due

Week	Topics	Assignments
Week 8	Review and Midterm Exam	Mid-Term Exam Due (Covers HW and Quizzes 1-6)
Week 9	Non-Diffusive Transport <ul style="list-style-type: none"> <li>• Piggy-back Processes</li> <li>• Serial and Parallel Processes</li> <li>• Two-Film Theory</li> </ul>	Homework 7 Quiz 7
Week 10	Steady-State Non-Equilibrium Models <ul style="list-style-type: none"> <li>• Fugacity Notation</li> <li>• Level III Models</li> </ul>	Homework 8 Due Quiz 8 Due Project Module III Assigned
Week 11	Introduction to Environmental Risk Assessment <ul style="list-style-type: none"> <li>• Exposure Pathways</li> <li>• Exposure Dosages</li> </ul>	Homework 9 Due Quiz 9 Due
Week 12	From Dose to Risk <ul style="list-style-type: none"> <li>• Epidemiology</li> <li>• Acute versus Chronic Effects</li> <li>• Slope Factors</li> </ul>	Homework 10 Due Quiz 10 Due
Week 13	Calculating Risk <ul style="list-style-type: none"> <li>• Calculating Risk</li> </ul>	Quiz 11 Due Project Module IV Assigned
Week 14	Course Review and Project Time	Homework 11 Due Quiz 12 Due Final Project Due
Finals	Final Exam	Final Exam

*The instructor reserves the right to revise, alter or amend this syllabus as necessary. Students will be notified in writing / email of any such changes.*

## ENVIRONMENTAL ENGINEERING 456/558

### SOLID AND HAZARDOUS WASTE MANAGEMENT

#### Fall 2022

George J. Hyfantis, Jr., PhD, PE  
(865) 689-1395, [ghyfantis@qe2llc.com](mailto:ghyfantis@qe2llc.com)

Office Hours: 1 hour before each class

Meeting Schedule: two 75-minute lectures per semester

Credit Hours: 3

Course Description: Magnitude and characteristics of solid and hazardous waste problems; collection systems; design of treatment and disposal systems; landfills, incineration, stabilization, composting, and remediation technologies; remedial investigations and feasibility studies; industrial solid and hazardous waste treatment; current and future regulations.

Prerequisites: ENVE/CE 381

Textbook: Integrated Solid Waste Management by George Tchobanoblos, ISBN 0-07-063237-5, plus handouts from EPA reports, internet sites etc.

Student Learning Outcomes:

- Students will be able to apply knowledge of waste characteristics and chemical formulas to classify various types of solid and hazardous wastes, predict their behavior in different environments, and suggest appropriate treatment strategies.
- Students will be able to use principles of sanitary landfill design to plan a simple landfill site, considering factors such as waste type, volume, location, and the environment.
- Students will be able to implement concepts of composting and recycling to propose methods for reducing the volume of solid waste at its source and to propose methods for resource recovery.
- Students will be able to apply current statutes and regulations to ensure the compliance of proposed waste collection and disposal systems, including those involving underground storage tanks.



- Students will be able to scrutinize site assessments and suggest appropriate remediation strategies for sites contaminated with various types of waste, including those with underground storage tanks.
- Students will be able to interpret the results of risk assessments to understand the potential impacts of different waste disposal methods on human health and the environment.
- Students will be able to evaluate different sources of groundwater contamination in relation to waste disposal practices, analyze the potential effects on local water quality, and propose appropriate monitoring and mitigation strategies.

**Grading:**

Homework: 30%

Mid-Term Exam: 35%

Final Exam: 35%

<b>SUBJECTS</b>	<b>DATE</b>
1 Introduction, Overview & Course Objectives, Ethics in Waste Management, Municipal Solid Waste Characteristics .....	Aug 30
2 Waste Characteristics, Chemical Formulas .....	Sept 8
3 Collection System Design- Understanding and Optimizing Collection Systems.....	Sept 15
4 Sanitary Landfill Design - Definitions, Siting Criteria, Design Criteria.....	Sept 22
5 Continue Sanitary Landfill Design .....	Sept 29
6 Leachate Treatment, Composting, Organic Chemistry.....	Oct 6
7 Mid-Term Exam .....	Oct 13
8 Solid and Hazardous Waste Statutes and Regulations .....	Oct 20
9 Recycling Technologies .....	Oct 27
10 UST and Hazardous Waste, Site Assessments, Treatment Technologies.....	Nov 3
11 Sevier County Compost Tour .....	Nov 10

- 12 Risk Assessment Methodologies..... Nov 17
- 13 Groundwater Contamination, Monitoring, Injection Well Disposal & Hazardous  
Waste Landfills --Take Home final Exam Issued .....Dec 1
- 14 Class Project Reports Due.....Dec 8
- 15 Final Exam Due.....Dec 8

The instructor of this class owns the copyright to the Introduction, schedule, handouts, assignments, quizzes, and exams associated with the class. All presentations developed by the instructor, as well as the instructor's lectures, are also protected by copyright, whether these presentations are delivered live in-class, shared through Zoom or other videoconference platforms, or uploaded to Canvas or similar sites. Sharing any of this material without the written permission of the instructor is a violation of copyright law and is therefore also a violation of the University's policy on acceptable use of information technology resources (UT policy number IT0110). That policy states that students will not commit copyright infringement, "including file sharing of video, audio, or data without permission from the copyright owner" and that file sharing is a violation of the university's student code of conduct. I will report all such violations to the Office of Student Conduct and Community Standards.

## [Env. Engr. 474/574 Syllabus](#)

# AIR POLLUTION ENGINEERING AND CONTROL

Environmental Engineering 474/574  
Professor: Dr. Joshua S. Fu

416 John D. Tickle Building; phone: 974-2629; E-mail: jsfu@utk.edu

**Fall Semester 2022 (3 units)**

Office hours: Wednesday and Thursday 1:30-3:30 PM or by appointment.

**Lectures** Thursday, 4:10-7:20 PM, JDT Building Room 402

***Prerequisite:***

ENVE 474: ENVE/CE 381

ENVE 574: graduate standing in science or engineering with background in air and waste. Courses in ENVE/CE 381 and ENVE 511 will be helpful.

***Course Description 474:*** Introduction to the fundamentals of air pollution, light scattering and visibility reduction, air quality laws and regulations, estimating concentrations from emission factors, theory and design of settling chambers, cyclone separators, wet collectors, fabric filters, electrostatic precipitator and control methods for gaseous air pollutants.

***Course Description 574:*** Graduate level introductory course on air quality management and pollution control. Introduces concepts of air pollution, analysis of relationships between sources, effects, ambient air quality standards, meteorology, dispersion of pollutants, emission control technologies, and emission standards.

***Textbook:*** Wark/Warner/Davis: Air Pollution: Its Origin and Control Prentice Hall, 3rd Ed, 1998 and updated materials

***References:***

- Fundamentals of air pollution engineering / Richard C. Flagan and John H. Seinfeld. Dover Publications, 2012.

***Grading:*** The following weighting will be used in determining final grades in the course:

Problem Sets/Assignments 25%  
Each Test 25% x 3

**Learning Outcomes:**

- Apply fundamental knowledge of air pollution to describe the major sources, types, and impacts of air pollution.
- Apply knowledge of air quality laws and regulations to explain how these guidelines influence emission standards and pollution control.
- Use emission factors to estimate the concentrations of various pollutants in a given context.
- Predict downstream concentrations of air pollutants using air dispersion models
- Design air pollution control technologies such as settling chambers, cyclone separators, wet collectors, fabric filters, electrostatic precipitators to control air pollution in specific scenarios.
- Analyze the suitability and efficiency of different emission control technologies for various industrial applications.

Date	Tentative Topic	Reading Assignment
8/24	Introduction Physical/Chem. Description of Pollutants Growth of Air Pollution Air Quality Management OAQPS TTN/Other Web sites	Chapter 1
8/31	Visibility/Haze Effects of Air Pollution Air Quality Criteria Photochemistry Emission Factors (AP42) Development of Federal APC Programs Clean Air Act (1967, 1970, 1977, 1997, 2003, 2008, 2014)	Chapters 1,2
9/7	Emission Standards/NAAQS NSPS/SIPs/PSD/BACT/NESHAPS/GEP/LAER Clean Air Act 1990 Air Toxics/MACT Meteorological Bases of Air Pollution Climatology/Plume Behavior	Chapter 2,3
9/14	Dispersion Modeling Gaussian Equation, Point Sources Dispersion Modeling (cont.) Line Sources, Puffs, Plume Rise	Chapter 4
9/21	Elements of Regulatory Control Engineering Control Concepts Introduction to APC Devices Collection Efficiency Particle Size Distributions Particulate Control Equipment Settling Chambers/Cyclones	Chapter 5

9/28	Electrostatic Precipitators Current air pollution issues (reports) Library study	Chapter 5 Literature review
<b>10/05</b>	<b>Test # 1 (120 minutes)</b>	
10/12	Particulate Wet Scrubbers Fabric Filters Novel Systems	Chapter 5
10/19	Control of Gases and Vapors Adsorption Absorption The Combustion Process Combustion Balances	Chapter 6
10/26	Control of Combustion Processes Control of Acid Gases (SO <sub>2</sub> , HCl ...)	Chapter 7
<b>11/02</b>	<b>Test # 2 (120 minutes)</b>	
11/09	Control of NO <sub>x</sub> /APC of Other Sources	Chapter 8
11/16	Mobile Sources: Regulations/Control Green Energy Strategies	Chapter 10
11/23	New Control Technologies and Alternatives	
<b>11/24-25</b>	<b>Thanksgiving Holiday (no class)</b>	
12/07	Technology Alternatives	
<b>12/12</b>	<b>Final Online Test # 3 (180 min.)</b> <b>Note time: 4:10-7:20 PM</b>	

# ENVIRONMENTAL ENGINEERING/CIVIL ENGINEERING 481

## ENVIRONMENTAL ENGINEERING II

### SPRING 2023

Haochen Li, PhD  
420 John D. Tickle Building  
Phone: 865-974-7731  
E-mail: [hli111@utk.edu](mailto:hli111@utk.edu)

Office Hours: Tue & Thur 2:10 PM - 3:30 PM or by an email appointment

Meeting Schedule: Tue & Thur; 12:55 PM - 2:10 PM; 404 John D. Tickle Engineering

Credit Hours: 3

Course Description: Theory and design of drinking water and wastewater treatment systems.

Prerequisites: ENVE/CE 381

Textbook: Davis, M. L. (2019). *Water and Wastewater Engineering: Design Principles and Practice* (Second Edit). McGraw-Hill.

Student Learning Outcomes:

- Students will be able to explain the design criteria process for water and wastewater treatment.
- Students will be able to apply both theoretical and empirical ideas and equations related to the design of water and wastewater treatment plants
- Students will be able to create preliminary designs for water and wastewater treatment plants
- Students will be able to develop presentations to communicate design ideas and goals

Grading:

Homework: 10%

Drinking Water Treatment Design Project: 25%

Wastewater Treatment Design Project: 25%

Mid-Term Exam: 20%

Final Exam: 20%

## Course Schedule

Lecture	Date	Topic	Chapter	Project Due
1	01/24	Introduction and Overview	1	
2	01/26	Water Treatment Process Overview	2	
3	01/31	Coagulation and Flocculation 1	6	
4	02/02	Coagulation and Flocculation 2	6	
5	02/07	Lime-Soda Softening 1	7	
6	02/09	Lime-Soda Softening 2	7	
7	02/14	Sedimentation 1	10	Project 1 Part 1
8	02/16	Sedimentation 2	10	
9	02/21	Filtration	11	
10	02/23	Disinfection and Fluoridation	13	
11	02/28	Water Plant Residual Management	15	Project 1 Part 2
12	03/02	Overflow		
13	03/07	Field Trip		
14	03/09	Midterm Exam		
	03/14	# Spring Break		
	03/16	# Spring Break		
15	03/21	Wastewater treatment process overview	18	Project 1 Final
16	03/23	Headworks and Preliminary treatment	20	
17	03/28	Primary Treatment	21	
18	03/30	Biological Treatment 1	21	
19	04/04	Biological Treatment 2	22	Project 2 Part 1
	04/06	# No Class Day		
20	04/11	Activated sludge Process 1	23	
21	04/13	Activated sludge Process 2	23	
22	04/18	Activated sludge Process 3	23	
23	04/20	Attached Growth Systems	24	Project 2 Part 2
24	04/25	Secondary Clarification	25	
25	04/27	Membrane Filtration	9/12	
26	05/02	Wastewater Plant Residual Management	27	
27	05/04	Overflow		Project 2 Final
28	05/09	Summary and Overlook		
	05/11	Final Exam		

## [ENVE/CE 482 Environmental Engineering Lab](#) [Spring 2023 Syllabus](#)

<b>DESCRIPTION:</b>	Laboratory-based introduction to performing and interpreting physical, chemical, and biological characterization of water and wastewater (1 credit-hour)
<b>PREREQUISITES:</b>	Civil/Environmental Engineering Lab (CE 310); Environmental Engineering 1 (ENVE/CE 381)
<b>SCHEDULE:</b>	Tuesday/Wednesday 8:00-11:30 AM, 58 Perkins Hall
<b>INSTRUCTOR:</b>	Dr. Adrian Gonzalez (Dr. G), <a href="mailto:agonza17@utk.edu">agonza17@utk.edu</a> , 865-673-4820, S.E.R.F. Bldg. 317
<b>TEACHING ASSISTANT:</b>	Ms. Caitlyn Smugor, <a href="mailto:csmugor@tennessee.edu">csmugor@tennessee.edu</a>
<b>LAB SUPPORT:</b>	Sharon Hale, <a href="mailto:sfhale@utk.edu">sfhale@utk.edu</a> , 865-974-7719, 56 Perkins Hall
<b>COMMUNICATION:</b>	Best way to reach Dr. G is text-messaging. Use email for longer or non-urgent communications. Face-to-face meetings by appointment; Zoom is always an option

### **COURSE OBJECTIVES:**

- Identify common water quality (WQ) parameters pertinent to the physical and chemical processes occurring at water/wastewater treatment plants (WWTP).
- Explain what each WQ parameter says or indicates about WWTP processes.
- Competently (and safely) perform physical and chemical characterizations in the lab, based on written procedures.
- Refine your sound technical judgment skills, through evaluating and interpreting data, observations, and outcomes.
- Refine technical writing skills, through lab reports for the semester's lab activities.
- Competently apply knowledge of WWTP process characterization, lab safety and methods, sound technical judgment, and technical writing skill to an end-of-semester lab project (characterize an unknown material).

### **TEXTBOOKS/MATERIALS:**

- *Environmental/Civil Engineering 482 Laboratory Manual* (posted on Canvas as individual labs)
- Personal protection equipment (PPE) (loaned by department)
- Lab worksheets, data spreadsheets, procedures, and photo documentation.



## COURSE SCHEDULE

Date	Lab	Topic	Due
24/25-Jan	Intro	Course Introduction/Orientation/Lab Safety	--
31/1-Feb	Lab 1	pH, Conductivity, Turbidity	Safety Quiz
7/8-Feb	Lab 2	Alkalinity, Hardness	Lab 1
14/15-Feb		Lab Report Assistance	--
21/22-Feb	Lab 3 (4)	Gravimetric Analysis - Solids Determination	Lab 2*
F28/1-Mar	Lab 4a (5a)	Chemical Oxygen Demand & Biochemical Oxygen Demand	--
7/8-Mar	Lab 4b (5b)	Chemical Oxygen Demand & Biochemical Oxygen Demand	Lab 3
14/15-Mar		No Lab "Spring Break"	--
21/22-Mar	Lab 5 (3)	Coagulation and Flocculation	Lab 4
28/29-Mar	Lab 6a	Indicator Organisms / Independent Study Option Selection	Lab 5
4/5-Apr	Lab 6b	Indicator Organisms (read plates) / Ind. Study Work Plan	Work Plan
11/12-Apr	Lab 7a	Mystery/Design Lab – Begin Lab Work	Lab 6
18/19-Apr	Lab 7b	Mystery/Design Lab – Complete Lab Work (if needed)	--
25/26-Apr		No Lab	Lab 7
* Optional Lab 1 report rewrite due on same day			

## COURSE EXPECTATIONS

**ATTENDANCE:** Labs are by definition, hands-on endeavors. Attendance is mandatory. It is important that you arrive early, as some of the experiments will require the entire class period. Due to the cooperative nature of the class and the setup requirements for each experiment, it will not be possible to make up labs. Students must attend the lab session to which they are registered. If a switch is necessary, the student must obtain approval from the lab instructor at least one week in advance, with a maximum of one switch per semester; the reason for absence from the registered lab session must be approved. Students with COVID related illness must not attend class. **Contact the instructor to discuss/plan for alternate lab participation and assignment.**

**CLASS PARTICIPATION:** It is each student's responsibility to fully engage in the lab course. This includes being on time for all lab periods, wearing lab-appropriate dress, familiarizing oneself before class with the lab's specific principles and procedures, collecting and posting appropriate raw data, and completing lab duties. Lab duties include storing PPE, cleaning lab spaces, and storing glassware and equipment prior to leaving, as directed by the instructor/TA. Students not wearing proper lab-attire will be penalized on their participation grade for that lab.

**PRE-LAB QUIZZES:** You are required to thoroughly review the upcoming lab's theory and procedures. A quiz is given prior to each new lab unit to evaluate student's familiarity with lab theory and procedures. Quizzes must be completed on Canvas **prior** to the corresponding lab period.

**In-CLASS INTERVIEWS:** These are informal conversations during the lab period focusing on observations and interpretation of the lab activities. Example: "Did you expect that reaction/outcome?" "What does that tell you about the sample?" "Why do the procedures specify using that reagent?" These are not formally graded but will be considered when determining final participation evaluation.

**DISCUSSION BOARD:** Each student will post their data to the discussion board within 24 hours of leaving your lab section. Data from both sections will be combined into one dataset for use in completing the lab report. If you do not post the data within 24 hours of your lab session, you will lose the 5 points towards the lab in addition to 0.25 points towards your attendance/participation. For lab teams, only one submission per team is required, but the submission must list all team members' names. The submission can be typed into the discussion board, posted as an excel file, or as a picture (Note: pictures must be in-focus, well-illuminated, and legible).

**LAB REPORT FORMAT:** Reports for this lab course will be formatted similar to formal scientific journal articles. Each report will contain: a cover page (use UTK branding template, provided), an introduction, method, results, discussion, conclusion, references, and an appendix. They shall be written in grammatically correct technical English prose. You have one week to prepare each lab report and upload it to Canvas. Each student will prepare/submit their own individual lab report (no "team" lab reports). Use a 12 pt., sans-serif font (ex., Tahoma, Calibri, Arial). Raw data tables are to be put in the report appendix. Tabulated data summaries (if applicable) go in the appropriate section of the report (results and/or discussion sections). The tabulated summary tables can include simple statistical calculations (e.g., averages or ranges; unit conversions; equivalency calculations; etc.). Include one long-hand calculation of data manipulations performed on raw data. This serves as an accuracy check on spreadsheet formulae/calculations.

**LAB REPORT CONTENT and EVALUATION CRITERIA:** You have been provided a generic lab report checklist to help organize report information and content format. Download it from Canvas, through the **Syllabus** link/folder. That same checklist serves as the grading rubric; points for each report section are listed on the far-right column. For report sections *Tables, Figures, Results, and Discussion*, the expected content is explained in the lab-specific *Report Content Instructions* document found under the **Assignments** link/folder.

**GRADING:** Lab reports, attendance/class participation, and pre-lab quizzes will be evaluated and scored. Final grade is calculated as weighted averages of category-specific scores, as follows:

Assignment	Percent Contribution to Final Grade
Lab Reports (1 - 6)	11% each (66% total)
Final Project: workplan 11%; Lab 7 report (11%)	22%
Attendance/Class Participation	5%
Pre-Lab Quizzes	7%

**WATER RESOURCES ENGINEERING II**  
**Environmental Engineering (ENVE) 494 / 497**  
**Civil Engineering (CE) 494 / 497**

FALL 2022 COURSE OUTLINE

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**DESCRIPTION:** The course covers analysis and design concepts in environmental and water resources in civil engineering with a focus on municipal water and wastewater transport systems. Design applications utilize hydraulic principles for pressure- and gravity-flow pipes, and pump curves. The course includes water supply identification, groundwater capacity analysis, water system design, wastewater gravity-sewer design, and pump stations. Design of water supply networks utilizes the EPANET (v.2) software. Professional practices will be introduced for system design components, i.e., pipe, pipe fittings, valves, flow measurement, other. Sanitary sewer design includes topics of alternative systems and rehabilitation methods.

**PREREQUISITES:** ENVE/CE 391 Water Resources Engineering I.

**CREDIT:** 3 semester hours

**SCHEDULE:** Lecture: MWF 12:40 PM – 1:30 PM; 402 John D Tickle Engineering Building

**INSTRUCTOR:** **Dr. John S. Schwartz**  
 University of Tennessee; Civil and Environmental Engineering Dept.  
 413 John D. Tickle Engineering Bldg.; Knoxville, Tennessee 37996  
 Telephone: (865) 974-7721; Fax: (865) 974-2669  
 E-mail: [jschwart@utk.edu](mailto:jschwart@utk.edu)

**LEARNING OUTCOMES/COURSE GOALS:**

- Students will learn concepts of population forecasting and water/waste system capacity and apply them in water infrastructure master planning.
- Students will integrate knowledge of pressure hydraulics, pump characteristics, site-specific conditions, and applicable codes and regulations to design a water supply or wastewater pump station.
- Students will learn EPANET software and use it to analyze the performance of a water distribution system
- Students will integrate concepts from open-channel flow, site specific conditions, and applicable codes and regulations to design a sanitary sewer collection system.

**COURSE MATERIALS/TEXTS**

- Supporting Texts:** Fluid Mechanics with Engineering Applications, 2002 Tenth edition; by E.J. Finnemore and J. B. Franzini; McGraw-Hill, New York, NY. [FF]
- Water Resources Engineering, 2005 Second edition; by L.W Mays; John Wiley & Sons, Inc., Hoboken, NJ. [M]
- Water Supply and Pollution Control, 2009 Eight edition; by W. Viessman, M.J. Hammer, E. M. Perez, and P.A. Chadik; Pearson Education, USA. [VH]
- Hydrology and Hydraulic Systems, 2001. By R.S. Gupta; Waveland Press, Inc. [G]

**Supporting Documents:** Various supporting documents from textbooks, US EPA and AWWA documents, and Standards will be used.

**PROFESSIONAL SUPPORT:** Mr. Mark McKinney, P.E., and Mr. Edwin Deyton, P.E.; First Utility District of Knox County, Tennessee (FUD KNOX) will provide six presentations during the semester on design and practice of water/ wastewater municipal systems. The presentation will generally follow the lecture materials and relate to the class projects. Quizzes will be given on the presentation materials the following lecture period.

**EVALUATION:** Homework (15%); Quizzes (5%); Exams (30%); Projects (45%); and Final Exam (5%)

**HOMEWORK:** Individual homework as class handouts will be assigned throughout the course and posted on Canvas. Grading emphasis for homework is on the problem-solving approach, demonstrated understanding of the concepts, level of effort, and professional presentation and appearance (see attached homework guidelines). If needed, you are encouraged to use word processing, spreadsheets, graphics, and code programming for solving the homework problems. Homework format requirements follow. Pay attention to requirements for homework that require a spreadsheet.

Homework is due one week from the assigned date, the day the handout is provided in class. Homework will be graded and returned by a teaching assistant as soon as possible and before exams. No late homework will be accepted. Keys to homework solutions will be posted on Canvas.

**QUIZZES:** Quizzes include questions from the FUD KNOX professional presentations. Other quizzes will be periodically given during the semester based on lecture material. Quizzes will follow the next lecture period after the FUD KNOX presentation. and announced one lecture period before the quiz on short problems.

**PROJECTS:** Three projects will be assigned during the course: 1) water system analysis applying fundamental pressure-pipe hydraulics and pump design criteria; and a water supply pump station design component; 2) water distribution system analysis using EPANET; and 3) a sanitary sewer design and wastewater pump station design including the force main. Projects will be conducted in teams of three to four students. Each team will submit an engineering design report of professional quality. Details will be provided on producing a

professional technical report are summarized in an attachment below. Students enrolled in the honors class ENVE/CE 497 have additional advanced content incorporated into project 3.

**EXAMS:** Midterm exams will consist of three in-class exams (see attached exam guidelines). In-class exams will consist of short answer covering key concepts, simple problems, and longer more challenging problems. The midterm exams are closed book, but one formula sheet will be allowed. The *formula sheet* is a *single-sided 8-1/2" by 11" sheet of paper*, in which you can write formulas. Formula sheets shall be hand-written notes only, no photocopy paste on information will be allowed. *Formula sheets must be turned in with exam*, failure to turn the sheet in or violate the rules will result in -5 points. Constants and conversion factors will be provided with the in-class exams so they don't need to be on your formula sheet.

**FINAL EXAM:** Students will be required to choose a system component (e.g. valve, pump, controls, etc.) and prepare a two-page description of its use in water/wastewater system design, and four- to five-minute oral "zip talk" presentation on your selected topic. Zip talks will be presented during finals week at the class' scheduled period.

#### **KNOWLEDGE AND SKILLS ACQUIRED:**

Students will learn key design elements of water resources engineering for municipal public works, including water supply, wastewater collection sewers and pump stations, and storm/drainage sewers. Hydraulic analysis skilled will be enhanced.

To note, complete water system knowledge is acquired through taking other CE and ENVE courses: 1) water and wastewater treatment are covered in ENVE/CE 381 and ENVE/CE 481; 2) groundwater supply covered in GEOL/CE 485 (Principles of Hydrogeology), 3) hydrological systems and design of stormwater control measures are covered in ENVE/CE 495 (Hydrology), ENVE516 (Watershed Management), and ENVE533 (Green Infrastructure Design); and 4) surface water flow for channel conveyance, bridge, and culvert designs are covered in ENVE515 (Open Channel Hydraulics).

Date	Topic	Chapter Readings	
August	24	Course Introduction, Municipal Systems; Terms	VH 1, 2; M 1, G 1
	26	CE 391 Hydraulic Problems: <i>Self-Study Review</i>	Hydr. HO
	29	<i>Review: Pressure Pipe Flow: Series and Minor Losses</i>	FF 8, G 11
	31	<i>Review: Pressure Pipe Flow, Parallel Pipes</i>	FF 8, M 4
September	2	<i>Review: Pressure Pipe Flow, Parallel Pipes continued...</i>	FF 8, M 4
	5	Labor Day – no class	----
	7	Pressure pipe flow, branching pipes	FF 8, M 4
	9	Pressure flow in pipes, networks	FF 8, M 12
	12	Municipal Infrastructure Master Planning / Reports	----
	14	Water source identification; population projections	VH 3, G 2
	16	<b>Midterm Exam 1: Fundamental Hydraulics</b>	----
	19	Pipe materials and construction standards (FUD)	----
	21	Groundwater sources and aquifer capacity	VH 3; M 6, G 3
	23	Groundwater, well production and design	M 6, G 5
	26	Water demands; capacity analysis; storage	VH 4; M 11
	28	Water supply system components: design elements	VH 6, M 11
	30	Pumping station, water system design	----
October	3	Pumping stations, general design elements (FUD)	----
	5	Pumps, manufacturer pump curves, pump stations	FF 15, Mv12
	7	Fall Break – no class	----
	10	Pumps systems, HGL/EL computations	G 11, M 12
	12	Pumps: cavitation and water hammer	FF 15, G11
	14	Problem solving: spreadsheets/Project 1	----
	17	Project 1 Assistance	----
	19	<i>Mid-term Exam Review</i>	----
	21	<b>Midterm Exam 2</b>	----
	24	Intro: EPANET Model	EPA User's Manual
26	Water distribution system analysis/design (FUD)	----	
28	Project 2 Introduction	----	
31	EPANET Modeling / Project Problem Solving	----	
November	2	Project 2 Assistance	----
	4	<i>Review: Open channel hydraulics, uniform flow</i>	FF 10
	7	Open channel hydraulics, gradually-varied flow	FF10
	9	Open channel hydraulics: problem solving	----
	11	Sanitary sewer system components, demands & capacity	G 13, VH 5
	14	Sanitary sewer design, system layout	VH 7, M 15
	16	Sanitary sewer design standards (FUD)	----
	18	<b>Midterm Exam 3: Open Channel Hydraulics</b>	----
	21	Wastewater pumping stations, design considerations	----
	23-25	<b>NO CLASS</b> – Thanksgiving Holiday	----
	28	Pump station project design (FUD)	----
	30	Alternative sanitary systems, small demands	----
	2	Project 3 assistance	----
	5	Sanitary sewer: system: rehabilitation practices	----
7	Design drawings, general (FUD)	----	
8	<b>NO CLASS</b> – Study Day	----	
14	<b>Final Exam (oral presentations, written paper due) 1:00 PM – 3:15 PM</b>		

**HYDROLOGY**  
**Environmental Engineering (ENVE) 495 / 531**  
**Civil Engineering (CE) 495 / 531**

SPRING 2023 COURSE OUTLINE

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**DESCRIPTION:** Introduction to hydrology including hydrologic variability, precipitation, evaporation, infiltration, runoff, hydrographs, flood routing and conveyance system (pipes and channels). Course text (see below) will be supplemented by material provided on UTK Canvas.

**PREREQUISITES:** ENVE/CE 391 and 494: Water Resources I + II (fluid properties; flow measurement; fluid statics; basic conservation laws and properties of incompressible fluids (continuity, energy, and momentum equations); pipe flow and pump/turbine systems; and open channel flow) and hydrologic concepts (basic hydrological and watershed processes; water budgets; rainfall-runoff models; groundwater flow and well performance; and water resource system characteristics).

Also must have competency in differential and integral calculus, basic mechanics and dynamics. Knowledge of PC usage and word processing, spreadsheet, and graphing software is expected.

**CREDIT:** 3 semester hours (lecture only).

**SCHEDULE:** Lecture: MWF 12:40 – 1:30 PM - JDT 434

**INSTRUCTOR:** **Dr. Jon M. Hathaway, PE**  
 415 John D. Tickle Building, Knoxville, TN 37996  
 E-mail: [hathaway@utk.edu](mailto:hathaway@utk.edu)  
 Phone: (865) 974-6058  
 Website: <http://hathaway.utk.edu>

**TA: Probal Saha**  
 411 John D. Tickle Building  
 E-mail: [psaha2@vols.utk.edu](mailto:psaha2@vols.utk.edu)

**OFFICE HOURS:** **Hathaway: By appointment (Zoom)**

**Probal Saha: By appointment (Zoom)**

**TEXT:** Hydrology and Floodplain Analysis, 2018 sixth edition; by P.B. Bedient, W.C. Huber, and B.E. Vieux; Prentice Hall, Pearson Education, Inc., Upper Saddle River, NJ.

\* Various materials/documents will be posted on the Blackboard as additional resources.

**LEARNING OUTCOMES/COURSE GOALS:**

1. Modeling Hydrologic Cycle: Students will demonstrate an understanding of the Hydrologic Cycle and will be able to apply models for simulating various stages of this cycle, such as evaporation, transpiration, and infiltration.
2. Analyze and Interpret Data: Students will be able to examine and interpret various types of hydrologic data (including precipitation, watershed characteristics, and water quality parameters), employing statistical methods to draw conclusions about hydrologic phenomena and trends.
3. Apply Rational Method and SCS Curve Number Method: Students will be able to apply the Rational Method and SCS Curve Number Method to real-world scenarios to estimate runoff and predict flood events, analyzing the factors that influence the results.
4. Perform Watershed Delineation and Analysis: Students will be able to perform delineation of a watershed using GIS tools and analyze its key properties like catchment area, slope, drainage density, etc and use this information in HEC-HMS models.
5. Understand and Apply Hydrological Methods: Students will develop the ability to employ hydrological methods, such as unit hydrographs and routing, in solving problems related to surface water hydrology.
6. Groundwater Hydrology: Students will be able to analyze subsurface water movement, aquifer properties, and impacts of human activities on groundwater resources, integrating their knowledge of the entire hydrologic cycle.
7. Erosion and Sediment Control: Students will understand the factors contributing to erosion and sediment transport, and be able to propose and analyze various control measures, taking into account environmental and engineering perspectives.
8. Low Impact Development and Water Quality: Students will be able to assess how different low impact development strategies can improve water quality and hydrological conditions, conducting a comparative analysis of various strategies based on effectiveness, cost, and sustainability.

**EVALUATION:** (25%) Homework/Quizzes/Project  
 (25%) Exam 1  
 (25%) Exam 2  
 (25%) Final Project  
 \* For graduate / honors sections, Homework will be 20%, Additional Final Project/Essay/Presentation will be 5% (see details below)

**HOMEWORK:** Individual homework will be assigned throughout the course and posted on Canvas. Grading emphasis for homework is on the problem-solving approach, demonstrated understanding of the concepts, level of effort, and professional presentation and appearance (see attached homework guidelines). You are encouraged to use word processing, spreadsheet, graphics, and computer spreadsheets for solving the homework problems.



Homework due dates will be posted on each homework assignment. Homework will be graded and returned as soon as possible and before exams. **Late homework will receive a 10 point deduction for being up to 2 days late, a 30 point deduction for being up to a week late, and will not be accepted afterward unless by special arrangement with the instructor.** Complications submitting homework due to verifiable emergencies will be handled on a case-by-case basis.

**EXAMS:** Exams will consist of two in-class exams and a final comprehensive exam (see attached exam guidelines) and will consist of short answer covering key concepts, simple problems, discussions, and longer more challenging problems. Exams may be closed or open book at the discretion of the instructor.

**MAKE-UP WORK:** Unless prior arrangements are made with the instructor, or unless there is an unforeseen, **verifiable** emergency, **no** make-up work (exams, homework assignments) will be considered. See HOMEWORK for discussion on penalties for late homework.

**HONOR CODE:** All students must pledge to uphold the UT Honor Code. Strict enforcement of the code in this class is expected. Students are encouraged to "work together" on homework assignments as far as discussing solution approaches, comparing answers, and to giving and receiving guidance. However, all work submitted for an individual grade should be that individual's work.

**CELL PHONES:** Cell phones are to be stowed away in book packs during all class periods, non-exam and exam days. If the use of a cell phone is distracting the instructor or fellow students, the individual using the phone may be asked to leave the room.

**GRADUATE STUDENTS / HONORS STUDENTS:**

An additional assignment will be required of graduate students and honors students enrolled in the course. This will consist of a critical review of a paper and a short literature review on a recent, pressing issue in the field of hydrology. Students will also deliver a short presentation on their topic.

## Water Resources Engineering Laboratory

### ENVE/CE496 Syllabus – Fall 2022

*Class Periods:* Tuesday 0810 – 1105 (Section 001)/ Friday 0800 – 1120 (Section 002)

*Location:* Room 200 Tickle (Water Resources & Hydraulics Teaching Facility)

Date	Week Beginning	Topics	Chapter
January	23	Class Introduction, Hydrologic Cycle, Models, Data Sources, Precipitation, Watersheds, Watershed Delineation	1, 2
	30	1. Tree Hydrology 2. Interception & Storage / Evaporation & Transpiration (Water Budget, Pan, Penman)	2
Feb	6	1. Infiltration 2. Time of Concentration, Rational Method, Surface Water Hydrology, USGS Regression Equations	
	13	1. SCS Curve Number Method 2. GIS tutorial 1	
	20	1. HEC-HMS Intro / Demo 2. GIS tutorial 2	
	27	Test Review, <b>Test 1</b>	
March	6	1. GIS tutorial 3 2. Hydrologic Measurements	
	13	<b>Spring Break</b>	
	20	1. Statistical Methods in Hydrology 2. Unit Hydrographs	
	27	1. Routing Intro, Weirs, Orifice Equation 2. Routing / level pool	
April	3	1. HEC-HMS Demo (Routing) 2. HEC - HMS (subcatchments)	
	10	1. HEC-HMS continuous simulation 2. Culvert / Swale Design 3. <b>No Class 15th</b>	
	17	1. Groundwater Hydrology 2. Erosion and Sediment Control	
	24	Test 2 Review, <b>Test 2</b>	
May	1	1. Low Impact Development and Stormwater Controls 2. Water Quality	
	5 <sup>th</sup> and 8 <sup>th</sup>	Grad Student / Honors Presentations	
	17	<b>Final Exam</b> (Final Project Due)	

*Instructor:* Dr. Adrian Gonzalez (“Dr. G”) (agonza17@utk.edu)

865-673-4820 (mobile phone – preferred contact by text)

On-campus location: 317 Science & Engineering Research Facility (SERF)  
1414 Circle Drive (across road from Perkins Hall)

*Office Hours:* By appointment for in-person meetings; Text for quick communications

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## Introduction

Water Resources Engineering (WRE) Laboratory (ENVE/CE 496) will provide you the opportunity to observe and apply fundamental hydraulic principles introduced in lecture courses. Through hands-on experimentation, you'll explore basic properties of incompressible fluids; conservation laws of mass, energy, and momentum; open channel flow; pipe flow; friction losses; and flow measurement techniques. You'll see examples of fundamental WRE principles in action in real-world design and field conditions.

Throughout the semester, student-teams will operate equipment, use instruments, and collect and process data. This hands-on learning experience is supplemented by short quizzes, formal lab reports, and in-class presentations. Cooperative team interactions and discussions among team-members provide a third aspect of learning in this course. Through these experiences, civil engineering students build their technical competence. They also practice valuable professional skills in support of future careers. Such skills include (1) designing, organizing, and executing investigative studies, (2) compiling and organizing project data and information (e.g., objectives, methods, analyses, and findings), and (3) clearly and efficiently communicating this information to audiences with various levels of knowledge (lay-public, decision-makers, and technical experts).

## Course Details and Expectations

*Pre-Requisites:* ENVE/CE 391 (Water Resources Engineering I); differential and integral calculus; basic mechanics and dynamics; knowledge of current software (spreadsheet, word processing, presentation).

*Printed Class Material (Textbook / Laboratory Manual):*

No textbook is required for this lab course. You will be provided lab manual sections each week. It contains background theory, protocols, and data sheets needed to complete each week's lab. Background material relevant to the lab manual can be found in the book *Fluid Mechanics* (2<sup>nd</sup> Ed.) by R.C. Hibbeler (Pearson Education Inc., New York, NY), or similar current textbook.

*Expected Learning Objectives:*

1. Reinforce basic concepts through hands-on experience measuring fluid mechanical and hydraulic parameters. Lab activities reinforce material in ENVE/CE 391 (Water Resources Engineering I) and ENVE/CE 494 (Water Resources Engineering II).

**NOTE: This lab DOES NOT parallel the sequence of ENVE/CE391 OR ENVE/CE494.**

2. Learn the theory and operation of equipment and instrumentation used for measuring/quantifying/calculating fluid mechanical and hydraulic parameters
3. Practice and refine skills for collecting, analyzing, and critically assessing data
4. Practice and refine technical communication skills through (1) team and class discussions; (2) technical report writing, and (3) engaging oral presentations
5. Practice and refine professional/interpersonal communication and cooperation for achieving common project objectives

*Course Attendance and Participation:*

ENVE/CE 496 is a **hands-on experience** in identifying, quantifying, and evaluating fluid mechanical and hydraulic parameters. Thus, attendance and participation in all lab sessions is required of each student.

*Grading Weights and Ranges:*

Attendance/Participation: 10%; Quizzes: 15%; Lab Reports: 60%; Presentation: 15%

## Tentative CE496 Schedule (Fall 2022):

Date	Wk	Topic
(F) August 26 (T) August 30	0	<b>Orientation</b> – introductions; course policies and expectations. Overview of material to be covered.
(F) Sept. 2 (T) Sept. 6	1	<b>WREL-1: Forces in Balance</b> – Fluid properties, force balance, hydrometers, viscometers, Stokes’s Law, terminal velocity
(F) Sept. 9 (T) Sept. 13	2	<b>WREL-2: Hydraulic Pressure</b> – Hydrostatic pressure, Pascal’s Law, center of pressure, barometer, Bourdon pressure gauges
(F) Sept. 16 (T) Sept. 20	3	<b>WREL-3: Friction and Energy Loss</b> – Pipe flow, friction losses, energy balance, Bernoulli’s Theorem, Reynolds Number, Moody diagram, Venturi flow meters
(F) Sept. 23 (T) Sept. 27	4	<b>WREL-4. Pumps and Energy Gain</b> – Pump operation and efficiency, System curves, pump curves, impeller characteristics
(F) Sept. 30 (T) Oct. 4	5	<b>WREL-5. Natural Flow Underground</b> – Darcy’s law, aquifer properties, porosity, permeability
(F) October 6-7 (T) October 11		<b>Fall Break (no class)</b> <b>Tuesday section cancelled</b>
(F) Oct. 14 (T) Oct. 18	6	<b>WREL-6. Natural Flow Aboveground</b> – portable flow gages, USGS data, field equipment
(F) Oct. 21 (T) Oct. 25	7	<b>WREL-7. Turbulence and Energy Loss</b> – velocity vectors, vertical velocity profile, turbulence, ADV flow measurement
		<b>Engineer’s Day (Thursday October 27)</b>
(F) Oct. 28 (T) Nov. 1	8	<b>WREL-8A. Open Channel Flume</b> – Flume orientation, calibration, and applications
(F) Nov. 4 (T) Nov. 8	9	<b>WREL-8B. Manning’s Equation (... not Peyton’s)</b> – Manning’s $n$ , hydraulic jump calculations
(F) Nov. 11 (T) Nov. 15	10	<b>WREL-8C. Watch Where Weir Flowing</b> – Culverts and Weirs (obstructions to open channel flow)
(F) Nov. 18 (T) Nov. 22		<b>In-class Presentations</b>
(F) Nov. 25 (T) Nov. 29		<b>Thanksgiving Holiday (no class)</b> <b>Tuesday section cancelled</b>

## Geovisualization & Geographic Information for Researchers & Professionals

### Geography 495/520 Spring—2023

#### Course Information

- **Course number:** GEOG 495/520
- **Credit hours:** This course is 3 credit hours consisting of two 50-minute lectures, one 50-minute in-person lab, and 65-minute online lab per week.

#### Course Description

Geographic Information System (GIS) is a powerful tool that may be used to visualize, query, analyze, and interpret spatial and non-spatial data. GEOG 520 covers fundamental concepts and methods of geovisualization and geographic information science, including properties, sources, uses, design, and production of maps and basic spatial analysis functions. It emphasizes applications of geovisualization and mapping as well as geospatial analysis in graduate student research and projects.

#### Central Learning Objectives

Students who have successfully completed the course should be able to:

- Explain the core concepts and technologies involved in GIScience.
- Describe the key components of GISystems (e.g., software, hardware, and geospatial data).
- Know basic GIS operations on vector and raster data.
- Apply basic spatial analysis methods to real-world problems.
- Design and carry out a simple GIS project soundly.

#### Textbook

Paul Bolstad (**PB**), 2019. GIS Fundamentals: A First Text on Geographic Information Systems, 6<sup>th</sup> Edition. Eider Press.

#### Prerequisites and Skills

GEOG 520 is a GIS course for graduate students who have no background in GIS but want to accelerate their GIS knowledge and skills so they can apply it into their research or projects quickly and effectively. As such, students do not need to have basic understanding of GIS and cartography to be successful in GEOG 411. On the other hand, students are expected to be computer literate and have a good working knowledge of the Windows environment file management. It is student's responsibility to learn by him/herself to make familiar with some basic software's function. Specifically, students should be able to:

- Communicate with the instructor and lab TAs using e-mail.
- Search the Internet for data and information relevant to the course.
- Know the basic operation of Online@UT Canvas.
- Download files from Canvas, handle zip/unzip the file for compressed file (.zip., .tar. etc.) using compression software (7-Zip, Win-zip)
- Need a working knowledge of Microsoft PowerPoint for final project presentation.

### How will your final grade be calculated?

- Lab Assignments (35%)
- Quizzes (15%)
- Two Midterm Exams (15% each)
- Term project (20%)
- Literature Review (part of the term project)

### Tentative Course Schedule\*

**\*Note:** this is a tentative course schedule. We may need to adjust it depending on our actual progress.

Week (Month, Dates)	Lecture Topics	Reading Chapters	Lab Sections
Week 1 (Aug. 22, 24)	- Course overview and policy - Review of GIS basics	1	Lab policy and introduction of GTAs <b>Lab0:</b> ArcMap revisit/introduction
Week 2 (Aug. 27, 29, Sep. 1)	- Coordinates & projections - GIS data models: vector & raster - Triangulated irregular network (TIN)	2, 3	<b>Lab1:</b> Projecting geographic data
Week 3 (Sep. 5, 7)	- Join and relate <b>*No lecture on Sep. 3 (Labor Day)</b>	8	<b>Lab2:</b> Table operations
Week 4 (Sep. 10, 12, 14)	- Spatial join & buffer - Vector overlay operations (I)	9	<b>Lab3:</b> Spatial selection, importing, joining tables
Week 5 (Sep. 17, 19, 21)	- Vector overlay operations (I) - Raster analysis (I)	9, 10	<b>Lab4:</b> Buffering & Overlay
Week 6 (Sep. 24, 26, 28)	- Raster analysis (II) - Terrain analysis	10, 11	<b>Lab5:</b> Raster analysis
Week 7 (Oct. 1, 3)	- <b>1st Midterm Exam (Oct. 1)</b> - Hydrologic analysis		No lab on Oct. 5 (Fall Break)
Week 8 (Oct. 8, 10, 12)	- Basic spatial statistics (I) - Basic spatial statistics (II)		<b>Lab6:</b> Terrain analysis
Week 9 (Oct. 15, 17, 19)	- Spatial interpolation (I) - Spatial interpolation (II) - Final project guide	12	<b>Lab7:</b> Sampling & Interpolation
Week 10 (Oct. 22, 24, 26)	- GIS modeling (I) - GIS modeling (II)		<b>Lab8:</b> Modelbuilder
Week 11 (Oct. 29, 31, Nov. 2)	- Spatial statistics (I) - 2 <sup>nd</sup> midterm exam guide		<b>Final project (I):</b> proposal presentations
Week 12 (Nov. 5, 7, 9)	- Spatial statistics (II) - <b>2<sup>nd</sup> midterm exam: in-class (Nov. 7)</b>		<b>Lab9:</b> Web-based GIS
Week 13 (Nov. 12, 14, 16)	- Web-based GIS (I) - Web-based GIS (II)		<b>Final project (II):</b> working on your final project
Week 14 (Nov. 19, 21)	- Geospatial database - Course summary	8	<b>* No lab on Nov. 23 (Thanksgiving)</b>
Week 15 (Nov. 26, 28, 30)	- No lecture - Final project presentations		Final project presentations (Nov. 30)
Week 16 (Dec. 3)	- Project presentations		<b>* Classes end on Dec. 4</b>



## Appendix G: Assessment Documents

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Example course-level assessments are included on the following pages.

