PURDUE SCHOOL OF ENGINEERING AND TECHNOLOGY 2019-2020 ACADEMIC YEAR ASSESSMENT REPORT

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Introduction

The Purdue School of Engineering and Technology, IUPUI (E&T) continues its tradition of reporting its outcomes assessment activities by academic program. The assessment activities of most programs in the school are guided by the discipline-specific accreditation requirements of ABET, Inc. (http://abet.org/, formerly the Accreditation Board for Engineering and Technology), which accredits our engineering, technology, and computing programs; of the National Association of Schools of Music (NASM, http://nasm.arts-accredit.org/), through which the department of Music and Arts Technology is accredited, and the American Music Therapy Association (AMTA, https://www.musictherapy.org/), which accredits our Music Therapy programs; of the Council for Interior Design Technology (CIDA, http://www.accredit-id.org/), the accrediting body for our Interior Design Technology program; and the American Council for Construction Education (ACCE, https://www.acce-hq.org/), which accredits our Construction Management program. The Organizational Leadership and Supervision (OLS) program and Technical Communication (TCM) programs, which are not accredited at the program level, have developed their own set of learning outcomes that reflect both learning in the major and support for the desired outcomes of other programs that incorporate OLS and TCM service courses in their plans of study.

School Assessment Processes

Student Learning Outcomes for degrees and certificates in E&T are published in the Bulletin: https://bulletins.iu.edu/iupui/2021-2022/schools/purdue-engineer-tech/undergraduate/student_learning_outcomes/index.shtml. For ease of review, the outcomes of our baccalaureate programs are included in the appendix of this report.

Each undergraduate course taught in the school has one or more identified learning outcomes. These individual course outcomes are then mapped to program-level learning outcomes. Based on these defined areas of emphasis, specific courses may be targeted for assessment of a given outcome. The bulk of program assessment is administered and performed at the department level, with the school Assessment Committee providing a mechanism for sharing resources and best practices, as well as disseminating information and guidance on new campus-level assessment processes. Due to the needs of program accreditation, most assessment data is framed in the language of discipline-specific outcomes. However, the program outcomes defined by ABET, NASM/AMTA, CIDA, and ACCE to describe the knowledge, skills, and habits of mind expected of successful graduates of these programs cover the same broad areas as IUPUI's Profiles of Learning for Undergraduate Success, just with more specificity appropriate to the needs of each discipline. Thus, by focusing on attainment of discipline-specific outcomes, programs are assured of meeting the more broadly-defined Profiles. To make these linkages explicit, mappings between discipline-specific outcomes and the Profiles have been established for each program. An example of such a mapping (for the ABET Engineering outcomes) is shown in the table on the next page.

Prompted by the establishment of Principles of Graduate Learning at IUPUI, graduate programs in the School of Engineering and Technology have likewise established student learning outcomes, published in the Bulletin: https://bulletins.iu.edu/iupui/2021-2022/schools/purdue-engineer-tech/graduate/student_learning_outcomes/index.shtml. Due to the highly specialized, integrative

nature of graduate programs, assessment of these outcomes focuses primarily on the thesis (or final project) rather than on individual courses.

IUPUI Profiles of Learning for Undergraduate Success	Communicator				Problem Solver				Innovator				Community Contributor			
	Evaluates Information	Listens Actively	Builds Relationships	Conveys Ideas Effectively	Thinks Critically	Collaborates	Analyzes, Synthesizes, Evaluates	Perseveres	Investigates	Creates/ Designs	Confronts Challenges	Makes Decisions	Builds Community	Respectfully Engages Own and Other Cultures	Behaves Ethically	Anticipates Consequences
ABET Outcomes (ENGINEERING):																
1 Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	x				x		x	x	x							
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	x				x	x	x	x	x	x	x	x		x	x	x
3 Communicate effectively with a range of audiences	x	x	x	x	x	x	x						x	x	x	x
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	x				x	x	x		x		x	x	x	x	x	x
5 Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	x	x	x	x	x	x	x	x			x	x	x	x	x	x
6 Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	x			x	x		x	x	x	x		x			x	x
7 Acquire and apply new knowledge as needed, using appropriate learning strategies	x	x			x		x	x	x							

Table 1: Map of ABET program-level learning outcomes to IUPUI Profiles. For easier readability, the individual components (in order) of each of the four Profiles categories are: COMMUNICATOR (Evaluates Information; Listens Actively; Builds Relationships; Conveys Ideas Effectively) – PROBLEM SOLVER (Thinks Critically; Collaborates; Analyzes/Synthesizes/Evaluates; Perseveres) – INNOVATOR (Investigates; Creates/Designs; Confronts Challenges; Makes Decisions) – COMMUNITY CONTRIBUTOR (Builds Community; Respectfully Engages Own and Other Cultures; Behaves Ethically; Anticipates Consequences).