1. Student Learning Outcome 1. an ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics as assessed in CE 391, Spring Semester 2023. ENVE 391 and CE 391 are cross-listed in the new BS ENVE curriculum.
2. Student Learning Outcome: 2. Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors, as assessed in CE 400 Spring semester 2022. ENVE 400 is planned to be patterned after CE 400, so similar assessment procedures are likely to be followed.
3. Student Learning Outcome: 6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions, as assessed in CE 482, Spring Semester 2023. ENVE 482 and CE 482 are cross-listed in the new BS-ENVE curriculum.

**Outcome:** *1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics*

**Context for Assessment:** CE 391. Exam problem on development of hydraulic system curve

**Assessment Method Description:** Students should complete a multi-step problem that includes development of a system curve using an energy equation, drawing the system curve on top of a pump curve given by the instructor, and identifying the operating point.

**Assessment of Results and Analysis:** 84% of students fell in the Satisfactory or Exemplary category. 98% of students fell in a category of Developing or higher. Exemplary students were able to identify that the energy equation was needed, could formulate this equation, solve the equation (including minor and frictional losses) with only minor errors, plot this equation on a pump curve, and identify the operating point. Unsatisfactory students were unable to recognize that the energy equation was needed and thus could not solve any of the required elements. This problem was one of 3 problems given as part of a test in the class.

**Actions Taken:** Students **did** reach the desired level of performance. In comparison to Fall 2020, the following actions were taken to improve scores: (1) the number of test questions was reduced from 4 to 3 on this exam to give the students more time, and (2) a lecture was added to the course curriculum to show students how elements of the energy equation are combined into one equation and used to develop a system curve.

**Instructor:** Jon Hathaway

**Date:** May 30, 2023

Map to Language in Student Outcome	Weight	Indicators	Levels of Performance			
			Unsatisfactory	Developing	Satisfactory	Exemplary
The ability to identify and formulate engineering problems by applying principles of engineering, science, and mathematics	50	Understanding Problem Statement and formulate approach to set up problem	Cannot sufficiently interpret the problem statement.	Can sufficiently interpret the problem statement but unable to develop an approach that can lead to a solution.	Can sufficiently interpret the problem statement and develop an approach that can lead to a solution.	Can sufficiently interpret the problem statement and develop an approach that can lead to a solution. Documents the engineering, science, and math principles needed to solve problem.
The ability to solve complex engineering problems by applying principles of engineering, science, and mathematics	50	Succeeds in solving elements of the problem based on engineering principles.	Cannot complete most aspects of the problem solving outcome. Unable to link engineering, science, and math principles and understanding to solutions.	Can perform some aspects of problem solving correctly, but unable to complete full problem solution and/or (multiple) errors in interpreting variables.	Can solve all aspects of the problem and achieve the correct solution. Does not adequately document work and/or minor errors in interpreting variables or completing the problem.	Can solve all aspects of engineering problem. Shows all work, illustrating engineering, science and math principles. Presents the results in a meaningful way.

## SAMPLE STUDENTS' RESULTS SUMMARY

Using the specific in-class activity, record the performance for each indicator presented in the rubric.

Ranking Scheme:

Performance Level	Value
Unsatisfactory	1
Developing	2
Satisfactory	3
Exemplary	4

Scoring System: ` Weighted average of performance level value and performance indicator weights.

Performance Level	Score
Unsatisfactory	$\leq 1$
Developing	1.1 – 2.0
Satisfactory	2.1 – 3.2
Exemplary	3.3 – 4.0

Student	Understanding Problem Statement and formulate approach to set up problem.	Succeeds in solving elements of the problem based on engineering principles.		
	50	50	Magnitude	Level
1	3	2	2.5	Satisfactory
2	3	3	3	Satisfactory
3	3	3	3	Satisfactory
4	4	3	3.5	Exemplary
5	2	3	2.5	Satisfactory
6	4	3	3.5	Exemplary
7	4	3	3.5	Exemplary
8	4	3	3.5	Exemplary
9	2	2	2	Developing
10	4	4	4	Exemplary
11	2	2	2	Developing
12	2	2	2	Developing
13	2	2	2	Developing
14	3	4	3.5	Exemplary
15	3	3	3	Satisfactory
16	4	2	3	Satisfactory
17	3	3	3	Satisfactory
18	3	2	2.5	Satisfactory

Student	Understanding Problem Statement and formulate approach to set up problem.	Succeeds in solving elements of the problem based on engineering principles.		
19	4	3	3.5	Exemplary
20	3	2	2.5	Satisfactory
21	3	2	2.5	Satisfactory
22	3	2	2.5	Satisfactory
23	4	2	3	Satisfactory
24	2	2	2	Developing
25	3	2	2.5	Satisfactory
26	3	2	2.5	Satisfactory
27	3	4	3.5	Exemplary
28	3	4	3.5	Exemplary
29	3	3	3	Satisfactory
30	4	3	3.5	Exemplary
31	3	2	2.5	Satisfactory
32	3	2	2.5	Satisfactory
33	3	3	3	Satisfactory
34	3	3	3	Satisfactory
35	2	4	3	Satisfactory
36	3	3	3	Satisfactory
37	2	2	2	Developing
38	2	3	2.5	Satisfactory
39	3	3	3	Satisfactory
40	1	1	1	Unsatisfactory
41	4	3	3.5	Exemplary
42	3	3	3	Satisfactory
43	4	4	4	Exemplary
44	4	3	3.5	Exemplary
45	3	3	3	Satisfactory
Average	3.0	2.7	2.9	

**Outcome:** 2. *Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.*

**Context for Assessment:** CE400: Faculty interviews after the 100% Design Development review.  
CE 399S: Reflection Narrative III

**Assessment Method Description:** This outcome is measured through two efforts, one capturing performance in the first term of the senior design course experience and an additional experience in the second (final) term of the course sequence. The first course (CE399S) engages students in a variety of professional and management skills lessons. Students participate in a workshop focused on design factors external to the formal project scope of work – including topics of global, local, social, environmental, and economic factors (herein referred to as “GCSEE factors”). Students are asked to author a reflection narrative demonstrating their understanding of these design efforts in the context of their design project and early career. In the CE400 course (second and final term for the senior design project course), students focus more intently on the engineering services. An interview with a faculty member allows the students to express the technical achievements accomplished in their design work; they specifically prepare an exhibit of work demonstrating consideration of explicitly stated design criteria as well as implicitly recognized criteria. The students also express the compliance criteria guiding design decisions, specifically those focused on ensuring public health, safety, and welfare.

**Assessment of Results and Analysis:**

- 82% of students fell in the Satisfactory or Exemplary category for consideration of both explicitly and implicitly stated components of design, with 100% performing at Developing or better.
- 86% of students fell in the Satisfactory or Exemplary category for design work abiding by governing standards and protocols, with 100% of the students performing at Developing or better.
- Composite scores show 92% of students in Satisfactory or better and 100% in Developing or better.

**Actions Taken:** Student performance is good. No action is required.

**Instructor:** Jennifer Retherford

**Date:** May 17, 2022

Student Outcome Label: (2)

Student Outcome Descriptor: Students must demonstrate: *An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare as well as global, cultural, social, environmental, and economic factors.*

## RUBRIC

Map to Language in Student Outcome	Weight	Indicators	Levels of Performance			
			Unsatisfactory	Developing	Satisfactory	Exemplary
Apply design to produce solutions that meet specified needs both explicitly and implicitly stated.	50	Documented evidence of applied engineering analysis and design process. Design solution articulated or identified. Sufficient evidence supports evaluation of design solution beyond code-driven requirements.	Documentation demonstrates incorrect analysis or design, may include major fundamental flaws in assumptions, process, or effort, or does not resolve to an appropriate solution. Documentation lacks evidence supporting evaluation of solution beyond code criteria.	Documentation either: <ul style="list-style-type: none"> <li>• Demonstrates major errors in analysis or design.</li> <li>• Work is incomplete or includes major errors or omissions.</li> <li>• Lacks sufficient evidence for evaluation of solution beyond application of code criteria.</li> </ul>	Documentation either: <ul style="list-style-type: none"> <li>• Demonstrates minor errors in analysis or design.</li> <li>• Contains minor or trivial effort towards evaluating design solution beyond code criteria.</li> </ul>	Documentation demonstrates application of standard engineering fundamentals and analysis to identify a solution. Specific evidence supports consideration of outcomes or consequences of design beyond those dictated by codes and standards.
Produce solutions to meet specified needs: public health, safety, welfare.	30	Documented solution implements applicable codes, standards, and guidance documents such as those articulated for the PE exam (e.g. IBC, ACI, AISC, OSHA, AASHTO)	Documentation does not demonstrate application or implementation of criteria specified in relevant codes, standards, or guidance documents.	Documentation either: <ul style="list-style-type: none"> <li>• Demonstrates major errors in application of codes, standards, or guidance documents.</li> <li>• Demonstrates major omissions of relevant content from</li> </ul>	Documentation either: <ul style="list-style-type: none"> <li>• Demonstrates minor errors in application of codes, standards, or guidance documents.</li> <li>• Demonstrates a lack of use of some applicable parts of</li> </ul>	Documentation demonstrates use of codes, standards, and/or guidance documents to develop an engineered solution.

				applicable codes, standards, or guidance documents	relevant codes, standards, or guidance documents	
Produce solutions to meet specified needs including: global, cultural, social, and economic factors.	20	Documentation supports consideration of (4) specified conditions in addition to other project-specific constraints (as applicable).	Documentation demonstrates complete disregard of (4) specified factors.	Documentation either: <ul style="list-style-type: none"> <li>• Demonstrates complete disregard to few factors.</li> <li>• Demonstrates partial disregard to most factors.</li> <li>• Demonstrates significant lack of integration of consideration within solution presented.</li> </ul>	Documentation either: <ul style="list-style-type: none"> <li>• Demonstrates some, but not all (4) factors.</li> <li>• Demonstrates partial, but not full consideration of factors.</li> <li>• Demonstrates solution with minor errors related to considered factors.</li> </ul>	Documentation of consideration of global, cultural, social, and economic factors is evident in arriving at a solution. Other project-specific constraints of similar nature also evident in solution created.

NOTES:

Criteria c not measured in CE400.



## SAMPLE STUDENTS' RESULTS SUMMARY

Using the specific in-class activity, record the performance for each indicator presented in the rubric.

Ranking Scheme:

Performance Level	Value
Unsatisfactory	1
Developing	2
Satisfactory	3
Exemplary	4

Scoring System: Weighted average of performance level value and performance indicator weights.

Performance Level	Score
Unsatisfactory	≤1
Developing	1.1 – 2.0
Satisfactory	2.1 – 3.2
Exemplary	3.3 – 4.0

Student	Rubric Indicator			Score	
	Documented evidence of applied engineering analysis and design process. Design solution articulated or identified.	Documented solution implements applicable codes, standards, and guidance documents such as those articulated for the PE exam (e.g. IBC, ACI, AISC, OSHA, AASHTO)	Documentation supports consideration of (4) specified conditions in addition to other project-specific constraints (as applicable).	Magnitude	Level
	50	30	20		
1	2	3		2.375	Satisfactory
2	3	3		3	Satisfactory
3	3	3		3	Satisfactory
4	3	3		3	Satisfactory
5	3	3		3	Satisfactory
6	3	4		3.375	Exemplary
7	3	3		3	Satisfactory
8	3	3		3	Satisfactory
9	3	4		3.375	Exemplary
10	3	4		3.375	Exemplary
11	3	3		3	Satisfactory
12	3	3		3	Satisfactory
13	3	2		2.625	Satisfactory
14	3	3		3	Satisfactory

15	3	3		3	Satisfactory
16	2	3		2.375	Satisfactory
17	3	3		3	Satisfactory
18	4	3		3.625	Exemplary
19	4	4		4	Exemplary
20	3	3		3	Satisfactory
21	2	2		2	Developing
22	4	4		4	Exemplary
23	4	3		3.625	Exemplary
24	4	4		4	Exemplary
25	4	3		3.625	Exemplary
26	2	3		2.375	Satisfactory
27	4	3		3.625	Exemplary
28	3	4		3.375	Exemplary
29	3	3		3	Satisfactory
30	4	3		3.625	Exemplary
31	3	3		3	Satisfactory
32	3	3		3	Satisfactory
33	3	3		3	Satisfactory
34	2	2		2	Developing
35	3	3		3	Satisfactory
36	2	3		2.375	Satisfactory
37	3	3		3	Satisfactory
38	2	2		2	Developing
39	4	3		3.625	Exemplary
40	4	3		3.625	Exemplary
41	3	2		2.625	Satisfactory
42	3	3		3	Satisfactory
43	3	2		2.625	Satisfactory
44	2	2		2	Developing
45	4	4		4	Exemplary
46	3	4		3.375	Exemplary
47	3	4		3.375	Exemplary
48	2	3		2.375	Satisfactory
49	3	3		3	Satisfactory

**Outcome:** 6. *An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions*

**Context for Assessment:** CE 482, Lab 7 Independent Study Comprehensive Lab

**Assessment Method Description:** Students are assigned one or more water samples of unknown composition and are asked to determine its identity or develop the outline for an appropriate treatment program for the source water. They are asked to make a preliminary assessment of the nature of their sample(s) and develop a characterization plan using as many of the semester's test procedures as appropriate. Their work plan, submitted for grade, must include technical justification for selecting (or excluding) each test procedure, a list of the equipment and reagents (and volumes) needed (based on desired number of replicates), data collection procedures, data analysis/reporting procedure, and an approximate schedule. Students are given access to the lab to execute their work plan. The criteria are 1) if the test selection is appropriate to the water sample, 2) if the work plan shows understanding of the application and performance of procedures and principles of data analysis, 3) if the writing shows critical thinking about the merits and limitations of the test procedures, and 4) if the final report shows a comprehensive and appropriate logical rationale (based on test results) for their conclusion. Correct identification of the unknown is a lesser criterion for this evaluation. More weight is given to the student's conclusion being well-supported with documented evidence and a clearly presented narrative discussion.

**Assessment of Results and Analysis:** 100% of students fell in the Satisfactory or Exemplary category.

**Actions Taken:** Continue to integrate skills learned early in the semester into the Independent Study module.

**Instructor:** Dr. Adrian Gonzalez

**Date:** May 30, 2023

Map to Language in Student Outcome	Weight	Indicators	Levels of Performance			
			Unsatisfactory	Developing	Satisfactory	Exemplary
Develop and Conduct Appropriate Experimentation	33.33	Understanding Problem Statement and Developing an Experimental Plan. Executing the plan	1: Cannot sufficiently interpret the problem statement.	2: Can sufficiently interpret the problem statement but unable to develop an experiment that adequately provides a solution to the problem.	Can sufficiently interpret the problem statement and develop an experiment that can adequately provide a solution to the problem.	Can interpret the problem statement, develop an experiment that can provide an adequate solution to the problem, and can execute the experiment and generate data.
Analyze and Interpret Data	33.33	Can perform summary or statistical analysis of data generated in experiment. Can interpret data toward specific findings.	1: Cannot summarize and/or perform statistical analysis on data in ways that can provide meaningful interpretation	2: Can perform limited summary and/or statistical analysis on data. Analysis has shortcomings that limit the ability to interpret findings.	Adequately performs summary and/or statistical analysis. Interpretation of analysis has flaws, but can still produce a solution.	Adequately performs all levels of summary and/or statistical analysis of data. Interprets analysis that can lead to engineering conclusions.
Use Engineering Judgment to Draw Conclusions	33.33	Can apply engineering judgment to data generated in experiment to draw engineering conclusions.	1: Cannot apply engineering judgment to interpret data and ultimately draw meaningful conclusions	2: Shortcomings in ability to apply engineering judgment to interpret data that casts doubt in the ability to draw conclusions.	Can apply engineering judgment to interpret data, but lacks ability to draw full conclusions.	Can apply engineering judgment to all aspects of data and comprehensively draw conclusions based on interpreted data and engineering judgment.

## SAMPLE STUDENTS' RESULTS SUMMARY

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Using the specific in-class activity, record the performance for each indicator presented in the rubric. Ranking Scheme:

Performance Level	Value
Unsatisfactory	1
Developing	2
Satisfactory	3
Exemplary	4

Scoring System: ` Weighted average of performance level value and performance indicator weights.

Performance Level	Score
Unsatisfactory	$\leq 1$
Developing	1.1 - 2.0
Satisfactory	2.1 - 3.2
Exemplary	3.3 - 4.0

Student	Score				
	Understanding Problem Statement and Developing an Experimental Plan. Executing the plan	Can perform summary or statistical analysis of data generated in experiment. Can interpret data toward specific findings.	Can apply engineering judgment to data generated in experiment to draw engineering conclusions.		
	33.33	33.33	33.33	Magn.	Level
Student 01	4	4	3	3.67	Exemplary
Student 02	3	3	3	3.00	Satisfactory
Student 03	3	4	4	3.67	Exemplary
Student 04	3	3	4	3.33	Exemplary
Student 05	3	4	4	3.67	Exemplary
Student 06	4	4	4	4.00	Exemplary
Student 07	3	2	3	2.67	Satisfactory
Student 08	3	3	3	3.00	Satisfactory
Student 09	3	3	3	3.00	Satisfactory
Student 10	3	4	4	3.67	Exemplary
Student 11	3	2	3	2.67	Satisfactory
Student 12	3	3	4	3.33	Exemplary
Student 13	4	4	4	4.00	Exemplary
Student 14	3	3	4	3.33	Exemplary
Student 15	3	3	3	3.00	Satisfactory
Column Mean	3.20	3.27	3.53	3.35	

# Academic Program Modification Proposal

Doctor of Engineering in Industrial Engineering

APM Request Type: Add a Degree Designation to an Existing Program

Submitted by

Department of Industrial and Systems Engineering

Tickle College of Engineering

University of Tennessee, Knoxville



THE UNIVERSITY OF  
TENNESSEE  
KNOXVILLE

Updated February 16, 2024

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# Documentation of Board Approval

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(Inserted after UT Board of Trustees Meeting)

## Cover Letter from Chief Academic Officer



February 15, 2024

President Randy Boyd  
505 Summer Place / UT Tower  
Knoxville, TN 37902

President Boyd:

Please accept the attached application for a new doctoral program, Doctor of Engineering in Industrial Engineering (D.Eng.) in the Tickle College of Engineering at the University of Tennessee, Knoxville.

The proposed D.Eng. program is a new degree designation on an existing PhD program in Industrial Engineering. The proposed program is an online program to satisfy growing demand from working professionals in industries for a doctoral degree in engineering. The new program will be a great addition and fulfill the need for online graduate programs with the concentration in Engineering Management at three different levels, from graduate certificate to Master of Science, and now to Doctor of Engineering. The new program focuses on industrial applications and will complement the existing PhD program, which emphasizes academic research. No additional resources will be required in the new D.Eng. program.

This new program has been reviewed and approved by the appropriate department, college, and campus bodies on the Knoxville campus, and has the full support of campus administration. At this time, we request transmission to THEC for approval. Please contact me if you have any questions or need additional documentation.

Thank you in advance for your attention to this matter.

Sincerely,

John Zomchick  
Provost and Senior Vice Chancellor

cc: Donde Plowman, Chancellor  
Matthew Mench, Dean, Tickle College of Engineering  
Mingzhou Jin, Department of Industrial and Systems Engineering  
Andrew Yu, Professor of Industrial & Systems Engineering  
Bernie Savarese, Vice President for Academic Affairs, Research and Student Success  
Karen Galicia, Director of Academic Affairs  
Betty Dandridge Johnson, Academic Affairs Consultant

Office of the Provost and Senior Vice Chancellor  
527 Andy Holt Tower, Knoxville, TN 37996-0152  
865-974-2445 865-974-4811 fax provost.utk.edu

Flagship Campus of the University of Tennessee System

## Proposed Program Information

<b>Institution:</b>	University of Tennessee, Knoxville
<b>College:</b>	Tickle College of Engineering
<b>Department:</b>	Industrial and Systems Engineering
<b>Existing Degree Program:</b>	Ph.D. in Industrial Engineering
<b>Existing Concentration(s):</b>	(1) Engineering Management and (2) Energy Science and Engineering
<b>Current CIP Code:</b>	14.3501 (Industrial Engineering)
<b>Title of Proposed Degree:</b>	Doctor of Engineering in Industrial Engineering
<b>Proposed Concentration(s):</b>	(1) Engineering Management
<b>Proposed CIP Code:</b>	14.3501 (Industrial Engineering)
<b>Degree Designation:</b>	Doctor of Engineering
<b>Formal Degree Abbreviation:</b>	D.Eng.
<b>Proposed UT BOT Approval:</b>	February 2024
<b>Proposed THEC Approval:</b>	March 2024
<b>Proposed Implementation Date:</b>	August 2024
<b>Anticipated Delivery Site:</b>	Online
<b>Approved Off-Campus Site(s):</b>	N/A
<b>Delivery Mode:</b>	Synchronous and Asynchronous
<b>Academic Program Liaison:</b>	Karen Galicia Director of Academic Affairs, UT System Email: <a href="mailto:galicia@tennessee.edu">galicia@tennessee.edu</a> Phone: 865-974-2104 505 Summer Place / UT Tower 1268-B Knoxville, TN 37902
<b>Departmental Contact:</b>	Andrew Yu Professor of Industrial & Systems Engineering 520 Tickle Building 851 Neyland Drive University of Tennessee Knoxville, TN 37996-2315 Phone: 865-974-6148 Email: <a href="mailto:ajyu@utk.edu">ajyu@utk.edu</a>

## Background on Proposed Academic Program Modification

The University of Tennessee, Knoxville's (UTK) Tickle College of Engineering (TCE) currently offers a bachelor's, master's, and doctoral program in Industrial Engineering. The existing PhD program in Industrial Engineering draws significant interest from working professionals in industry. However, we strongly encourage applicants who are working professionals not to apply because the PhD program is a research-focused degree program. The current PhD program is not a good fit for them because they are more interested in applications for their thesis instead of academic research typical for a PhD program. Nevertheless, we receive at least a dozen applications annually. To meet this demand, UTK proposes adding the degree designation of a Doctor of Engineering (D.Eng.) program to the Industrial Engineering doctoral program. The proposed degree focuses more on practice and application—as opposed to research—and will be more suitable for people working full-time. Many of the applicants denied to our PhD program could be admitted to the proposed D.Eng. program, and the PhD students who were unable to complete their program could be more successful with their rich industrial experience in the D.Eng. program. Although D.Eng. programs are offered at several large R1 universities<sup>1</sup>, such a doctoral program in engineering will be the first in the state and the region. The proposed program will satisfy the high demand from industry that we have seen over the years.

The PhD program in Industrial Engineering with an Engineering Management concentration remains popular and in high demand among working professionals. Due to the high standards and demands of academic research in the PhD program, we have turned away many applications in the past. A Doctor of Engineering program will provide a terminal degree for those (a) seeking a doctoral program and (b) working full-time. We expect the proposed program will be in high demand based on the interest we have seen in our online PhD program. Although the current PhD program is both residential and online, most online PhD students who work full-time are either only interested in applications or not able to conduct research at the level needed for a dissertation.

Much like the Ph.D. in Industrial Engineering with a Concentration in Engineering Management, the proposed D.Eng. will also focus on Engineering Management (EM) through the available concentration area. The D.Eng. program will be more suitable for those working full-time who are more interested in applications than academic research. The proposed program will be delivered entirely online in both asynchronous and synchronous courses. The program is an extension of our MS EM program and will fulfill the education needs of students to the highest level. The total credit hours for the proposed D.Eng. program will be 48 credit hours beyond the master's degree, including 27 credit hours of coursework, 3 hours of seminars, and 18 credit hours of an applied doctoral capstone project. Highlights of the unique features of the two doctoral programs in Industrial Engineering appear in Table 1.

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<sup>1</sup> See Appendix A for a list of other DEng programs outside Tennessee.

Table 1 summarizes the unique features of the D.Eng. as compared to the Ph.D. in Industrial Engineering.

Comparison Criteria	Doctor of Philosophy in Industrial Engineering	Doctor of Engineering in Industrial Engineering
Guiding Philosophy	Engineering theory and scholarship	Engineering practice and application
Typical Student	Early career	Mid-career
Student Goal	Academic or industrial research career	Technical leadership role in industry or public sector
Student Employment	Typically commit full-time to the program of study	Typically work full-time during the program
Coursework	Residential, on-campus	Non-residential, online
Academic Home	Department-based	Department-based
How Tuition is Paid	Research Assistantships	Employer or Student
Qualifications Needed for Admission	Bachelor's degree and GRE	Master's degree and professional experience
Program Length	4-5 Years	3-4 Years
Final Student Work to Complete the Program	Dissertation	Capstone project

*Note: For the Ph.D. program, students typically require four years of study when they have an MS and five years of study for those with only a BS. For some students, it may take longer due to challenges conducting research, and they often take more than 24 hours of dissertation hours.*

## Justification/ Rationale for the Proposed Change

Based on the Tennessee Master Plan, it is imperative for Tennessee's economy and the financial security of Tennesseans that higher education prepares its graduates for high-demand jobs. This is true for the current economy but is even more critical as we consider Tennessee's future economy. The proposed doctoral program is designated to train the advanced workforce for emerging and innovative technology, such as data analytics and artificial intelligence, that will best support Tennessee's economy, both today and tomorrow. The proposed D.Eng. program is a graduate program at its highest level that will help our best working professionals in the industry to become the best of the best to lead the practice and application of the latest technology in the industry. See Appendix B for letters of support from various community partners. The program perfectly aligns with the State Master Plan, vital to our state's future.

As indicated in UTK's institutional mission profile, UT Knoxville serves all Tennesseans through academic excellence, groundbreaking research, community investment, and industry partnerships—all powered by the Volunteer spirit of leadership and service. The proposed doctoral program represents an investment in the community, focusing on industrial practice and application with the latest technology that UTK can bring to our industrial partners to support and sustain Tennessee's economy.

For years, the department has had many working professionals interested in the online PhD program in Industrial Engineering with an Engineering Management concentration. However, the high academic research requirement for the PhD program is very challenging for distance students working in industry who often have more practice experience but less academic research capability due to their time limitations and interests. For that reason, we have denied many applications in recent years. Every year, we deny a couple of dozen applications to our online PhD program from domestic applicants working in the industry. The Doctor of Engineering will be an ideal doctoral program for these PhD applicants as it will meet their needs for a doctoral program, focusing on practice and application of academic theory at the highest level.

## Potential Impact on Existing Programs

### *Impact on the Modified Program*

The impact of the new proposed program, Doctor of Engineering in Industrial Engineering, on the modified program, PhD in Industrial Engineering, is negligible. The foci of the two programs are distinct; as shown earlier, the PhD focuses on academic research, while the D.Eng. focuses on practice and applications. Students in the D.Eng. program would be online and part-time while working full-time. They are typically not interested in or qualify for the PhD program. Our existing PhD program, with or without an EM concentration, has already changed its admission and graduation requirements, leaving students who work full-time and are interested in practice and applications a poor fit for the program. The proposed D.Eng. program will be an appropriate alternative for them.

### *Impact on Other or Similar Programs*

No other doctoral program is offered besides the proposed and modified programs. Similar programs at the master's level will be required for the proposed D.Eng. program.

## Teach-Out Plan for Current Students

Not Applicable—no programs will be terminated because of this modification to add the D.Eng. degree designation.

## Similar Programs Offered at Public and Private TN Institutions

**Table 2**

Existing Similar Programs in Tennessee

Institution Name	Program Title and Degree Designation	CIP Code	Description/ Focus of Program	Miles from UTK Campus
University of Tennessee, Knoxville	BS Industrial Engineering	14.3501	The undergraduate program prepares graduates to achieve the following program objectives 3-5 years after graduation: Objective 1: Have successful professional careers based on industrial engineering knowledge and skills that endow them to integrate, design, and implement effective ways to solve complex problems in industry. Objective 2: Engage in professional development practices that enable them to remain competent in the ever-expanding discipline of industrial engineering. Objective 3: Provide strong leadership and quality service to their organization, community, and society.	--
University of Tennessee, Knoxville	MS Industrial Engineering	14.35.01	The Master of Science in Industrial Engineering (MS-IE) Program provides our students with technical and professional skills needed for industrial engineering applications in manufacturing, healthcare, service, and other sectors and for taking leadership roles in their organizations. In addition, the program prepares students to pursue further graduate study at the doctoral level.	N/A
University of Tennessee, Knoxville	PhD Industrial Engineering	14.3501	The PhD in Industrial Engineering Program provides our students with skills needed for independent research and applications in industrial engineering and prepares them to pursue further scientific and academic research.	--

University of Tennessee, Knoxville	Engineering Management	15.1501	The Master of Science in Engineering Management (MS-EM) Program provides practicing engineers with an education experience balancing technical depth with leadership, project management, financial management, technology management, organizational behavior and team relations, supply chain and manufacturing, and engineering data analytics. It empowers students with the knowledge and skills needed to lead technical organizations or processes to success.	--
University of Tennessee at Chattanooga	MS Engineering Management	15.1501	Designed for individuals with engineering or science backgrounds who have moved, or expect to move, into managerial responsibilities. Topics in these fields include strategic management, construction law, sustainability, engineering economics, and quality control and reliability.	113
Tennessee Tech University	Engineering Management - Master's (MSEM)	15.1501	The MS in Engineering Management is a 100% online, interdisciplinary program offered collaboratively by the College of Engineering and the College of Business. The degree is designed to provide early-career engineering and related professionals with leadership and management knowledge and technical skills to enhance their job performance, expand their career opportunities, and add value to their organizations. The program prepares technical professionals to use a variety of quantitative tools for decision-making, effective personnel supervision, and successful project and process management.	103
Lipscomb University	Master of Management: Engineering	15.1501	The mission of the Master of Management: Engineering program at Lipscomb University is to assist students with their need for lifelong learning that will enhance their leadership and technical skills, along with moral guidance to ethically lead engineering-focused organizations. Lipscomb's Master of Management: Engineering is an executive-level program that allows students to complete their degree while continuing their present careers.	180



Vanderbilt University	Master of Engineering: Engineering Management	15.1501	The online program explores how business areas such as project management, product development, and organizational behavior affect engineering firms' output, preparing you to pursue leadership roles across a range of industries.	180
Middle Tennessee State University	BS Concrete Industry Management	15.1501	The Engineering Management M.S. was created to provide engineers, scientists, and technicians with the business and management tools needed for leadership positions in manufacturing and industry. The program helps equip students with skills to implement and manage competitive process innovations and product development. The Engineering Management M.S. is a Master of Science in Professional Science degree with advanced science courses, business management courses, and a capstone internship.	181
Christian Brothers University	Master of Science in Engineering Management	15.1501	The Master of Science in Engineering Management (MSEM) bridges the gap between technology and business. It empowers practicing engineers, scientists, and technicians with the knowledge, skills, and tools needed to lead organizations to success and competitive advantages for career advancement. When you join the program, you should expect to improve your leadership, project management, financial management, strategic planning, technology transfer, ethical and legal perspectives, team relations, and organizational behavior skills.	393

The University of Memphis	MS in Engineering Management	15.1501	The MS in Engineering Management is designed for the working professional and allows graduates of BS programs in engineering to prepare themselves for careers as managers. The curriculum consists of further technical training in two concentrations, transportation, and manufacturing, as well as basic management instruction. With the cooperation of the Fogelman College of Business and Economics, the degree will be awarded by the Herff College of Engineering.	393
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## Curriculum Comparison

**Table 3**  
Comparison of PhD and D.Eng. Curriculum

Existing Ph.D. Program in IE (EM Concentration)		Proposed D.Eng. Program in IE (EM Concentration)	
<b>Core/Foundations (17 Hours)</b>		<b>Core/Foundations (15 Hours)</b>	
<i>Course No. and Title</i>	<i>Hours</i>	<i>Course No. and Title</i>	<i>Hours</i>
IE 503 Research Methods in ISE	2	IE 526 Advanced Applications of Systems Modeling and Simulation	3
IE 522 Optimization Methods in Industrial Engineering	3	IE 522 Optimization Methods in Industrial Engineering	3
IE 550 Graduate Seminar (x3)	3	IE 550 Graduate Seminar (x3)	3
IE 560 Introduction to Proofs- Real and Convex Analysis	3	IE 533 Theory and Practice of Engineering Management	3
IE 565 Applied Data Science	3	IE 536 Project Management	3
COSC 505 Introduction to Programming	3		
<i>Total Hours</i>	17	<i>Total Hours</i>	15
<b>Electives – 600 level (9 Hours)</b>		<b>Required – 600 level (6 Hours)</b>	
<i>Course No. and Title</i>	<i>Hours</i>	<i>Course No. and Title</i>	<i>Hours</i>
IE 600-level	3	IE 601 Systems Theory and Engineering	3
IE 600-level	3	IE 605 Supply Chain and Logistics Systems Engineering	3
IE 600-level	3		
<i>Total Hours</i>	9	<i>Total Hours</i>	6

Doctoral Research and Dissertation (24 Hours)		Doctoral Capstone Project (18 Hours)	
Course No. and Title	Hours	Course No. and Title	Hours
IE 600 Doctoral Research and Dissertation	24	IE 650 Doctoral Capstone Project	18
Electives – 500 level or above (22 Hours)		Electives – 500 level or above (33Hours)	
IE 500-level or above (For students without MS)	22	500-level or above	9
		500-level or above (From required MS degree*)	24
<b>TOTAL HOURS</b>	<b>72</b>	<b>TOTAL HOURS</b>	<b>72</b>

\* A prior MS degree is typically required for admission to the DE program.

## New Courses Needed

The proposed Doctor of Engineering program requires 18 credit hours for a capstone project, which requires one new course for the doctoral program. This is the only new course needed, and its addition has already been submitted for approval at various levels on campus.

IE 650 Doctoral Capstone Project (3-18 credit hours)

Grading Restriction: P/NP only.

Repeatability: May be repeated.

Registration Restriction(s): Minimum student level – graduate.

## Accreditation

ABET accredits all of UTK's undergraduate programs in engineering; however, no programmatic accreditation with ABET is available for graduate programs. Like our PhD program in Industrial Engineering, the proposed D.Eng. program in Industrial Engineering will be accredited by the Southern Association of Colleges and Schools Commission on Colleges (SACSCOC). Heather Hartman, SACSCOC liaison for UTK, has been notified of the proposed change and will be responsible for communicating information about the new degree designation to the institutional accreditor.

## THEC Financial Projection Form and Associated Narrative

There will not be any anticipated new costs associated with the proposed D.Eng. program.

## Appendix A – Examples of D.Eng. Programs Outside of Tennessee

Johns Hopkins University

[Doctor of Engineering | About the Program - Doctor of Engineering \(jhu.edu\)](#)

Texas A&M University

[Online Doctor of Engineering | Texas A&M University Engineering \(tamu.edu\)](#)

Morgan State University

[Doctor of Engineering \(D. Eng.\) \(morgan.edu\)](#)

Colorado State University

[Doctor of Engineering \(D.Eng.\) - Systems Engineering \(colostate.edu\)](#)

Columbia University

[Doctor of Engineering Science | Department of Computer Science, Columbia University](#)

George Washington University

[Doctor of Engineering in Engineering Management | GW Online Programs | The George Washington University \(gwu.edu\)](#)

Penn State University

[Doctor of Engineering Online - Penn State World Campus \(psu.edu\)](#)

Lamar University

[Doctor of Engineering \(lamar.edu\)](#)

## Appendix B – Letters of Support



May 30, 2023

Tennessee Higher Education Commission  
404 James Robertson Parkway  
Suite 1900  
Nashville, TN 37243

To Whom It May Concern,

I am writing this letter to express the East Tennessee Economic Council's (ETEC) strong support for the approval of the new Doctor of Engineering degree program that is being proposed in the College of Engineering at the University of Tennessee. As president of an organization who has been a stakeholder in workforce development efforts for many years, I believe that this program will be an important asset to the region and to the field of engineering.

ETEC is an independent, regional, non-profit, membership organization created in the early 1970s. Being dedicated to supporting the federal government's missions in the East Tennessee region, we seek new ways to create prosperity, promote regional development, and explore opportunities for growth. I feel that this program will enable that prosperity, development, and growth for both the individuals and for the organizations that employ the students.

Working in a collaborative setting with industry presents a unique opportunity for students to address specific industry needs and acquire valuable experience and insights in the process. It provides students with the required coursework and valuable hands-on application through project-based learning. I feel the program would equip graduates with the skills and knowledge necessary to meet industry demands, enabling them to make an immediate and positive impact on their organizations.

The proposed Doctor of Engineering program will be a valuable addition to the region's workforce development efforts. It can provide students with an opportunity to display their expertise with the application focus while providing meaningful contributions to real-world problems.

This type of educational program gives employers an opportunity to leverage employee development, retention efforts, and succession planning due in part to the application focus of the program. It is a way to upskill and invest in their current workforce and prepare them for leadership roles within the organization.

ETEC has been involved with the University of Tennessee at multiple levels and varying capacities and fully supports the approval of this program. We look forward to seeing the benefits it will bring to all the stakeholders.

Sincerely,

Tracy Boatner  
President

1201 Oak Ridge Turnpike, Suite 100 | Oak Ridge, Tennessee | 37830  
Phone: 865-483-4577 | email: info@eteconline.org | www.eteconline.org



**RE: SUPPORT OF NEW DOCTOR OF ENGINEERING PROGRAM**

To Whom It May Concern,

I am writing to express my strong support for approving the new Doctor of Engineering degree program proposed in the College of Engineering at the University of Tennessee. As someone who has been a stakeholder in workforce development, systems engineering, and cultural change efforts for many years, this program will be an important asset to the region and the engineering field.

Working in a collaborative setting with industry presents a unique opportunity for students to address specific industry needs and acquire valuable experience and insights. It provides students with the required coursework and valuable hands-on application through project-based learning. The program would equip graduates with the skills and knowledge necessary to meet industry demands, enabling them to make an immediate and positive impact on their organizations.

The proposed Doctor of Engineering program will benefit the region's workforce development efforts. It can allow students to display their expertise with the application focus while providing meaningful contributions to real-world problems.

This type of educational program allows employers to leverage employee development, retention efforts, and succession planning due in part to the application focus of the program. It is a way to upskill and invest in their current workforce and prepare them for leadership roles within the organization.

I have personally been involved with the University of Tennessee at various levels. I fully support the approval of this program and look forward to seeing the benefits it will bring to all stakeholders. Thank you for the opportunity to offer my input and full support of this program.

Sincerely,

**Doug Freund**  
Senior Vice President  
Kiewit Nuclear Solution

Douglas.freund@kiewit.com | 913-392-0952

KIEWIT NUCLEAR SOLUTIONS CO. | 105 MITCHELL ROAD | OAK RIDGE, TN 37830



**Gavin Newsom**  
Governor

400 Capitol Mall, Suite 2340  
Sacramento, CA 95814  
916-323-5400  
[www.calsta.ca.gov](http://www.calsta.ca.gov)

**Toks Omishakin**  
Secretary

June 14, 2023

Tennessee Higher Education Commission  
404 James Robertson Parkway  
Suite 1900  
Nashville, TN 37243

Dear Tennessee Higher Education Commission,

I'd like to take this opportunity to express my strong support for the approval of the proposed Doctor of Engineering degree program for the College of Engineering at the University of Tennessee. I truly believe this program will be an important asset to the state of Tennessee, the region and to the field of engineering overall.

As a stakeholder in the engineering industry through my current role, I not only support the approval of this program, but strongly encourage it. Having previously served as Deputy Commissioner of the Tennessee Department of Transportation to now serving as California's Transportation Secretary, I have had the fortunate opportunity to serve alongside and have oversight of more than 10,000 engineers. Over the years, the expectations and demands of the profession have evolved to leaning more towards a ready-to-serve-promptly environment. Increased infrastructure funding at local, state and federal levels—along with the pressures of extreme weather and an aged infrastructure system—are also creating an expectation of more practical experience.

This program would equip graduates with the skills and knowledge necessary to meet industry demands and would facilitate their immediate and positive impact on their organizations.

The proposed Doctor of Engineering program will unequivocally educate and expand the important engineering workforce. Directly from this workforce emerge many who are needed in public sector organizations such as the agency I lead, the California State Transportation Agency (CalSTA). This proposed program will provide engineers and engineering project leaders the critical advanced engineering, technological and management skills needed to become the best of the best leaders in this essential line of work. I look

California Transportation Commission • Board of Pilot Commissioners • California Highway Patrol • Department of Motor Vehicles  
Department of Transportation • High Speed Rail Authority • Office of Traffic Safety • New Motor Vehicle Board



June 14, 2023  
Page 2

5

forward to seeing the advantages that the Doctor of Engineering program will bring to all stakeholders. Thank you for the opportunity to offer my input and full support of this rewarding program. Please feel free to reach out to me directly with any additional questions.

Sincerely,

*Toks Omishakin*

Toks Omishakin  
Secretary, California State Transportation Agency

## Linehan Consulting

May 23, 2023

Tennessee Higher Education Commission  
404 James Robertson Parkway  
Suite 1900  
Nashville, TN 37243

To Whom It May Concern,

I would like to express my strong support for the approval of the new Doctor of Engineering degree program that is being proposed in the College of Engineering at the University of Tennessee. By partnering with industry, this advanced degree program will offer employers a competitive advantage and employees accepted into the program a path to career advancement. This program would also advance the state of the workforce, which over time would lead to competitive advantages for the employer.

Having worked in the defense industrial base for over thirty years, including being responsible for multi-billion dollar programs involving over ten-thousand employees in multiple locations, I have felt first hand the affects of high attrition involving mainly early and mid-career employees seeking advancement. Programs like this give employers a competitive advantage by enabling them to attract and retain top talent in such a highly competitive jobs market. Additionally, employees completing this program gain the skills and knowledge necessary to advance their careers within their current employers to become the next generation of leaders. This in turn will ultimately enable employers to improve their performance thru the advanced skills learned by graduating employees.

I am also a lecturer in the Masters of Systems Engineering program at the University of Tennessee, Knoxville, providing students with requisite knowledge and guidance as they conceive and progress their employer-focused Capstone projects. Because the Doctorate program applies the same learning principles and employer-focused Capstone projects as the Masters program but with more intensity, I believe both employers and employees will seek out this program, which will provide benefits to both the surrounding community and the University of Tennessee and will contribute to regional workforce development efforts.

I have been personally involved with the University of Tennessee as both a student and a lecturer and I fully support the approval of this program. I look forward to seeing the benefits that it will bring to all stakeholders. Thank you for the opportunity to offer my input and full support of this program.

Sincerely,

  
Dan Linehan  
Owner, Linehan Consulting



Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402

July 05, 2023

Tennessee Higher Education Commission  
404 James Robertson Parkway  
Suite 1900  
Nashville, TN 37243

To Whom It May Concern,

I am writing this letter to express my support for the new *Doctor of Engineering* degree program in *Industrial Engineering* with a concentration in *Engineering Management* that is being proposed by the Tickle College of Engineering at the University of Tennessee, Knoxville. With 10,000 employees, the Tennessee Valley Authority (TVA) serves one of the fastest-growing regions of the country. The ongoing transition to clean energy and a net zero economy brings TVA and the region unprecedented opportunities. At the same time, there are challenges in accessing an advanced workforce who can manage complex engineering systems. I believe the proposed *Doctor of Engineering* in *Industrial Engineering* will help with the urgent need in the Tennessee Valley of developing a workforce that has evolving innovative skills.

With the rapid progression of advanced techniques for engineering and management, such as big data analytics, artificial intelligence, new engineering management tools, and advanced technology management theories, it is necessary for our employees to learn more beyond a master's program. A Doctor of Engineering program would be a perfect "next-step" in their continued development, providing our engineering project leaders with critical and advanced engineering, technological, communication, and management skills, in a form that is less research-based and more practice-oriented. Personally, I am the recipient of a Doctoral Degree in Leadership from Carolina University and have benefited greatly from the research-based experience. It is my hope that others will find the joy of continuing their education and broadening their minds to the next level.

As the Vice President of TVA's Civil Projects and Equipment Support Services, I fully support the proposed Doctor of Engineering Program in Industrial Engineering with a concentration in Engineering Management and urge the Tennessee Higher Education Commission to approve this new doctoral program.

Sincerely,

Scott Turnbow, PhD  
Vice President – Civil Projects and Equipment Support Services  
Tennessee Valley Authority  
M. 423-826-9328 E. [msturnbow@tva.gov](mailto:msturnbow@tva.gov)  
1101 Market Street, Chattanooga, TN 37402

## New Academic Unit Request

College of Health, Education and Professional Studies  
Department of Applied Leadership and Learning



THE UNIVERSITY OF TENNESSEE  
CHATTANOOGA

Updated: January 17, 2024

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## Academic Unit Information

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<b>Institution:</b>	University of Tennessee at Chattanooga
<b>Type of Unit:</b>	Academic Department
<b>Proposed Unit Name:</b>	Applied Leadership and Learning
<b>Summary of Proposed Change:</b>	To establish a new academic department for the associated undergraduate and graduate programs offered within the College of Health, Education, and Professional Studies.
<b>Proposed Unit Location:</b>	College of Health, Education & Professional Studies
<b>Proposed UT BOT Approval:</b>	February 2024
<b>Proposed THEC Approval:</b>	March 2024
<b>Proposed Implementation Date:</b>	July 1, 2024

## Documentation of Board Approval

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(Inserted after UT Board of Trustees Meeting)

## Campus Letter of Support

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Academic Affairs  
615 McCallie Ave., Dept. 5555  
Chattanooga, TN 37403  
Phone 423-425-4633  
[utc.edu/academic-affairs](http://utc.edu/academic-affairs)

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January 8, 2024

President Randy Boyd  
The University of Tennessee  
505 Summer Place  
UT Tower #1288  
Knoxville, TN 37902

President Boyd:

Please accept the attached THEC New Academic Unit Request for formal approval to establish the Department of Applied Leadership and Learning within the College of Health, Education, and Professional Studies at the University of Tennessee at Chattanooga.