School Assessment Milestones

ABET-accredited engineering and computing programs have been heavily involved in data collection, preliminary analysis, and self-study writing in advance of their next accreditation visit in Fall 2022. The programs to be evaluated include:

- Biomedical Engineering
- Computer Engineering
- Electrical Engineering
- Energy Engineering
- Mechanical Engineering
- Motorsports Engineering
- Computer and Information Technology
- Computer Graphics Technology

Next year's PRAC Annual Report will highlight the assessment findings and program improvements reported in the comprehensive self study for each of these programs.

The department of Music and Arts Technology, home to the Music Technology and Music Therapy programs, is on-track for their next accreditation visit by the National Association of Schools of Music (NASM) in Spring 2023. (This visit was originally anticipated for this spring, but was delayed at the request of NASM due to pandemic-related logistical challenges.)

As reported last year, undergraduate programs in E&T have mapped the IUPUI Profiles of Learning for Undergraduate Success to their capstone courses, and have also identified and mapped the Profiles to a cornerstone course (key sophomore- or junior-level course). Several programs participated in a pilot project overseen by the Institute for Engaged Learning to assess the Profiles in a sample of these capstone courses. Highlights of those results are summarized below.

2020-2021 Report Overview

As many programs in E&T focus on preparing for re-accreditation and continue to collect and analyze data that will be reported next year, this year's report will highlight two initiatives relevant to campus-level goals and assessment:

- Highlights from the pilot project to assess the Profiles in Capstone courses
- Efforts to incorporate courses and experiences into the Experiential and Applied Learning Record

For more program-specific descriptions of assessment processes, results, and assessment-driven improvements, the table below outlines reporting for the school over the last several years. Previous years' reports are available at https://planning.iupui.edu/assessment/prac-files/school-reports/prac-school-reports.html.

Programs		2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2019-20
BME		x	x	x	x	x	x	
EE/CE			x			x		
ME/EEN			x	x				
MSTE			x					
CIT			x	x				
CGT			x	x				
INTR		x	x			x		
TCM		x			x			
OLS		x			x			
ECET		x	x			x		x
MET		x	x					x
HETM		x	x			x		x
CEMT		x	x				x	
MAT					x			
NSAAC				x				

Assessing the Profiles in E&T Capstone Courses: Highlights

Seven programs in the School of Engineering and Technology participated in this capstone assessment pilot. Three of these programs are the Engineering Technology programs highlighted in last year's Annual Report, and a fourth (Motorsports Engineering) presented their results primarily in the context of ABET outcomes rather than the Profiles, although they did include a table broadly mapping program-level outcomes to the Profiles. Here, we highlight assessment findings from the remaining three programs: Biomedical Engineering, Interior Design Technology, and Construction Management.

Biomedical Engineering

The Biomedical Engineering program employs a 2-semester capstone experience (BME 49100 and 49200) in which student teams design, test, and refine a product or process to meet the needs of their project sponsor. Individual projects are sponsored by faculty from BME or other IU departments (most commonly in the School of Medicine, School of Dentistry, or other areas with a clinical focus) as well as industry partners. The BME program assesses student attainment of both ABET outcomes and the IUPUI Profiles using the following key deliverables:

- Final written report documenting progression of the biomedical engineering design process from user need identification to verification and validation
- Oral presentations at the end of each semester
- A team assessment completed by individual team members to evaluate their own and others' contributions as well as team strengths and areas for improvement
- Project prototypes, assessed for functionality and use of iterative design
- Final poster succinctly documenting the project and results
- Final exams covering aspects of the design process, knowledge of FDA regulation fundamentals covering medical devices, and student understanding of their own projects

<u>BME assessment results relative to the Profiles</u>

- Biomedical engineering student teams successfully communicate complex biomedical engineering problems to a variety of audiences. **(Communication and Community Contributor)**

Since moving to oral slide presentations from a previous poster-based final presentation, all teams have consistently met the department's target performance levels. Written reports also continue to meet performance targets, and show incremental improvmenent in the specific and meaningful use of modeling tools for analysis (e.g. finite element modeling to inform design decisions).