The establishment of the Department of Applied Leadership and Learning will allow for tailored support and development of the undergraduate and graduate programs which are heavily focused on competency-based education for contemporary adult learners. Further, the proposed unit aligns with both the State Master Plan and the institution's mission in many ways, including the Drive to 55 initiatives for adult learners with increasing access through flexible pathways. By establishing strong partnerships with professional associations, businesses, and community leaders, the department will ensure the programs teach interpersonal skills most valued in the workforce. Please note that the THEC Financial Projection Form for Academic Unit is provided although the small increase in administrative costs associated with the establishment of this department will be covered by the College of Health, Education, and Professional Studies.

Thank you in advance for your attention to this matter.

Sincerely,

A handwritten signature in black ink, appearing to read 'J. Hale'.

Dr. Jerold Hale  
Provost and Senior Vice Chancellor of Academic Affairs

UTC is a comprehensive, community-engaged campus of the UT System. UTC is an EEO/AA/Title VI and IX Section 304/ADA/ADEA institution.



## Feasibility of New Academic Unit

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### *Overview of Proposed Unit*

The Learning and Leadership graduate programs (EdD, Ph.D., and Higher Ed graduate certificate) along with the Applied Leadership baccalaureate program and the Essentials of Leadership certificate (collectively referred to as LEAD) are currently housed within the College of Health, Education, and Professional Studies (CHEPS) School of Professional Studies. These programs would be better served within a focused department structure.

A department for the LEAD programs is needed as the programs are focused on significant competency areas and created to meet the needs of adult and contemporary learners. Course designs, delivery modalities, and assessment strategies, including in-depth credit for prior learning methods, are utilized. The support, guidance, and mentoring of students in all LEAD programs require evening and weekend access to faculty and staff as a critical element of student success. All the programs in the proposed unit are designed and delivered for contemporary (adult) learners, with coursework and related advising and support services offered via online and hybrid modalities. Because of this and the specific support needs of these non-traditional learners, all faculty and staff in the unit are 12-month employees, unlike the more typical 9-month faculty who work 4-5 days per week in the School of Professional Studies. Additionally, these programs focus on engagement with external, professional, and workforce constituents to ensure that graduates have the skills and competencies to engage in the workforce and their communities. Industry engagement is critical because it further validates success; it is a virtuous, self-reinforcing cycle that creates internal and external advantages. As marquee organizations and executives engage, others will join, creating more effective, long-lived relationships rather than simple transactions, which is critical to program success.

UTC seeks to create a Department of Applied Leadership and Learning within the College of Health, Education, and Professional Studies. Creating a dedicated department for the Learning and Leadership programs (EdD, Ph.D., Higher Ed graduate certificate, Applied Leadership bachelor's, and Essentials of Leadership certificate) will allow for tailored support and development of these offerings. Grouping these programs makes sense, given their shared focus on competency-based education for contemporary adult learners.

The current configuration with the School of Professional Studies places the leadership programs within a school structure where all other programs are separately accredited by discipline (Social Work, Interior Architecture, Counseling, School Psychology). Including the leadership programs within the School of Professional Studies often impedes the leadership and decision-making processes with an unneeded middle layer of administration. The director's focus for the School of Professional Studies is required for other program accreditation issues; therefore, creating a specific unit for the leadership programs will allow the faculty and staff to serve better and respond to the needs of students and other stakeholders.

Specific benefits of establishing the Applied Leadership and Learning department include:

- Customized curriculum, delivery methods, and assessments designed for the needs of working professionals and lifelong learners. This includes extensive prior learning assessment and flexible scheduling.
- Enhanced student support and faculty/staff availability during evenings and weekends when many students are engaged in coursework. Access to guidance and mentoring is critical for adult student success.
- Increased opportunities to cultivate deep external partnerships and relationships with professional organizations and workforce leaders. This engagement validates the programs' success and employability outcomes for graduates. It also enables virtuous cycles of continuous improvement as industry partners provide insights into the evolving competencies and skills most relevant to students' career trajectories.
- Increased focus on career outcomes and how programs equip graduates with in-demand leadership, critical thinking, and people skills. Engagement with industry highlights the programs' workforce-relevant curricula.
- Enhanced reputation and stature by concentrating expertise, resources, and external engagement activities within a dedicated unit. This enables more targeted advancement, recruitment, and marketing efforts.

### *Existing Programs Associated with New Unit*

*Table 1: Existing Programs Associated with New Academic Unit*

Program Type	Program Name	CIP Code	Program Description
BAS	Applied Leadership	52.0213	<ul style="list-style-type: none"> <li>• 120 credits</li> <li>• Online modality</li> </ul>
Cert (C3)	Essentials of Leadership	52.0213	<ul style="list-style-type: none"> <li>• 15 credits</li> <li>• Online modality</li> </ul>
EdD	Leadership and Professional Practice	13.0401	<ul style="list-style-type: none"> <li>• 66 credits</li> <li>• Online modality</li> </ul>
PhD	Leadership and Decision-Making	13.0401	<ul style="list-style-type: none"> <li>• 76 credits</li> <li>• Hybrid</li> </ul>
Cert (C4)	Higher Education Leadership & Decision-Making	13.0401	<ul style="list-style-type: none"> <li>• 15 credits</li> <li>• Online, Hybrid modality</li> </ul>

### *Planned Future Programs Associated with New Unit*

Currently, there are no specific plans for future programs.

## Alignment of Academic Unit

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### *Alignment with State Master Plan*

This department would align with the State Master Plan in support of the Drive to 55 initiatives and the state's focus on adult learners. All programs within the department have an adult learning focus, and the BAS: Applied Leadership and Certificate in Essentials of Leadership are specifically designed for adult learners who may have some college but have not earned a specific degree to earn a credential.

### *Alignment with Institutional Mission*

UTC's mission is to be "a driving force for achieving excellence by actively engaging students, faculty, and staff, embracing diversity and inclusion, inspiring positive change, and enriching and sustaining our community." This department would align with the values of the UTC Mission and Strategic Plan by using competency-based and prior learning programs to increase access for busy working adults and contemporary learners seeking career advancement. The programs attract many mid-career professionals seeking to upskill and meet this student demographic's needs, expanding the university's impact and reach.

The department will establish strong partnerships with professional associations, businesses, and community leaders to ensure that programs teach the most in-demand leadership, organizational, and people skills. The applied, active learning curriculum translates liberal arts principles into real-world leadership, critical thinking, and interpersonal skills valued in the workforce. The LEAD programs blend theory and practice for career relevance. Additionally, workplace-engaged capstone projects provide career-focused culminating experiences.

The department will exemplify the university's strategy by increasing access through flexible pathways, delivering a distinctive blend of experiential and applied learning, and cultivating deep engagement with workforce partners to align offerings with regional needs. This expands the university's transformative power.

## Academic Unit Financials

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### *Required Investment for New/Renovated Facilities*

The new Applied Leadership and Learning Department would utilize existing facilities that already house the faculty and staff for the programs included in the department. All the faculty and staff to be housed in the new department are currently located on the 4th floor of Hunter Hall. For current faculty and staff, no new facilities are needed. With the ongoing use of online programming and flexible scheduling, Hunter Hall has adequate office space for program growth.

### *Overall Costs Associated with New Unit*

There will be minimal costs associated with the creation of this department. The faculty and most of the administrative staff are already in place. Restructuring resources already in place to create the unit will maximize the efficiency of operations, which will help us to control costs. The programs within this department have institutionally allocated resources already in existence for standard operation. An administrative assistant must be hired in year one at an estimated salary of \$40,000. An additional 41% for benefits and a 3% annual increase have also been included in this projection. The year one salary for this position will be absorbed by CHEPS with requested funding from program revenues beginning in year 2.

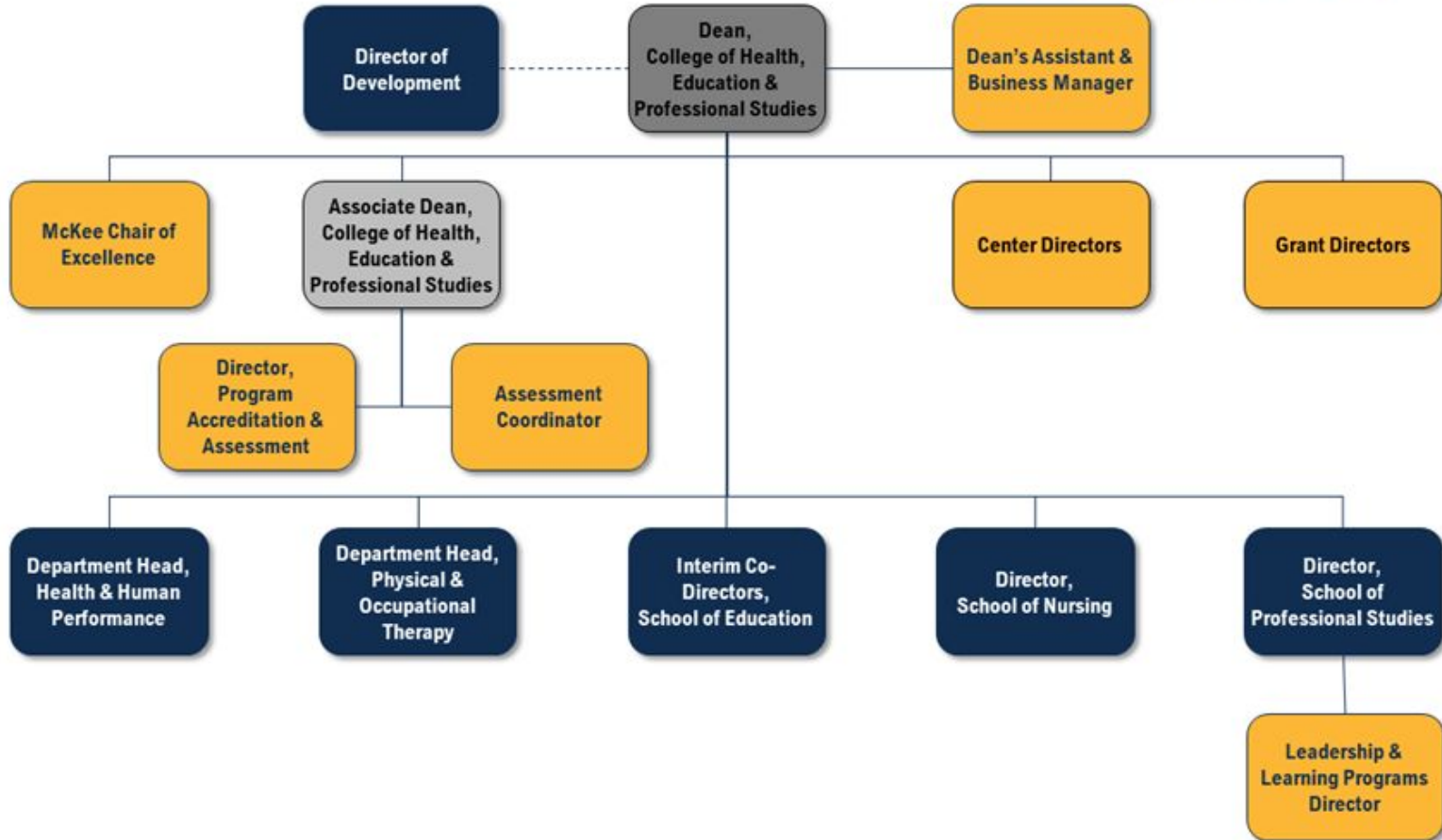
The LEAD programs have shown growth over the past 3-5 years and are expected to continue to grow, increasing revenue going forward.

## Organizational Charts

### Current Organizational Chart



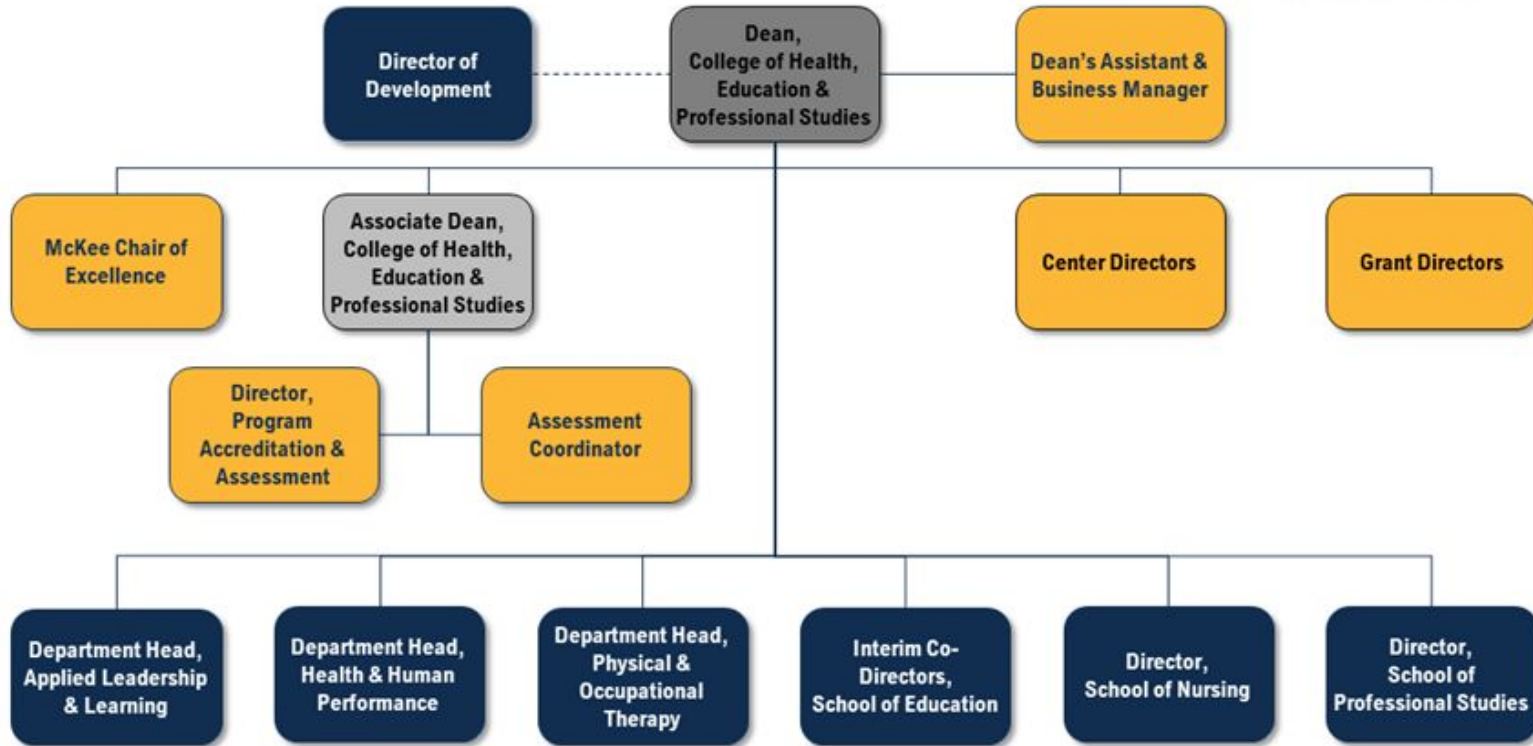
### College of Health, Education, and Professional Studies



*Proposed Organizational Chart*



**College of Health, Education,  
and Professional Studies**



## Financial Projections Form



Financial Projections Form						
<b>Institution</b>	University of Tennessee at Chattanooga					
<b>Program Name</b>	Department of Applied Leadership and Learning					
Projected One-Time Expenditures						
Category	Planning	Year 1	Year 2	Year 3	Year 4	Year 5
Faculty & Instructional Staff						
Non-Instructional Staff						
Graduate Assistants						
Accreditation						
Consultants						
Equipment						
Information Technology						
Library resources						
Marketing						
Facilities						
Travel						
Other						
<i>Total One-Time Expenditures</i>	\$0	\$0	\$0	\$0	\$0	\$0
Projected Recurring Expenditures						
Category	Planning	Year 1	Year 2	Year 3	Year 4	Year 5
Faculty & Instructional Staff						
Non-Instructional Staff		\$56,400	\$58,092	\$59,835	\$61,630	\$63,479
Graduate Assistants						
Accreditation						
Consultants						
Equipment						
Information Technology						
Library						
Marketing						
Facilities						
Travel						
Other						
<i>Total Recurring Expenditures</i>	\$0	\$56,400	\$58,092	\$59,835	\$61,630	\$63,479
<b>Grand Total (One-Time and Recurring)</b>	<b>\$0</b>	<b>\$56,400</b>	<b>\$58,092</b>	<b>\$59,835</b>	<b>\$61,630</b>	<b>\$63,479</b>

Projected Revenue						
Category	Planning	Year 1	Year 2	Year 3	Year 4	Year 5
Tuition						
Grants						
Other						
<b>Total Revenues</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>

**New Academic Unit Request**  
Tickle College of Engineering  
Department of Biomedical Engineering

7



THE UNIVERSITY OF  
**TENNESSEE**  
KNOXVILLE

Updated: November 30, 2023



## Academic Unit Information

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<b>Institution:</b>	The University of Tennessee, Knoxville
<b>Type of Unit:</b>	Academic Department
<b>Proposed Unit Name:</b>	Department of Biomedical Engineering (BME)
<b>Summary of Proposed Change:</b>	UTK proposes separating its current Department of Mechanical, Aerospace, and Biomedical Engineering by removing Biomedical Engineering to make it an independent academic department that will house several programs.
<b>Proposed Unit Location:</b>	Tickle College of Engineering
<b>Proposed UT Board Approval:</b>	February 2024
<b>Proposed THEC Approval:</b>	March 2024
<b>Proposed Implementation:</b>	July 2024

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## Documentation of Board Approval

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(Inserted after UT Board of Trustees Meeting)

## Campus Letter of Support

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THE UNIVERSITY OF  
TENNESSEE  
KNOXVILLE

7

October 6, 2023

President Randy Boyd  
University of Tennessee  
505 Summer Place / UT Tower  
Knoxville, TN 37902

Re: Support for the establishment of a Department of Biomedical Engineering at the University of Tennessee

President Boyd:

I am writing in my role as the provost of the University of Tennessee, Knoxville, to express the university's full support for the establishment of a Department of Biomedical Engineering (BME) within the Tickle College of Engineering.

The proposal to create this new department aligns with several strategic initiatives of our university, including a campus-wide focus on promoting health and human wellness through education, discovery, and engagement. It also represents UT's commitment to staying at the forefront of engineering education and research.

Our nationally ranked BME program, which offers undergraduate and graduate degrees, has been operational at UTK for nearly two decades as part of the Department of Mechanical, Aerospace and Biomedical Engineering (MABE). In recent years, the program has seen considerable growth in enrollment (over 17 percent growth in the past five years), indicating strong interest and demand from our students. Outputs of the BME program have also grown. We have experienced a 58 percent increase in graduates over the last five years, representing an annual average growth of 11.6 percent. A recent career outcome report on 2022 graduates, collected by the UTK Center for Career Development & Academic Exploration and based on the National Association of Colleges and Employers protocols, reported that 85.2 percent of UT graduates who received a bachelor's degree in BME were employed or entered graduate school six months after graduation. Those who directly entered the workforce after graduation had a median salary of \$71,000, which is equal to the national median in the field.

According to the US Bureau of Labor Statistic (BLS), workforce need for BME graduates is expected to expand. The BLS projects that the job market for biomedical engineers will grow at an approximate annual rate of five percent through 2032.

Given the campus trends and the national need for biomedical engineers, I believe that the time is right to extract BME from MABE and make it a stand-alone department. This new department will strengthen specialization and external recognition in biomedical engineering, promote interdisciplinary collaborations, increase impact and workforce education in the biomedical space, and improve our engagement with the biomedical industry in the region and beyond. It will raise awareness of the discipline among students who might not be aware of opportunities that it offers, and it will offer those students customized advising and coaching to help them in their educational journeys and career development. I believe that it will also enhance our ability to recruit outstanding faculty through the creation of a department that is dedicated to their subdiscipline of engineering. Finally, national data show that BME programs have a far higher percentage of women engineers than other engineering programs. The creation of this department will aid us in participating in the national initiative to recruit more young women into engineering.

Office of the Provost  
527 Andy Holt Tower, Knoxville, TN 37996-0152  
865-974-2443 provost.utk.edu

Flagship Campus of the University of Tennessee System

The university has ensured that all internal processes, from administrative support to resource allocation, are aligned for seamless integration and functioning of the Department of Biomedical Engineering. We hope that the Tennessee Higher Education Commission recognizes the potential benefits of this proposal and supports us in our endeavor to further elevate the quality of education at UTK.

We are confident that, with your support, we can enhance the impact and external recognition of biomedical engineering education and research at UTK to the benefit of the citizens and employers of the state of Tennessee and beyond.

This request has been reviewed and approved by the college, and campus bodies on the University of Tennessee, Knoxville, campus and has the full support of campus administration. Currently, we request transmission to THEC for approval. Please contact me if you have any questions or need additional documentation.

Thank you in advance for your attention to this matter.

Sincerely,



John P. Zomchick  
Provost and Senior Vice Chancellor

CC: Donde Plowman  
Bernie Savarese  
Karen Etkorn  
Ozlem Kilic  
Matthew Mench

## Feasibility of the New Academic Unit

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### *Description of New Academic Unit*

Biomedical Engineering is a multidisciplinary field that merges the principles of engineering, biology, and medicine to improve human healthcare outcomes. The Tickle College of Engineering (TCE) at The University of Tennessee, Knoxville, has recognized the immense potential of this field by offering a Biomedical Engineering program within the Department of Mechanical, Aerospace, and Biomedical Engineering (MABE) since academic year 2001-2002 as a major. The program prepares students for careers in various healthcare-related professions (e.g., medical device manufacturing, regulatory agencies, or other biomedically related companies or continued education in graduate school). With the substantial growth in student interest and the potential for continued advancements, there is a compelling need to establish a standalone department dedicated solely to Biomedical Engineering (BME). The formation of the BME department will play a significant role in contributing to TCE's short-, medium-, and long-term priorities in areas such as enhanced enrollment, diversity, research and innovation, workforce development, and strength of industrial partnerships.

Over the years, interest in the BME program has grown significantly (with over a 21% increase in enrollment over the last five years and a 14th-day fall 2023 enrollment in undergraduate BME of 388 students). See enrollment data in Table 1. Creating a dedicated BME department demonstrates UTK's commitment to excellence in this space, making it attractive for aspiring engineers keen on making a difference in the biomedical field. Establishing this department will demonstrate to prospective students and faculty that the college and university are invested in this field and is an excellent place for an education or a career. Additionally, a focused BME department can better adapt to the rapid changes in the industry, offering rapidly changing cutting-edge curricula and research opportunities, which can attract high-achieving students. The BME department will gain greater national and international visibility through BME-focused leadership.

Table 1.

*Enrollment, graduation, and research expenditure data for the BME program over the last five years.*

<b>Biomedical Engineering Program Metrics</b>					
	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>
<b>Enrollment: 14<sup>th</sup> Day Fall 2023 Undergraduate BME Enrollment = 388</b>					
UG	315	319	325	337	364
MS	5	11	7	12	11
PhD	16	15	15	15	19
<b>Total</b>	<b>336</b>	<b>345</b>	<b>347</b>	<b>364</b>	<b>394</b>
<b>Degrees Granted</b>					
UG	34	38	37	42	62
MS	6	4	10	5	4
PhD	3	4	0	4	2
<b>Total</b>	<b>43</b>	<b>46</b>	<b>47</b>	<b>51</b>	<b>68</b>
<b>Research Expenditures</b>					
<b>Total</b>	<b>\$1,484,902</b>	<b>\$1,447,307</b>	<b>\$1,450,763</b>	<b>\$1,678,302</b>	<b>\$1,932,519</b>

Note: 14<sup>th</sup>-Day Fall 2023 Undergraduate BME Enrollment of 388 is used to calculate the undergraduate enrollment growth of >21% over the last five years (2019-2023).

Establishing an independent BME department with the existing ranked program and its faculty, the resources planned in the near-term, and the university-wide research thrust into health and human wellness will enable the program to attract top-tier faculty. This will further enhance student learning and drive cutting-edge research, better positioning the department and improving its overall external reputation. The current BME faculty perform research in various field, including tissue engineering, cellular biomechanics, computational biofluid mechanics, trauma biomechanics, and biofluids rheology, producing an annual research expenditure that has increased by 30% over the last five years with a 2022 research expenditure of > \$1.9M (see Table 1). This indicates a significant potential and capacity for growth. The new BME department will provide opportunities for leadership and cultivation of a differentiating identity, which will appeal to seasoned research faculty and academics interested in molding the direction and ethos of an academic unit to increase productivity and impact. These factors create an enriched environment for learning and innovation, enhancing the pedigree of the college and university nationally and globally in academic rankings.

The BME department will bolster outreach and cultivate stronger partnerships with industry, impacting the state in advancing healthcare delivery with more positive patient outcomes and reduced cost. By focusing on BME, the department establishes itself as a hub of expertise and innovation in the field. This concentrated expertise will naturally attract more industry partners seeking collaboration in research, development, and application of biomedical solutions in the region and beyond. Additionally, the department will be able to expand outreach programs, provide

reskilling and upskilling training to the biomedical workforce, offer micro-credential programs, and organize workshops and symposia, bridging the gap between academia and industry.

As a result of the influx of faculty and supporting staff (four new faculty are expected to be added in the near-term), the proposed department will have the capacity to offer specialized curricula tailored to the emerging innovations and advancements in BME (such as AI/ML in medicine), ensuring that students are equipped with up-to-date skills and knowledge. This expanded capacity will produce graduates ready for graduate school or BME jobs of the future. Greater identity and focus will increase experiential learning opportunities, including internships, co-ops, and applied senior design projects, providing the students with hands-on experience through real-world practical applications and creating a pipeline of job-ready professionals.

### **A Growing Future for BME**

Biomedical engineering is significant, driven by the increasing demand for innovative solutions in the healthcare industry. The shift toward personalized medicine and the rise of digital health technologies drive the need for professionals skilled in biomedical engineering. The proposed BME department will contribute to regional workforce development and beyond.

According to the US Bureau of Labor and Statistics, the employment of bioengineers and biomedical engineers is projected to grow five percent from 2022 to 2032, faster than the average for all occupations. Approximately 1,200 openings for bioengineers and biomedical engineers are projected each year over the decade.” This is at a 2022 median pay of nearly \$100,000 per year.

Our current BME program has produced an increasing number of graduates, with an over 58% increase over the last five years, representing a growing annual average of 11.6%. This graduation rate is significantly above the national average of 4.51% (<https://datausa.io/profile/cip/biomedical-engineering>). A recent class of 2022 career outcome report collected by the UTK Center for Career Development & Academic Exploration, based on the National Association of Colleges and Employers (NACE) protocols, reported that 85.2% of BME BS from UTK graduates were employed or entering graduate school six months after graduation. Those directly entering the workforce after a BS in BME in 2022 had a median salary of \$71,000, equal to that of the national median in the field. Building an even stronger program through an independent department's unique focus and direction will further strengthen the value added to our students and the future workforce.



*Inventory of Academic Programs in the New Academic Unit*

Table 2. Inventory of Academic Programs

Academic Program, Certificates, and Minors	Federal CIP Code
Biomedical Engineering, BSME	14.0501
Biomedical Engineering, MS	14.0501
Biomedical Engineering, PhD	14.0501
Biomedical Engineering (Minor)	--

## Alignment with Tennessee State Master Plan and Institutional Mission

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### *Alignment with State Master Plan*

The creation of the BME department is a significant step that is in alignment with the goals of the State Master Plan. The Master Plan, with its Drive to 55 initiative, seeks to elevate educational attainment levels in TN, particularly in economically distressed areas and among underrepresented populations. The proposed BME department not only addresses the educational needs of TN but also contributes to the future workforce by focusing on high-demand fields such as BME, which is vital to healthcare and technological innovation. The Drive to 55 initiative aims to raise the percentage of Tennesseans holding postsecondary credentials to 55% by 2025. This ambitious goal recognizes the importance of higher education in TN's workforce development. As of 2019, TN has made significant progress, with 43% of adults holding postsecondary credentials, but there is room for additional growth, particularly in underrepresented and underserved communities.

The proposed BME department directly contributes to the Drive to 55 initiative by offering programs that align with high-demand fields. BME is a critical discipline for addressing healthcare challenges and technological advancements. The programs that will be offered by the proposed department will provide educational opportunities for various students, from those seeking entry-level positions in healthcare technology to those pursuing advanced research and innovation. A key objective of the State Master Plan is to increase enrollment in majors leading to high-demand jobs. BME is inherently aligned with this goal. The proposed department will enable an increasing number of students to enroll in BME degree programs that prepare them for careers in a rapidly growing field. Our current BME program has seen an increasing enrollment with >21% over the last five years (2019-2023), which is already a major contribution to the Master Plan. According to the plan, increasing enrollment in such high-need fields is a priority, thus, the proposed BME department will continue to contribute to this goal by attracting more students interested in pursuing careers at the intersection of engineering and healthcare.

The Future of Work taskforce emphasizes the importance of preparing the TN's workforce for the demands of the future. It identified fields such as computer science and data analytics as critical areas of focus. BME integrates various elements of data analytics and technology-driven healthcare solutions, making it highly relevant to the future workforce. Moreover, the taskforce emphasized the need for diverse offerings in fields such as computer science and data analytics. The proposed BME department will align with this recommendation by offering different courses and concentrations, allowing students from diverse backgrounds to gain valuable skills in technology and data analytics focused on biomedical applications. The Master Plan recognizes the significance of stackable credentials in promoting lifelong learning and workforce adaptability. BME lends itself well to the concept of stackable credentials. The proposed BME department will have the capacity to create certificate programs in niche BME areas such as biomedical instrumentation, imaging,

device development, and data analytics. These stackable credentials will enable students to continuously build their skills and qualifications, ensuring that they remain competitive in the healthcare and technology domains.

The BME department will also contribute to TN's economic growth. Healthcare and technology sectors are among the rapidly growing industries in TN and in the nation, thus, by producing graduates with expertise in BME, the department will directly support local and regional industries, fostering innovation and job creation. This alignment with economic growth directly strengthens TN's economic vitality. Graduates from our current BME program, who were employed (with a median salary of \$71,000) or entering graduate school six months after graduation (about 85.2%), are already in the position of contributing to economic growth. The proposed BME department will have the capacity to improve its economic growth contributions as it will expand its program offerings and increase enrollment to produce career-ready graduates.

The creation of the BME department will serve as a catalyst for inclusivity within TN's higher education. It presents a great opportunity to actively engage with underserved communities, encourage students from diverse backgrounds to pursue careers in STEM fields, and promote mentorship programs that support traditionally underrepresented students. The proposed department's commitment to diversity and inclusion will contribute to closing educational and workforce attainment gaps among various demographic groups. For example, our current BME program has >53% female students compared to ~25% for the average of other engineering disciplines. This demonstrates the capacity of the proposed BME department to contribute to closing educational and workforce attainment gaps in STEM fields.

The proposed BME department aligns well with the State Master Plan's Drive to 55 initiative and its broader goals for educational attainment, workforce development, and future workforce readiness. The proposed BME department is a testament to the commitment of UTK, as a land grant institution, to provide Tennesseans with valuable educational opportunities and support a thriving workforce.

***Alignment with Institutional Mission*****Goals of the Institution and College**

The five strategic goals for the University of Tennessee, Knoxville (<https://www.utk.edu/vision>) are to:

- Demonstrate leadership in providing high-quality educational opportunities for people at every stage of life, whenever and wherever they seek to learn.
- Advance the frontiers of knowledge to create a more just, prosperous, and sustainable future through world-class research, scholarship, and creative work.
- Develop and sustain a nurturing university culture where diversity and community are enduring sources of strength.
- Empower and sustain a culture of collaboration, adaptability, and innovation.
- Connect with every Tennessean and with communities worldwide, inspiring future Volunteers to join our diverse community.

In alignment with these university strategic goals, the strategic priorities for the Tickle College of Engineering are to:

- Be a recognized leader in engineering education, lifelong learning, and student success.
- Be a recognized leader in engineering research expertise, technology developments, and societal impact.
- Empower a recognized culture that attracts and enables the success of students, faculty, and staff from underrepresented groups in engineering.
- Be a robust and agile college that embraces opportunities and resilience to change.
- Exemplify the Volunteer spirit through our leadership, partnership, and service to engineer advances for Tennessee and the world.

The new BME department fully aligns with all of these goals.

**Overview of Proposed Unit**

The existing BME program provides a broad-based integration of courses and experience that prepares its graduates to practice their profession successfully, to apply their skills to solve current engineering problems collaboratively, and to help advance the knowledge and engineering practice in their field. The educational objectives of the BME program are:

- Graduates will meet or exceed the expectations of employers of biomedical engineers, such as industry, government, academia, or non-governmental organizations.
- Graduates will continue professional development by participating in structured professional activities and/or by obtaining professional registration or certification, post-graduate credits and/or advanced degrees.

The proposal to establish a separate BME department represents a forward-thinking strategy that underpins UTK's dedication to excellence and commitment to addressing the needs of the 21<sup>st</sup> century. Biomedical Engineering, as an interdisciplinary field, represents the future of healthcare,

where technology and innovation play a critical role in enhancing patient outcomes. By creating a dedicated BME department, the university is ensuring that its students, who are the next generation biomedical engineers, receive training that is both profound in its depth and expansive in its breadth. The current BME program at TCE is the largest in Tennessee, with about 388 UG students. Vanderbilt reports their UG BME enrollment as of Fall 2022 to be 242, making the TCE BME program already the largest ABET-accredited higher education institutional BME program in the state, providing access to this growing field to the state's population.

#### **BME expands engineering access to female students:**

The global significance of the biomedical revolution promises an influx of diverse talent, which will make the department a hub for diverse ideas and innovation. This potential aligns with UTK's vision of cultivating a space for diversity, access, and engagement. It is important to mention that BME programs usually have a higher representation of female students, with our BME program having >53% female students (compared to roughly 25% for the average of other engineering disciplines). For many female students, the allure of BME lies in the opportunity to make a tangible and compassionate difference in people's lives. While all engineering disciplines offer the chance to solve problems meant to improve human life, biomedical engineering provides the unique opportunity to directly impact human health and well-being. This personal relevance resonates strongly with many female students who seek a uniform blend of technical challenges and tangible, impactful outcomes.

#### **BME promotes industry partnership and innovation.**

The potential of the proposed BME department is enormous in terms of workforce development and research impact. The BME discipline mandates a collaborative approach as the challenges are multifaceted, requiring interdisciplinary solutions. The BME department will create fertile grounds to encourage faculty from various disciplines to collaborate, students to think beyond the textbooks and obtain practical experience, and industry professionals to engage in meaningful dialogues with faculty and students. The TCE and university will cultivate an enhanced collaborative culture through the focused growth of an inherently collaborative discipline.

Biomedical engineering represents a meld of medicine and technology, two of the fastest-growing domains. With the rapid technological advancements and increasing healthcare needs, the BME department will be vital in positioning UTK at the forefront of innovation. By creating a stand-alone BME department, UTK strengthens its academic offerings and research programs and aligns itself with global trends, cultivating an environment where students, faculty, and industry players collaborate to pursue innovation to make a concrete societal impact. The proposed BME department represents a strategic endeavor that further solidifies UTK's land grant mission and remains a beacon of progress, innovation, and excellence in the evolving landscape of higher education.

## Investment for New and/or Renovated Facilities

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At present, the BME program has various instructional and research lab spaces, facilities, and equipment that will form part of the new BME department. However, it is expected that the facilities and equipment inventory will grow with the formation of the new department and the potential growth in the existing faculty lines, as each faculty line typically comes with an average of \$500,000-\$1M in start-up investment for a senior hire in the BME field. The new department is anticipated to have additional educational labs, meeting rooms, classrooms, and administrative, faculty, postdoc, and graduate student offices in one building (Perkins Hall). TCE has thoroughly planned a staged move within the next few years.

The staged move plan is carefully designed to ensure a seamless transition and to accommodate the anticipated expansion of the BME department. A plan exists to provide office space for all BME faculty members, BME departmental staff and operations, BME undergraduate student advisors, BME postdocs, BME graduate students, a BME instructional dry lab, and a departmental conference room. This plan occupies about 15,000 net assignable square feet in Perkins Hall, which is shared with UTK Student Success, campus-hosted classrooms, TCE Finance and Administration offices, instructional labs for TCE Kao Innovation and Collaboration Studio, and instructional laboratory for the Department of Civil and Environmental Engineering. Before the BME personnel and operations occupy their space in Perkins Hall, the College will fund a renovation that upgrades flooring, freshly paints spaces, and provides utilities and information technology upgrades for the BME instructional lab, conference room, and departmental main office, plus provides signage to identify and brand the department.

Research laboratories will not be moved to Perkins Hall because the building utilities do not support research laboratories. Consequently, existing and new research laboratories will be located across Dougherty Hall, Science Engineering Research Facility (SERF), and the Zeanah Engineering Complex. The distribution of departmentally related research laboratories in several buildings is typical for all Tickle College of Engineering departments. The research labs of existing BME faculty members will remain in Dougherty and SERF. The research labs for the new BME faculty hires will be placed in some combination of SERF and Zeanah as a function of the most efficient match of laboratory requirements to available utilities and casework in the spaces to be allocated and used.

We will prioritize the transition of teaching and research labs based on academic needs to ensure no disruptions to teaching activities and research projects. We will also use academic breaks/holidays to minimize interference with academic activities. After the staged move, we will perform a space utilization assessment and make adjustments to accommodate future growth.

## Overall Costs for New Academic Unit

---

This cost-benefit analysis of the proposed BME department focuses on the direct benefits to the State, potential sources of cost coverage, and projected revenues. There are several key cost considerations. However, it should be mentioned that the BME program has existed in TCE for several years with dedicated facilities and faculty; hence, new investments in infrastructure and personnel will be progressively added as the program continues to grow and with advancements in innovation and instructional technologies in the field.

The infrastructure and facility adjustments are critical. The new BME department will be in Perkins Hall (Address is 1506 Middle Drive, Knoxville, TN 37996). The space will be remodeled to create more office spaces and additional laboratories. The estimated one-time cost for the space remodeling is \$400,000. Additionally, \$300,000 is estimated to purchase new equipment for various BME teaching labs. For operational costs, the BME department will require a department chair, administrative personnel, and a business manager. One purchasing staff will also be hired in year 4, and this position will contribute to the monthly and yearly payroll commitments. As the BME program has existing BME faculty lines (8 tenured/tenure-track faculty, one research faculty, and one senior lecturer), these lines will be moved from the MABE department to the BME department. These faculty salaries are estimated at \$1,443,690 per year, with 3% annual increases over the next five years. In addition to the new DH, four new faculty are anticipated to be added over the next five years (one full professor, one associate professor, and two assistant professors). Given the rapid technological advancements in BME, there will be costs linked with equipment upgrades, maintenance, and associated utilities. Such upgrades and maintenance are estimated to cost \$200,000 annually. Annual lab consumables (chemicals, etc.), printing, and travel are estimated to be \$190,000 per year.

The benefits are multi-fold. A prominent advantage is the enhanced reputation of the BME program, which will translate into increased enrollment for both in-state and out-of-state students. The BME program has seen a growing percentage of out-of-state students (see Table 3) over the last five years, and this is projected to increase further with the creation of the new BME department. The current percentage of out-of-state students is >18%. The increase in intake will correspond to increased tuition revenue, estimated to be about \$7,097,956 based on current enrollment data (14<sup>th</sup> day Fall 2023 UG BME enrollment data. See Table 1.) with a projected 5% increase in enrollment each year. Another tangible benefit is the potential for more focused research development. The BME department will be more competitive in securing research grants (NSF, NIH, DoD, DoE, etc.), potentially increasing the annual research expenditure to an estimated amount of \$3,500,000 per year in five years. Additionally, development funding (e.g., gifts and endowments) will also form part of the funding generated from the BME department, estimated to increase to \$250,000 per year in five years. The specialized nature of the department will expand access to lucrative industry partnerships. By offering industry-specific training and micro-credentials in addition to potential research translation, an additional revenue stream can be

anticipated, which is projected conservatively to be about \$100,000 annually starting from the third year. See Appendix A, supporting the financial projections and cost-benefit analysis.

Table 3.

Percentage of in-state and out-of-state undergraduate students in the BME program.

Undergraduates in BME:	In-state vs Out-of-state Students				
	2018	2019	2020	2021	2022
In-state	276	279	284	284	295
Out-of-state	30	32	37	50	67
International	9	8	4	3	2
Total	315	319	325	337	364
% Out-of-state	9.5%	10.0%	11.4%	14.8%	18.4%

Financial sustainability is critical for the proposed BME department. The financial projections indicate a significant sustainable cost-benefit margin, mostly from tuition revenues. The financial projections based on UG tuition revenues put the proposed BME department in a similar state as our existing civil and environmental engineering (CEE) department (with UG enrollment of about 417 students) and better than our existing material science and engineering (MSE) department (with UG enrollment of about 49 students), chemical and biomolecular engineering (CBE) department (with UG enrollment of about 274 students), and nuclear engineering (NE) department (with UG enrollment of about 211 students). This further indicates that the BME program has evolved to a level justifying its segregation as a dedicated department. However, it should be mentioned that our existing CEE, MSE, CBE, and NE departments, which are fully established departments and have been in operation for several years, are highly engaged in more research activities (see FY22 funding expenditure in Table 4), attracting federal research funding from various sources (e.g., NSF and DOE). The new BME department will leverage insights from TCE's established and seasoned engineering departments to enhance its federal funding. In addition to the direct cost benefits to the State and UTK, there are indirect cost benefits. Firstly, the BME specialization will enhance the state's reputation as an innovative hub in this rapidly growing sector. This will translate into attracting high-quality talent to the state, leading to innovations that will encourage local industries and attract new businesses. Moreover, graduates from this program, well-equipped with cutting-edge skills, will contribute significantly to the state's workforce in high-paying sectors, thereby augmenting the state's economic health. An increase in high-skilled job placements would mean increased tax revenue for the state. While the initial and operational costs of the proposed BME department are evident, the cost benefits present a compelling justification. This initiative solidifies UTK's commitment to cutting-edge disciplines and promises a significant return on investment.



Table 4.

## Fy22 Research Expenditures for TCE Departments

<b>TCE Academic Units</b>	<b>Research Expenditures</b>
Chemical and Biomolecular Engineering	\$ 4,241,922.00
Civil and Environmental Engineering	\$ 5,822,671.00
Electrical Engineering and Computer Science	\$ 22,337,037.00
Industrial and Systems Engineering	\$ 2,577,339.00
Materials Science and Engineering	\$ 6,751,151.00
Mechanical, Aerospace, and Biomedical Engineering	\$ 16,138,109.00
Biomedical Engineering program	\$ 1,932,519.00
Nuclear Engineering	\$ 12,793,085.00

# Organizational Charts

## Current Organizational Chart

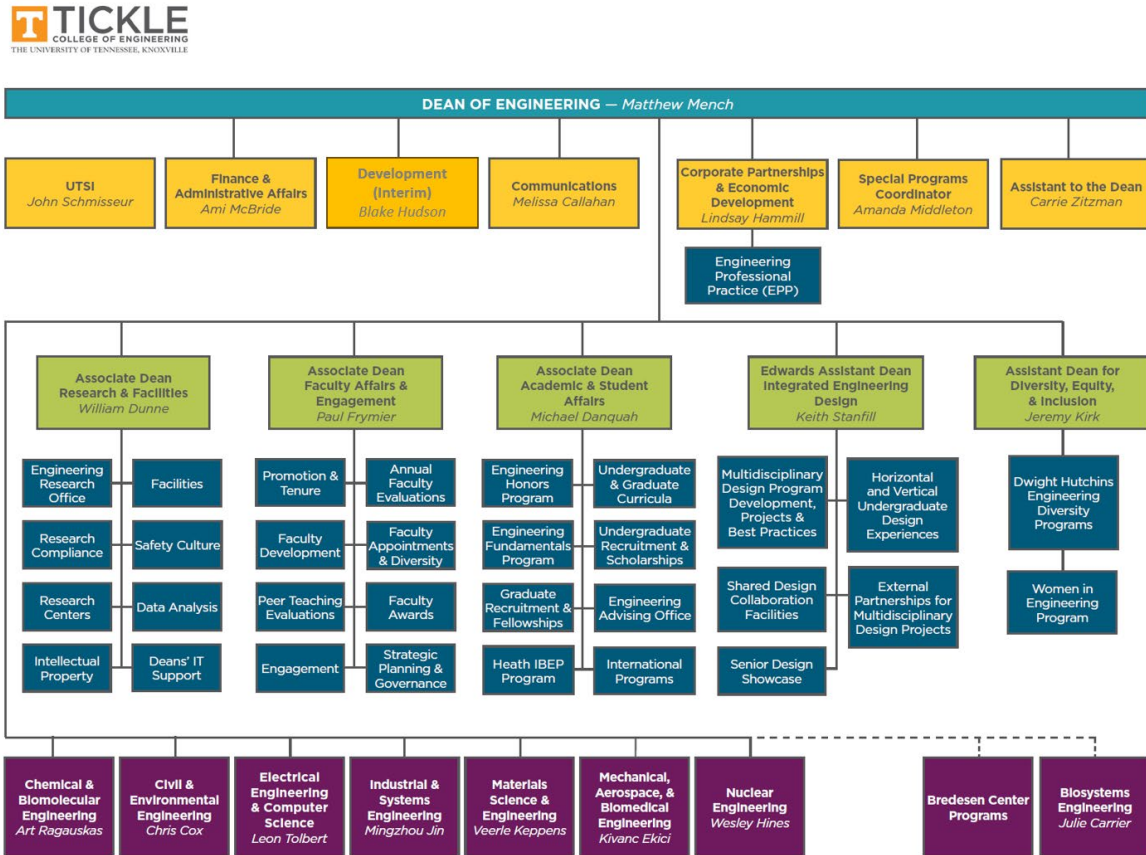


Figure 1. Organizational chart for the Tickle College of Engineering.

The current organizational chart of the TCE shows the Dean, supported by three Associate Deans (in Academic and Student Affairs, Faculty Affairs and Engagement, Research and Facilities) and two Assistant Deans. The BME program currently resides in the MABE department. The Dean is also supported by directors of specific functions. These are finance and administrative affairs, development, communications, corporate partnership and economic development, special programs, and administrative assistance. Seven academic department heads also report to the Dean, including the departments of (1) chemical and biomolecular engineering, (2) civil and environmental engineering, (3) electrical engineering and computer science, (4) industrial and systems engineering, (5) materials science and engineering, (6) nuclear engineering, and (7) mechanical, aerospace, and biomedical engineering (MABE).

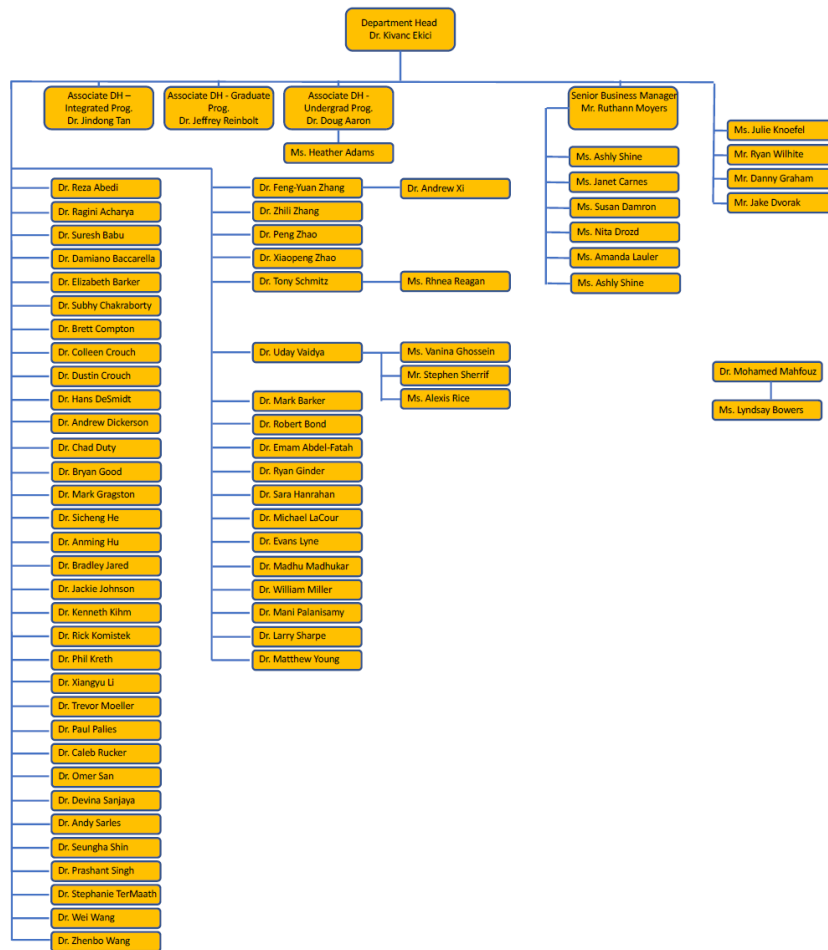


Figure 2. Organizational chart for the Department of Mechanical, Aerospace, and Biomedical Engineering.

The current organizational chart of the Department of Mechanical, Aerospace, and Biomedical Engineering (MABE) has a Department Head (DH) who is supported by three Associate Department Heads (ADHs). These ADHs are responsible for undergraduate, graduate, and integrated programs, respectively. Each ADH directly reports to the DH. In addition, the DH is assisted by a Business Manager, who oversees the departmental budget, purchasing, accounting, and expenditures for the various programs. A team of four administrative staff also supports the DH. Within the MABE department are over 50 faculty members (tenure track, tenured, lecturers, and senior lecturers), some of whom lead distinct research centers and programs and have their own direct reports (research staff, admins, etc.). Some of these faculty are affiliated with the University of Tennessee Space Institute (UTSI). The current BME program is part of the MABE department.

*Proposed (New) Organizational Chart*

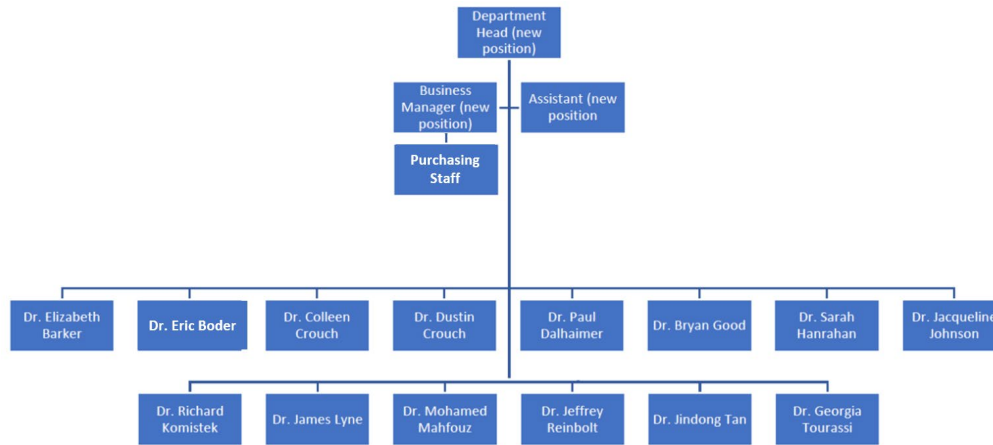



Figure 3. Organizational chart for the proposed Department of Biomedical Engineering (BME).

The proposed Department of Biomedical Engineering organizational chart has a Department Head (DH), supported by an Administrative Assistant and a Business Manager. The Business Manager will oversee the departmental budget, purchasing, accounting, and expenditure. The DH, Business Manager, and Administrative Assistant positions are yet to be filled. The BME program currently has ten tenured/tenure track faculty who presently report to the department head for MABE. Once the BME department is established, these faculty will report to the new BME department head. Due to the interdisciplinary nature of biomedical engineering, four additional faculty with joint appointments in other departments support the BME program. In addition to the new BME department head position, we will hire four new faculty to support the BME department in the next five years. Appendix A captures these additional faculty lines in the financial projection.

## Appendix A: THEC Financial Projections

					
Financial Projections Form					
Institution	University of Tennessee, Knoxville				
Academic Unit	Department of Biomedical Engineering				
Projected One-Time Expenditures					
Category	Year 1	Year 2	Year 3	Year 4	Year 5
Equipment	\$300,000				
Other	\$800,000	\$400,000	\$550,000	\$500,000	\$500,000
<i>Total One-Time Expenditures</i>	<i>\$1,100,000</i>	<i>\$400,000</i>	<i>\$550,000</i>	<i>\$500,000</i>	<i>\$500,000</i>
Projected Recurring Expenditures					
Category	Year 1	Year 2	Year 3	Year 4	Year 5
Faculty & Instructional Staff	\$2,166,479	\$2,439,473	\$2,681,658	\$2,898,607	\$3,090,566
Non-Instructional Staff	\$226,800	\$233,604	\$240,612	\$329,030	\$338,901
Equipment	\$0	\$200,000	\$200,000	\$200,000	\$200,000
Travel	\$40,000	\$40,000	\$40,000	\$40,000	\$40,000
Other	\$150,000	\$150,000	\$150,000	\$150,000	\$150,000
<i>Total Recurring Expenditures</i>	<i>\$2,583,279</i>	<i>\$3,063,077</i>	<i>\$3,312,270</i>	<i>\$3,617,638</i>	<i>\$3,819,467</i>
<b>Grand Total (One-Time and Recurring)</b>	<b>\$3,683,279</b>	<b>\$3,463,077</b>	<b>\$3,862,270</b>	<b>\$4,117,638</b>	<b>\$4,319,467</b>
Projected Revenue					
Category	Year 1	Year 2	Year 3	Year 4	Year 5
Tuition	\$7,097,956	\$7,470,956	\$7,843,956	\$8,216,956	\$8,589,956
Grants	\$2,100,000	\$2,650,000	\$2,975,000	\$3,400,000	\$3,750,000
Other	\$0	\$0	\$100,000	\$100,000	\$100,000
<b>Total Revenues</b>	<b>\$9,197,956</b>	<b>\$10,120,956</b>	<b>\$10,918,956</b>	<b>\$11,716,956</b>	<b>\$12,439,956</b>

**New Academic Unit Request**  
**Tickle College of Engineering**  
**Department of Applied Engineering and Technology**



THE UNIVERSITY OF  
**TENNESSEE**  
KNOXVILLE

Updated: January 17, 2024

## Academic Unit Information

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<b>Institution:</b>	The University of Tennessee, Knoxville
<b>Type of Unit:</b>	Academic Department
<b>Proposed Unit Name:</b>	Department of Applied Engineering and Technology (AET)
<b>Summary of Proposed Change:</b>	UTK seeks to establish a Department of Applied Engineering and Technology to offer 4-year academic degree programs that directly apply engineering principles to tangible, real-world challenges that align with the workforce needs of current and emerging industries.
<b>Proposed Unit Location:</b>	Tickle College of Engineering
<b>Proposed UT Board Approval:</b>	February 2024
<b>Proposed THEC Approval:</b>	March 2024
<b>Proposed Implementation:</b>	July 2024

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## Documentation of Board Approval

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(Inserted after UT Board of Trustees Meeting)

## Campus Letter of Support

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THE UNIVERSITY OF  
TENNESSEE  
KNOXVILLE

January 11, 2024

President Randy Boyd  
University of Tennessee  
505 Summer Place / UT Tower #1288  
Knoxville, TN 37902

President Boyd:

Please accept the attached application for a Department of Applied Engineering and Technology (AET) in the Tickle College of Engineering (TCE) at the University of Tennessee, Knoxville.

The proposed AET department will offer industry-integrated academic programs that apply engineering principles to tangible, real-world challenges in alignment with the workforce needs of current and emerging industries, including manufacturing, defense, and sustainable energy. Such programs will be designed to ensure that students receive the needed practical experience and industry exposure to foster a seamless transition into industry employment. These programs will not compete with the existing traditional engineering curriculum but provide a complementary set of programs focused on satisfying regional workforce needs. They will also increase enrollment in the Tickle College of Engineering by attracting students who are not drawn to traditional engineering curricula while building stronger and closer partnerships with state-wide industry.

Nationally, there is an ongoing shortage of STEM workforce. A report from the National Association of Manufacturing and Deloitte predicts a deficit of up to 3.5 million STEM workers by 2025. This shortage spans critical workforce areas including engineering, healthcare, and IT. In addition, the Bureau of Labor Statistics projects that STEM occupations will increase by ~11% from 2021 to 2031, which is more than double the total for all occupations, indicating a current and ongoing strong demand for STEM qualifications. This underscores the need for more academic programs in STEM to increase access and train more engineers and computer scientists.

Over the last five years about 16% of the applicants to TCE are denied admission to our traditional engineering and computer science programs (averaging about 500 denials per year). The proposed AET department, which will have different admission criteria than other departments in TCE, will create an opportunity for such students to receive engineering education that prepares them for productive roles in industry. In addition, the AET department will provide continuous training for holders of associate degrees in STEM fields, thereby enabling them to update their skills as their roles in industry change.

The need for this program has been verified through various meetings with regional industry representatives, who have been in unanimous support for the creation of such a program within the TCE. For example, the proposed AET department has received support from various Volkswagen, Pilot, Jacobs Space Exploration Group, Raytheon Missiles & Defense, NASA ERC among many others as well as by the TCE Advisory Board.

This new AET department has been reviewed and approved by the TCE and campus bodies on the Knoxville campus and has the full support of campus administration. The university has ensured that all internal processes, from administrative support to resource allocation, are aligned for seamless integration and functioning of this new department.

At this time, we request transmission to the Board of Trustees for approval. Please contact me if you have any questions or need additional documentation.

Office of the Provost  
327 Andy Holt Tower, Knoxville, TN 37996-0152  
865-974-2443 provost.utk.edu

Flagship Campus of the University of Tennessee System

Page 2, AET request  
January 11, 2024

Thank you in advance for your attention to this matter.

Sincerely,



John P. Zomchick  
Provost and Senior Vice Chancellor

CC: Bernie Savarese  
Karen Galicia  
Betty Dandridge Johnson  
Ozlem Kilic  
Matthew Mench  
Heather Hartman

## Feasibility of the New Academic Unit

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### *Description of New Academic Unit*

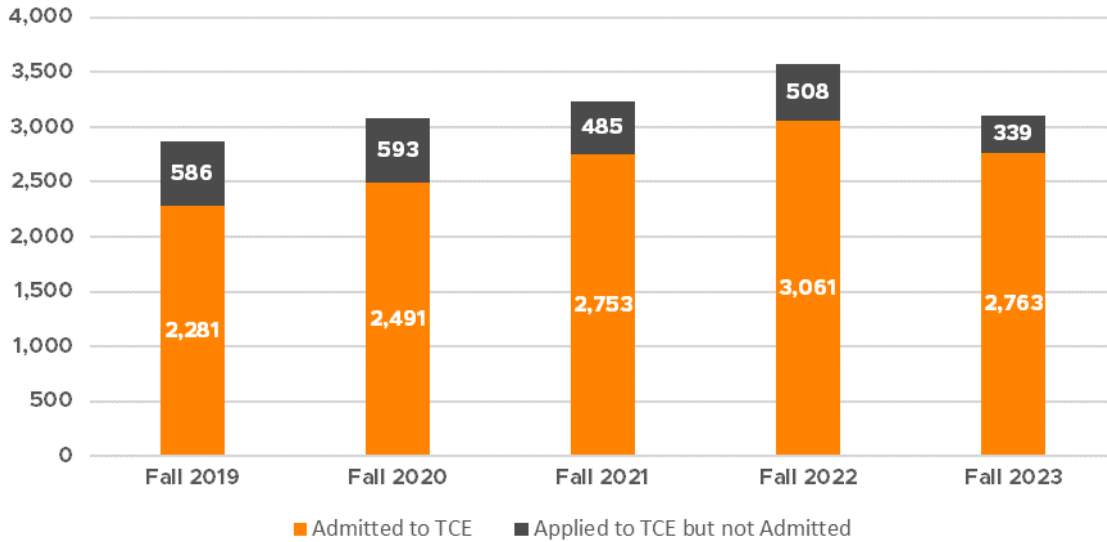
Applied engineering and technology (AET) disciplines combine hands-on practical applications of engineering principles and technological innovations to solve real-world problems and develop new products, processes, or systems. The applied nature of the discipline focuses on real-world applications, from designing new processes to developing new products and technologies, with a commitment to testing, analyzing, optimizing, and maintaining existing systems for enhanced performance and innovation. The Tickle College of Engineering (TCE) at The University of Tennessee, Knoxville, proposes to establish a Department of Applied Engineering and Technology to offer industry-integrated academic programs that emphasize the direct application of engineering principles to tangible, real-world challenges in alignment with the workforce needs of current and emerging industries. Such programs will ensure that students receive practical experience and industry exposure to foster a seamless transition into industry. The creation of the AET department will play a vital role in contributing to TCE's short-, medium-, and long-term priorities in areas such as enhanced enrollment, diversity, workforce development, outreach, and industry partnerships.

The AET department will offer a transformative pathway to a world-class engineering education for Tennessee students from high school and community college, particularly those who thrive on hands-on learning and seek tangible applications of theoretical knowledge, offering a platform to channel their practical orientation into structured problem-solving that is directly relevant to industry. It will also provide opportunities to train students with an entrepreneurial mindset and those aiming to be pioneers in emerging tech domains. At the high school level, students begin to chart their academic and career trajectories, often seeking disciplines that resonate with their innate strengths and aspirations. AET will be attractive to those who have a penchant for problem-solving and working in industry, providing avenues for students who thrive on knowledge application in modern industrial settings, such as designing and fabricating rapid prototypes, optimizing operations, and performing testing, evaluation, and troubleshooting for manufacturing and other processes.

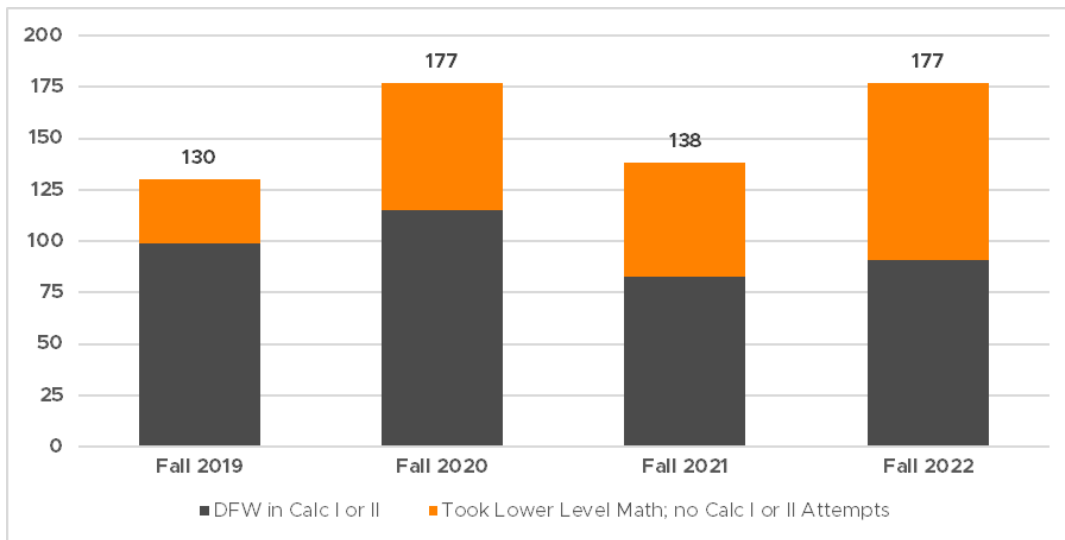
### *Serving a Wider Student Population*

The AET department will admit top first-year students interested in pursuing applied engineering programs and entering the workforce upon graduation. The department will have a reduced ACT score requirement to provide access to students who cannot get into the traditional TCE engineering programs, which are more focused on fundamental theory, creating an opportunity for such students to receive an engineering education that prepares them for engineering jobs upon graduation. Fig. 1 shows the 5-year trend of first-year students who applied to TCE but were not admitted. A significant percentage of AET students (>30%) will emerge from this population. In addition, the AET programs will have a reduced math requirement, attracting students who cannot progress in regular engineering programs due to calculus deficits, which often result from their high school preparation. On average, about 150 TCE students annually either have deficits in calculus (DFW) or decide to take lower-level math and leave TCE to pursue another major (see Fig. 2). The

proposed AET department will create the opportunity to develop these students into the engineering workforce needed by the state and southeast region.



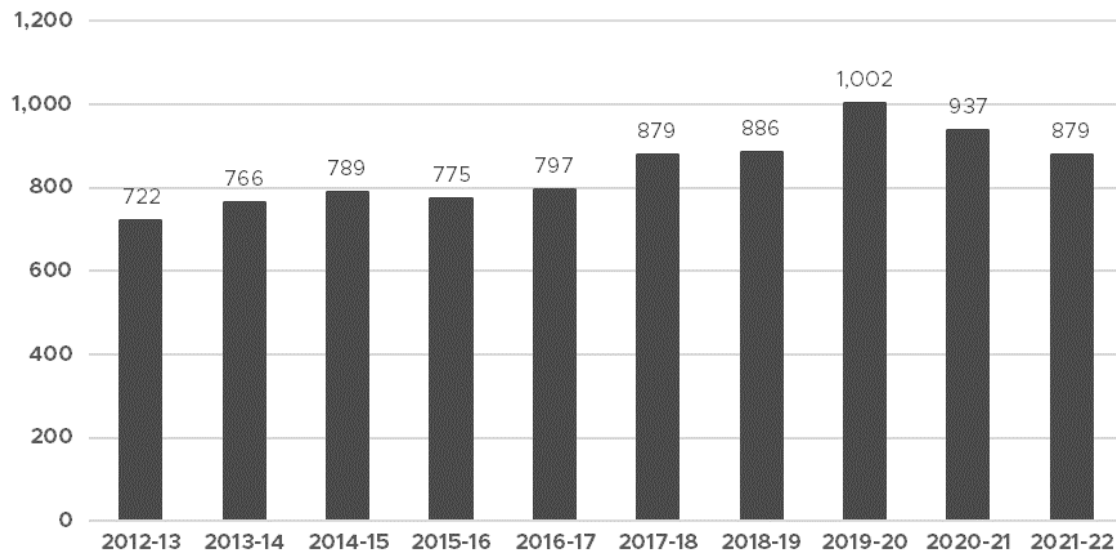
**Fig. 1.** Five-year trend of first-year students who applied to TCE but were not admitted. A portion of this student population (approximately 500 students per year) could be admitted to the AET department for engineering training.



**Fig. 2.** Yearly trend of TCE students who either have Calculus (DFW) deficits or decide to take lower-level math and leave TCE.

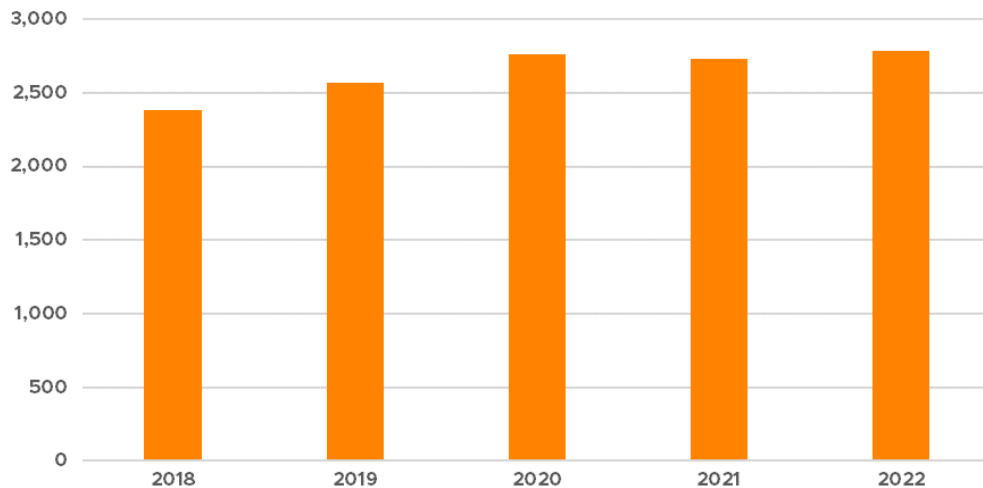
For community college graduates who have already embarked on their higher education journey, the AET department will offer a seamless transition into specialized fields that promise job readiness and growth opportunities. Having acquired an AS or AAS degree, these students can receive further training in the AET department to enhance their skills while earning a bachelor's degree, making them more industry-ready and adaptable to the rapidly changing technological field.

Fig. 3 shows the 10-year data for holders of AS degrees in Engineering Technology from TN Board of Regents (TBR) community colleges, representing another target population for the department. The AET department will provide continuous training for holders of AS degrees in STEM fields to adequately prepare them for progressive industry roles. Parallel to this effort, the department will provide AS and AAS degree holders already in the workforce opportunities to upskill and reskill in specific areas for career progression. The proposed AET department plans to develop various degree programs, including a Bachelor of Science (BS), a Bachelor of Applied Science (BAS), and diverse undergraduate and graduate certificate programs in specific areas of workforce needs in close partnership with industry.



**Fig. 3.** Ten-year trend for holders of AS degrees in Engineering Technology from TBR community colleges. Data shows an increased trend with a potential Covid effect from 2020-2022. This population averages around 845 students per year. Data includes computer and information sciences to assess pipelines into the AET department.

The AET department will promote a diverse and inclusive learning environment, particularly for minority engineering student populations such as female students, veterans, and underrepresented groups who respond well to experiential and hands-on learning and building a closer alignment between theory, application, and impact. Such opportunities will foster greater diversity in the TN STEM workforce. For example, as shown in Fig. 4, an increasing number of women awarded bachelor's degrees in engineering technology nationwide over the last five years. Women are usually drawn to applied engineering fields because they offer opportunities to solve real-world problems creatively and make a tangible impact on society and technology [1, 2]. This finding demonstrates the capacity of the proposed AET department to attract TN female students into engineering disciplines.



**Fig. 4.** Increasing trend in the number of female students awarded bachelor's degrees in engineering technology across the nation over the last five years.

### *Industry Partnerships*

The AET department will establish robust industry partnerships through its industrial board of advisors, enabling students to engage directly through internships, co-ops, and capstone projects. Such partnerships will offer students invaluable industry experience as future employees well-versed in current and emerging technological challenges. The AET department will become a hub of expertise and innovation. This concentrated expertise will naturally attract more industrial partners seeking to partner with the university to enhance their highly skilled workforce. In addition,

[1] Sinkele, C.N. and Mupinga, D.M., 2011. The effectiveness of engineering workshops in attracting females into engineering fields: A review of the literature. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas*, 84(1), pp.37-42.

[2] Bielefeldt, A.R., 2014, June. Does Engineering Attract or Repel Female Students Who Passionately Want to Help People? In 2014 ASEE Annual Conference & Exposition (pp. 24-442).

the department will be able to expand outreach programs, provide reskilling and upskilling training to the STEM workforce of various industries, offer micro-credential programs, and organize workshops and symposia, bridging the gap between academia and industry. The department will be able to provide specialized curricula tailored to emerging technological innovations, ensuring that students are equipped with up-to-date skills. This approach will produce graduates ready for current and emerging industries.

### ***Contrasting Applied Engineering and Traditional Engineering Programs***

The AET department will offer applied engineering programs that differ from traditional engineering programs in several distinctive ways, reflecting its dedication to preparing students for immediate integration into the industrial workforce. Unlike traditional programs, students in the applied engineering programs will be solely prepared for hands-on, direct industrial roles rather than graduate school and research programs. The program curriculum will be developed in partnership with an industrial board of advisors composed of partner companies, closely guiding and tailoring the curriculum content to meet the current and emerging needs of the industry. This level of industry involvement will ensure our graduates are well-prepared and aligned with the demands of the job market. The faculty composition of the proposed AET department will differ significantly from traditional programs. We will hire professors of practice from industry to enrich the educational experience with real-world insights and expertise. In addition, a mandatory co-op or internship component will be integrated into the curriculum, providing students with invaluable practical experience, thereby bridging the gap between academic knowledge and real-world application.

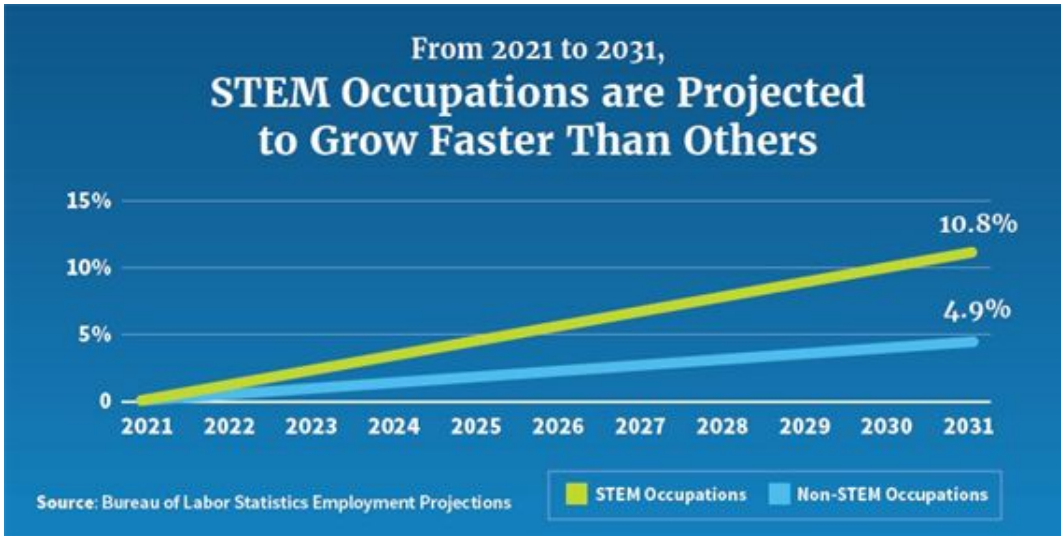
Our approach to teaching engineering fundamentals in applied engineering programs will be distinct, emphasizing pre-calculus through applied calculus with a strong emphasis on experiential learning, allowing students to learn and apply their knowledge immediately. Instead of delving deep into fundamental derivations, the applied engineering programs will focus on computational and hands-on tools, equipping students with the practical skills and problem-solving abilities demanded by industry. Moreover, non-engineering coursework in the applied engineering programs will be more prescribed than traditional programs to prioritize skillsets directly relevant to the industry, ensuring that graduates possess a comprehensive skillset tailored to their chosen field. The applied engineering programs will prioritize project-based learning where students work on real-world projects from industry partners. This approach provides students with practical problem-solving skills and a portfolio of work relevant to their future careers, whereas traditional programs may rely more on theoretical coursework. The applied engineering programs will also offer the flexibility to integrate industry certifications into the curriculum, making graduates even more attractive to potential employers. These certifications validate the students' skills and readiness for the workforce, a feature less commonly found in traditional programs. The applied engineering programs will strongly emphasize soft skills, such as communication, teamwork, leadership, and project management skills, to prepare graduates for collaborative and progressive roles in industry.



A major distinctive aspect of applied engineering programs is their performance evaluation metric. Rather than relying on traditional ranking systems (e.g., USNWR ranking), these programs are assessed based on the successful placement of their graduates into industrial positions. This emphasis on tangible career outcomes underscores their commitment to producing job-ready professionals who immediately contribute to the workforce. The unique focus of applied engineering programs on industry partnership, hands-on experience, industry-focused curriculum, experiential learning, and outcome-driven assessment sets it apart from traditional engineering programs as a crucial pathway for those seeking to excel in direct industrial roles.

### ***Meeting STEM Workforce Needs***

With its growing industrial base, Tennessee is poised to significantly benefit from fit-for-purpose workforce training that aligns with industry needs. According to a National Association of Manufacturing and Deloitte report, there is an ongoing shortage of STEM workers in the United States, with a report predicting a deficit of up to 3.5 million STEM workers by 2025. This shortage spans critical areas, including engineering, healthcare, and IT. Additionally, the Bureau of Labor Statistics projects that STEM occupations will increase by approximately 11% from 2021 to 2031, which is more than double the total for all occupations, indicating a strong demand for STEM qualifications (see Fig. 5). This finding underscores the need for more academic programs in STEM to increase access and train more engineers and computer scientists. The increasing technological and industrial evolution brings opportunities and challenges that demand a dynamic, skilled, and versatile workforce. As TN positions itself as a competitive hub for emerging industries, creating educational programs tailored to its workforce needs becomes imperative. The proposed AET department will provide a continuous pipeline to increase access to engineering training and strengthen TN's capacity to meet its STEM workforce needs, representing a strategic investment in TN's future economic development.



**Fig. 5.** BLS projections for STEM and non-STEM workforce from 2021 to 2031 show an increase of ~11% from 2021 to 2031, more than double the total for non-STEM occupations.

***Planned Future Programs to be Associated with the New Unit***

The following academic programs have been planned as the initial offerings of the AET department. These programs will be progressively introduced as we strengthen the needed faculty expertise and expand our instructional facilities to support each one adequately.

- Bachelor of Science in Applied Engineering
- Bachelor of Science in Applied Manufacturing
- Bachelor of Science in Applied Aerospace Engineering
- Bachelor of Science in Applied Energy Storage and Conversion Engineering
- Bachelor of Science in Applied Computer Science

Over the first five years, we will launch a Bachelor of Science in Applied Engineering with concentrations in Applied Manufacturing, Applied Aerospace, Energy Storage and Conversion Engineering, and Applied Computer Science and monitor the performance of each concentration for a few years in terms of enrollment and industry feedback before elevating them into majors. These selected initial program domains reflect the core of the required skills needed to support the changing industry landscape in TN, and they resulted from various stakeholder meetings and engagement with industries in the region, including PILOT, Ford, Jacobs Space Exploration Group, Raytheon Missiles & Defense, NASA ERC, etc. Applied manufacturing techniques, such as 3D printing, automation, and robotics, are reshaping the manufacturing sector. As traditional manufacturing jobs undergo transformation, there is an urgent need for a workforce skilled in these next-generation techniques. A program in applied manufacturing, leveraging existing resources and strengths of TN-MADE (Advanced Manufacturing and Design Enterprise), the Institute for Advanced Materials and Manufacturing, and Kao Innovation and Collaboration Studio will ensure that TN remains a manufacturing hub and adapt well to the evolving needs of the 21st century.

Another program planned to be offered by the proposed department is Applied Aerospace Engineering. This degree is one of the fastest growing in America, as the demand for qualified engineers is much greater than is currently being produced. However, most emerging aerospace technology programs being developed focus on airport operations. For this degree, the university would leverage its UT Space Institute campus (UTSI) in Tullahoma and its proximity to Huntsville to create an engineering workforce capable of meeting the testing and evaluation needs of the Department of Defense and civilian aviation. A workforce trained in applied aerospace technologies will propel TN forward as a leader in defense solutions, leveraging existing efforts from UTSI, which is part of TCE. This potential program will bolster TN's contributions to national security and open avenues for high-tech defense contracts, fostering economic growth and job creation. In-depth stakeholder surveys and in-person interviews revealed a strong desire to partner with the university to help start this program.

A third program to be developed within the proposed department is Applied Energy Storage and Conversion Engineering. This degree program would be unique among its peers and respond to an enormous need from the state and region to produce engineers capable of working in battery and other clean energy technologies. With the shift from fossil fuels to renewable energy sources, the demand for efficient and scalable energy storage solutions is increasing. TN can be at the forefront of technology and a leader to help serve the workforce needs of the growing battery and other energy-related industries of the future. The existing partnership between UTK and ORNL in energy systems (e.g., Bredesen Center) will be leveraged to support student training and research innovation.

Another program to be developed within the proposed department is Applied Computer Science. From artificial intelligence to cybersecurity, the applications are vast and essential. An applied computer science program will equip TN students with the skills to enter the workforce prepared to contribute to fields such as big data, machine learning, and digital infrastructure, driving the state's technological prowess and ensuring its industries remain globally competitive. Industrial stakeholders have identified a tremendous need to train more people with applied skills and capabilities to leverage data into a competitive advantage through computer sciences. Graduates of this program will be able to provide programming skills across business and industrial sectors with additional education that empowers understanding of the industrial context and the need for such skills.

## Alignment with Tennessee State Master Plan and Institutional Mission

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### *Alignment with State Master Plan*

The proposed AET department aligns closely with the State Master Plan, particularly the 'Drive to 55' initiative. It represents a significant step toward achieving the goals outlined in this initiative. The state plan aims to increase the proportion of Tennesseans with postsecondary credentials to 55% by 2025. The AET department will directly contribute to the Drive to 55 goals by increasing the number of Tennesseans with postsecondary credentials in high-demand fields (such as applied manufacturing, aerospace, energy, and computer science) critical to workforce development. The new department will constitute a major stride in bridging the gap in educational attainment across TN. These initial focus areas espoused by the department will contribute to meeting the high-need and/or top-income-earning jobs identified by THEC in its Academic Supply & Occupational Demand report [3]. For example, applied manufacturing will cater to workforce needs in manufacturing engineering technology/technician; applied computer science will cater to workforce needs in software developers and software quality assurance analysts and testers; and applied aerospace engineering will cater to workforce needs in aircraft mechanics and service technicians.

The focus on STEM disciplines, particularly in areas such as applied manufacturing, aerospace, computer science, and energy storage, aligns with the state's emphasis on enhancing education in technical fields. These areas are essential for the current and emerging workforce and are expected to be in high demand in the future job market. The proposed AET department's approach to education, which emphasizes practical and applied learning, will ensure that graduates are not just academically proficient but are also ready to meet the demands of the workforce. This approach is critical as the TN economy evolves with advancements in technology and automation.

The department will attract a diverse range of students, including adult learners and individuals from underrepresented communities. Attracting these students will be crucial for raising the overall education level across counties in TN, especially those economically underserved. The department's focus on applied engineering and technology fields also fills a vital gap in the state's educational offerings, providing students with the skills and knowledge needed in critical sectors that can make a difference in building the economy of various counties through entrepreneurship and the establishment of local businesses by graduates from the proposed department.

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[3] Tennessee Higher Education Commission. Academic Supply & Occupational Demand report, 2021 ([https://www.tn.gov/content/dam/tn/thecc/bureau/research/other-research/supply-demand/Academic%20Supply%20and%20Occupational%20Demand\\_FINAL.pdf](https://www.tn.gov/content/dam/tn/thecc/bureau/research/other-research/supply-demand/Academic%20Supply%20and%20Occupational%20Demand_FINAL.pdf))

In addition to the initial programs, the proposed AET department will facilitate the creation of certificate programs that will be either standalone or embedded into the degree programs to demonstrate specific competencies. These certificate offerings will open doors for stackable credentials, a key focus of the Drive to 55 initiative, and allow students to accumulate credentials over time in a flexible manner tailored to the evolving needs of the industry. Such stackable credentials will make programs offered by the department more accessible and relevant, allowing learners to continuously upgrade their skills and knowledge in line with industry needs. The stackable credentials will also allow for creating interdisciplinary programs in partnership with industry.

The alignment with the Drive to 55 initiative extends beyond educational offerings. It plays a crucial role in TN's broader economic development strategy. As the department process produces graduates with skills in high-demand fields, the department will help attract businesses and industries to the state, fostering economic growth and creating job opportunities. This, in turn, will contribute to the overall prosperity and development of TN, aligning with the initiative's goal of enhancing the state's economic competitiveness through education. In addition to academic and economic contributions, the proposed department will play a pivotal role in outreach and collaboration, working closely with local industries, high schools, and community organizations to increase awareness and access to STEM higher education among traditionally underserved communities. These efforts will be crucial for ensuring that more Tennesseans are aware and prepared for the opportunities in technical and applied fields.

The proposal to create the AET department is strategic, progressive, and aligns closely with the TN Master Plan. The proposed department addresses critical state objectives such as increasing educational attainment, meeting workforce needs, preparing for future economic challenges, and promoting equity in education. It will also contribute significantly to the state's educational landscape and economic development, ultimately helping TN achieve its ambitious educational and workforce development goals.

### ***Alignment with Institutional Mission***

#### **Goals of the Institution and College**

The five strategic goals for the University of Tennessee, Knoxville (<https://www.utk.edu/vision>) are to:

- Demonstrate leadership in providing high-quality educational opportunities for people at every stage of life, whenever and wherever they seek to learn.
- Advance the frontiers of knowledge to create a more just, prosperous, and sustainable future through world-class research, scholarship, and creative work.
- Develop and sustain a nurturing university culture where diversity and community are enduring sources of strength.

- Empower and sustain a culture of collaboration, adaptability, and innovation.

Connect with every Tennessean and communities worldwide, inspiring future Volunteers to join our diverse community. In alignment with these university strategic goals, the strategic priorities for the Tickle College of Engineering are to:

- Be a recognized leader in engineering education, lifelong learning, and student success.
- Be a recognized leader in engineering research expertise, technology developments, and societal impact.
- Empower a recognized culture that attracts and enables the success of students, faculty, and staff from underrepresented groups in engineering.
- Be a robust and agile college that embraces opportunities and resilience to change.
- Exemplify the Volunteer spirit through our leadership, partnership, and service to engineer advances for Tennessee and the world.

The new AET department fully aligns with all these goals.

### **Overview of Proposed Unit**

The proposed AET department will offer fit-for-purpose programs designed around the core philosophy of experiential learning and direct industry engagement. The program curricula will embed dynamic innovations in current and emerging industries, ensuring graduates are well-equipped to join the workforce. Pioneering such a transformative educational experience, the department will build curricula emphasizing hands-on learning, strong industry collaboration, and meaningful community engagement. The goals of the proposed AET department are to:

- Develop industry-relevant programs and curriculums that reflect the dynamic needs of industries, ensuring that graduates are always at the forefront of engineering advancements.
- Create a hands-on and applied learning environment that bridges theoretical concepts with tangible applications, preparing students to tackle real-world engineering challenges.
- Establish robust partnerships with leading industry stakeholders, providing students with invaluable exposure to ensure a seamless transition to industry.
- Engage in community outreach to foster a vibrant exchange with local industries and the community towards innovation, shared growth, and mutual benefit.

The proposal to establish an AET department represents a forward-thinking strategy that underpins UTK's dedication to excellence and commitment to addressing the needs of the 21st century. The AET department will offer hands-on, interdisciplinary programs that directly align with industry needs. UTK's creation of the AET department demonstrates the university's commitment to ensuring that its students, the next generation of the industry workforce, receive training that provides the required knowledge and experiences for current and emerging industries. The AET department will be one of a kind in TN, creating opportunities for students to study hands-on, industry-relevant programs, collaborate closely with industries, and develop skill sets aligned with the workforce's evolving demands. This unique approach will empower students to be at the

forefront of innovative solutions, ensuring they are well-equipped to lead in their respective fields post-graduation.

While several community colleges in TN offer Associate of Science (AS) and Associate of Applied Science (AAS) programs in Engineering Technology, there are only a few Bachelor of Science (BS) programs in AET-related areas. These BS programs are crucial for AS and AAS degree holders, offering them a chance to enhance their skills further and prepare them comprehensively for industry roles. No SEC schools currently have an AET department, though some have baccalaureate-level Engineering Technology programs or Engineering programs with narrower and more direct applications (see Table 1). Aside from the Engineering Technology and Information Technology programs, none appear to have significantly different curricula from traditional programs, nor is there clear evidence of a more hands-on instructional approach. Given the substantial number of students who graduate with AS degrees in AET in TN (see Fig. 3) and neighboring states compared to the paucity of BS programs in AET, there's an apparent regional demand for the opportunity to train holders of AS degrees further to prepare them for the workforce adequately, underscoring the statewide need for the proposed AET department.

Table 1: Applied or Related Programs and Engineering Technology Programs at SEC<sup>4</sup> Institutions

Engineering Technology and Information Technology Programs	Engineering Programs with Targeted Area of Application
<ul style="list-style-type: none"> <li>• University of Kentucky (<i>Computer Systems, Lean Systems, both completion programs with local community college</i>)</li> <li>• University of Missouri (<i>Information Technology</i>)</li> <li>• University of South Carolina (<i>Info. Tech., Computer Information Systems</i>)</li> <li>• Texas A&amp;M University (<i>Electronic Systems, Manufacturing and Mechanical Technology, Multidisciplinary Technology</i>)</li> </ul>	<ul style="list-style-type: none"> <li>• University of Alabama (<i>Manufacturing Systems Engineering, Construction Engineering, Cybersecurity, Musical Audio Engineering</i>)</li> <li>• Auburn University (<i>Software Engineering, Wireless Engineering</i>)</li> <li>• University of Florida (<i>Digital Arts &amp; Sciences</i>)</li> <li>• University of Kentucky (<i>Mining Engineering</i>)</li> <li>• Louisiana State University (<i>Construction Management</i>)</li> <li>• Mississippi State University (<i>Software Engineering, Cybersecurity Operations</i>)</li> <li>• Texas A&amp;M University (<i>Industrial Distribution</i>)</li> </ul>

<sup>4</sup>Including the University of Oklahoma and the University of Texas at Austin, who will join the SEC in 2024.



**The AET department will cultivate a cutting-edge workforce and innovation.**

The potential of the proposed AET department is enormous regarding cutting-edge workforce development and the impact of industrial research. AET programs mandate a collaborative approach as current and emerging industrial challenges are multifaceted, requiring interdisciplinary solutions. The proposed AET department will create fertile ground to encourage faculty from various disciplines to collaborate, students to think beyond the textbooks and obtain practical experience, and industry professionals to engage in meaningful dialogues with faculty and students. We will hire faculty with industry experience (e.g., professors of practice) to teach in this department. TCE and UTK have cultivated enhanced collaborative culture via focused growth of inherently collaborative disciplines. With the rapid technological advancements and increasing industrial needs, the AET department will be vital in positioning UTK at the forefront of cutting-edge workforce development and innovation. Strong industry partnerships will be forged, bringing in collaborative projects and opening avenues for internships and job opportunities for the students. The direct link with industries will ensure a continuously evolving curriculum, keeping pace with technological advancements. Such an alignment will enhance UTK's global competitiveness and provide its contributions have a tangible societal impact.

**The AET department will attract more diverse students into engineering.**

AET is uniquely positioned as a medium for promoting diversity and attracting female students, an essential undertaking in addressing the gender disparity in many engineering disciplines. It also attracts non-traditional students, such as first-generation college students and veterans, creating a pipeline for non-traditional students graduating from 2-year community college programs. This aligns with UTK's mission of cultivating a space for diversity, access, and engagement. The AET department will emphasize experiential learning that bridges the gap between theoretical knowledge and tangible, real-world applications. This emphasis will bring forth the immediate impact and relevance of engineering work and present opportunities that resonate with a broader audience, especially women seeking to make a difference. Historically, women and non-traditional students have a keen interest in disciplines with a clear societal impact [5, 6]. With its emphasis on addressing pressing industrial and societal challenges, AET aligns perfectly with this inclination. Highlighting the real-world implications of AET programs underscores their direct contribution to the betterment of society, making them an attractive option for many female students. In addition, the hands-on nature of AET allows for collaborative environments, fostering team-based projects and solutions. Such collaborative settings often prove appealing to female and non-traditional students, as they encourage communication, teamwork, and holistic problem-solving. The AET department will address representation and harness varied perspectives to tackle global challenges.

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[5] Auguste, Elizabeth, Becky Wai-Ling Packard, and Alexandra Keep. "Nontraditional women students' experiences of identity recognition and marginalization during advising." *NACADA Journal* 38.2 (2018): 45-60.

[6] Henderson, Jerrod, et al. "Factors impacting engineering advanced degree pursuit and attainment among Black males." *Journal of Women and Minorities in Science and Engineering* 28.4 (2022).