While the program does see evidence of teams documenting global, economic, environmental, and societal impacts of their proposed solution, there is room for improvement for teams to be more intentional if there is no effect (e.g., the engineering solution does not have an apparent environmental impact).

ABET / EAC Criteria #3 2019-2020 Evaluation Criteria Outcomes and Metrics for Capstone	**IUPUI PROFILES OF LEARNING FOR UNDERGRADUATE SUCCESS**			
	COMMUNICATOR	**PROBLEM SOLVER**	**INNOVATOR**	**COMMUNITY CONTRIBUTOR**
(1) Teams will deliver a working prototype of a design that meets product specifications.	Final Report	Final Report	Prototype (75% of teams deliver working prototype)	
(2) Each team will deliver a product specification, design documentation, test plan and test results, with a focus on meeting relevant FDA or other regulatory standards	Team Progress Reports; Final Report	Final Report (80% of teams will score >60% on standards)	Prototype	Final Report
(3) Teams will present their design problem and solution in a variety of ways (poster, oral presentation, written report)	Final Report; Presentations; Poster			
(4) Teams will perform a background assessment to evaluate the relevance of their design project, its application, and need for the project as part of their concept description (4) Design/Student teams will identify in their product specifications key relevant needs and requirements including: cost, safety, biocompatibility, environmental impact, and user or societal benefit.	Fall Final Exam (Individual assessment; 80% of students can identify specs in their own projects)	Spring Final Exam; Interim & Final Reports (80% of teams will score 70% on Interim Report; 75% of teams will identify key requirements)		
(5) Students will complete a major 2-semester design project as part of a 4-5 member team.		Team Contracts; Team Progress Reports		Team Assessment (90% of students score 2.5/3.0 on team rubric)
(6) Design teams will develop, implement, and evaluate the success of a Verification and Validation plan. (6) Students will use appropriate development and analysis tools for each project;		Final Report (80% of teams score 60% on V&V)	Final Report; Prototype (75% of teams deliver working prototype)	
(7) Students will use appropriate development and analysis tools for each project.	Final Report (75% of teams identify and use appropriate analysis tools)			

- Individually and as part of a team, biomedical engineering students problem solve to provide solutions to complex biomedical engineering problems. **(Problem Solver)**

BME students think critically as they design and iterate working prototypes. The department continues to monitor the percentage of successful prototypes as a metric of success (2020-21 was at 80%). Working on a team to solve a complex problem involves collaboration, is evidenced by individually via team citizenship assessments and team check documentation, and as a team by delivering quantitative verification tests to determine if user needs have been satisfied. Posters report trace matrix-level detail and if user needs have been met. From a teaming perspective, not all team members achieve our internal teaming metric (average score of 2.5/3.0). However, teams are continually challenged to resolve conflicts and take criticism to keep projects moving. All teams in 2020-21 were able to provide verification tests and data.

- Biomedical engineering teams pose solutions through an iterative, data-driven design process. **(Innovator)**

Before any solution can be proposed, student teams clearly investigate the clinical problem and user need. Each year, our teams show they can research, describe, and explain why a clinical need exists and pose

how to solve the identified need. Combining creativity, design, and fundamental BME knowledge, teams synthesize information to provide a prototype (In 2020-21, 80% of teams had a working prototype). The final report details the design history of the prototype and documents where challenges are confronted, and decisions made based on engineering constraints.

BME Improvements made based on assessment findings

The BME Profiles assessment report cited several examples of improvements based on assessment findings in the Capstone:

- The move from poster presentations to oral slide presentations as the culminating presentation for the two-semester course was initially prompted by COVID concerns in Spring 2020, as slide-based presentations could more easily be presented via Zoom. However, it was found that the change in format also improved the presentations themselves, most likely because the slide format forces teams to more carefully consider the order and logical flow of the information they plan to present. Thus, even though we have returned to in-person final presentations as of Spring 2021, the slide-based format is being retained.
- Final capstone presentations are attended by the BME faculty, who score and provide feedback about the projects and presentations. A recurring theme of this feedback was a concern that students were not taking sufficient advantage of analytical modeling tools in the pre-prototype phase of the design process. As a result of this feedback, the sophomore and junior-level lab courses were re-vamped to include team-based design experiences to help students build confidence and familiarity with the BME design process and exposure to analytical tools and methods that support the process. As a result, the program has seen an increase in the number of BME capstone teams that implement modeling analysis as part of their design process, resulting in better final designs.
- Assessment findings from lab reports and other individual written assignments in the BME curriculum indicated that while some students were skilled with scientific and technical writing and presentation, others struggled with expressing technical ideas clearly and concisely. In response, an existing 2-credit hour Technical Communication (TCM) course focused on general topics relevant to writing in the engineering workplace was split into two 1-credit hour TCM courses, each paired with an existing laboratory course with a significant report writing and/or presentation component. The goal of this change was twofold: it is hoped the integration will help students be more intentional in following good writing and presentation practices in their technical classes, rather than thinking of those practices as something that only matters in their communication classes; and, by tying the two required TCM classes to a sophomore and a junior-level laboratory, it solves the common problem of students putting off their TCM requirement until the final semester of their program, thus being unable to apply any lessons learned in their core BME courses.