## Investment for New and/or Renovated Facilities

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The proposed AET department will align its academic offerings with the evolving needs of the engineering industry. The plan to invest in new and renovated facilities is a cornerstone of this initiative, ensuring the department has state-of-the-art resources to support its programs. Initially, the AET department will be integrated into the existing structures and facilities of the Tickle College of Engineering. This integration is a practical approach that allows for the immediate launch of the department while minimizing initial costs. However, recognizing the unique needs of AET programs, there is a clear plan for the gradual development of dedicated facilities, including instructional labs, collaborative studios, meeting rooms, classrooms, and office spaces for administration and faculty.

We will begin by remodeling, renovating, and repurposing existing classrooms and office spaces in the Tickle, Zeanah, and Perkins buildings (e.g., the 5<sup>th</sup> floor of Zeanah and Perkins sub-basement) to create spaces for the department. A budget of \$1,000,000 will be committed to the space remodeling and renovation. These initial investments are crucial in setting the foundation for the department's future growth. We will create multifunctional spaces that can adapt to various learning activities. Classrooms will be designed for flexibility to cater for both traditional lectures and hands-on interactive learning. Similarly, labs will be equipped to be multipurpose, capable of supporting a diverse range of hands-on instructional and project needs. As the AET department grows, we will invest in a dedicated building to house all its operations. The building will feature advanced research labs, collaborative workspaces, and smart classrooms designed to foster industry collaboration, innovation, and creativity.

In addition to the space work, a budget allocation of \$800,000 per year is set to procure innovative technology as advancements in the field emerge. This investment is crucial in keeping pace with industry needs, ensuring that the department offers hands-on instruction with the latest tools and techniques, enhancing the learning experience, and ensuring that graduates are well-prepared for the demands of the modern workforce. The existing facilities at the Kao Innovation and Collaboration Studio, Tennessee MADE (Advanced Manufacturing and Design Enterprise), and the Institute for Advanced Materials and Manufacturing (IAMM) will play a pivotal role in the department's initial phase.

These facilities, with their advanced manufacturing and materials technologies, are well-aligned with the focus of the BS in Applied Manufacturing program. For instance, the Fibers and Composites Manufacturing Facility under IAMM offers comprehensive capabilities in developing and prototyping advanced composites, which is fundamental to modern manufacturing practices. The Machine Tool Research Center, equipped with an array of sophisticated Computer Numerical Control (CNC) machining centers and additive manufacturing technologies, provides an ideal setting for practical and hands-on learning. As new programs are introduced within the AET department, the plan is to leverage existing facilities in the college (e.g., UTSI and Bredesen Center) while also acquiring additional resources to support the expanded programs. This approach ensures

that each program has the necessary tools and environment to provide a high-quality educational experience. The commitment to continuous investment in facility upgrades and innovative technology acquisition reflects our dedication to staying at the forefront of engineering education. The investment plan for the proposed AET department balances immediate needs with long-term growth. As we renovate existing spaces, invest in cutting-edge equipment, leverage current facilities, and support faculty, the AET department will be well-positioned to become a leader in engineering education.

## Overall Costs for New Academic Unit

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This cost-benefit analysis of the proposed AET department focuses on the direct benefits to the State, potential sources of cost coverage, and projected revenues. There are several essential cost items. However, it should be mentioned that the AET program will initially leverage existing spaces, instructional facilities, and faculty; hence, new investments in infrastructure and personnel will be progressively added as the department and its programs continue to grow with advancements in innovation and instructional technologies.

The infrastructure and facility adjustments are critical. The new AET department will initially be housed in the Tickle and Zeanah buildings. The spaces will be remodeled to create more office spaces and instructional labs. The estimated one-time cost for the space remodeling is \$1,000,000. Additionally, \$800,000 is estimated to purchase new equipment for various AET teaching labs. For operational costs, the proposed AET department will require a department head, administrative personnel, a business manager, and an accounting specialist (in year 4). These positions will contribute to the monthly and yearly payroll commitments. Initially, five new professors of practice will be hired in addition to the new department head within the first five years. We will provide a start-up package of \$150,000 for new faculty, which will aid in recruiting top-tier professors of practice and fuel innovation within the department. Faculty can use this fund to acquire new equipment to support the teaching needs of the programs and sponsored project activities. Three adjunct faculty will also be hired. Additional full-time faculty will be employed as the program and department grows. These faculty salaries are estimated at \$117,000 annually, with 3% annual increases. The effort of these faculty will be complemented by existing faculty with expertise in applied manufacturing. Given the rapid technological advancements in AET, there will be costs associated with equipment maintenance, upgrades, and related utilities. Such maintenance and upgrades are estimated to be \$200,000 annually. Annual lab consumables (3D printing filament and resins, CNC tooling and cutting bits, composite materials, coolants and lubricant, welding supplies, etc.), printing, and travel are estimated at \$220,000 annually.

The benefits are multi-fold. The prominent one is the projected enrollment for both in-state and out-of-state students (see Table 1) in the first five years, with further anticipated increases beyond the first five years as we start new programs. Year 1 activities include space renovation, equipment purchases, DH/faculty hiring, course development, and marketing and student recruitment, so no tuition revenue is anticipated. Student enrollment in the department will correspond to tuition revenue, which is estimated to be about \$4,043,415 in year 5. Another tangible benefit is the

potential for focused research on, for example, enhanced STEM pedagogies to support applied engineering education and product, process development, and evaluation research with industry partnerships. The AET department would attract grants (industry, NSF, DoD, DoE, etc.), potentially generating an annual research expenditure of \$500,000 starting year 4. Development funding (e.g., gifts and endowments) will also form part of the funding generated by the AET department and is estimated to be \$150,000 per year starting in year two and increasing to \$250,000 in year 5. The specialized nature of the department will expand access to lucrative industry partnerships. As we offer industry-specific training and micro-credentials in addition to potential technology translation, another revenue stream can be anticipated, projected conservatively to be about \$150,000 annually starting from the third year. See Appendix A, supporting the financial projections and cost-benefit analysis.

**Table 1.**

*Enrollment projection of in-state and out-of-state undergraduate students in the AET department for the first five years.*

Year	Total Enrolled, Cumulative	In-State	Out-of-State
Year 1	Year 1 activities include space renovation and remodeling, equipment purchases, DH/faculty hiring, THEC proposal for new program, course development, and marketing and student recruitment. Student enrollment = 0		
Year 2	50	45	5
Year 3	105	94	11
Year 4	160	144	16
Year 5	250	225	25

*Note: Estimates are based on a significantly conservative fraction of the number of students who apply for regular engineering programs in TCE but are unadmitted (see Fig 1).*

Financial sustainability is critical for the proposed AET department. The financial projections indicate a sustainable cost-benefit margin, mostly from tuition revenues. The financial projections based on UG tuition revenues alone put the proposed AET department in a similar state as our chemical and biomolecular engineering (CBE) department (with UG enrollment of approximately 274 students) and better than our material science and engineering (MSE) department (with UG enrollment of about 49 students), and nuclear engineering (NE) department (with UG enrollment of approximately 211 students) in five years, indicating the potential of the proposed AET department to contribute significantly to our UG engineering education. However, it should be mentioned that our existing MSE, CBE, and NE departments, which are fully established departments and have been in operation for several years, have graduate students and are highly engaged in more research activities, attracting federal research funding from various sources (e.g., NSF and DOE).

The new AET department will leverage insights from TCE's established and seasoned engineering departments to enhance its growth. In addition to the direct cost benefits to the State and UTK, there are indirect cost benefits. First, the AET programs will strengthen the state's reputation as an innovative hub in this rapidly growing sector, which will translate into attracting high-quality talent to the state, leading to innovations that will encourage local industries and attract new businesses. Second, graduates from this program, well-equipped with cutting-edge skills, will contribute significantly to the state's workforce in high-paying sectors, thereby augmenting the state's economic health. An increase in high-skilled job placements would mean increased tax revenue for the state. While the initial and operational costs of the proposed AET department are evident, the cost benefits present a compelling justification. This initiative solidifies UTK's commitment to cutting-edge disciplines and promises a significant return on investment.

## Organizational Charts

### Current Organizational Chart

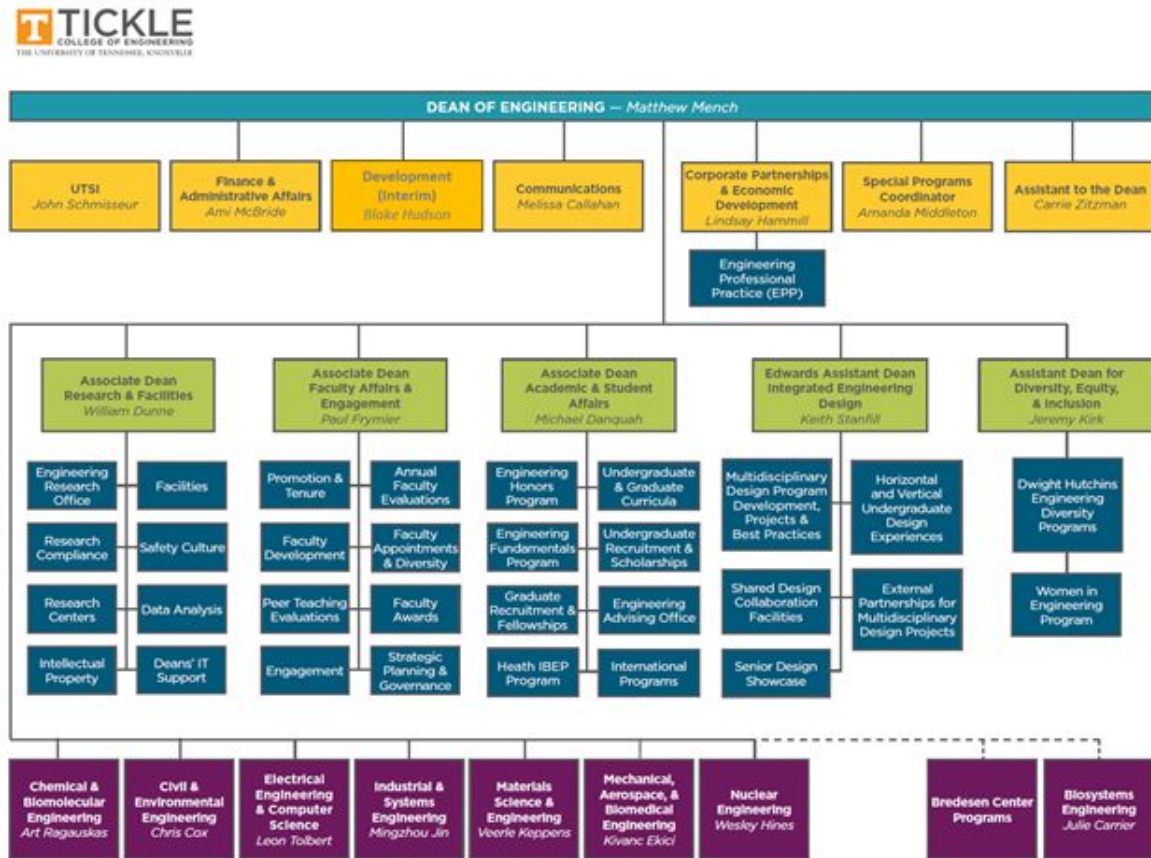
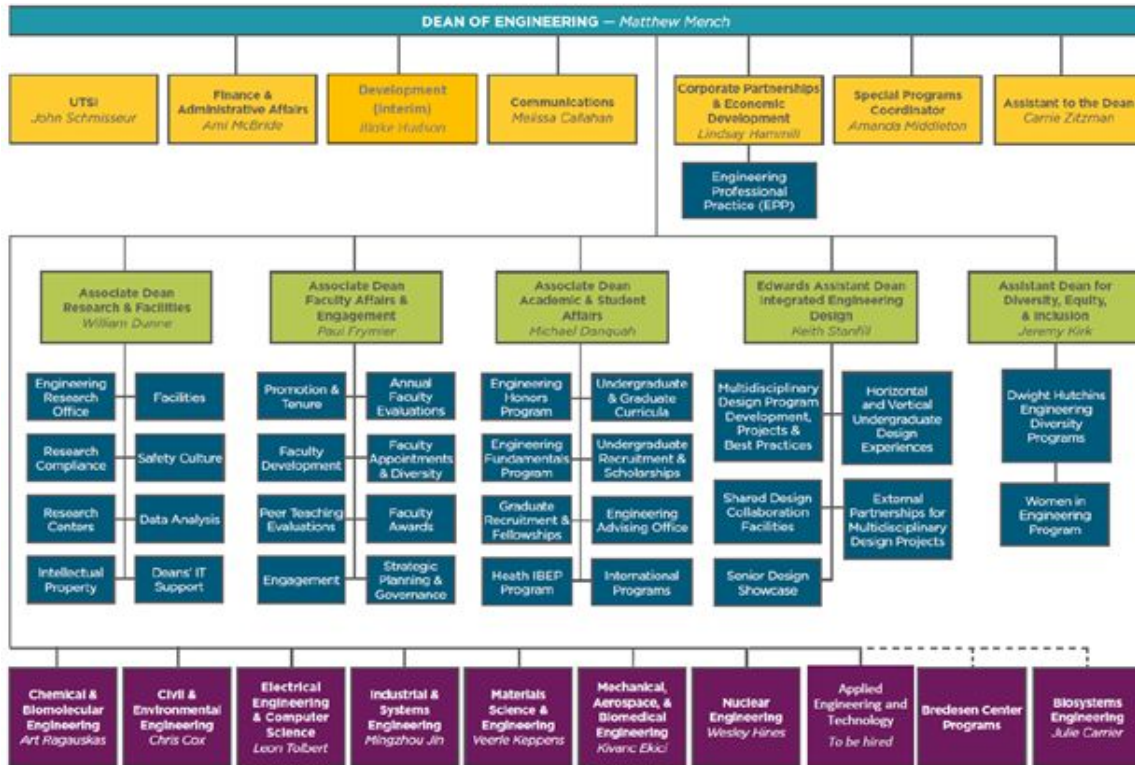


Fig. 6. Organizational chart for the Tickle College of Engineering.

The current organizational chart of the TCE shows the Dean, supported by three Associate Deans (in Academic and Student Affairs, Faculty Affairs and Engagement, and Research and Facilities) and two Assistant Deans. Directors of specific functions also support the Dean. These are finance and administrative affairs, development, communications, corporate partnership and economic development, special programs, and administrative assistance. Seven academic department heads also report to the Dean, including the departments of (1) chemical and biomolecular engineering, (2) civil and environmental engineering, (3) electrical engineering and computer science, (4) industrial and systems engineering, (5) materials science and engineering, (6) nuclear engineering, and (7) mechanical, aerospace, and biomedical engineering (MABE).

*Proposed (New) Organizational Chart*



8

**Fig. 7.** Organizational chart for the Tickle College of Engineering modified with the proposed AET department. The AET department head will report directly to the Dean.






**Fig. 8.** Organizational chart for the proposed AET department.

The AET department will have a Department Head (to be hired), supported by an Administrative Assistant and a Business Manager. The Business Manager will oversee the departmental budget, purchasing, accounting, and expenditure. The DH, Business Manager, and Administrative Assistant positions will be filled in year 1. The accounting specialist will be hired in year 4. Five new full-time AET faculty (professors of practice) will be engaged in the first five years and report directly to the new department head.



## Appendix A: THEC Financial Projections

					
<b>Financial Projections</b>					
Institution	University of Tennessee, Knoxville				
Academic Unit	Department of Applied Engineering and Technology				
Projected One-Time Expenditures					
Category	Year 1	Year 2	Year 3	Year 4	Year 5
Equipment	\$800,000				
Other <sup>7</sup>	\$1,200,000	\$300,000	\$150,000	\$150,000	\$150,000
<i>Total One-Time Expenditures</i>	\$2,000,000	\$300,000	\$150,000	\$150,000	\$150,000
Projected Recurring Expenditures					
Category	Year 1	Year 2	Year 3	Year 4	Year 5
Faculty & Instructional Staff	\$484,200	\$660,727	\$846,598	\$1,042,096	\$1,247,510
Non-Instructional Staff	\$259,000	\$266,770	\$274,774	\$362,117	\$372,981
Equipment	\$0	\$200,000	\$200,000	\$200,000	\$200,000
Travel	\$40,000	\$40,000	\$40,000	\$40,000	\$40,000
Other	\$165,000	\$180,000	\$180,000	\$180,000	\$180,000
<i>Total Recurring Expenditures</i>	\$948,200	\$1,347,497	\$1,541,372	\$1,824,213	\$2,040,491
Grand Total (One-Time and Recurring)	\$2,948,200	\$1,647,497	\$1,691,372	\$1,974,213	\$2,190,491
Projected Revenue					
Category	Year 1	Year 2	Year 3	Year 4	Year 5
Tuition <sup>8</sup>	\$0	\$801,300	\$1,701,485	\$2,598,430	\$4,043,415
Grants	\$0	\$150,000	\$150,000	\$700,000	\$750,000
Other	\$0	\$0	\$150,000	\$150,000	\$150,000
Total Revenues	\$0	\$951,300	\$2,001,485	\$3,448,430	\$4,943,415

<sup>7</sup>One-time space renovation and start-up funds for new faculty hires.

<sup>8</sup>Tuition revenues were calculated based on 85% retention for year 2 and 90% retention for years 3 and 4 for both in-state and out-of-state. The tuition calculation did not include the other fees (SPSF A&B, Library, Tech, Facilities, etc.)

# Off-Campus Instructional Center



## Springfield Center

Center Location: Springfield, TN

Updated January 17, 2024

DocuSign Envelope ID: 3FCC2898-A682-43FD-929D-E03415FA0B5A

**The University of Tennessee at Martin**  
**Letter of Notification**

**Springfield Off-Campus Center**  
October 20, 2023

**Signature Page**

We, the undersigned, support the creation of the University of Tennessee at Martin – Springfield Center, to be located on the campus of the Volunteer State Community College Springfield.

DocuSigned by:  
*Phil Cavalier*  
Philip Acree Cavalier, Provost  
UT Martin

DocuSigned by:  
*Petra McPhearson*  
Petra McPhearson, Vice Chancellor  
for Finance and Administration  
UT Martin

DocuSigned by:  
*Dana Hagan*  
Dana Hagan, Facilities Manager  
UT Martin

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## Name and Location of the New Center

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### *Proposed Area for the New Center*

The University of Tennessee at Martin–Springfield Center is the proposed name for the new UT Martin Center. The new Center will be located on the Volunteer State Community College – Highland Crest Campus premises in Springfield, Tennessee (Robertson County). In addition to the main campus in Martin, UT Martin currently operates five other regional Centers in West Tennessee, located in Jackson, Parsons, Ripley, Selmer, and Somerville. The Springfield Center will be UT Martin’s sixth Center and its first in Middle Tennessee.

### *Need for the New Center*

- a. Community/Industry Support
- b. Identify and describe the target population
- c. Contribution to State’s higher education completion agenda
- d. Alignment with Institutional Master Plan

#### ***a. Community/Industry Support***

##### Recognized Educational Need in Robertson County

Volunteer State Community College (VSCC) established its Springfield campus in 2011 to serve Robertson County and the surrounding region. For several years, VSCC partnered with Austin Peay State University (APSU) to offer degree completion programs. APSU recently ended this partnership, leaving a void in the availability of degree completion programs in Robertson County. VSCC approached the University of Tennessee at Martin (UT Martin) with an offer to partner to fill this void.

UT Martin already has full-time faculty in established undergraduate degree programs in agriculture, agricultural business, and interdisciplinary studies, and in the graduate (online) Master of Business Administration (MBA) and Master of Science in Agriculture and Natural Resources (MSANR) programs. This initiative is a true partnership with Volunteer State Community College, which currently offers and will continue delivering lower-division general education programming to traditional learners, local adults, and high school students. In addition to traditional face-to-face classes, UT Martin will leverage a mix of delivery methods, including flipped classrooms, online and distance learning coursework, and hybrid offerings to provide more effective utilization of resources and high-quality instruction for students seeking to continue their educational journey.

UT Martin is committed to building strategic collaborations with Volunteer State as well as with our own University of Tennessee resources from The Highland Rim AgResearch and Education Center (overseen by the UT Institute of Agriculture), which has already secured a long-standing strong and

supportive footing in Robertson County. Our philosophy, going forward, is to use this outreach center as a collaborative access point to the University's exceptional resources and expertise.

Attachment F includes letters of support for this partnership, including support from the Robertson County Chamber of Commerce, the Robertson County Mayor, the Springfield City Mayor, industry leaders, representatives from Robertson County Schools, and the UT Institute of Agriculture. These letters recognize the need for the programs that UT Martin will bring to the region. For example, Chris Cooksey, President – NA Operations for Hail & Cotton, recognizes that Robertson County is the third largest agricultural county in Tennessee, with 1,200 farms, 97% being family farms. He notes that the partnership will offer “local talent with the opportunity to broaden their knowledge in the field of agriculture while still living at home.” Jordan Osborne, the President of the Robertson County Chamber of Commerce, notes the importance of the region investing “in the education and training of the next generation of agricultural leaders, innovators, and professionals” and that this collaboration will offer “local students expanded access to high-quality educational programs, training, and support.”

#### Local and Regional Need/Demand

A recent economic overview for the third quarter of 2023 was presented in August 2023 by Lightcast. This report can be found in Attachment D. Excerpts are below.

- Concerning population growth: “As of 2022, the region's population has increased by 7.1% since 2017, growing by 4,968. Population is expected to increase by 7.3% between 2022 and 2027, adding 5,503.”
- Concerning job growth: “From 2017 to 2022, jobs increased by 0.8% in Robertson County, TN, from 26,577 to 26,784. This change fell short of the national growth rate of 3.8% by 3.0%. As the number of jobs increased, the labor force participation rate increased from 64.6% to 66.2% between 2017 and 2022.”
- Concerning educational preparation of the labor force: “15.3% of Robertson County, TN residents possess a bachelor's degree (5.5% below the national average), and 8.3% hold an associate's degree(0.5% below the national average).”
- Concerning the education level requirements for jobs: Data indicate that approximately 20% of jobs in Robertson County require at least a bachelor's degree.

Population growth has exceeded both job growth and increases in labor force participation rates over the same period. The relatively low educational attainment rates could be a contributing factor that has limited the growth of new jobs in the county. There exists a gap between educational attainment and workforce educational need in the region.

With the heavy presence of military students and families in Robertson County, UT Martin is well positioned to support and is dedicated to assisting veterans, active-duty service members, National Guard and Reservists, and eligible military families in achieving their educational and professional

goals. The University recognizes the adjustment from military service to college life can be incredibly challenging as one transitions into the post-secondary environment. Therefore, the UT Martin Springfield Center is committed to providing students with the tools, support, and encouragement needed to successfully transition to the classroom and understand the federal and state benefits that they have earned, which includes a Veteran's Coordinator who is dedicated to serving the UT Martin Regional Centers.

### Employer Demand

Robertson County and its surrounding area continue to experience substantial growth in the number of new companies establishing businesses there. Recent county data indicates approximately 32,000 people in the local labor force and 500,000 people in the regional labor force, with 2,860 new jobs in manufacturing alone created in the last decade. (Data provided by <https://growinrobertson.com/workforce/>.)

This trend is expected to continue, thus making it essential that access to post-secondary attainment (at the Bachelor/Master level) be available for those employees who are resource and time bound. A recent Lightcast program overview for Agriculture/Animal/Plant/Vet Science and Related Fields for the third quarter of 2023 indicated significant occupational needs such as Buyers/Purchasing Agents jobs reported in 2021 at 1,683 jobs is projected to reach 2,026 by the Year 2030 (20% increase). This report can be found in Attachment E.

Specific examples of the difference between the number of graduates in agricultural-related fields and the expected job growth in those fields from the Lightcast report include the following:

- In 2021, Tennessee State University (TSU) produced 32 completions of bachelor's degrees and 16 completions of master's degrees in these fields for students in Cheatham, Davidson, Robertson, and Sumner Counties. TSU was the only institution noting completions in this region (any others were deemed insignificant due to low numbers in this analysis). Trend data shows little variance from this number of completions in the past five years.
- Among the targeted occupations in these areas, Lightcast predicts 1,304 annual openings. Although not all of these openings require a bachelor's or higher degree, several occupations would benefit from having a larger workforce with baccalaureate or higher degrees in these areas. Examples include:
  - Buyers and Purchasing Agents (234 annual openings, expected growth of 20.45% by 2030)
  - Agricultural Technicians (13 annual openings, expected growth of 19.18% by 2030)
  - First-line Supervisors of Farming, Fishing, and Forestry Workers (13 annual openings, expected growth of 18.84% by 2030)
  - Soil and Plant Scientists (14 annual openings, expected growth of 66.13% by 2030)

**b. Identify and describe the target population**

As described above, the main target population will be students completing associate degrees through Volunteer State Community College and wishing to continue their education by completing a baccalaureate degree. UT Martin will utilize existing Tennessee Transfer Pathways to support VSCC students who continue at UT Martin. This population includes students completing high school and beginning their postsecondary careers at VSCC and working adults and veterans seeking a bachelor's degree.

A secondary target will be working adults and college graduates seeking to advance their careers through obtaining a master's degree. Although the coursework for the master's degree will be online, the Springfield Center will serve as a service center for local and regional students enrolled in the Master's degree programs by allowing students to get face-to-face assistance and support without requiring the student to drive two hours to the UT Martin main campus.

**c. Contribution to the State's higher education completion agenda**

According to the recent Lightcast Economy Report for Robertson County (Attachment D) concerning educational attainment, only 15.3% of Robertson County, TN residents possess a bachelor's degree (5.5% below the national average), and only 8.3% hold an associate's degree (0.5% below the national average) as noted above. The presence of the UT Martin Springfield Center will allow both traditional students and working adults in the region to obtain a baccalaureate degree that addresses their career goals and fulfills the needs of local business and industry. The Tennessee State Master Plan ([MasterPlan2025\\_0418.pdf \(tn.gov\)](#)) focuses on the Drive to 55 and calls for an increase in undergraduate programs, and the new site will assist in fulfilling this initiative. Students enrolled with VSCC can move seamlessly to UT Martin through the Tennessee Transfer Pathways, while TN Promise/TN Reconnect students will have the opportunity to fulfill a bachelor's degree.

**d. Alignment with Institutional Master Plan**

The Springfield Center will align with UT Martin's mission to educate and engage responsible citizens to lead and serve in a diverse world by developing programming that supports the regional workforce development needs of Robertson County and surrounding areas. The baccalaureate degree in Agricultural Business will help prepare workers to fill the estimated annual vacancies in agricultural areas. At the same time, the Bachelor of Interdisciplinary Studies will offer students and working adults the flexibility of pairing already-accrued credits with additional coursework to tailor a program to fit their experiences and career goals. The MBA and MSANR degrees will support current and future employers as the need for highly skilled employee leadership grows.

Offering these programs also aligns with the THEC Master Plan 2020 ([MasterPlan2025\\_0418.pdf \(tn.gov\)](#)) and the acknowledgment of the critical need for academic programs of distinction at the graduate and professional level to fully address Tennessee's economic development, workforce, and



research needs. The Springfield Center further aligns with recommendations to construct a culture of access and success through building capacity in local communities. The Center supports the concept of working with the Robertson County community to build a rich community-based culture that is supportive of local postsecondary student access and success by increasing outreach efforts to underserved student populations such as veterans, adult learners seeking career advancement, and students who intended to take a gap year during the covid pandemic but joined the workforce instead of returning to begin their post-secondary journey.

### *Proposed Academic Offerings and Degree Designations*

In Spring 2024, UT Martin will begin offering coursework at the VSCC site that will align with the following degrees. Enrollment in the degree completion programs will begin in Fall 2024 when the VSCC teaching site officially becomes the Springfield Center.

***BSAB: Bachelor of Science in Agricultural Business*** (Concentrations in Farm and Ranch Management; Agricultural Business)

*CIP Code: 01.01.0102.00*

*Academic Program Liaison (APL) name and contact information:*

Dr. Todd Winters, Dean of Agriculture and Applied Sciences

[winters@utm.edu](mailto:winters@utm.edu)

731-881-7251

***BIS: Bachelor of Interdisciplinary Studies***

*CIP Code: 21.30.0000.04*

*Academic Program Liaison (APL) name and contact information:*

Ms. Cindy West, Dean of Education, Health, and Behavioral Sciences

[cwest4@utm.edu](mailto:cwest4@utm.edu)

731-881-7127

***MBA: Master of Business Administration*** (Concentrations: Agricultural; General Business; Human Resource Management; Sport Business)

*CIP Code: 32.52.0201.00*

*Academic Program Liaison (APL) name and contact information:*

Ahmad Tootoonchi, Dean of Business and Global Affairs

[tootoonchi@utm.edu](mailto:tootoonchi@utm.edu)

731-881-7227

***MSANR: Master of Science in Agriculture and Natural Resources (Concentrations: Agribusiness and Risk Management; Natural Resources Systems Management; Systems Science in Agriculture)***

*CIP Code: 01.01.0101.00*

*Academic Program Liaison (APL) name and contact information:*

Dr. Todd Winters, Dean of Agriculture and Applied Sciences

[winters@utm.edu](mailto:winters@utm.edu)

731-881-7251

The first year of coursework to be offered includes the following courses:

<b>Spring 2024:</b>	<b>Summer 2024:</b>	<b>Fall 2024:</b>
AGEC 311	AGEC 475	AGEC 371/372
AGEC 370	INFS 351	MKTG 301
AGRI 411	MGT 303	POSC 362
MGT 300	POSC 361	*AGEC 110 for VSCC/dual
MGT 340		*AGEC 271 for VSCC/dual
*AGEC 110 for VSCC/dual		Graduate MSANR course
*AGEC 271 for VSCC/dual		Graduate MSANR course

*\*VSCC does not currently offer AGECE 110 and AGECE 271. VSCC has requested that UT Martin provide this coursework.*

Titles and course descriptions for these courses appear in Attachment C.

All teaching faculty must meet the University's SACSCOC qualifications and academic standards. Existing faculty were recruited and selected to participate in offering these programs by the respective academic department chair in which each course is housed, and all meet the qualifications of the University. Adjunct faculty teaching both face-to-face and online courses are expected to hold a master's degree in the teaching discipline or a master's degree in a related discipline with a minimum of 18 graduate hours in the teaching discipline and are required to submit official copies of their transcripts and a current vita for review by the Academic Department Chair and Executive Director of Regional Centers and Online Programs before approval to teach.

***Estimated Program Costs/Revenue Sources for the New Center***

The University will use existing full-time faculty to begin the programs offered at the Springfield Center. Eventually, the Department of Agriculture, Geosciences, and Natural Resources may need to add one FTE (Full Time Equivalent) as the BSAB program grows and more sections of the courses need to be offered. Only one full-time administrative support person will be needed to implement this initiative. The cost of travel and other technology items will be reduced using the large campus distance learning infrastructure already in place. No significant equipment needs are projected.

As stated in the **THEC Financial Projection/Budget Proposal Form** (see Attachment B) accompanying this Letter of Notification, the institution projects that the addition of the UT Martin Springfield Center will generate significant positive net revenues within the first three years of implementation due to enrollment growth in select degree programs.

#### Revenue stream

Conservatively, UT Martin predicts an enrollment of 25 full-time-equivalent (FTE) students in the first academic year (2024-25). For subsequent years, UT Martin predicts an increase of 5 FTE per year, reaching 45 FTE students in the 2028-29 academic year. Revenue is calculated by taking the number of FTE students each year and multiplying it by the estimated cost of tuition/fees each year, beginning with the current rate for the 2023-24 academic year and increasing by 2% each year.

#### Recurring expenditures

The most significant cost factor in the projections is for the administrative staff person on-site and instruction compensation for faculty directly supporting this Center. It is important to note that the regular faculty costs reflected in the form do not represent new costs for the institution but rather a reallocation of current faculty expenses as the respective faculty members already support other UT Martin sites, and their courses will be folded into this new program.

The cost for the administrative staff person (Center Director) includes a \$71,500 salary and approximately \$26,600 benefits in the first year and is estimated to increase by 2% each year. The cost of the full-time faculty is roughly \$75,000 salary and \$27,200 benefits in the first year, with a 2% increase each subsequent year. Finally, adjunct/overload pay is estimated to be \$11,000 in the first year, with a \$2,000 increase each subsequent year to cover one additional course per year.

Rental for the leased space is expected to be approximately \$4,300 per year. A total of \$2,500 is included for supplies annually for the first three years, with an increase to \$3,000 annually for subsequent years.

#### One-time expenditures

One-time expenditures in the first year include \$5,000 for signage to announce UT Martin's presence at the VSCC Highland Crest campus and \$6,000 in equipment (laptops for the Center Director, faculty, and labs).

Based on the revenue and expenditures outlined above, a brief fiscal outlook for the first three years of the Springfield Center is below. Full details are included in Attachment B.

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>
TOTAL REVENUES	\$255,200	\$312,000	\$371,000
TOTAL EXPENSES	\$229,100	\$224,106	\$230,165
<b>SURPLUS*</b>	<b>\$26,100</b>	<b>\$87,894</b>	<b>\$140,835</b>

\*Carry-forward for forthcoming faculty investment

### *Facilities Plans and Timeline for Facilities Acquisition*

*MOU/Lease Agreement:* The Tennessee Board of Regents and the University of Tennessee (on behalf of UT Martin) will enter a formal lease agreement to lease space for the UT Martin Springfield Center at the Volunteer State Community College – Highland Crest Campus located at 150 Laureate Avenue, Springfield, TN 37172, USA.

The lease agreement will mirror the similar active UT/TBR lease agreement for the UT Martin Jackson Center and Jackson State Community College. The UT/TBR lease agreement for the space will be effective January 1, 2024.

Leased space will include:

- One administrative office
- One faculty member's office
- One dedicated computer lab
- One dedicated classroom
- Shared use of adjunct instructor space

The distance from the Martin campus to the new Springfield Center is approximately 131 miles.

Oversight of the Springfield Center will be shared by:

- Dr. Meredith Young, Springfield Center Director, [Meredith.young@volstate.edu](mailto:Meredith.young@volstate.edu); 615-433-7034 (on behalf of VSCC), and
- Ms. Erica Bell, Director of UT Martin Regional Centers and Online Programs, [ebell3@utm.edu](mailto:ebell3@utm.edu); 731-881-7089 (on behalf of UT Martin).

## Attachments

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### *Attachment A: Mission, Values, and Campus Master Plan*

#### UT Martin Mission Statement

The University of Tennessee at Martin educates and engages responsible citizens to lead and serve in a diverse world.

#### UT Martin Core Values

- **ACADEMIC PROGRAM EXCELLENCE** - UT Martin embraces the critical role faculty play in developing and delivering an academically challenging curriculum, advising and mentoring students, and participating in scholarly activities.
- **STUDENT EXPERIENCE AND SUCCESS** - UT Martin is committed to providing a learning environment that encourages degree completion and our students' personal and professional development.
- **INCLUSION** - UT Martin is committed to creating a culture of belonging and a safe environment for all students, faculty, staff, and visitors to the campus.
- **ADVOCACY AND SERVICE** - UT Martin serves as an educational and cultural leader in West Tennessee, and we strive to partner with educational institutions, community leaders, government entities, businesses, and industry to enhance the quality of life in the region.

<https://www.utm.edu/about-ut-martin/mission-and-values.php>

#### UT Martin Campus Master Plan

A Campus Master Plan responds to the policy directions set by the University and the changing needs of the students and faculty in this educational environment. The campus strategic plan is used to guide this Master Plan.

The existing UT Martin Master Plan serves as a blueprint for rational building expansions and site improvements that preserve and renew existing facilities and reinforce the positive aspects of the campus. The following overarching goals of the existing 2010 Master Plan Update remain valid:

- Define current and future facility needs, including renovations, expansions, and new buildings that enhance the quality of academic programs and support campus community life issues.

- Develop facilities to support UT Martin’s mission of enhancing the region’s educational, cultural, and economic life and serving as a focal point for various programs and services.
- Provide an overall impression of quality in all aspects of the campus, allowing UT Martin to recruit and retain the highest quality students and faculty.
- Provide a variety of options for housing to attract and maintain students while supporting and promoting a sense of community interaction on campus.

The University has implemented a comprehensive plan to recruit and retain students who will flourish in the high-quality undergraduate and graduate education programs offered. Recruitment efforts include attracting students from West Tennessee and beyond to encounter the UT Martin experience, including the vision of an engaged living-learning environment. Construction and renovations are underway to improve the existing facilities.

<https://www.utm.edu/offices-and-services/campus-master-plan/campus-master-plan-goals-and-objectives.php>

*Attachment B: THEC Financial Projection Form*



Form A1.4AB

**Operational Costs/Revenues Estimate for Off-Campus Center Location**

Please include a brief **Budget Narrative** outlining the source of funds, any external assistance (e.g., private industry), and expenses associated with establishing this Center.

Please provide an explanation of the Other Sources category included in the Revenues section.

**Institution Name:** University of Tennessee at Martin

**Name of Proposed Off-Campus Center:** The University of Tennessee at Martin - Springfield Center

Five-year cost projections are required.

**Expenditures**

**One-time Expenditures**

	Year 1	Year 2	Year 3	Year 4	Year 5
New/Renovated Space <sup>1</sup>	\$ -	\$ -	\$ -	\$ -	\$ -
Equipment	\$ 11,000	\$ -	\$ -	\$ -	\$ -
Library	\$ -	\$ -	\$ -	\$ -	\$ -
<b>Sub-Total One-time</b>	<b>\$ 11,000</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>

**Recurring Expenditures**

	Year 1	Year 2	Year 3	Year 4	Year 5
<b>Administration</b>					
Salary	\$ 71,500	\$ 72,930	\$ 74,390	\$ 75,880	\$ 77,400
Benefits	\$ 26,600	\$ 27,132	\$ 27,675	\$ 28,230	\$ 28,800
Sub-Total Administration	\$ 98,100	\$ 100,062	\$ 102,065	\$ 104,110	\$ 106,200
<b>Faculty</b>					
Salary	\$ 86,000	\$ 89,500	\$ 93,000	\$ 96,600	\$ 100,200
Benefits	\$ 27,200	\$ 27,744	\$ 28,300	\$ 28,900	\$ 29,500
Sub-Total Faculty	\$ 113,200	\$ 117,244	\$ 121,300	\$ 125,500	\$ 129,700
<b>Support Staff</b>					
Salary	\$ -	\$ -	\$ -	\$ -	\$ -
Benefits	\$ -	\$ -	\$ -	\$ -	\$ -
Sub-Total Support Staff	\$ -	\$ -	\$ -	\$ -	\$ -
<b>Operating</b>					
Equipment	\$ -	\$ -	\$ -	\$ -	\$ -
Other	\$ 6,800	\$ 6,800	\$ 6,800	\$ 7,300	\$ 7,300
Sub-Total Operating	\$ 6,800	\$ 6,800	\$ 6,800	\$ 7,300	\$ 7,300
Sub-Total Recurring	\$ 218,100	\$ 224,106	\$ 230,165	\$ 236,910	\$ 243,200
<b>TOTAL EXPENDITURES</b>	<b>\$ 229,100</b>	<b>\$ 224,106</b>	<b>\$ 230,165</b>	<b>\$ 236,910</b>	<b>\$ 243,200</b>



Funding Source for Facilities/Space:

<hr/>	Owned by Institution
Yes - space at VSCC	Leased by Institution
Yes - space at VSCC	Owned by another public institution of higher education
<hr/>	Provided at no cost to the institution. Please document.
<hr/>	Facilities/Space Square Footage

## Revenues

### One-time Revenues

	Year 1	Year 2	Year 3	Year 4	Year 5
Tuition and Fees	\$ -	\$ -	\$ -	\$ -	\$ -
State Appropriations	\$ -	\$ -	\$ -	\$ -	\$ -
Sales and Services of Educational Activities	\$ -	\$ -	\$ -	\$ -	\$ -
Other Sources (provide explanation)	\$ -	\$ -	\$ -	\$ -	\$ -
<b>Sub-Total One-time</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>

### Recurring Revenues

	Year 1	Year 2	Year 3	Year 4	Year 5
Tuition and Fees	\$ 255,200	\$ 312,000	\$ 371,000	\$ 432,000	\$ 495,000
State Appropriations	\$ -	\$ -	\$ -	\$ -	\$ -
Sales and Services of Educational Activities	\$ -	\$ -	\$ -	\$ -	\$ -
Other Sources (provide explanation)	\$ -	\$ -	\$ -	\$ -	\$ -
<b>Sub-Total Recurring</b>	<b>\$ 255,200</b>	<b>\$ 312,000</b>	<b>\$ 371,000</b>	<b>\$ 432,000</b>	<b>\$ 495,000</b>

<b>TOTAL REVENUES</b>	<b>\$ 255,200</b>	<b>\$ 312,000</b>	<b>\$ 371,000</b>	<b>\$ 432,000</b>	<b>\$ 495,000</b>
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*Attachment C: Curriculum Plans*

The following courses are tentatively scheduled for the Springfield Center for Spring, Summer, and Fall 2024. Course descriptions follow the list of courses.

<b>Spring 2024:</b> AGECE 311 AGECE 370 AGRI 411 MGT 300 MGT 340 *AGECE 110 for VSCC/dual *AGECE 271 for VSCC/dual	<b>Summer 2024:</b> AGECE 475 INFS 351 MGT 303 POSC 361	<b>Fall 2024:</b> AGECE 371/372 MKTG 301 POSC 362 *AGECE 110 for VSCC/dual *AGECE 271 for VSCC/dual  Graduate MSANR course Graduate MSANR course
---	---	--

**Course Descriptions for Courses****Scheduled to be Offered in Spring, Summer, and Fall 2024****Department of Agriculture, Geosciences, and Natural Resources****AGECE 110 - Introduction to Agricultural Business**

**Credit(s): 3 Lecture Hours: 3 Lab Hours: 0 When Offered:** Fall, Spring, Summer

An introduction to the field of agricultural business and some of the essential tools and concepts of decision-making. Concepts are illustrated in terms of selected current social and economic issues in the industry of production agriculture, agricultural business, and the computer application of those concepts.

**AGECE 271 - Farm Management**

**Credit(s): 3 Lecture Hours: 3 Lab Hours: 0 When Offered:** Fall, Spring

Principles and procedures of farm management. Farm records, accounts, budgets, and their uses. Farm tax law. Financing farm acquisition and expansion.

**AGECE 311 - Spreadsheet Analysis in Agribusiness**

**Credit(s): 3 Lecture Hours: 3 Lab Hours: 0 When Offered:** Fall, Spring, Summer

Use computer spreadsheets to analyze complex and unique problems facing the agricultural firm. Specific emphasis on financial, statistical, and logical spreadsheet functions will be addressed. Topics include linear programming, optimization techniques, risk analysis, simulation, and data organization and communication. **Prerequisite(s):** AGECE 110 or AGECE 110.

**AGEC 370 - Agricultural Price Analysis****Credit(s): 3 Lecture Hours: 3 Lab Hours: 0 When Offered:** Fall-even, Spring, Summer

Factors influencing the level of food and agricultural prices, including trends and seasonal variation. Supply, demand, and price determination within various institutional environments of agricultural commodity markets. The roles provided by government intervention, marketing agreements, and cooperatives in agricultural markets. Ability to interpret graphical and statistical analysis of commodity market data. **Prerequisite(s):** ECON 202 **Corequisite(s):** AGEC 311

**AGEC 371 - Advanced Farm and Ranch Management****Credit(s): 3 Lecture Hours: 3 Lab Hours: 0 When Offered:** Fall, Spring

Development of problem-solving and risk management skills needed on the modern farm or ranch operation. Use of spreadsheets to perform production planning and analysis of farm and ranch problems with linear programming, simulations, and other tools. Analysis of the acquisition of resources and the use of information systems in managing the individual farm or ranch business. A complete farm plan will be developed and presented by class participants. **Prerequisite(s):** AGEC 271. **Corequisite(s):** AGEC 372.

**AGEC 372 - Advanced Farm and Ranch Management Lab****Credit(s): 1 Lecture Hours: 1 Lab Hours: 2 When Offered:** Fall, Spring

Application of principles learned in Advanced Farm and Ranch Management (AGEC 371). This lab is designed to give students practical experience developing simulation and linear program optimal solutions for farm management decision analysis—**Corequisite (s):** AGEC 371.

**AGRI 411 - Fundamentals of Cooperative Extension****Credit(s): 3 Lecture Hours: 3 Lab Hours: 0 When Offered:** As Needed

History, philosophy, and organizational structure of the Cooperative Extension Service, major areas of program emphasis, teaching methods used, and relationships with other educational agencies.

**AGEC 475 - Managerial and Entrepreneurial Strategies for Agribusiness****Credit(s): 3 Lecture Hours: 3 Lab Hours: 0 When Offered:** Spring

Odd Emphasis on entrepreneurial activity and business stability are essential for agribusiness survival at the local and international levels. Application of current management techniques to agribusiness problems will be developed with an emphasis on critical thinking skills. Focus on management from a systems approach utilizing all aspects of business and technology. Factors such as the adoption of technology, risk analysis, policy changes, and general world economic issues will be discussed—**Prerequisite (s):** Junior standing.

**Graduate courses in Agriculture and Natural Resources (to be determined)**

## Department of Management, Marketing, and Information Systems

### INFS 351 - Business Communication

**Credit(s): 3 Lecture Hours: 3 Lab Hours: 0 When Offered:** Fall, Spring, Summer

Communication of business information through oral presentations and written letters and reports, including research papers/formal reports. **Prerequisite(s):** ENGL 112 and junior standing.

### MGT 300 - Management and Behavior

**Credit(s): 3 Lecture Hours: 3 Lab Hours: 0 When Offered:** Fall, Spring, Summer

This is a study of managerial functions and decision-making and how these affect human behavior within organizations. This course also considers organizational structure and dynamics relative to the environment. **Prerequisite(s):** MATH 110 or higher; ECON 201 or ECON 202; have earned a minimum of 45 credit hours.

### MGT 303 - Organizational Behavior and Theory

**Credit(s): 3 Lecture Hours: 3 Lab Hours: 0 When Offered:** Fall, Spring, Summer

An advanced study of analyzing, directing, and changing organizational structure and dynamics relative to the environment. **Prerequisite(s):** MGT 300 or MGT 301.

### MGT 340 - Labor Relations Management

**Credit(s): 3 Lecture Hours: 3 Lab Hours: 0 When Offered:** Fall

An analysis of the relationship between management of private and public sector enterprises and labor organizations. Examining labor unions' development, government, and functions, the legal environment of labor relations, union organizing campaigns, and the collective bargaining process. **Prerequisite(s):** ECON 201-ECON 202.

### MKTG 301 - Principles of Marketing

**Credit(s): 3 Lecture Hours: 3 Lab Hours: 0 When Offered:** Fall, Spring, Summer

Introduction to the complexity of the modern marketing system, why it is essential, and how it performs. Identification and examination of business activities involved in planning and executing the conception, pricing, promotion, and distribution of ideas, goods, and services to create exchanges that satisfy individual and organizational objectives. **Prerequisite(s):** MATH 110 or higher, ECON 201 or ECON 202, have earned a minimum of 45 credit hours.

## Department of Accounting, Finance, Economics, and Political Science

### POSC 361 - Introduction to Public Administration

**Credit(s): 3 Lecture Hours: 3 Lab Hours: 0 When Offered:** Spring

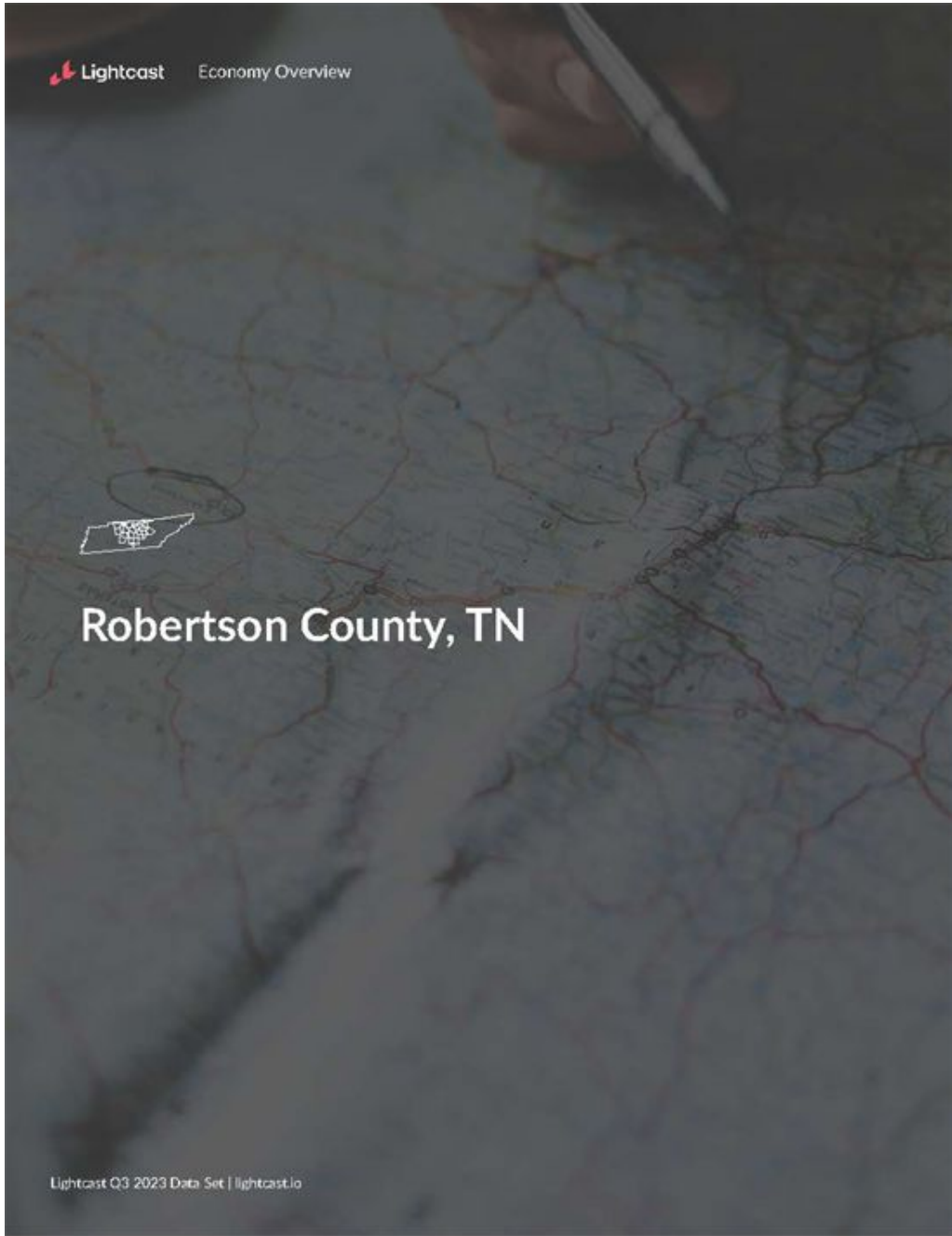
A study of bureaucracy in the United States. Emphasis on the environment of public administration, management of programs, and human behavior in organizations.

**POSC 362 - Introduction to Public Policy**

**Credit(s): 3 Lecture Hours: 3 Lab Hours: 0 When Offered: Fall**

A study of the process and substance of contemporary public policies in the nation and states.

*Attachment D: Lightcast Robertson County Economy Overview*



## Contents

Report Parameters .....	1
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Industry Characteristics .....	16
Business Characteristics .....	21
Workforce Characteristics .....	23
Educational Pipeline .....	29
In-Demand Skills .....	30



## Report Parameters

### 1 County

47147 Robertson County, TN

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### Class of Worker

QCEW Employees, Non-QCEW Employees, and Self-Employed

The information in this report pertains to the chosen geographical area.

## Economy Overview

<p><b>75,310</b></p> <p>Population (2022)</p> <p>Population grew by <b>4,968</b> over the last 5 years and is projected to grow by <b>5,503</b> over the next 5 years.</p>	<p><b>26,784</b></p> <p>Total Regional Employment</p> <p>Jobs grew by <b>207</b> over the last 5 years and are projected to grow by <b>2,924</b> over the next 5 years.</p>	<p><b>\$67.6K</b></p> <p>Median Household Income (2021)</p> <p>Median household income is <b>\$1.4K below</b> the national median household income of <b>\$69.0K</b>.</p>
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### Takeaways

- As of 2022 the region's population **increased by 7.1%** since 2017, growing by 4,968. Population is expected to increase by 7.3% between 2022 and 2027, adding 5,503.
- From 2017 to 2022, jobs **increased by 0.8%** in Robertson County, TN from 26,577 to **26,784**. This change **fell short of the national growth rate of 3.8% by 3.0%**. As the number of jobs increased, the **labor force participation rate increased from 64.6% to 66.2% between 2017 and 2022**.
- Concerning educational attainment, **15.3% of Robertson County, TN residents possess a Bachelor's Degree** (5.5% below the national average), and **8.3% hold an Associate's Degree** (0.5% below the national average).
- The top three industries in 2022 are Warehousing and Storage, Education and Hospitals (Local Government), and Restaurants and Other Eating Places.

	Population (2023)	Labor Force (Apr 2023)	Jobs (2022)	Cost of Living	GRP	Imports	Exports
Region	76,440	39,484	26,784	94.0	\$3.32B	\$5.71B	\$4.10B
State	7,122,435	3,355,763	3,573,606	92.3	\$472.86B	\$403.26B	\$498.53B

### Apr 2023 Labor Force Breakdown



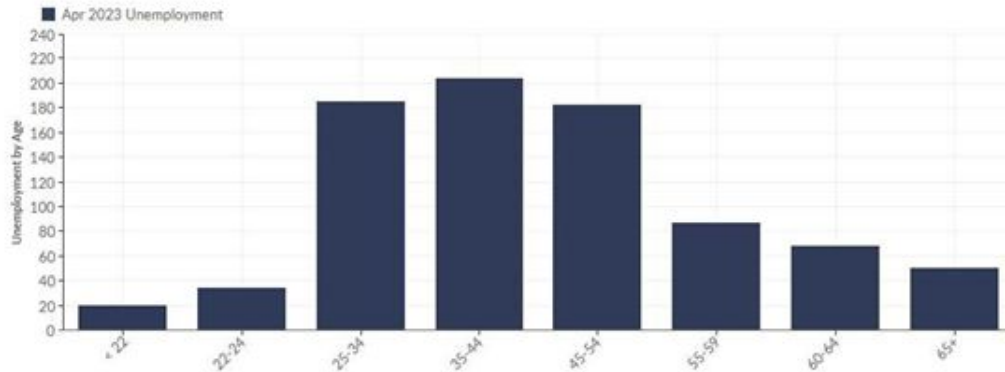
### Educational Attainment

Concerning educational attainment, 15.3% of Robertson County, TN residents possess a Bachelor's Degree (5.5% below the national average), and 8.3% hold an Associate's Degree (0.5% below the national average).



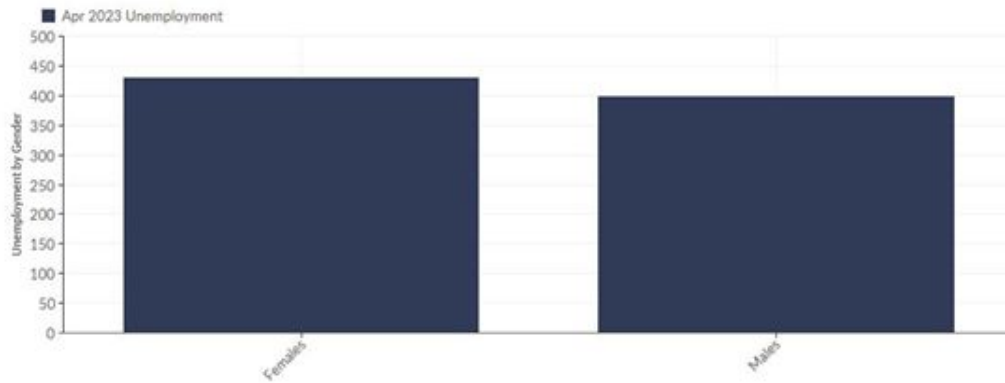
## Unemployment by Demographics

### Unemployment by Age



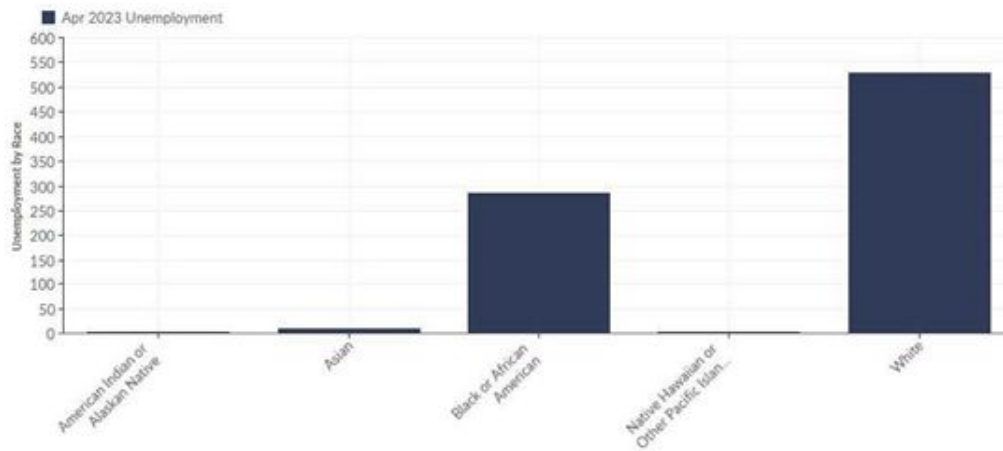
Age	Unemployment (Apr 2023)	% of Unemployed
< 22	19	2.29%
22-24	34	4.11%
25-34	184	22.22%
35-44	204	24.64%
45-54	182	21.98%
55-59	87	10.51%
60-64	68	8.21%
65+	50	6.04%
<b>Total</b>	<b>828</b>	<b>100.00%</b>

### Unemployment by Gender



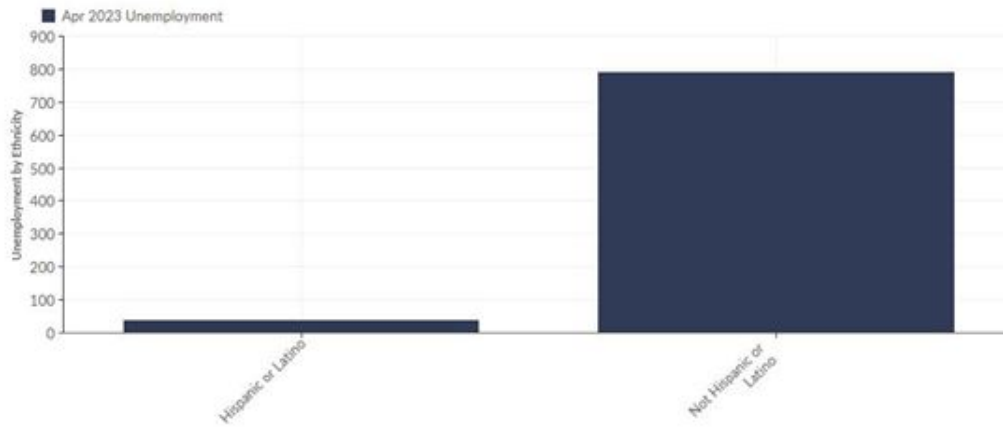
Gender	Unemployment (Apr 2023)	% of Unemployed
Females	430	51.93%
Males	398	48.07%
Total	828	100.00%

### Unemployment by Race



Race	Unemployment (Apr 2023)	% of Unemployed
American Indian or Alaskan Native	3	0.36%
Asian	9	1.09%
Black or African American	286	34.54%
Native Hawaiian or Other Pacific Islander	1	0.12%
White	529	63.89%
<b>Total</b>	<b>828</b>	<b>100.00%</b>

### Unemployment by Ethnicity

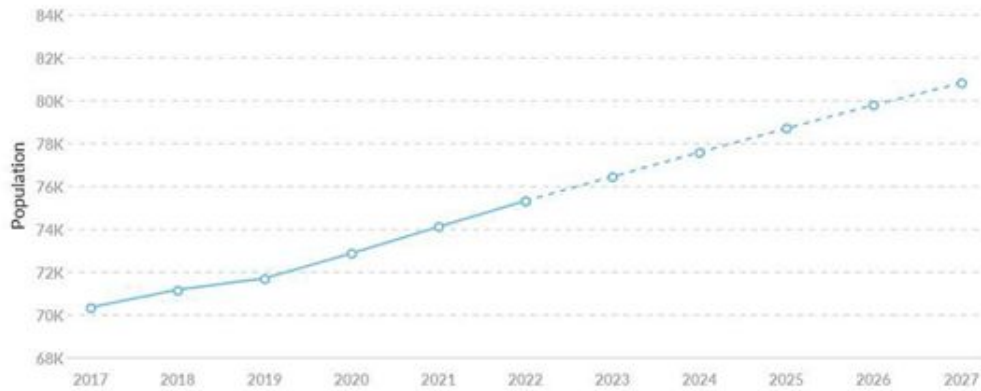


Ethnicity	Unemployment (Apr 2023)	% of Unemployed
Hispanic or Latino	38	4.59%
Not Hispanic or Latino	790	95.41%
Total	828	100.00%

## Historic & Projected Trends

### Population Trends

As of 2022 the region's population increased by 7.1% since 2017, growing by 4,968. Population is expected to increase by 7.3% between 2022 and 2027, adding 5,503.

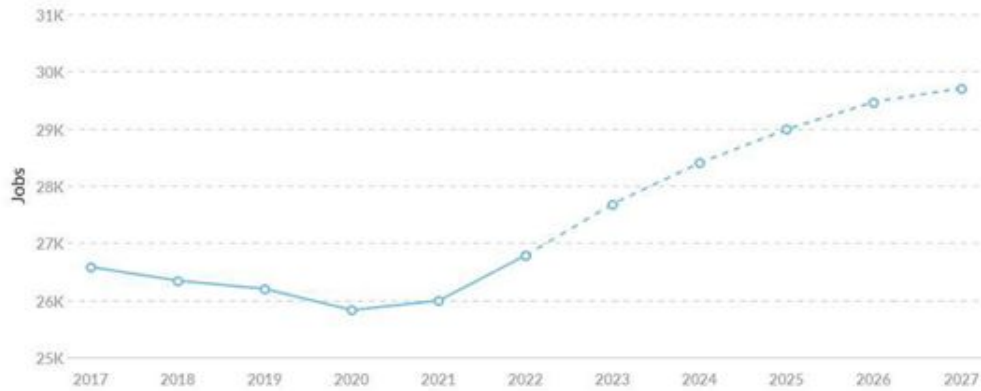


Timeframe	Population
2017	70,342
2018	71,159
2019	71,693
2020	72,860
2021	74,098
2022	75,310
2023	76,140
2024	77,571
2025	78,688
2026	79,775
2027	80,811



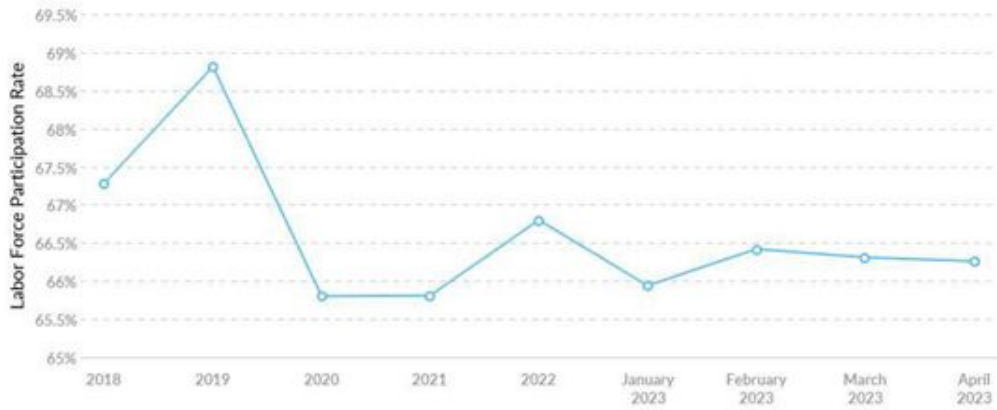
### Job Trends

From 2017 to 2022, jobs increased by 0.8% in Robertson County, TN from 26,577 to 26,784. This change fell short of the national growth rate of 3.8% by 3.0%.



Timeframe	Jobs
2017	26,577
2018	26,341
2019	26,195
2020	25,825
2021	25,991
2022	26,781
2023	27,683
2024	28,399
2025	28,987
2026	29,167
2027	29,709

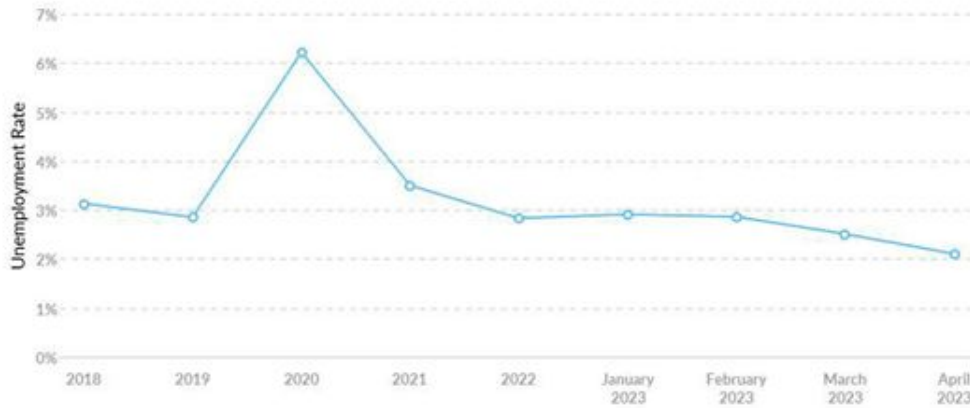
### Labor Force Participation Rate Trends



Timeframe	Labor Force Participation Rate
2018	67.28%
2019	68.81%
2020	65.80%
2021	65.81%
2022	66.80%
January 2023	65.94%
February 2023	66.12%
March 2023	66.31%
April 2023	66.26%

### Unemployment Rate Trends

Robertson County, TN had an April 2023 unemployment rate of 2.10%, decreasing from 3.13% 5 years before.



Timeframe	Unemployment Rate
2018	3.13%
2019	2.85%
2020	6.21%
2021	3.50%
2022	2.83%
January 2023	2.91%
February 2023	2.86%
March 2023	2.51%
April 2023	2.10%

## Population Characteristics



Millennials

Robertson County, TN has 14,401 millennials (ages 25-39). The national average for an area this size is 15,136.



Retiring Soon

Retirement risk is about average in Robertson County, TN. The national average for an area this size is 22,025 people 55 or older, while there are 21,922 here.



Racial Diversity

Racial diversity is low in Robertson County, TN. The national average for an area this size is 30,153 racially diverse people, while there are 13,575 here.



Veterans

Robertson County, TN has 3,796 veterans. The national average for an area this size is 3,892.



Violent Crime

Robertson County, TN has 3.32 violent crimes per 1,000 people. The national rate is 3.59 per 1,000 people.

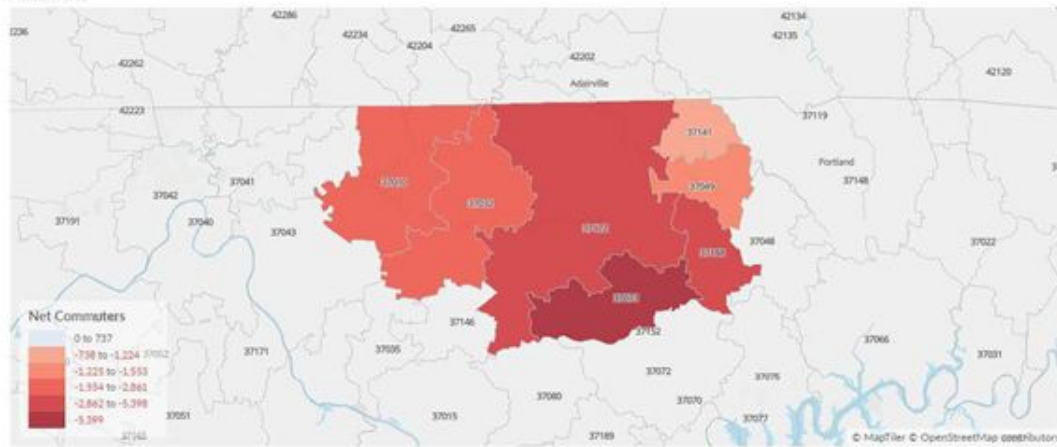


Property Crime

Robertson County, TN has 10.02 property crimes per 1,000 people. The national rate is 17.8 per 1,000 people.

### Place of Work vs Place of Residence

Understanding where talent in Robertson County, TN currently works compared to where talent lives can help you optimize site decisions.

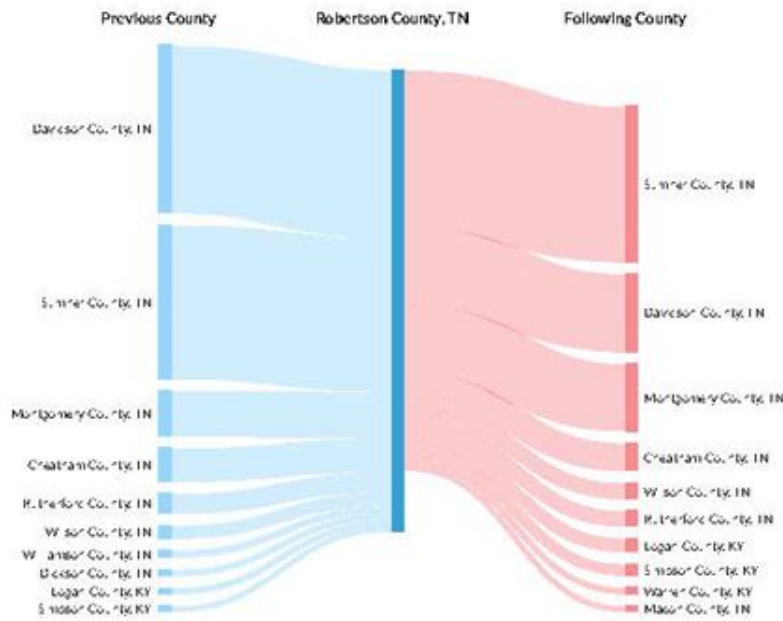


Where Talent Works			Where Talent Lives		
ZIP	Name	2022 Employment	ZIP	Name	2022 Workers
37172	Springfield, TN (in Robe...	13,892	37172	Springfield, TN (in Robe...	16,754
37188	White House, TN (in Ro...	6,911	37188	White House, TN (in Ro...	10,165
37073	Greenbrier, TN (in Robe...	3,298	37073	Greenbrier, TN (in Robe...	8,697
37049	Cross Plains, TN (in Rob...	812	37032	Cedar Hill, TN (in Rober...	2,612
37010	Adams, TN (in Robertso...	785	37010	Adams, TN (in Robertso...	2,339

## Inbound and Outbound Migration

The table below analyzes past and current residents of Robertson County, TN. The left column shows residents of other counties migrating to Robertson County, TN. The right column shows residents migrating from Robertson County, TN to other counties.

As of 2020, **1,156** people have migrated from Davidson County, TN to Robertson County, TN. In the same year, **1,074** people left Robertson County, TN migrating to Sumner County, TN. The total Net Migration for Robertson County, TN in 2020 was **657**.



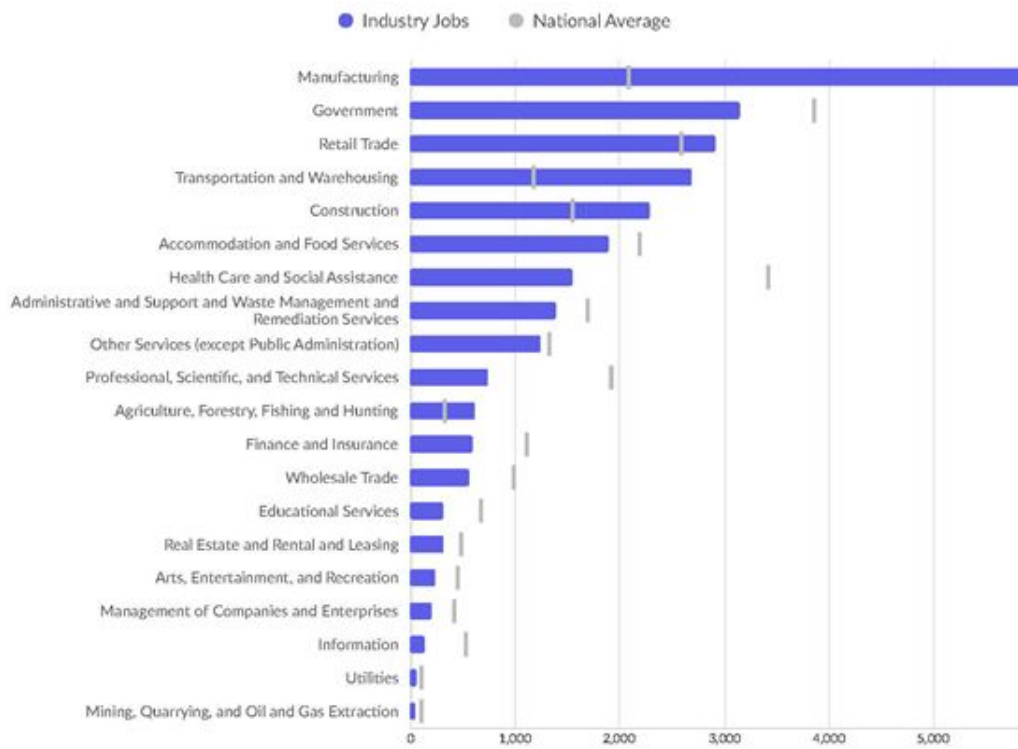
Top Previous Counties	Migrations
Davidson County, TN	1,156
Sumner County, TN	1,059
Montgomery County, TN	319
Cheatham County, TN	232
Rutherford County, TN	139
Wilson County, TN	91


**Lightcast** Economy Overview

Top Previous Counties	Migrations
Williamson County, TN	52
Dickson County, TN	45
Logan County, KY	45
Simpson County, KY	39
Los Angeles County, CA	35
Broward County, FL	35
Pinellas County, FL	33
Cook County, IL	25
Brevard County, FL	24
Top Following Counties	Migrations
Sumner County, TN	1,074
Davidson County, TN	538
Montgomery County, TN	466
Cheatham County, TN	193
Wilson County, TN	112
Rutherford County, TN	108
Logan County, KY	96
Simpson County, KY	81
Warren County, KY	46
Macon County, TN	42
Williamson County, TN	39
Madison County, AL	35
Williamson County, TX	35
Clayton County, GA	35
Cobb County, GA	34

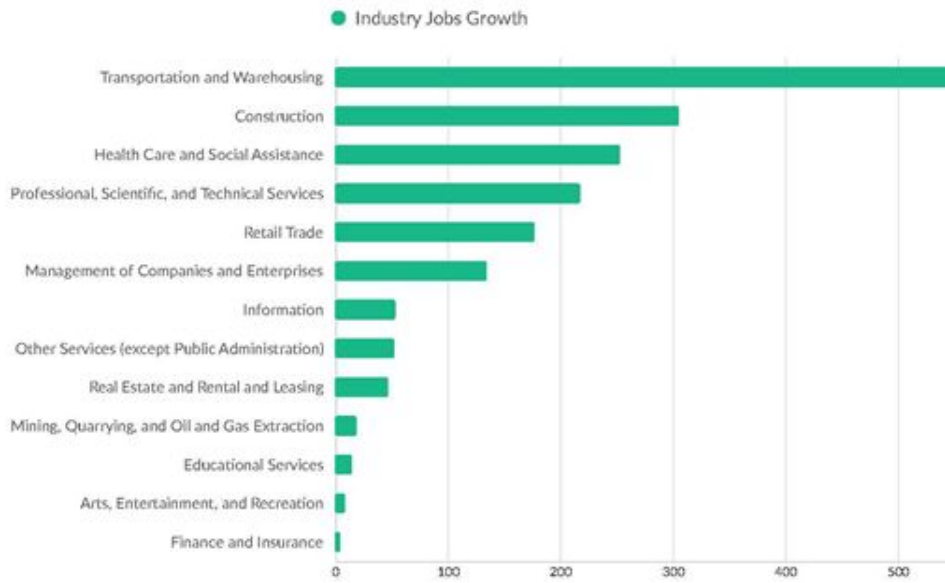
## Industry Characteristics

### Largest Industries

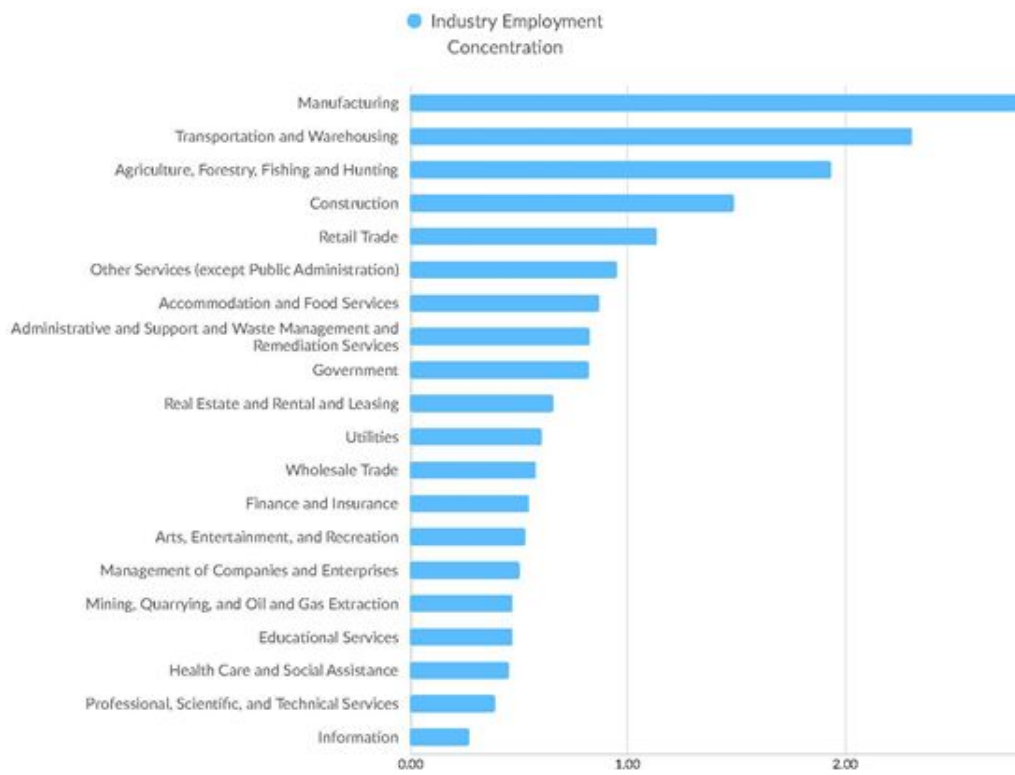




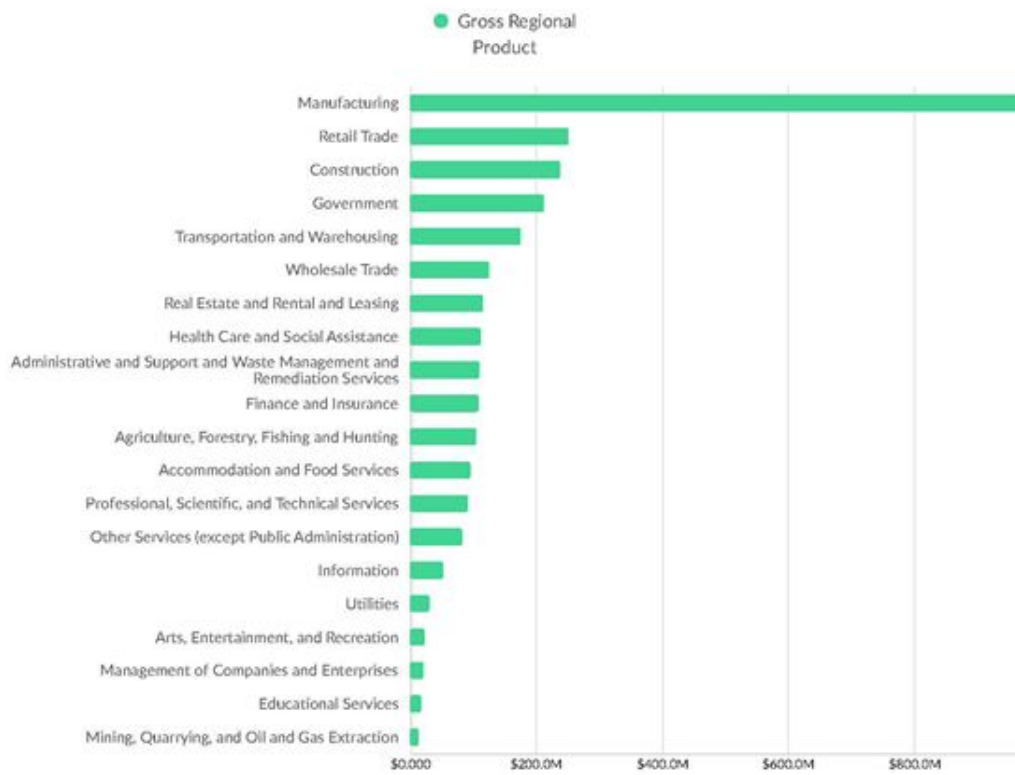
### Top Growing Industries



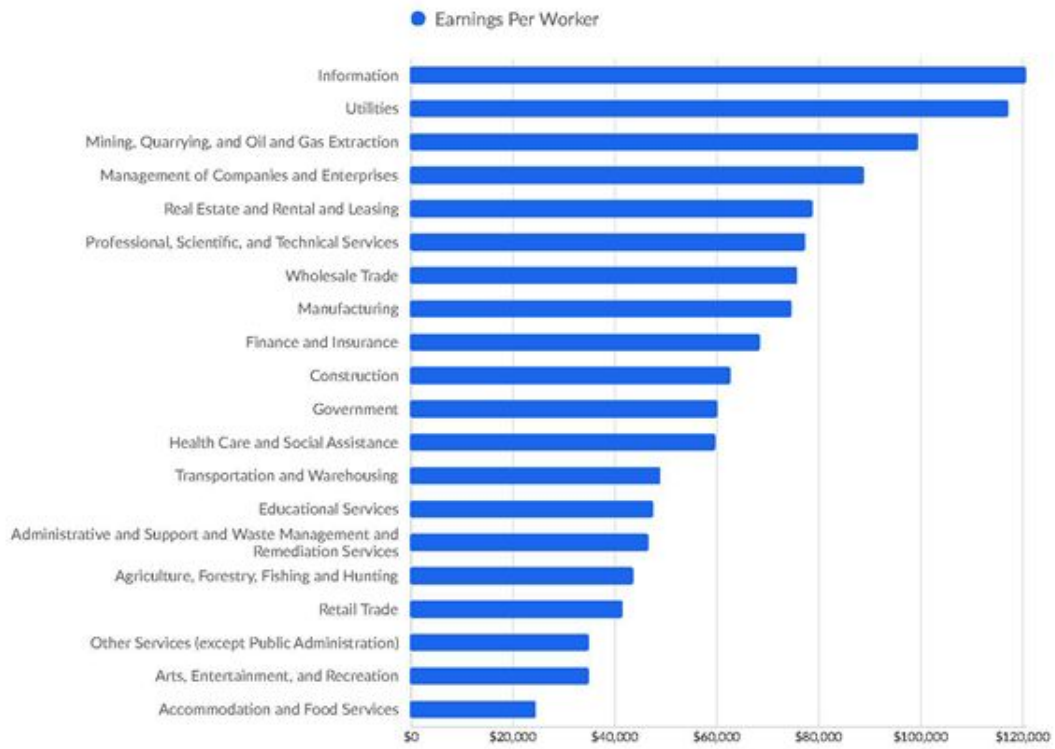
### Top Industry Employment Concentration



### Top Industry GRP



### Top Industry Earnings



## Business Characteristics

### 7,048 Companies Employ Your Workers

Online profiles for your workers mention 7,048 companies as employers, with the top 10 appearing below. In the last 12 months, 875 companies in Robertson County, TN posted job postings, with the top 10 appearing below.

Top Companies	Profiles	Top Companies Posting	Unique Postings
Electrolux	280 	Amazon	345 
Vanderbilt University	213 	HCA Healthcare	271 
HCA Healthcare	157	Randstad	234 
State of Tennessee	141	Electrolux	135 
Northcrest Medical Center	131	Kelly Services	118 
Robertson County Schools	131	Dollar General	107 
Walmart	90	Johnson Electric	93 
United States Army	89	Lowe's	79 
Dollar General	77	Walmart	72 
Kroger	66	Taco Bell	70 

### Business Size

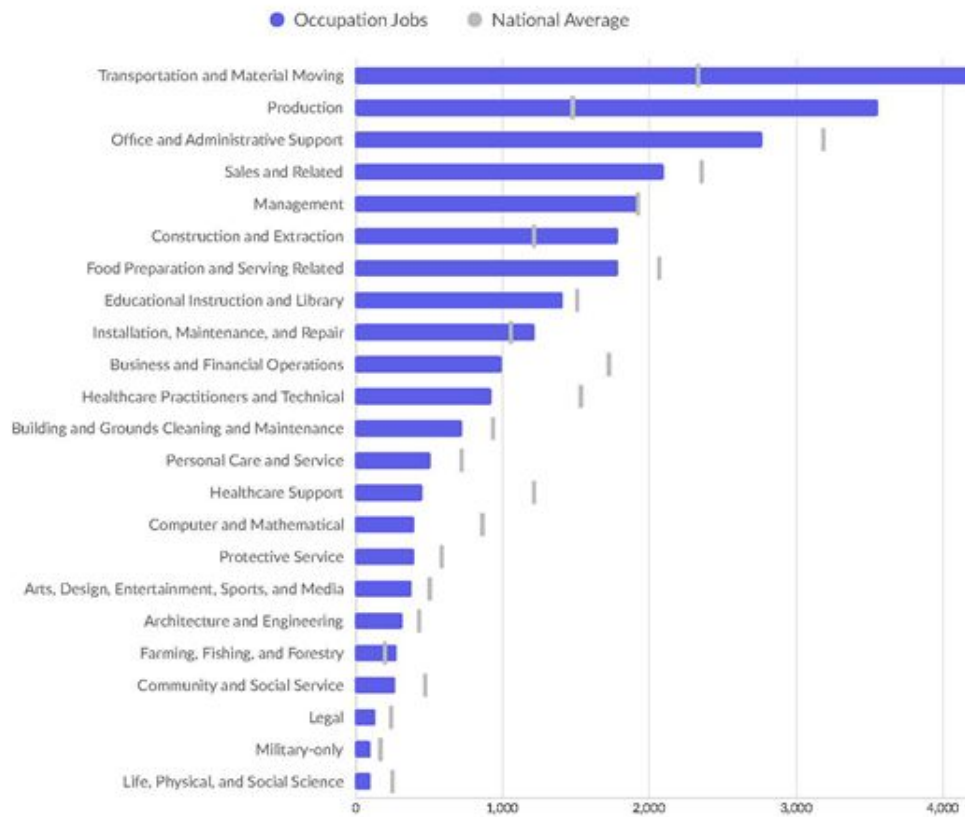


	Percentage	Business Count
1 to 4 employees	46.5%	1,091
5 to 9 employees	23.7%	557
10 to 19 employees	18.0%	422
20 to 49 employees	9.1%	214
50 to 99 employees	1.8%	43
100 to 249 employees	0.6%	13
250 to 499 employees	0.2%	5
500+ employees	0.1%	3

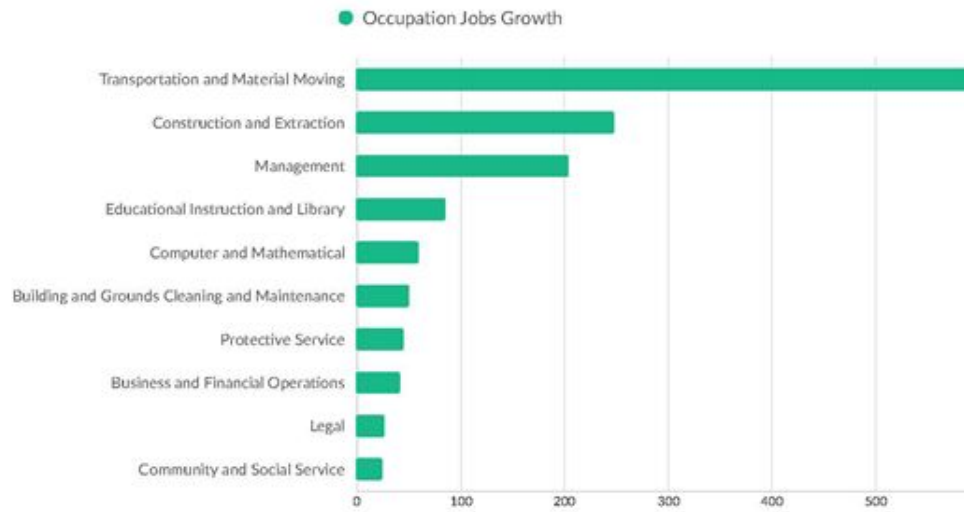
*\*Business Data by DatabaseUSA.com is third-party data provided by Lightcast to its customers as a convenience, and Lightcast does not endorse or warrant its accuracy or consistency with other published Lightcast data. In most cases, the Business Count will not match total companies with profiles on the summary tab.*

## Workforce Characteristics

### Largest Occupations

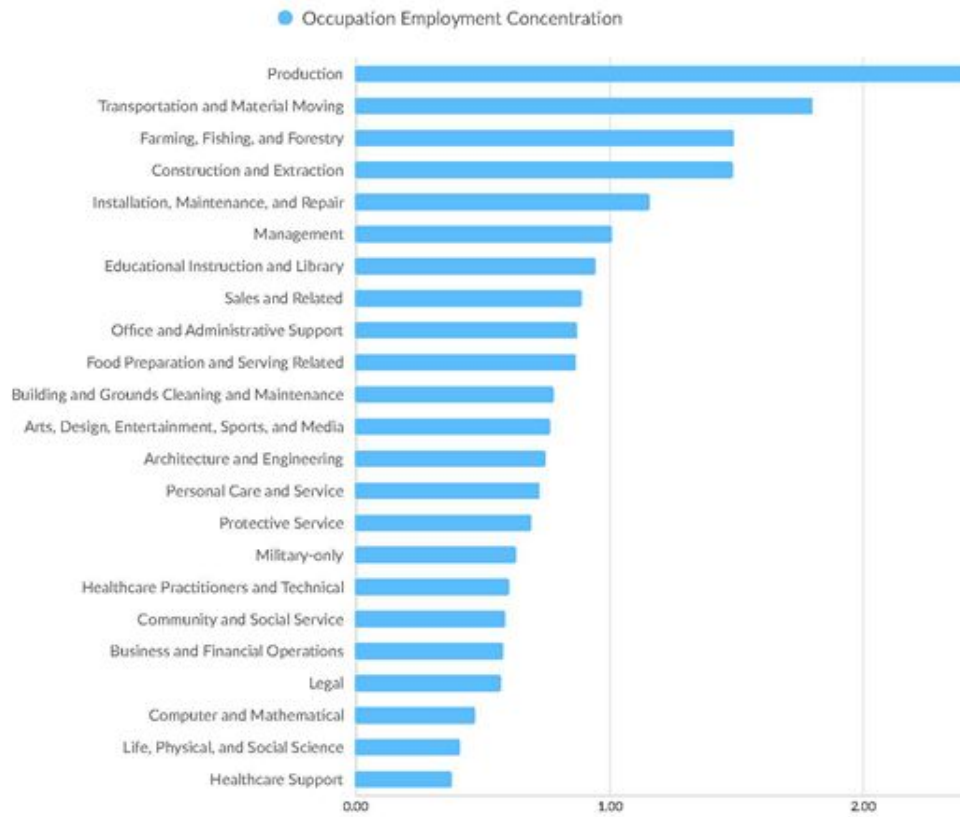


### Top Growing Occupations





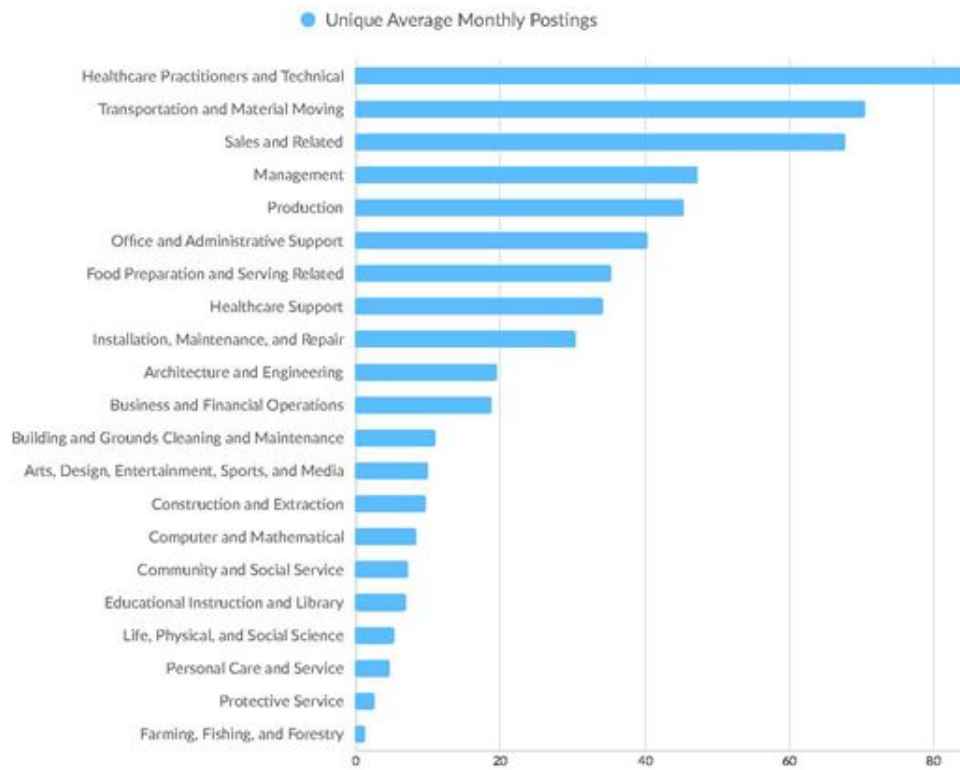
### Top Occupation Employment Concentration



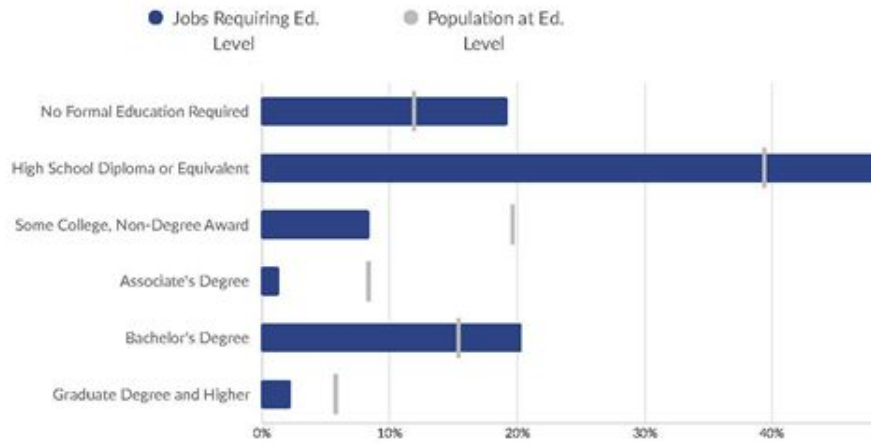
### Top Occupation Earnings



### Top Posted Occupations



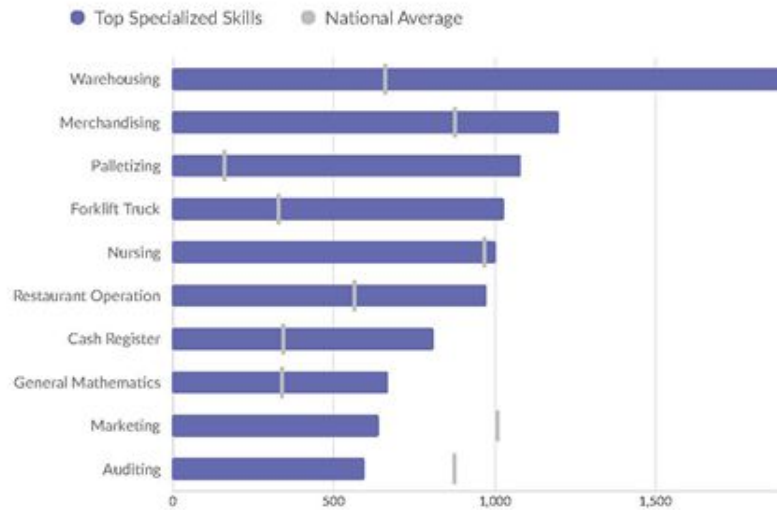
### Underemployment



## Educational Pipeline

Over the last 5 years, no schools in Robertson County, TN produced graduates.

### In-Demand Skills



*Attachment E: Lightcast Robertson County Program Overview*

## Program Overview

2 Agricultural/Animal/Plant/Veterinary Science And Related Fields

Lightcast Q3 2023 Data Set

August 2023

Tennessee

9

## Parameters

Completions Year: 2021

Jobs Timeframe: 2021 - 2030

Job Postings Timeframe: Dec 2018 - Jun 2023

Programs:

Code	Description
01.0102	Agribusiness/Agricultural Business Operations

Code	Description
01.0000	Agriculture, General

Regions:

Code	Description
47021	Cheatham County, TN
47037	Davidson County, TN

Code	Description
47147	Robertson County, TN
47165	Sumner County, TN

Education Level: Any

Tuition Type: Tuition & Fees

Graduate Status: Undergraduate

Residency: In-State



There are not enough institutions in this search to display this information.

### Program Overview



	Completions (2021)	% Completions	Institutions (2021)	% Institutions
● All Programs	48	100%	1	100%
● Distance Offered Programs	0	0%	0	0%
● Non-Distance Offered Programs	48	100%	1	100%

### Market Share by Institution Type



Institution Type	Completions (2021)	Market Share
● Public, 4-year or above	48	100.0%

### Market Share by Program

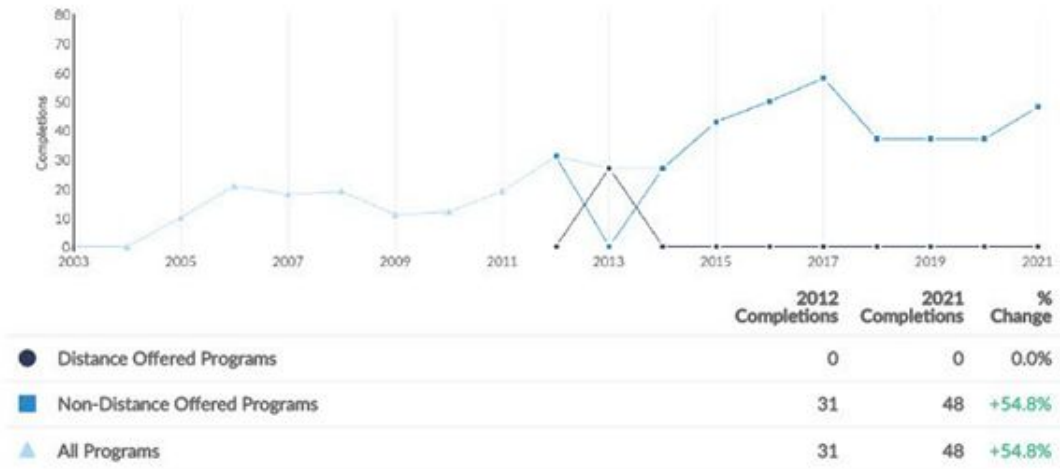


Program	Completions (2021)	Market Share
● Agriculture, General (01.0000)	48	100.0%

### Completions by Institution

Institution	Completions (2021)	Growth % YOY (2021)	Market Share (2021)	IPEDS Tuition & Fees (2021)	Completions Trend (2017-2021)
Tennessee State University	48	29.7%	100.0%	\$8,336	

### Regional Trends



### Regional Completions by Award Level



Award Level	Completions (2021)	Percent
● Bachelor's Degree	32	66.7%
● Master's Degree	16	33.3%
Award of less than 1 academic year	0	0.0%
Award of at least 1 but less than 2 academic years	0	0.0%
Associate's Degree	0	0.0%
Award of at least 2 but less than 4 academic years	0	0.0%
Postbaccalaureate certificate	0	0.0%
Post-masters certificate	0	0.0%
Doctor's Degree	0	0.0%

### Similar Programs

20 Programs (2021)		490 Completions (2021)
CIP Code	Program	Completions (2021)
26.0101	Biology/Biological Sciences, General	238
19.0706	Child Development	107
40.0501	Chemistry, General	61
19.0401	Family Resource Management Studies, General	28
40.0601	Geology/Earth Science, General	20
19.0704	Family Systems	9
19.0799	Human Development, Family Studies, and Related Services, Other	8
52.1902	Fashion Merchandising	7
01.9999	Agricultural/Animal/Plant/Veterinary Science and Related Fields, Other	4
46.0401	Building/Property Maintenance	3

9

### Target Occupations

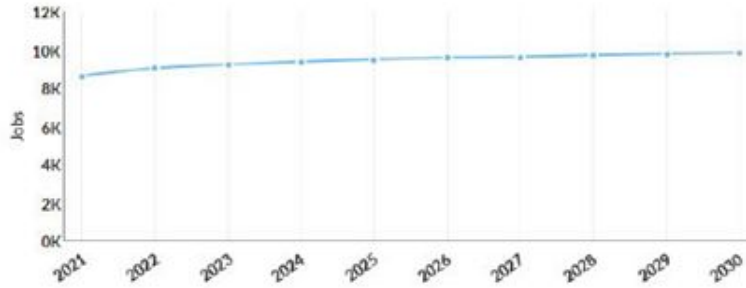
<p><b>8,645</b> Jobs (2021) 42% <b>below</b> National average</p>	<p><b>+13.8%</b> % Change (2021-2030) Nation: <b>+9.0%</b></p>	<p><b>\$18.95/hr</b> <b>\$39.4K/yr</b> Median Earnings Nation: \$17.45/hr; <b>\$36.3K/yr</b></p>	<p><b>1,304</b> Annual Openings</p>
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Occupation	2021 Jobs	Annual Openings	Median Earnings	Growth (2021 - 2030)	Employment Concentration (2021)
Landscaping and Groundskeeping Workers	4,459	683	\$16.89/hr	+12.92%	0.86
Buyers and Purchasing Agents	1,682	234	\$29.21/hr	+20.45%	0.88
First-Line Supervisors of Landscaping, Lawn Service, and Groundskeeping Workers	735	103	\$22.14/hr	+19.32%	1.10
Farmers, Ranchers, and Other Agricultural Managers	599	59	\$15.06/hr	-15.69%	0.25
Farmworkers and Laborers, Crop, Nursery, and Greenhouse	437	79	\$15.09/hr	+7.55%	0.17
Farmworkers, Farm, Ranch, and Aquacultural Animals	161	28	\$13.92/hr	+0.62%	0.23
Pesticide Handlers, Sprayers, and Applicators, Vegetation	122	19	\$17.70/hr	+15.57%	1.04
Agricultural Technicians	73	13	\$23.71/hr	+19.18%	0.89
First-Line Supervisors of Farming, Fishing, and Forestry Workers	69	13	\$20.71/hr	+18.84%	0.30
Life, Physical, and Social Science Technicians, All Other	65	23	\$25.96/hr	+113.85%	0.22
Agricultural Inspectors	62	10	\$24.04/hr	-22.58%	0.98
Soil and Plant Scientists	62	14	\$29.24/hr	+66.13%	0.75
Agricultural Equipment Operators	44	9	\$18.11/hr	+18.18%	0.16
Farm and Home Management Educators	27	2	\$23.92/hr	-3.70%	0.47
Graders and Sorters, Agricultural Products	24	8	\$15.13/hr	+75.00%	0.14
Food Scientists and Technologists	16	5	\$28.87/hr	+125.00%	0.26
Animal Scientists	<10	Insf. Data	Insf. Data	+Insf. Data	Insf. Data

Farm Labor Contractors	0	Insf. Data	\$0.00/hr	+Insf. Data	0.00
Animal Breeders	0	Insf. Data	Insf. Data	+Insf. Data	0.00

### Growth

8,645 2021 Jobs	9,837 2030 Jobs	1,192 Change (2021-2030)	13.8% % Change (2021-2030)
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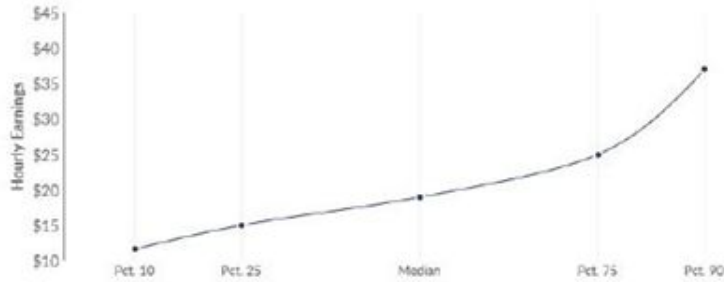
Occupation	2021 Jobs	2030 Jobs	Change	% Change
Farmers, Ranchers, and Other Agricultural Managers (11-9013)	599	505	-94	-16%
Buyers and Purchasing Agents (13-1028)	1,682	2,026	344	20%
Farm Labor Contractors (13-1074)	0	0	0	0%
Animal Scientists (19-1011)	7	3	-4	-57%
Food Scientists and Technologists (19-1012)	16	36	20	125%
Soil and Plant Scientists (19-1013)	62	103	41	66%
Agricultural Technicians (19-4012)	73	87	14	19%
Life, Physical, and Social Science Technicians, All Other (19-4099)	65	139	74	114%
Farm and Home Management Educators (25-9021)	27	26	-1	-4%
First-Line Supervisors of Landscaping, Lawn Service, and Groundskeeping Workers (37-1012)	735	877	142	19%
Landscaping and Groundskeeping Workers (37-3011)	4,459	5,035	576	13%
Pesticide Handlers, Sprayers, and Applicators, Vegetation (37-3012)	122	141	19	16%
First-Line Supervisors of Farming, Fishing, and Forestry Workers (45-1011)	69	82	13	19%

Agricultural Inspectors (45-2011)	62	48	-14	-23%
Animal Breeders (45-2021)	0	1	1	Insf. Data
Graders and Sorters, Agricultural Products (45-2041)	24	42	18	75%
Agricultural Equipment Operators (45-2091)	44	52	8	18%
Farmworkers and Laborers, Crop, Nursery, and Greenhouse (45-2092)	437	470	33	8%
Farmworkers, Farm, Ranch, and Aquacultural Animals (45-2093)	161	162	1	1%



### Percentile Earnings

<p><b>\$15.01/hr</b> 25th Percentile Earnings</p>	<p><b>\$18.95/hr</b> Median Earnings</p>	<p><b>\$24.97/hr</b> 75th Percentile Earnings</p>
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Occupation	25th Percentile Earnings	Median Earnings	75th Percentile Earnings
Farmers, Ranchers, and Other Agricultural Managers (11-9013)	\$7.25	\$15.06	\$29.03
Buyers and Purchasing Agents (13-1028)	\$22.27	\$29.21	\$38.25
Farm Labor Contractors (13-1074)	\$15.09	\$21.35	\$31.46
Animal Scientists (19-1011)	\$22.70	\$29.84	\$44.58
Food Scientists and Technologists (19-1012)	\$22.79	\$28.87	\$39.52
Soil and Plant Scientists (19-1013)	\$13.73	\$29.24	\$33.03
Agricultural Technicians (19-4012)	\$20.93	\$23.71	\$29.32
Life, Physical, and Social Science Technicians, All Other (19-4099)	\$17.95	\$25.96	\$29.16
Farm and Home Management Educators (25-9021)	\$16.88	\$23.92	\$33.00
First-Line Supervisors of Landscaping, Lawn Service, and Groundskeeping Workers (37-1012)	\$19.04	\$22.14	\$25.30
Landscaping and Groundskeeping Workers (37-3011)	\$14.47	\$16.89	\$19.92
Pesticide Handlers, Sprayers, and Applicators, Vegetation (37-3012)	\$15.24	\$17.70	\$22.83
First-Line Supervisors of Farming, Fishing, and Forestry Workers (45-1011)	\$15.93	\$20.71	\$28.34

Agricultural Inspectors (45-2011)	\$19.08	\$24.04	\$36.20
Animal Breeders (45-2021)	\$14.10	\$19.94	\$27.33
Graders and Sorters, Agricultural Products (45-2041)	\$13.60	\$15.13	\$16.68
Agricultural Equipment Operators (45-2091)	\$12.22	\$18.11	\$22.39
Farmworkers and Laborers, Crop, Nursery, and Greenhouse (45-2092)	\$10.42	\$15.09	\$19.51
Farmworkers, Farm, Ranch, and Aquacultural Animals (45-2093)	\$8.63	\$13.92	\$19.12

### Job Postings Summary



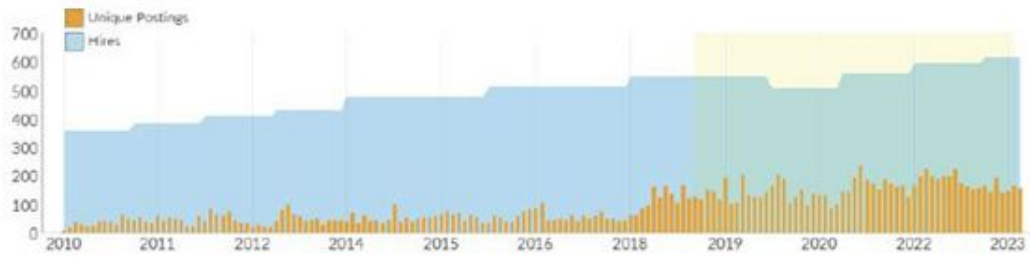
There were 26,579 total job postings for your selection from December 2018 to June 2023, of which 8,623 were unique. These numbers give us a Posting Intensity of 3-to-1, meaning that for every 3 postings there is 1 unique job posting.

This is close to the Posting Intensity for all other occupations and companies in the region (3-to-1), indicating that they are putting average effort toward hiring for this position.

### Job Postings vs. Hires










In an average month, there were 157 newly posted job postings for 19 Occupations, and 559 actually hired. This means there were approximately 4 hires for 19 Occupations for every 1 unique job posting.



Occupation	Avg Monthly Postings (Dec 2018 - Jun 2023)	Avg Monthly Hires (Dec 2018 - Jun 2023)
Landscaping and Groundskeeping Workers	55	282
Buyers and Purchasing Agents	50	91
Life, Physical, and Social Science Technicians, All Other	22	10
First-Line Supervisors of Landscaping, Lawn Service, and Groundskeeping Workers	9	51
Farm and Home Management Educators	5	1
Farmworkers and Laborers, Crop, Nursery, and Greenhouse	4	52
Pesticide Handlers, Sprayers, and Applicators, Vegetation	4	11
Farmers, Ranchers, and Other Agricultural Managers	3	10
Farmworkers, Farm, Ranch, and Aquacultural Animals	2	13
Food Scientists and Technologists	1	3
Soil and Plant Scientists	1	6
First-Line Supervisors of Farming, Fishing, and Forestry Workers	1	7
Graders and Sorters, Agricultural Products	1	6

Agricultural Technicians	0	7
Agricultural Equipment Operators	0	7
Farm Labor Contractors	0	0
Animal Scientists	0	0
Agricultural Inspectors	0	3
Animal Breeders	0	0

### Top Companies Posting

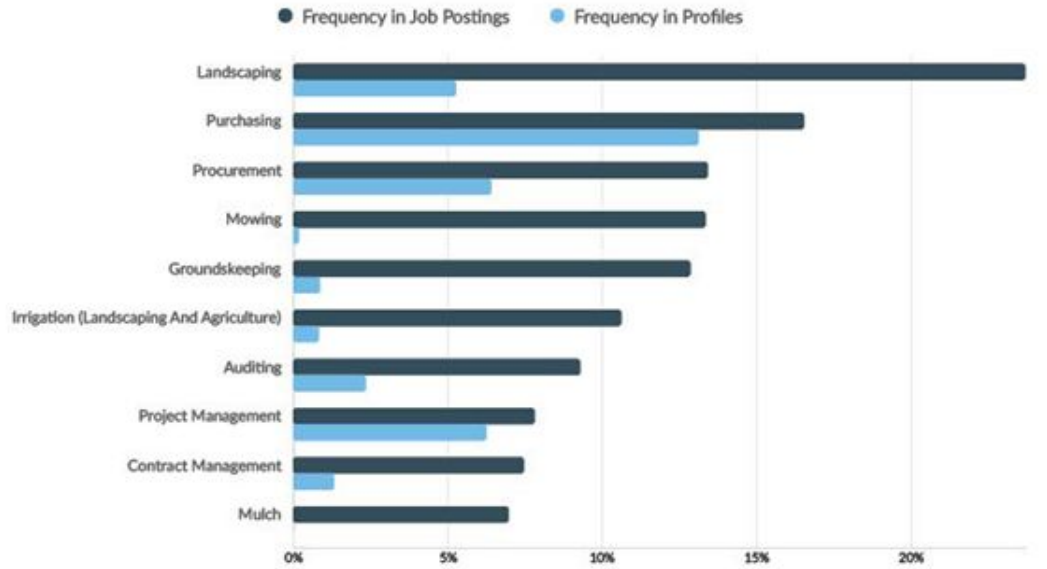
Company	Total/Unique (Dec 2018 - Jun 2023)	Posting Intensity	Median Posting Duration
HCA Healthcare	958 / 211	5 : 1 	23 days
Randstad	406 / 173	2 : 1 	26 days
Landscape Services	425 / 139	3 : 1 	41 days
State of Tennessee	282 / 131	2 : 1 	39 days
Marriott International	340 / 117	3 : 1 	41 days
Dollar General	291 / 93	3 : 1 	19 days
TruGreen	379 / 80	5 : 1 	21 days
The Davey Tree Expert Company	245 / 76	3 : 1 	37 days
Brightview	167 / 66	3 : 1 	21 days
Milosi Landscape	189 / 60	3 : 1 	58 days

### Top Posted Job Titles

Job Title	Total/Unique (Dec 2018 - Jun 2023)	Posting Intensity	Median Posting Duration
Groundskeepers	2,725 / 864	3 : 1	32 days
Landscape Crew Leaders	1,031 / 263	4 : 1	33 days
Contract Administrators	642 / 218	3 : 1	28 days
Landscape Crew Members	674 / 191	4 : 1	31 days
Buyers	639 / 182	4 : 1	31 days
Irrigation Technicians	681 / 180	4 : 1	35 days
Quality Assurance Technicians	554 / 177	3 : 1	29 days
Purchasing Agents	395 / 176	2 : 1	28 days
Contracts Managers	342 / 119	3 : 1	19 days
Contract Specialists	275 / 115	2 : 1	25 days

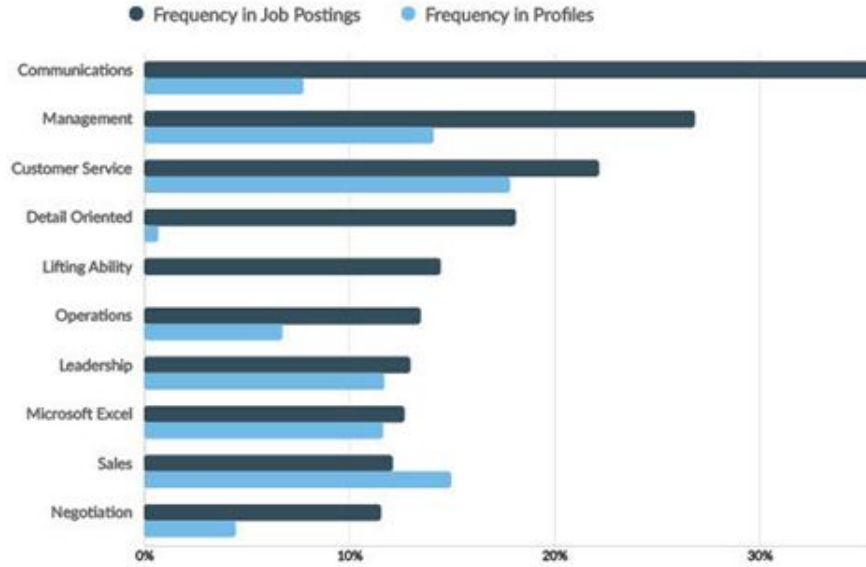
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### Top Specialized Skills



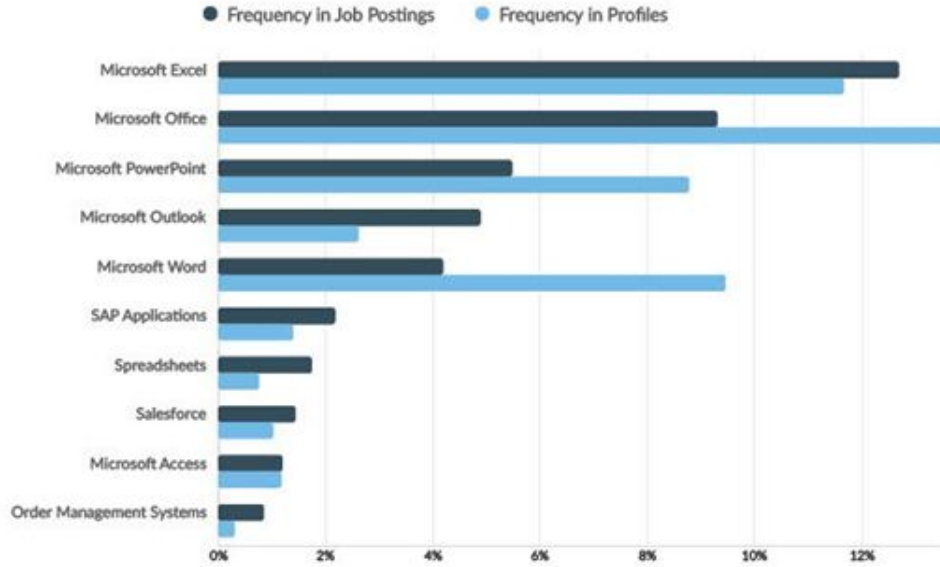
Skills	Postings	% of Total Postings	Profiles	% of Total Profiles
Landscaping	2,047	24%	265	5%
Purchasing	1,429	17%	657	13%
Procurement	1,159	13%	322	6%
Mowing	1,153	13%	10	0%
Groundskeeping	1,109	13%	43	1%
Irrigation (Landscaping And Agriculture)	918	11%	41	1%
Auditing	804	9%	117	2%
Project Management	676	8%	313	6%
Contract Management	644	7%	67	1%
Mulch	603	7%	0	0%

### Top Common Skills



Skills	Postings	% of Total Postings	Profiles	% of Total Profiles
Communications	3,081	36%	390	8%
Management	2,319	27%	706	14%
Customer Service	1,915	22%	893	18%
Detail Oriented	1,564	18%	35	1%
Lifting Ability	1,247	14%	0	0%
Operations	1,163	13%	337	7%
Leadership	1,121	13%	585	12%
Microsoft Excel	1,095	13%	584	12%
Sales	1,046	12%	749	15%
Negotiation	995	12%	224	4%

### Top Software Skills



Skills	Postings	% of Total Postings	Profiles	% of Total Profiles
Microsoft Excel	1,095	13%	584	12%
Microsoft Office	803	9%	684	14%
Microsoft PowerPoint	473	5%	440	9%
Microsoft Outlook	422	5%	131	3%
Microsoft Word	363	4%	474	9%
SAP Applications	188	2%	70	1%
Spreadsheets	151	2%	38	1%
Salesforce	124	1%	51	1%
Microsoft Access	104	1%	59	1%
Order Management Systems	73	1%	15	0%



## Top Qualifications

Qualification	Postings with Qualification
Valid Driver's License	2,163
Cardiopulmonary Resuscitation (CPR) Certification	105
First Aid Certification	99
Commercial Driver's License (CDL)	62
American Society For Clinical Pathology (ASCP) Certification	57
Pesticide Applicator License	57
Security Clearance	57
Certified Arborist	50
Real Estate Salesperson License	41
Licensed Practical Nurse (LPN)	38

9

## Appendix A

### Program Selection Details

CIP Code	Program Name
01.0000	Agriculture, General
01.0102	Agribusiness/Agricultural Business Operations

## Appendix B - Data Sources and Calculations

### Institution Data

The institution data in this report is taken directly from the national IPEDS database published by the U.S. Department of Education's National Center for Education Statistics.

### Location Quotient

Location quotient (LQ) is a way of quantifying how concentrated a particular industry, cluster, occupation, or demographic group is in a region as compared to the nation. It can reveal what makes a particular region unique in comparison to the national average.

### Occupation Data

Emsi occupation employment data are based on final Emsi industry data and final Emsi staffing patterns. Wage estimates are based on Occupational Employment Statistics (QCEW and Non-QCEW Employees classes of worker) and the American Community Survey (Self-Employed and Extended Proprietors). Occupational wage estimates are also affected by county-level Emsi earnings by industry.

### Lightcast Job Postings

Job postings are collected from various sources and processed/enriched to provide information such as standardized company name, occupation, skills, and geography.

### State Data Sources

This report uses state data from the following agencies: Tennessee Department of Labor & Workforce Development

*Attachment F: Letters of Support*

Jordan C Osborne  
President  
Robertson County Chamber of Commerce

405 West Court Square  
Springfield, TN 37172

josborne@robertsonchamber.org  
615.384.3800



9/01/2023

Randy Boyd  
President  
The University of Tennessee

Dear President Boyd,

I am writing on behalf of the Robertson County Chamber of Commerce to express our enthusiastic support for the proposed partnership between the University of Tennessee at Martin and Volunteer State Community College at the Highland Crest College Campus in Springfield, Tennessee. We believe that this collaboration holds immense potential for our community and the broader region.

The Robertson County Chamber of Commerce recognizes the vital role that agriculture plays in our county's economy and its impact on the overall well-being of our residents. Agriculture has been the cornerstone of our community for generations, providing jobs, sustenance, and a way of life that is deeply ingrained in our cultural identity. As such, it is imperative that we continue to invest in the education and training of the next generation of agricultural leaders, innovators, and professionals.

The proposed partnership between UT Martin and Volunteer State Community College will undoubtedly contribute to the growth and advancement of agricultural education in our region. By leveraging the strengths and resources of these esteemed institutions, the Highland Crest College Campus will become a hub of excellence in agricultural studies, research, and workforce development. This collaboration will offer our local students expanded access to high-quality educational programs, training, and support, ultimately preparing them for successful careers in agriculture.

ROBERTSON COUNTY CHAMBER OF COMMERCE 405 WEST COURT SQUARE SPRINGFIELD, TN 37172

Moreover, the impact of this partnership extends beyond our county's borders. As agriculture is a vital industry not only for Robertson County but for the entire state of Tennessee, the innovations and knowledge generated through this collaboration will benefit the broader agricultural community. The research conducted at Highland Crest College Campus will contribute to the sustainability and productivity of our agricultural sector, ensuring its continued growth and prosperity.

In addition to its direct contributions to agriculture, this partnership also aligns with our broader economic development goals. A well-educated and skilled workforce is a key driver of economic growth and innovation. By providing accessible educational opportunities, the U.T. Martin program of study at Highland Crest College Campus will help attract and retain talent in our region, foster entrepreneurship, and create a more robust and diversified local economy.

We firmly believe that the partnership between the University of Tennessee at Martin and Volunteer State Community College at the Highland Crest College Campus represents a transformative opportunity for our community, our county, and our region. We pledge our full support to this endeavor and look forward to working collaboratively to make it a reality.

Please do not hesitate to reach out if you require any further information or assistance from the Robertson County Chamber of Commerce. We are committed to ensuring the success of this partnership and are excited about the positive impact it will have on our community.

Thank you for your dedication to advancing education and agriculture in our region. We eagerly anticipate the positive outcomes that will result from this partnership.

Sincerely,



Jordan C Osborne  
President  
Robertson County Chamber of Commerce

ROBERTSON COUNTY CHAMBER OF COMMERCE 405 WEST COURT SQUARE SPRINGFIELD, TN 37172



To Whom It May Concern,

I am Julie Newberry, an agriculture educator and FFA Advisor for Springfield High School. I am familiar with the Ag Business bachelor's degree proposal being offered in conjunction with Vol State and UT Martin. I personally know many of my students that are enrolled in dual credit classes are seeking a degree in Ag Business. Ag Business degrees open many opportunities in the world of agriculture.

Please accept this letter as support for the Ag Business Program being developed here in Robertson County with the partnership of Vol State and UT Martin. As the agriculture teacher for Springfield High School, I know many students would benefit from a program that offers a bachelor's degree with the added benefit of staying here in Robertson County as they complete their education.

Sincerely,

Julie Newberry  
Ag Educator  
FFA Advisor  
Springfield High School



HAIL & COTTON, INC.  
P.O. Box 638  
2500 South Main Street  
Springfield, TN 37172 USA  
+1 (615) 384.9576

Chris Cooksey  
President – NA Operations  
[c.cooksey@hailcotton.com](mailto:c.cooksey@hailcotton.com)  
615.384.9576 ext.137

September 26, 2023

Mr. Randy Boyd  
President  
The University of Tennessee

Dear President Boyd,

On behalf of myself and Hail & Cotton I am writing to you about the proposed partnership between the University of Tennessee at Martin and Volunteer State Community College at Highland Crest Campus in Springfield, TN. This partnership would add great value to Robertson County and our surrounding communities.

Since its founding in 1796, Robertson County has been one of the leading agriculture counties in our great State. It is currently the third largest agricultural county in Tennessee with:

- 1,200 farms; of these 97% are family farms.
- 200,000 acres, almost two-thirds of the entire county.
- Approaching \$150 million of products sold annually.

If for these reasons alone it only adds to the great need for UT Martin and Vol State to partner together to offer these studies in Agriculture Business at Highland Crest College. However, there are more reasons: Robertson County, like many of the other counties in Tennessee has seen unprecedented population growth in the last 5 years. While this is good for the economy and future of our community it also highlights the importance of agriculture and its commodities. More people mean more food and jobs and agriculture provides both.

This partnership will also provide local talent with the opportunity to broaden their knowledge in the field of agriculture while still living at home. There has been students in year's past, drop out of school because of finances and honestly being away from home. With Highland Crest's location, most students living in Robertson County would have less than a 30-minute commute to classes. Being able to offer a degree of this magnitude in the backyard of our community would further enhance the workforce of not only Robertson County but our State as well.

Mr. Boyd, as you know, agriculture is vital to the economy and our future on a global level. Wouldn't be great to see more Tennesseans contributing to this sector? This partnership will provide these opportunities. Whether it is through research, new technology or innovations, or a small dairy farmer selling to local markets, these degrees will provide the steppingstone to a sustainable and economically viable future.



HAIL & COTTON, INC.  
P.O. Box 638  
2500 South Main Street  
Springfield, TN 37172 USA  
+1 (615) 384.9576

I am truly excited about this potential partnership and the impact it will have on Robertson County. If you would like to discuss this further, please feel free to contact me at any time.

Thank you in advance for your time and attention to this matter and furthermore thank you for the leadership and dedication you provide in education.

Respectfully,

Chris Cooksey  
President – NA Operations  
Hail & Cotton, Inc.

CC:  
UTM Chancellor Yancey Freeman  
Dr. Philip Cavalier, UTM Provost  
Erica Bell, UTM Executive Director of Regional Centers and Online Programs





**William A. Vogle**  
**Robertson County Mayor**  
108 Courthouse  
Springfield, Tennessee 37172  
Phone (615)384-2476

October 12, 2023

President Randy Boyd  
University of Tennessee

Dear Mr. Boyd,

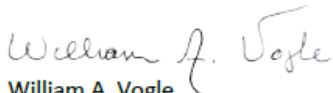
I am writing to encourage a possible partnership between the University of Tennessee at Martin and Volunteer State Community College at Highland Crest.

My understanding is the goal of the partnership would be to offer a bachelor's degree program with an agriculture focus. We are very proud of our Highland Crest campus and what is offered to our citizens right in our own backyard. Adding such a program, with Robertson County's past, present and future dedicated to agriculture, would be just another bonus.

As county mayor, my goal is to encourage reasonable and responsible growth and development in Robertson County. Highland Crest is in Springfield, our county seat, so anything we can do to give people more opportunities to live, work and play here is beneficial to all of us.

I hope you will consider this future partnership.

Sincerely,

  
William A. Vogle  
Robertson County Mayor

CC:

UTM Chancellor Yancy Freeman  
Dr. Philip Cavalier, UTM Provost  
Erica Bell, UTM Executive Director of Regional Centers and Online Programs

**October 13, 2023**

**Dear University of Tennessee President Randy Boyd,**

**This letter is written in support of University of Tennessee at Martin partnering with Volunteer State Community College at Highland Crest in Springfield TN. Our community would be greatly enriched by the opportunity to receive an agricultural business degree while still being able to live and work at home. Our county has such a rich history of agricultural business with over \$140 million in agricultural products and service revenue annually. Thus, making us the third largest agricultural county in the state. The agricultural industry is important to our county and community, we are committed to seeing it continue to prosper.**

**Your support in helping us see our goals would enhance our community enormously.**

**Thank you,**

**Ann Schneider Williams  
Springfield Mayor**



Robertson County  
408 North Main Street  
Springfield, TN 37172  
office: (615) 384-7936  
robertson.tennessee.edu

October 13, 2023

To:  
The University of Tennessee  
President Randy Boyd

CC:  
UTM Chancellor Yancy Freeman  
Dr. Philip Cavalier, UTM Provost  
Erica Bell, UTM Executive Director of Regional Centers and Online Programs

President Boyd,

Since learning about the possibility of a partnership between UT Martin and Volunteer State Community College, UT Extension- Robertson County has grown excited about the opportunities this could present for Robertson County and Extension as a whole!

Robertson County has strong agricultural roots. With approximately 200,000 acres of farmland, 1,200 farms, and an agricultural output estimated economic impact of \$884.5 million, agriculture continues to be significant in Robertson County. There are well over 2,300 workers employed in agriculture in the county. A partnership between UT Martin and Vol State Community College would allow high school graduates to obtain an agriculture degree right here in Robertson County where they could be immersed in an agricultural community and join the workforce after graduation.

As an UT Extension office, there are many possibilities for partnerships. UT Extension- Robertson County frequently hosts student interns, including former interns from UT Martin, and we provide many educational experiences that could benefit college students. In addition, students with agriculture degrees are also eligible for Extension positions such as an Agriculture and Natural Resources Extension Agent and 4-H Youth Development Extension Agent as well as positions throughout UTIA, so they could seek employment through the University of Tennessee following graduation.

UT Extension- Robertson County strongly supports the partnership between UT Martin and Volunteer State Community College to bring more degree programs including agriculture to Robertson County.

Sincerely,

*Lauren M. Patterson*  
Lauren M. Patterson  
Extension Agent & County Director

*Lauren Balthrop*  
Lauren Balthrop  
Extension Agent

*Elizabeth Fletcher*  
Elizabeth Fletcher  
Extension Agent

*Timmy Mann*  
Timmy Mann  
Extension Agent



## Robertson County Schools

800 M. S. Couts Boulevard • Springfield, Tennessee 37172 • Phone (615) 384-5588 • Fax (615) 384-9749  
*Melanie Dickerson, Interim Director of Schools*

October 18, 2023

The University of Tennessee

President Randy Boyd

CC:

UTM Chancellor Yancy Freeman

Dr. Phillip Cavalier, UTM Provost

Erica Bell, UTM Executive Director of Regional Center and Online Programs

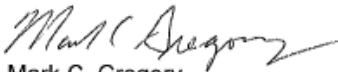
President Boyd,

I am very excited to hear about the plans for Volunteer State and UT Martin working in partnership to bring courses to the Highland Crest Campus in Springfield. This partnership will begin with an Agriculture Business pathway for adults and dual enrollment students. Robertson County Schools has been participating in online dual enrollment for several years and our students have been very successful in those classes. I believe that collaborating with VSCC to provide an associate's degree in Ag Business is a great addition to our community.

In spite of our proximity to Davidson County, it is amazing how much agriculture takes place in Robertson County. Our county is still among the state leaders in corn, wheat, soybeans and tobacco production. There is also a large number of cow-calf beef operations in our county as well as thriving Ag tourism businesses. We still have five high school with thriving agriculture programs and many students interested in agriculture studies. Students will have the opportunity to stay in Springfield to complete this program.

For these reasons, I ask for your support for the Ag Business pathway partnership between VSCC and UTM.

Sincerely,



Mark C. Gregory

Supervisor of Career and Technical Education

Robertson County Schools

DEMETRIA WHITE \* CONNIE HOGAN \* JOSH WHITE \* SCOTT RICE \* STEPHEN AYRES \* JEFF WHITE  
The Robertson County School System does not discriminate on the basis of race, color, national origin, sex, disability, age, religion or marital status.



Caroline Huffines  
Chief Financial Officer  
Robertson Cheatham Farmers Cooperative

5546 Wallace Road  
Springfield, TN 37172

chuffines@rcfarmerscoop.com  
615-384-3573

10/19/2023

Randy Boyd  
President  
The University of Tennessee

Dear President Boyd,

I am writing you on behalf of Robertson Cheatham Farmers Cooperative in support of the proposed partnership between The University of Tennessee at Martin and Volunteer State Community College at the Highland Crest Campus in Springfield, TN.

My perspective was created in a small rural town in West Tennessee where opportunities for higher education were limited. Living at home while attaining my degree gave me the opportunity to keep my student loan debt to a minimum, and I think this is important to college students today. This partnership would allow young adults an excellent chance to avoid traveling to Clarksville or Nashville to pursue their degrees.

As a member of the management team at Robertson Cheatham Farmers Co-op I know first-hand how difficult it is to hire capable, local talent. Educating the students from our local high schools and then bringing them into the workforce after college can be a great benefit to local businesses.

Agriculture is our business, and The University of Tennessee is well qualified to prepare the future workforce to continue a great legacy of agriculture production in Robertson County.

Sincerely,

A handwritten signature in black ink that reads "Caroline Huffines".

Caroline Huffines  
Chief Financial Officer  
Robertson Cheatham Farmers Cooperative



# Off-Campus Instructional Center



College of Pharmacy  
Center Location: Knoxville, TN

Updated January 17, 2024

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Signed Campus Memo

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**Office of Academic, Faculty and Student Affairs**

Hyman Building, Suite 400 | 62 S. Dunlap | Memphis, TN 38163  
t 901.448.4930 | [afsa@uthsc.edu](mailto:afsa@uthsc.edu)

**Healthy Tennesseans. Thriving Communities.**

MEMORANDUM

TO: Randy Boyd  
President  
The University of Tennessee System

FROM:  Cindy Russell, Chief Academic Officer  
Raaj Kurapati, Executive Vice Chancellor  
The University of Tennessee Health Science Center

RE: System and THEC approval of an Off Campus Center

The University of Tennessee Health Science Center seeks UT System and Tennessee Higher Education Commission approval of an Off Campus Center at 1924 Alcoa Highway, Knoxville TN 37920. This is the University of Tennessee Medical Center (UTMC). The UTHSC College of Pharmacy provides students at UTMC the coursework and clinical training needed to earn the PharmD degree. As background, prior to 2015 UTHSC was accredited as part of UT Knoxville. UT Knoxville had established the UTMC as a THEC Off Campus Center and this designation covered UTHSC's pharmacy educational activities at the site. In 2015 UTHSC was separately accredited by SACSCOC and should have initiated the procedure to seek THEC approval of the UTMC as an Off Campus Site. Further, in fall 2022, new incoming (P1) pharmacy students were placed at the site which allowed students to complete the entire PharmD degree at UTMC and the site should have been upgraded to an Off Campus Center at that time. The documents herein represent UTHSC's rectification of this situation.

The College of Pharmacy has the financial and personnel resources to provide an outstanding education and clinical training to students at this location. UTHSC provides certain central support services to the pharmacy students at this location. As can be seen in the accompanying document, the PharmD program at the UTMC in Knoxville is self-supporting.

Please let us know if you need additional information.

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## Letter of Notification (LON)

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At the University of Tennessee Health Science Center, the Knoxville location was originally developed to facilitate clinical rotations of 3rd year (M3) and 4th year (M4) students in the College of Medicine. The College of Pharmacy initiated many clinical sites in the Knoxville area, and a central location for students to meet face-to-face with each other and with faculty advisors and mentors was established at the College of Medicine location. After establishing the Knoxville Pharmacy clinical location, students expressed a desire to complete all four years of the curriculum in the same location, and a limited number of P2 students were allowed to complete their 2nd year in Knoxville starting in 2012. Every year, more students wish to move to Knoxville than there are slots available.

The Pharmacy curriculum is exactly the same across Memphis, Nashville, and Knoxville. Students in Nashville attend class at the same time as students in Memphis and Knoxville (synchronous); some lectures originate in Memphis and are webcast to Nashville and Knoxville; some lectures originate in Nashville and are webcast to Memphis and Knoxville; and some lectures originate in Knoxville and are webcast to Memphis and Nashville. All students, regardless of location, receive the same education. Evidence shows that student performance on the standard course exams and the NAPLEX (professional pharmacy licensure exam) are similar for all three locations.

The UT Graduate School of Medicine has a long history of graduate medical training. The "Internship Program" (the predecessor to a Transitional Residency Program) was the first program officially accredited in 1956 with the opening of the new UT Memorial Research Center and Hospital. In 1957, programs in Internal Medicine, Anesthesiology, "General Practice" (now known as Family Medicine), Obstetrics and Gynecology, Orthopedic Surgery, Radiology, Pathology, Pediatrics and Surgery received accreditation and were established. Today, the UT Graduate School of Medicine (GSM) in Knoxville is home to more than 190 residents in 12 medical and dental training programs, 12 specialty fellowships, clerkship rotations, and scores of continuing education opportunities.

The College of Medicine currently has only M3 and M4 students in Knoxville. It should be noted that M3 and M4 students are not "assigned" to Knoxville but move in and out to complete clinical rotations there. While a medical student can complete all clinical rotations in Knoxville (subject to scheduling restrictions), very few students do all rotations in Knoxville and most complete rotations around the state.

## Off-Campus Center Location

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UTHSC Knoxville UTMC  
1924 Alcoa Highway Box 117  
Knoxville, TN 37920  
Distance from main campus: 388 miles

## Implementation Date

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In Fall 2023, a limited number of P1 students were allowed to begin the PharmD in Knoxville. Therefore, the effective implementation date is Spring 2024, retroactive to Fall 2023. These students are projected to complete the PharmD in Spring 2027. They will be closely tracked to ensure that their performance is similar to that of students who begin the program in Memphis. Note that the number of admitted students who expressed a desire to start the program in Knoxville exceeded the number of slots available, and several admitted students who were not selected to start in Knoxville elected to defer matriculation to get a Knoxville slot for their first year.

## Need for Center

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### *Need for Center*

#### Documented Need for Pharmacists

The Centers for Disease Control and Prevention (CDC) has stated that "Pharmacists are well poised to improve access to quality care" based on the serious issues facing health care today. These issues include a current physician shortage, suboptimal medication adherence, increased prescription drug use, and an aging U.S. population. The key target population is patients at risk for or diagnosed with chronic disease. The CDC suggests involving pharmacists via Collaborative Practice Agreements (CPA) or Integrated Medication Therapy Management (MTM), improving clinical indicators and reducing overall care costs. Additionally, while the number of pharmacies in the U.S. has hovered near 64,000 since 2014, there has been a distribution shift away from low-income and majority-Black and Latinx neighborhoods. This trend could exacerbate racial and economic healthcare disparities. Furthermore, while just 11% of the nation's primary care physicians are located in rural areas, over three-quarters of independent community pharmacies serve areas with populations below 50,000.

#### Documented Need for Pharmacists in Tennessee

As the CDC noted, an aging U.S. population is one of the issues facing health care today, and this is never more true in Knox County (Knoxville). Population estimates from the Tennessee Department of Health (adapted from projections developed by the Boyd Center for Business and Economic Research at the University of Tennessee Knoxville) attest to the aging populations in this area, as seen in Table 1:

Table 1: County of Knox Population Estimates

Knox	2023	2025	%	2030	%	2034	%
65 - 69	26302	26644	1.30%	27006	2.68%	27174	3.32%
70 - 74	22198	22757	2.52%	23721	6.86%	24139	8.74%
75 - 79	16530	17576	6.33%	19332	16.95%	20171	22.03%
80 - 84	10849	12035	10.93%	14336	32.14%	15584	43.64%
85 plus	9862	10852	10.04%	13653	38.44%	15888	61.10%

\*Note: The percent increases are from the baseline in 2023. The yellow highlight emphasizes the dramatic increase in the older population.

There are also significant healthcare issues in Knox County, as seen in Table 2:

Table 2: Healthcare Issues in Knox County

	Poor or Fair Health (1)	Poor Physical Health Days (2)	Adult Obesity (3)	Physical Inactivity (4)	Preventable Hospital Stays (5)
Knox	Rank* 6 @ 19.1%	Rank 5 @ 4.3	Rank 5 @ 28.7%	Rank 7 @ 29.7%	Rank 5 @ 45.07

Source: Tennessee Department of Health

\*Rank out of 95 counties in Tennessee.

- 1) Poor or Fair Health: Percentage of adults reporting fair or poor health.
- 2) Poor Physical Health Days: Average number of physically unhealthy days reported in the past 30 days.
- 3) Adult Obesity: Percentage of adults that report a BMI of 30 or more.
- 4) Physical Inactivity: Percentage of adults age 30 and over reporting no leisure-time physical activity.
- 5) Preventable Hospital Stays: Number of hospital stays for ambulatory care-sensitive conditions per 1,000 Medicare enrollees.

According to the Tennessee Pharmacists Research and Education Foundation (TPREF), chronic health conditions such as diabetes and hypertension continue to affect a large number of patients in Tennessee. According to the CDC, incorporating pharmacists in team-based care increases patient awareness of the importance of medication adherence. Further, it encourages and supports behavior change and self-management of many chronic illnesses and diseases. The Bureau of Labor Statistics' Occupational Outlook Handbook projects a need for 320 pharmacists annually.

**Target Population**

The target population is those students who wish to study and eventually practice pharmacy and medicine in East Tennessee (Knoxville). This furthers the UTHSC mission and commitment to serving the entire state of Tennessee. UTHSC's Vision, Healthy Tennesseans, Thriving Communities, is served well by this target.

**Contribution to State's Higher Education Completion Agenda**

Tennessee Code Annotated § 49-7-202(c)(1) directs the Tennessee Higher Education Commission to construct a statewide master plan that directs higher education to be accountable for increasing the educational attainment levels of Tennesseans. Although THEC's Master Plan places certificate training and undergraduate education at the center of the state's college completion policy agenda, the state continues to acknowledge the critical need for academic programs of distinction at the graduate and professional level to fully address Tennessee's economic development, workforce, and research needs. The entry-level degree in Pharmacy is a PharmD. Thus, a graduate and professional degree in Pharmacy contributes to the State's higher education completion agenda by addressing the significant need for pharmacists in Tennessee.

The College of Pharmacy at the University of Tennessee Health Science Center provides a doctoral program of distinction as evidenced by the most recent pass rates for the North American Pharmacist Licensure Examination (NAPLEX), Table 3, and the Multistate Pharmacy Jurisprudence Examination (MPJE), Table 4:

Table 3: First-Time NAPLEX Pass Rates

	National	UTHSC	Memphis	Nashville	Knoxville
2020	86%	93%	94.5%	88.2%	91.4%
2021	82%	85.4%	83.7%	81.2%	92.3%
2022	80%	79.1%	77.1%	76.7%	86%

Table 4: First-Time MPJE Pass Rates\*

	National	UTHSC
2020	83%	88%
2021	79%	79.3%
2022	77%	82.8%

\*NABP does not provide a breakdown by campus.

**Alignment with Institutional Master Plan**

The institutional master plan for UTHSC identifies five planning principles, including Showcase and Connect Centers of Excellence. The centers for UTHSC's PharmD program exemplify this principle with integrated practice labs in our advanced simulation facilities. Hands-on learning with practical experience starts the first semester and touts the nation's top clinical practice sites, including St. Jude Children's Research Hospital, UT Medical Center, St. Thomas Hospital, Vanderbilt Hospital, and numerous VA hospitals. Students in the PharmD program have access to groundbreaking research in a program ranked as #6 in NIH funding.

*Psalms 124:2-3*

**Headcount for Five Years**

Table 5: Total Projected Enrollment

Four-Year PharmD Enrollment Sequence: Class 2027 - 2031

	2023-2024		2024-2025		2025-2026		2026-2027		2027-2028	
	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
P1	20	20	32	32	32	32	32	32	32	32
P2	31	31	32	32	32	32	32	32	32	32
P3	19	19	31	31	32	32	32	32	32	32
P4 - rotation	32	32	19	19	31	31	32	32	32	32
Total	102	102	114	114	127	127	128	128	128	128

Projected New Enrollment	Class of 2027	Class of 2028	Class of 2029	Class of 2030	Class of 2031
Existing Enrollment	Class of 2026	Class of 2025	Class of 2024		

**Full-Time Enrollment for Five Years**

Table 6: UTHSC's College of Pharmacy Fall Enrollment in Graduate/Professional Degrees in 2019 - 2023

	Fall 2019	Fall 2020	Fall 2021	Fall 2022	Fall 2023
UTHSC	727	724	681	573	486
Memphis	505	489	453	391	291
Nashville	97	107	112	92	93
Knoxville	125	128	116	90	102

Table 7: UTHSC College of Pharmacy Professional Doctorates Awarded 2018-2019 – 2022-2023

	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023
UTHSC	187	156	159	188	178
Memphis	101	99	88	98	106
Nashville	45	21	32	45	31
Knoxville	41	36	39	45	41

There is strong market demand for students going directly into the workforce; 85% of the Class of 2023 had job offers before graduation day. 100% of job-seeking graduates were licensed and employed as pharmacists three months post-graduation. Eighty-four members of the Class of 2023 were matched to post-graduate fellowships and residencies. In the Class of 2027, 20 students started in Knoxville. Nine were waitlisted but agreed to go to Knoxville in their P2 year. Three agreed to go to Knoxville in this P2 year. Thus, the total going to Knoxville is 32.

### *Nddc eswPwtsxdt Pwi vaq Oedhri x*

The CDC has concluded that many issues indicate an increasing need for pharmacists, including a current physician shortage, suboptimal medication adherence, increased prescription drug use, and an aging U.S. population. Population estimates from the Tennessee Department of Health attest to the aging populations in Knox County. The aging population exacerbates significant healthcare issues in the county, including Knox's rank as #5 in the state for poor physical health days, adult obesity, and preventable hospital stays. Data from the Bureau of Labor Statistics corroborate these factors.

## Finances

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The financial data is presented in the Excel file, THEC Budget Knoxville\_A1.4AB.

### *Bzci dyNawayad*

The Knoxville facility, located at the University of Tennessee Medical Center, is owned by the University of Tennessee. There are six pharmacy faculty members located at the facility in addition to the Associate Dean. There are no one-time expenditures. The recurring expenditures consist of salary and benefits for an administrator (an Associate Dean), six faculty members, and support staff members. The operating expenses cover general expenses common to any academic program. UTHSC does not pay for the use of the facility. Faculty development expenses are covered by the overall College of Pharmacy budget.

Revenues consist of tuition, calculated based on the projected enrollment, as noted earlier in the section Projected Enrollment (Refer to the Excel file, THEC Budget Knoxville\_A1.4AB). The in-state tuition rate is used to calculate tuition revenues. No attempt has been made to project future tuition increases. As seen in the THEC Budget Excel file, the tuition revenue exceeds the costs of providing the PharmD program at the location.

### *Fabygydx*

The institutional master plan for UTHSC identifies five planning principles, including Showcase and Connect Centers of Excellence. The centers for UTHSC's PharmD program exemplify this principle with integrated practice labs in our advanced simulation facilities. The Knoxville Pharmacy space includes offices, classrooms with technology to connect the site to Memphis and Nashville for synchronous course delivery, and other facilities available for student use and meets the programmatic needs of the pharmacy students, faculty, and staff.

## Faculty and Staff

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### *Pj awq abā*

#### **James Wheeler, PharmD, BCPS** **Associate Dean, Knoxville**

Dr. Wheeler earned a Bachelor of Science in Business from the University of Tennessee at Chattanooga in 2007 and a PharmD from the University of Tennessee Health Science Center (UTHSC). He joined the faculty of the College of Pharmacy at UTHSC in 2015 and became the Associate Dean of the Knoxville location in 2020.

#### **Andrea Franks, PharmD, BCPS** **Vice Chair for Education**

Professor  
Department of Clinical Pharmacy and Translational Science  
Associate Professor  
Department of Family Medicine  
University of Tennessee Graduate School of Medicine  
PharmD, The University of Tennessee Health Science Center, 1992, Major: Pharmacy

#### **Leslie A. Hamilton, PharmD, FCCP, FCCM, FNCS, BCPS, BCCCP** **Professor**

Department of Clinical Pharmacy and Translational Science  
PharmD, The University of Tennessee Health Science Center, 2007, Major: Pharmacy  
BA, University of Tennessee Knoxville, 2003, Major: English Literature

#### **Brandon Hawkins, PharmD, BCIDP, AAHIVP** **Assistant Professor**

Department of Clinical Pharmacy and Translational Science  
PharmD, The University of Tennessee Health Science Center, 2018, Major: Pharmacy  
BA, University of Tennessee Knoxville, 2014, Major: Biology

#### **Thaddeus McGiness, PharmD, BCPS** **Assistant Professor**

Department of Clinical Pharmacy and Translational Science  
PharmD, The University of Tennessee Health Science Center, 2013, Major: Pharmacy  
BS, Saginaw Valley State University, 2009, Major: Biology

**Tyler Melton, PharmD, MPH, BCPS**

**Assistant Professor**

Department of Clinical Pharmacy and Translational Science  
 PharmD, East Tennessee State University, 2012, Major: Pharmacy  
 Master of Public Health, East Tennessee State University, 2012, Major: Public Health  
 BS, Western Carolina University, 2008, Major: Chemistry and Biology

**A. Shaun Rowe, PharmD, MS, BCCCP, FNCS, FCCP, FCCM**

**Director of Faculty Affairs**

Professor  
 Department of Clinical Pharmacy and Translational Science  
 PharmD, Campbell University, 2003, Major: Pharmacy  
 MS, University of Tennessee Health Science Center, 2018, Major: Epidemiology

**Nikki Bozarth**

**Senior Conference Specialist**

College of Pharmacy, Continuing Education Office  
 Knoxville Campus

**Melissa Smith**

**Student Affairs Coordinator**

**Kevin Carmon**

**Senior IT Technologist II**

**Melissa Edwards**

**Administrative Aide**

*Mcjbr d*

As noted earlier, the UT Graduate School of Medicine (GSM) in Knoxville is home to more than 190 residents in 12 medical and dental training programs, 12 specialty fellowships, clerkship rotations, and scores of continuing education opportunities. To adequately support the diversity of residency programs, most [faculty affiliated with GSM in Knoxville](#) are less than 5%.

*Pwtsxd: Pwi vaq Oedjri x, Ddi vldDdji raysr, arc CIP Cscd*

**4-Year Course Sequence (PharmD)**

The 4-year sequence is identical across Memphis, Nashville, and Knoxville.

**First Professional Year**

Fall Term

PHCY 1105 - Interprofessional Education and Clinical Simulation I	Cr Hrs: 2
PHCY 1106 - Introductory Pharmacy Practice Experience (IPPE) I: Introduction to Patient Care	Cr Hrs: 1
PHCY 1110 - Dosage Design, Delivery, and Dispensing I	Cr Hrs: 3
PHCY 1112 - Foundations of Pharmacy	Cr Hrs: 2
PHCY 1113 - Pharm-Ready	Cr Hrs: 4.0
PHCY 1114 - Molecular Foundations of Drug Action	Cr Hrs: 4
PHCY 1115 - Integrated Pharmacotherapy I	Cr Hrs: 3
Total: 19 credit hours	

Spring Term

PHCY 1202 - Pharmacokinetics & Dose Optimization	Cr Hrs: 4
PHCY 1205 - Interprofessional Education and Clinical Simulation II	Cr Hrs: 1
PHCY 1209 - Pharmacy-based Immunization Delivery	Cr Hrs: 0.5
PHCY 1210 - Dosage Design, Delivery, and Dispensing II	Cr Hrs: 2
PHCY 1212 - Information, Technology, and Safety	Cr Hrs: 2
PHCY 1215 - Integrated Pharmacotherapy 2	Cr Hrs: 3

PHCY 1216 - Integrated Pharmacotherapy 3	Cr Hrs: 3
PHCY 1217 - Pharmacy Professional Pathway	Cr Hrs: 1
PHCY 1218 - Pharmacy Calculations and Terminology	Cr Hrs: 1
	Total: 17.5 credit hours

### Second Professional Year

#### Fall Term

PHCY 4000 - IPPE II: Community Pharmacy Practice	Cr Hrs: 2
PHCY 2105 - Interprofessional Education and Clinical Simulation III	Cr Hrs: 1
PHCY 2106 - Musculoskeletal, Diabetes, and Nephrology	Cr Hrs: 4
PHCY 2107 - Pharmacy Professional Development III	Cr Hrs: 0.5
PHCY 2109 - Pharmacogenomics for the Pharmacist	Cr Hrs: 2
PHCY 2112 - Health Systems, Delivery, and Economics	Cr Hrs: 3
PHCY 2113 - Endocrinology and Pulmonology	Cr Hrs: 3.5
PHCY 2114 - Principles of Medical Microbiology and Immunology	Cr Hrs: 3
PHCY 4073 - IPPE III: Introduction to Medication Therapy Management	Cr Hrs: 1
	Total: 20 credit hours

#### Spring Term

PHCY 2202 - Surgery, Critical Care, Transplant	Cr Hrs: 3.5
PHCY 2204 - Literature Evaluation and Study Design	Cr Hrs: 2
PHCY 2205 - Interprofessional Education and Clinical Simulation IV	Cr Hrs: 1
PHCY 2206 - Introductory Pharmacy Practice Experience (IPPE) IV: Applied Therapeutics I	Cr Hrs: 2
PHCY 2207 - Pharmacy Professional Development IV	Cr Hrs: 0.5
PHCY 2210 - Infectious Diseases	Cr Hrs: 4.5
PHCY 2212 - Healthcare Leadership, Innovation, and Management	Cr Hrs: 3
Didactic Elective	Cr Hrs: 2
	Total: 18.5 credit hours

### Third Professional Year

#### Fall Term

PHCY 4001 - IPPE V: Institutional Pharmacy Practice	Cr Hrs: 2
PHCY 3100 - Neurology and Psychiatry	Cr Hrs: 4.5
PHCY 3101 - Substance Abuse, Gastroenterology, and Nutrition	Cr Hrs: 3.5
PHCY 3104 - Pharmacy Law	Cr Hrs: 3
PHCY 3105 - Interprofessional Education and Clinical Simulation V	Cr Hrs: 1
PHCY 3106 - Introductory Pharmacy Practice Experience (IPPE) VI: Applied Therapeutics II	Cr Hrs: 2
PHCY 3107 - Pharmacy Professional Development V	Cr Hrs: 0.5

Didactic Elective	Cr Hrs: 2
	Total: 18.5 credit hours

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Spring Term

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PHCY 3201 - Hematology and Oncology	Cr Hrs: 2.5
PHCY 3208 - APPE Ready	Cr Hrs: 2
PHCY 3209 - Practice Ready 1	Cr Hrs: 1
Didactic Elective	Cr Hrs: 2
	Total: 7.5 credit hours (didactic)

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**Fourth Professional Year**

Fall Term

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PHCY 4107 - Pharmacy Professional Development VII	Cr Hrs: 0.5
PHCY 4200 - Pharmacy Exam Review I	Cr Hrs: 2
	Total: 2.5 credit hours (didactic)

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Spring Term

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PHCY 4207 - Pharmacy Professional Development VIII	Cr Hrs: 0.5
PHCY 4201 - Pharmacy Exam Review II	Cr Hrs: 2
	Total: 2.5 credit hours (didactic)

*PharmD CIP Code*

51.2001 Pharmacy (PharmD [USA], PharmD or BS/BPharm [Canada]). A program that prepares individuals for the independent or employed practice of preparing and dispensing drugs and medications in consultation with prescribing physicians and other health care professionals, and for managing pharmacy practices and counseling patients. Includes instruction in mathematics, physics, chemistry, biochemistry, anatomy, physiology, pharmacology, pharmaceutical chemistry, pharmacognosy, pharmacy practice, pharmacy administration, applicable regulations, and professional standards and ethics.

**Existing Programs Offered at Public Institutions**

Table 8: Existing Programs Offered at Public Institutions

Institution	Federal CIP Code	Major Name	Award
East Tennessee State University	31.51.2001.00	PHARMACY	PharmD
University of Tennessee Health Science Center	31.51.2001.00	PHARMACY	PHARMD

East Tennessee State (ETSU) is in Johnson City, TN, the northeastern corner of the state. Its target population is students from the surrounding Appalachian Mountain range communities. Its location is distant from the major urban locales in Tennessee. Specifically, ETSU is 108 miles from UTHSC's Knoxville location.

**Accreditation**

During the 2020 reaffirmation of accreditation by SACSCOC, members of the On-Site Committee reviewed this location and found that UTHSC was in compliance with all applicable standards. ACPE (Accreditation Council for Pharmacy Education, the pharmacy accreditor) has also approved the Knoxville location.



Financial Projections



Form A1.4AB

Operational Costs/Revenues Estimate for Off-Campus Center Location

Please include a brief Budget Narrative outlining the source of funds, any external assistance (e.g., private industry), and expenses associated with the establishment of this Center.

Please provide explanation of the Other Sources category included in the Revenues section.

Institution Name: UTHSC  
 Name of Proposed Off-Campus Center: Knoxville  
 Five-year cost projections are required.

Expenditures

One-time Expenditures

	Year 1	Year 2	Year 3	Year 4	Year 5
New/Renovated Space <sup>1</sup>	\$ -	\$ -	\$ -	\$ -	\$ -
Equipment	\$ -	\$ -	\$ -	\$ -	\$ -
Library	\$ -	\$ -	\$ -	\$ -	\$ -
<b>Sub-Total One-time</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>

Recurring Expenditures

	Year 1	Year 2	Year 3	Year 4	Year 5
<b>Administration</b>					
Salary	\$ 22,797	\$ 23,481	\$ 24,185	\$ 24,911	\$ 25,658
Benefits	\$ 7,067	\$ 7,279	\$ 7,497	\$ 7,722	\$ 7,954
<b>Sub-Total Administration</b>	<b>\$ 29,864</b>	<b>\$ 30,760</b>	<b>\$ 31,683</b>	<b>\$ 32,633</b>	<b>\$ 33,612</b>
<b>Faculty</b>					
Salary	\$ 1,059,996	\$ 1,091,796	\$ 1,124,550	\$ 1,158,286	\$ 1,193,035
Benefits	\$ 328,599	\$ 338,457	\$ 348,610	\$ 359,069	\$ 369,841
<b>Sub-Total Faculty</b>	<b>\$ 1,388,595</b>	<b>\$ 1,430,253</b>	<b>\$ 1,473,160</b>	<b>\$ 1,517,355</b>	<b>\$ 1,562,876</b>
<b>Support Staff</b>					
Salary	\$ 116,605	\$ 120,103	\$ 123,706	\$ 127,417	\$ 131,240
Benefits	\$ 36,148	\$ 37,232	\$ 38,349	\$ 39,499	\$ 40,684
<b>Sub-Total Support Staff</b>	<b>\$ 152,753</b>	<b>\$ 157,335</b>	<b>\$ 162,055</b>	<b>\$ 166,917</b>	<b>\$ 171,924</b>
<b>Operating</b>					
Equipment	\$ -	\$ -	\$ -	\$ -	\$ -
Other	\$ 88,988	\$ 92,548	\$ 96,249	\$ 100,099	\$ 104,103
<b>Sub-Total Operating</b>	<b>\$ 88,988</b>	<b>\$ 92,548</b>	<b>\$ 96,249</b>	<b>\$ 100,099</b>	<b>\$ 104,103</b>
<b>Sub-Total Recurring</b>	<b>\$ 1,660,199</b>	<b>\$ 1,710,895</b>	<b>\$ 1,763,148</b>	<b>\$ 1,817,004</b>	<b>\$ 1,872,516</b>
<b>TOTAL EXPENDITURES</b>	<b>\$ 1,660,199</b>	<b>\$ 1,710,895</b>	<b>\$ 1,763,148</b>	<b>\$ 1,817,004</b>	<b>\$ 1,872,516</b>

Funding Source for Facilities/Space:

- Owned by Institution
- Leased by Institution
- Owned by another public institution of higher education
- Provided at no cost to the institution. Please document.
- Facilities/Space Square Footage

Revenues

One-time Revenues

	Year 1	Year 2	Year 3	Year 4	Year 5
Tuition and Fees	\$ -	\$ -	\$ -	\$ -	\$ -
State Appropriations	\$ -	\$ -	\$ -	\$ -	\$ -
Sales and Services of Education	\$ -	\$ -	\$ -	\$ -	\$ -
Activities	\$ -	\$ -	\$ -	\$ -	\$ -
Other Sources (provide explanation)	\$ -	\$ -	\$ -	\$ -	\$ -
<b>Sub-Total One-time</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>

Recurring Revenues

	Year 1	Year 2	Year 3	Year 4	Year 5
Tuition and Fees	\$ 2,316,012	\$ 2,588,484	\$ 2,883,662	\$ 2,906,368	\$ 2,906,368
State Appropriations	\$ -	\$ -	\$ -	\$ -	\$ -
Sales and Services of Education	\$ -	\$ -	\$ -	\$ -	\$ -
Educational Activities	\$ -	\$ -	\$ -	\$ -	\$ -
Other Sources (provide explanation)	\$ -	\$ -	\$ -	\$ -	\$ -
<b>Sub-Total Recurring</b>	<b>\$ 2,316,012</b>	<b>\$ 2,588,484</b>	<b>\$ 2,883,662</b>	<b>\$ 2,906,368</b>	<b>\$ 2,906,368</b>
<b>TOTAL REVENUES</b>	<b>\$ 2,316,012</b>	<b>\$ 2,588,484</b>	<b>\$ 2,883,662</b>	<b>\$ 2,906,368</b>	<b>\$ 2,906,368</b>

**Excess Operating Revenues:** \$ 655,813 \$ 877,589 \$ 1,120,514 \$ 1,089,364 \$ 1,033,852

\* Tuition is based on 2023-24 in-state rate at \$22,706.

10

# Off-Campus Instructional Center



College of Pharmacy  
Center Location: Nashville, TN

Updated January 18, 2024

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## Letter of Notification (LON)

At the University of Tennessee Health Science Center, the Nashville Pharmacy location was originally developed to facilitate clinical rotations of 3rd year (P3) and 4th year (P4) students. The College of Pharmacy initiated many clinical sites in the Nashville area, and a central location for students to meet face-to-face with each other and with faculty advisors and mentors was established. After establishing the Nashville clinical location, students expressed a desire to complete all four years of the curriculum in the same location, and a limited number of P2 students were allowed to complete their 2nd year in Nashville starting in 2012. Every year, more students wish to move to Nashville than there are slots available.

The curriculum is exactly the same across Memphis, Nashville, and Knoxville. Students in Nashville attend class at the same time as students in Memphis and Knoxville (synchronous); some lectures originate in Memphis and are webcast to Nashville and Knoxville; some lectures originate in Nashville and are webcast to Memphis and Knoxville; and some lectures originate in Knoxville and are webcast to Memphis and Nashville. All students, regardless of location, receive the same education, and evidence shows that student performance on the standard course exams and the NAPLEX (professional pharmacy licensure exam) are similar for students at all three locations.

## Off-Campus Center Location

UTHSC Nashville Perimeter Park  
 301 S. Perimeter Park Drive, Suite 220  
 Nashville, TN 37211  
 Davidson County  
 Distance from main campus: 219 miles

## Implementation Date

In Fall 2023, a limited number of P1 students were allowed to begin the PharmD in Nashville. These students are projected to complete the PharmD in Spring 2027. Therefore, the effective implementation date is Spring 2024, retroactive to Fall 2023. These students are projected to complete the PharmD in Spring 2027. They will be closely tracked to ensure that their performance is similar to that of students who begin the program in Memphis. Note that the number of admitted students who expressed a desire to start the program in Nashville exceeded the number of slots available, and several admitted students who were not selected to begin in Nashville elected to defer matriculation to get a Nashville slot for their first year.

## Need for Center

### *Nddcx Aoxdoq d r y*

#### Documented Need for Pharmacists

The Centers for Disease Control and Prevention (CDC) has stated that “Pharmacists are well poised to improve access to quality care” based on the serious issues facing health care today. These issues include a current physician shortage, suboptimal medication adherence, increased prescription drug use, and an aging U.S. population. The key target population is patients at risk for or diagnosed with chronic disease. The CDC suggests involving pharmacists via Collaborative Practice Agreements (CPA) or Integrated Medication Therapy Management (MTM) will improve clinical indicators and reduce overall care costs. Additionally, while the number of pharmacies in the U.S. has hovered near 64,000 since 2014, there has been a distribution shift away from low-income and majority-Black and Latinx neighborhoods. This trend could exacerbate racial and economic healthcare disparities. Furthermore, while just 11% of the nation’s primary care physicians are located in rural areas, over three-quarters of independent community pharmacies serve areas with populations below 50,000.

#### Documented Need for Pharmacists in Tennessee

As the CDC noted, an aging U.S. population is one of the issues facing health care today, and this is never truer than in the county of Davidson (Nashville). Population estimates from the Tennessee Department of Health (adapted from projections developed by the Boyd Center for Business and Economic Research at the University of Tennessee Knoxville) attest to the aging populations in this area, as seen in Table 1.

Table 1: County of Davidson Population Estimates

Davidson	2023	2025	%	2030	%	2034	%
65 - 69	32579	32901	0.99%	33272	2.13%	33882	4.00%
70 - 74	25134	26082	3.77%	27415	9.08%	28041	11.57%
75 - 79	17877	19168	7.22%	21459	20.04%	22535	26.06%
80 - 84	11727	12845	9.53%	15320	30.64%	16759	42.91%
85 plus	11010	11826	7.41%	14429	31.05%	16707	51.74%

\*Note: The percent increases are from the baseline in 2023. The yellow highlight emphasizes the dramatic increase in the older population.

There are also significant healthcare issues in Davidson County, as seen in Table 2:

Table 2: Healthcare Issues in Davidson County

	Poor or Fair Health (1)	Poor Physical Health Days (2)	Adult Obesity (3)	Physical Inactivity (4)	Preventable Hospital Stays (5)
Davidson	Rank* 16 @ 20.3%	Rank 21 @ 4.6	Rank 28 @ 31.5%	Rank 2 @ 25.8%	Rank 16 @ 59.97

Source: Tennessee Department of Health

\*Rank out of 95 counties in Tennessee.

- 1) Poor or Fair Health: Percentage of adults reporting fair or poor health.
- 2) Poor Physical Health Days: Average number of physically unhealthy days reported in the past 30 days.
- 3) Adult Obesity: Percentage of adults that report a BMI of 30 or more.
- 4) Physical Inactivity: Percentage of adults aged 30 and over reporting no leisure-time physical activity.
- 5) Preventable Hospital Stays: Number of hospital stays for ambulatory care-sensitive conditions per 1,000 Medicare enrollees.

According to the Tennessee Pharmacists Research and Education Foundation (TPREF), chronic health conditions such as diabetes and hypertension continue to affect a large number of patients in Tennessee. According to the CDC, incorporating pharmacists in team-based care increases patient awareness of the importance of medication adherence. Further, it encourages and supports behavior change and self-management of many chronic illnesses and diseases. The Bureau of Labor Statistics' Occupational Outlook Handbook projects a need for 320 pharmacists annually.

**Target Population**

The target population is those students who wish to study and eventually practice pharmacy and medicine in Middle Tennessee (Nashville). This furthers the UTHSC mission and commitment to serving the entire state of Tennessee. UTHSC's Vision, Healthy Tennesseans, Thriving Communities, is served well by this target.

**Contribution to State's Higher Education Completion Agenda**

Tennessee Code Annotated § 49-7-202(c)(1) directs the Tennessee Higher Education Commission to construct a statewide master plan that directs higher education to be accountable for increasing the educational attainment levels of Tennesseans. Although THEC's Master Plan places certificate training and undergraduate education are at the center of the state's college completion policy agenda, the state continues to acknowledge the critical need for academic programs of distinction at the graduate and professional level to fully address Tennessee's economic development, workforce, and research needs. The entry-level degree in Pharmacy is a PharmD. Thus, a graduate and professional degree in Pharmacy contributes to the State's higher education completion agenda by addressing the significant need for pharmacists in Tennessee.

The College of Pharmacy at the University of Tennessee Health Science Center provides a doctoral program of distinction as evidenced by the most recent first-time pass rates for the North American Pharmacist Licensure Examination (NAPLEX), Table 3, and the Multistate Pharmacy Jurisprudence Examination (MPJE), Table 4:

Table 3: First-Time NAPLEX Pass Rates

	National	UTHSC	Memphis	Nashville	Knoxville
2020	86%	93%	94.5%	88.2%	91.4%
2021	82%	85.4%	83.7%	81.2%	92.3%
2022	80%	79.1%	77.1%	76.7%	86%

Table 4: First-Time MPJE Pass Rates\*

	National	UTHSC
2020	83%	88%
2021	79%	79.3%
2022	77%	82.8%

\*NABP does not provide a breakdown by campus

**Alignment with Institutional Master Plan**

The institutional master plan for UTHSC identifies five planning principles, including Showcase and Connect Centers of Excellence. The centers for UTHSC's PharmD program exemplify this principle with integrated practice labs in our advanced simulation facilities. Hands-on learning with practical experience starts the first semester and touts the nation's top clinical practice sites, including St. Jude Children's Research Hospital, UT Medical Center, St. Thomas Hospital, Vanderbilt Hospital, and numerous VA hospitals. Students in the PharmD program have access to groundbreaking research in a program ranked as #6 in NIH funding.

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**Headcount for Five Years**

Table 5: Total Projected Enrollment

Four-Year PharmD Enrollment Sequence: Class 2027 - 2031

	2023-2024		2024-2025		2025-2026		2026-2027		2027-2028	
	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
P1	20	20	20	20	20	20	20	20	20	20
P2	12	12	24	24	20	20	20	20	20	20
P3	25	25	12	12	24	24	20	20	20	20
P4 - rotation	36	36	26	26	12	12	24	24	20	20
Total	93	93	82	82	76	76	84	84	80	80

Projected New Enrollment	Class of 2027	Class of 2028	Class of 2029	Class of 2030	Class of 2031
Existing Enrollment	Class of 2026	Class of 2025	Class of 2024		

**Full-Time Enrollment for Five Years**

Table 6: UTHSC's College of Pharmacy Fall Enrollment in Graduate/Professional Degrees 2019 - 2023

	Fall 2019	Fall 2020	Fall 2021	Fall 2022	Fall 2023
UTHSC	727	724	681	573	486
Memphis	505	489	453	391	291
Nashville	97	107	112	92	93
Knoxville	125	128	116	90	102

Table 7: UTHSC College of Pharmacy Professional Doctorates Awarded 2018-2019 - 2022-2023

	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023
UTHSC	187	156	159	188	178
Memphis	101	99	88	98	106
Nashville	45	21	32	45	31
Knoxville	41	36	39	45	41

There is strong market demand for students going directly into the workforce; 85% of the Class of 2023 had job offers before graduation day. 100% of job-seeking graduates were licensed and employed as pharmacists three months post-graduation. Eighty-four members of the Class of 2023 were matched to post-graduate fellowships and residencies. For the current class 2027, 20 students started as P1s in Nashville. One student was waitlisted but agreed to attend Nashville in their P2 year. Three students agreed to go to Nashville in this P2 year.

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The CDC has concluded that many issues indicate an increasing need for pharmacists, including a current physician shortage, suboptimal medication adherence, increased prescription drug use, and an aging U.S. population. Population estimates from the Tennessee Department of Health attest to the aging populations in Davidson County. The aging population exacerbates significant healthcare issues in the county, including Davidson's rank as #2 in the state for the percentage of physically inactive adults. Data from the Bureau of Labor Statistics corroborate these factors.

**Finances**

The financial data are presented in the Excel file, THEC Budget Nashville\_A1.4AB.

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The Nashville facility, located at 301 S. Perimeter Park Drive, Suite 200, is leased. Five pharmacy faculty members are located at the facility, in addition to the associate dean. There are no one-time expenditures. The recurring expenditures consist of salary and benefits for an administrator (an Associate Dean), five faculty members, and support staff members. The operating expenses cover the annual lease payments and general expenses common to any academic program. Faculty development expenses are covered by the overall College of Pharmacy budget. Revenues consist of tuition, calculated based on the projected enrollment, as noted earlier in the section Projected Enrollment (Refer to the Excel file, THEC Budget Nashville\_A1.4AB). The in-state tuition rate is used to calculate tuition revenues. No attempt has been made to project future tuition increases. As seen in the THEC Budget Excel file, the tuition revenue exceeds the costs of providing the PharmD program at the location.

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The institutional master plan for UTHSC identifies five planning principles, including Showcase and Connect Centers of Excellence. The centers for UTHSC's PharmD program exemplify this principle with integrated practice labs in our advanced simulation facilities. The College of Pharmacy [space](#) in Nashville is in a commercial park and is leased. It includes faculty offices, two conference rooms, study spaces, and lecture and team-based learning classrooms with videoconferencing facilities to provide synchronous connections to Memphis and Knoxville. The space is adequate to meet the current and projected needs of the educational program.

## Faculty and Staff

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### **Tracy M. Hagemann, PharmD, MS, FCCP, FPPA**

#### **Associate Dean, Nashville**

After graduating from the University of Missouri at Kansas City School of Pharmacy in 1994, Dr. Hagemann completed a Pharmacy Practice Residency at the Regional Medical Center in Memphis, Tennessee, followed by a Pediatric Specialty Residency at the University of Oklahoma and Children's Hospital of Oklahoma. As a faculty member at the OU College of Pharmacy, she served as Program Director for the PGY2 Pediatric Residency for 11 years and Program Director of the Pediatric Pharmacotherapy Fellowship for two years. She is also an Adjunct Professor of Pediatrics at the OU College of Medicine. With a research focus on pediatric pharmacotherapy, Dr. Hagemann has authored or co-authored more than 45 publications. She has received many teaching awards, including the American Association of Colleges of Pharmacy (AACP) Experiential Education Section 2014 Award of Excellence in Scholarship in Experiential Education. Dr. Hagemann has also been very active in state and national organizations, serving as President of the Oklahoma Society of Health-System Pharmacists (OSHP), Chair of the Legislative Committee (OSHP), Chair of the Pediatric Practice Research Network of the American College of Clinical Pharmacy (ACCP), and Faculty Delegate to AACP. She serves on the Board of Directors of the Pediatric Pharmacy Advocacy Group (PPAG) as Chair of the Pediatric SIG of AACP and has been appointed to the Council on Public Policy of the American Society of Health-System Pharmacists (ASHP). She is an AACP Academic Leadership Fellow and a Fellow in ACCP and PPAG. In addition to academic and teaching awards, Dr. Hagemann has received many pharmacy practice awards, including the Distinguished Young Pharmacist-Oklahoma Award in 2005 and the OSHP Pharmacist of the Year award in 2008.

### **Alina Cernasev, PhD, PharmD, MS**

#### **Assistant Professor**

Department of Clinical Pharmacy and Translational Science  
Ph.D., University of Minnesota, 2019, Major: Pharmacy, Social and Administrative Pharmacy  
PharmD, University of Minnesota, 2015  
MSc, University of London, 2004, Major: Drug Delivery  
BPharm, University of Pharmacy "Grigore T. Popa," 2002, Major: Pharmacy

### **Kelsey Frederick, PharmD**

#### **Assistant Professor**

Department of Clinical Pharmacy and Translational Science  
PharmD, Auburn University, 2018, Major: Pharmacy  
BS, Auburn University, 2014, Major: Biomedical Sciences

### **Kenneth C. Hohmeier, PharmD**

#### **Professor**

Director of Community Affairs  
Department of Clinical Pharmacy and Translational Science  
PharmD, The University of Toledo, 2010, Major: Pharmacy  
BS, The University of Toledo, 2008, Major: Pharmaceutical Sciences

### **Joel C. Marrs, PharmD, MPH, BCACP, BCCP, BCPS**

#### **Professor**

Coordinator of Clinical Outreach  
Department of Clinical Pharmacy and Translational Science  
PharmD, Butler University, 2004, Major: Pharmacy  
Master of Public Health, University of Colorado Anschutz Medical Campus, 2019, Major: Public Health Epidemiology

### **Jeremy Stultz, PharmD**

#### **Associate Professor**

Department of Clinical Pharmacy and Translational Science  
PharmD, University of Pittsburgh, 2010, Major: Pharmacy

### **Kelsey Curry**

#### **Student Services Coordinator**

### **Adam Brown**

#### **Senior IT Technician II**

### **Carol Taylor**

#### **Administrative Aide**

## Proposed Program Offerings, Degree Designation, and CIP Code

### 4-Year Curriculum Sequence (PharmD)

The 4-year sequence is identical across Memphis, Nashville, and Knoxville.

#### First Professional Year

##### Fall Term

PHCY 1105 - Interprofessional Education and Clinical Simulation I	Cr Hrs: 2
PHCY 1106 - Introductory Pharmacy Practice Experience (IPPE) I: Introduction to Patient Care	Cr Hrs: 1
PHCY 1110 - Dosage Design, Delivery, and Dispensing I	Cr Hrs: 3
PHCY 1112 - Foundations of Pharmacy	Cr Hrs: 2
PHCY 1113 - Pharm-Ready	Cr Hrs: 4.0
PHCY 1114 - Molecular Foundations of Drug Action	Cr Hrs: 4
PHCY 1115 - Integrated Pharmacotherapy I	Cr Hrs: 3
Total: 19 credit hours	

##### Spring Term

PHCY 1202 - Pharmacokinetics & Dose Optimization	Cr Hrs: 4
PHCY 1205 - Interprofessional Education and Clinical Simulation II	Cr Hrs: 1
PHCY 1209 - Pharmacy-based Immunization Delivery	Cr Hrs: 0.5
PHCY 1210 - Dosage Design, Delivery, and Dispensing II	Cr Hrs: 2
PHCY 1212 - Information, Technology, and Safety	Cr Hrs: 2
PHCY 1215 - Integrated Pharmacotherapy 2	Cr Hrs: 3
PHCY 1216 - Integrated Pharmacotherapy 3	Cr Hrs: 3
PHCY 1217 - Pharmacy Professional Pathway	Cr Hrs: 1
PHCY 1218 - Pharmacy Calculations and Terminology	Cr Hrs: 1
Total: 17.5 credit hours	

#### Second Professional Year

##### Fall Term

PHCY 4000 - IPPE II: Community Pharmacy Practice	Cr Hrs: 2
PHCY 2105 - Interprofessional Education and Clinical Simulation III	Cr Hrs: 1
PHCY 2106 - Musculoskeletal, Diabetes, and Nephrology	Cr Hrs: 4
PHCY 2107 - Pharmacy Professional Development III	Cr Hrs: 0.5
PHCY 2109 - Pharmacogenomics for the Pharmacist	Cr Hrs: 2
PHCY 2112 - Health Systems, Delivery, and Economics	Cr Hrs: 3
PHCY 2113 - Endocrinology and Pulmonology	Cr Hrs: 3.5
PHCY 2114 - Principles of Medical Microbiology and Immunology	Cr Hrs: 3
PHCY 4073 - IPPE III: Introduction to Medication Therapy Management	Cr Hrs: 1
Total: 20 Credit Hours	



## Spring Term

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PHCY 2202 - Surgery, Critical Care, Transplant	Cr Hrs: 3.5
PHCY 2204 - Literature Evaluation and Study Design	Cr Hrs: 2
PHCY 2205 - Interprofessional Education and Clinical Simulation IV	Cr Hrs: 1
PHCY 2206 - Introductory Pharmacy Practice Experience (IPPE) IV: Applied Therapeutics I	Cr Hrs: 2
PHCY 2207 - Pharmacy Professional Development IV	Cr Hrs: 0.5
PHCY 2210 - Infectious Diseases	Cr Hrs: 4.5
PHCY 2212 - Healthcare Leadership, Innovation, and Management	Cr Hrs: 3
Didactic Elective	Cr Hrs: 2
	Total: 18.5 credit hours

**Third Professional Year**

## Fall Term

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PHCY 4001 - IPPE V: Institutional Pharmacy Practice	Cr Hrs: 2
PHCY 3100 - Neurology and Psychiatry	Cr Hrs: 4.5
PHCY 3101 - Substance Abuse, Gastroenterology, and Nutrition	Cr Hrs: 3.5
PHCY 3104 - Pharmacy Law	Cr Hrs: 3
PHCY 3105 - Interprofessional Education and Clinical Simulation V	Cr Hrs: 1
PHCY 3106 - Introductory Pharmacy Practice Experience (IPPE) VI: Applied Therapeutics II	Cr Hrs: 2
PHCY 3107 - Pharmacy Professional Development V	Cr Hrs: 0.5
Didactic Elective	Cr Hrs: 2
	Total: 18.5 credit hours

## Spring Term

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PHCY 3201 - Hematology and Oncology	Cr Hrs: 2.5
PHCY 3208 - APPE Ready	Cr Hrs: 2
PHCY 3209 - Practice Ready 1	Cr Hrs: 1
Didactic Elective	Cr Hrs: 2
	Total: 7.5 credit hours (didactic)

**Fourth Professional Year**

## Fall Term

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PHCY 4107 - Pharmacy Professional Development VII	Cr Hrs: 0.5
PHCY 4200 - Pharmacy Exam Review I	Cr Hrs: 2
	Total: 2.5 credit hours (didactic)

## Spring Term

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PHCY 4207 - Pharmacy Professional Development VIII	Cr Hrs: 0.5
PHCY 4201 - Pharmacy Exam Review II	Cr Hrs: 2
	Total: 2.5 credit hours (didactic)

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- 51.20 Pharmacy, Pharmaceutical Sciences, and Administration. Instructional content for this group of programs is defined in codes 51.2001 - 51.2099.
- 51.2001 Pharmacy (PharmD [USA], PharmD or BS/BPharm [Canada]). A program that prepares individuals for the independent or employed practice of preparing and dispensing drugs and medications in consultation with prescribing physicians and other health care professionals, managing pharmacy practices, and counseling patients. Includes instruction in mathematics, physics, chemistry, biochemistry, anatomy, physiology, pharmacology, pharmaceutical chemistry, pharmacognosy, pharmacy practice, pharmacy administration, applicable regulations, and professional standards and ethics.

**Existing Programs Offered at Public Institutions**

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Table 8: Existing Programs Offered at Public Institutions

Institution	Federal CIP Code	Major Name	Award
East Tennessee State University	31.51.2001.00	PHARMACY	PharmD
University of Tennessee Health Science Center	31.51.2001.00	PHARMACY	PHARMD

East Tennessee State (ETSU) is in Johnson City, TN, the northeastern corner of the state. Its target population is students from the surrounding Appalachian Mountain range communities. Its location is distant from the major urban locales in Tennessee. Specifically, ETSU is 284 miles from the Nashville location.

**Accreditation**

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During the 2020 reaffirmation of accreditation by SACSCOC, members of the On-Site Committee reviewed this location and found that UTHSC was in compliance with all applicable standards. ACPE, the pharmacy accreditor, has also approved the Nashville location.