Interior Design Technology

The Interior Design Technology (INTR) has identified the following Course Learning Outcomes for the INTR 42800 capstone course:

Course Learning Outcomes (CLOs)

C1. Increase knowledge and application of the design process
C2. Enhance knowledge of program development and analysis, construction documents, schedules, details, graphic representation using scale, and oral/visual presentations
C3. Increase the ability to think a project through to logical proposals and solutions
C4. Enhance knowledge of applying historical precedent to a design

C5. Increase experience with the integration of codes as they pertain to state, federal, and ADA regulations
C6. Further knowledge of commercial products and finishes
C7. Increase awareness and solutions sensitive to sustainable design issues
C8. Increase awareness and solutions sensitive to community development issues
C9. Improve communication skills via sketches, notations, and presentations
C10. Increase experience with project planning, management, research, and administration

These support the following Program-level Learning Outcomes (PLOs) defined by their accreditor:
- Demonstrate technical knowledge and application of the design process
- Solve problems that are quantitative in nature
- Practice effective communication skills in oral, written, and visual presentations
- Work collaboratively and effectively in technology and design related industries
- Understand the environmental, ethical, diversity, cultural, and contemporary aspects of their work
- Be responsible citizens

For program assessment purposes, each PLO is mapped to one or more CLO as well as to a primary associated Profile:

Program-level Learning Outcomes	**Level of Knowledge***	**Course Learning Outcomes**	**Profiles of Learning for Undergraduate Success**	**Assessment**
Demonstrate technical knowledge and application of the design process	R	C1, C2	P2.3. Problem Solver: Analyzes, synthesizes, and evaluates	Final Project Drawings
Solve problems that are quantitative in nature	M	C3	P2.1. Problem Solver: Think critically	Final Project Drawings
Practice effective communication skills in oral, written, and visual presentations	M	C9	P1.4. Communicator: Conveys ideas effectively	Meeting Minutes; Oral Presentations
Work collaboratively and effectively in technology and design related industries	R	C5, C6	P3.2. Innovator: Creates/designs	Peer Review Exercise; Group Design Proposal Documents
Understand the environmental, ethical, diversity, cultural, and contemporary aspects of their work	I	C4, C7, C8	P4.2. Respectfully Engages Own and Other Cultures	Final Project Drawings; Client Critique
Be responsible citizens	R	C8, C10	P4.3. Behaves Ethically	Proposal Documents; Final Project Drawings

*Indicators of level of knowledge: I – Introduce; R – Reinforce; M – Master

INTR assessment results relative to the Profiles

The INTR report summarized assessment findings relative to the Profiles in the following table:

Assessment Findings:

Program-level Learning Outcomes	**Profiles of Learning for Undergraduate Success**	**Assessment Findings**
Demonstrate technical knowledge and application of the design process	P2.3. Problem Solver: Analyzes, synthesizes, and evaluates	**Final Project Drawings**: Students exhibit a wide range of technical abilities; application of design process is strong in all projects
Solve problems that are quantitative in nature	P2.1. Problem Solver: Think critically	**Final Project Drawings**: Most student solutions are creative and consider the program carefully; Downfall is in attention to detail
Practice effective communication skills in oral, written, and visual presentations	P1.4. Communicator: Conveys ideas effectively	**Meeting Minutes**: Some students have strong written communication skills while others struggle to capture the essence of project meetings in detail
Work collaboratively and effectively in technology and design related industries	P3.2. Innovator: Creates/designs	**Peer Review Exercise**: Students work together well to accomplish a common goal; all students contribute where their skills are most useful
Understand the environmental, ethical, diversity, cultural, and contemporary aspects of their work	P4.2. Respectfully Engages Own and Other Cultures	**Final Project Drawings**: Student work depicts research and evidence-based application of contemporary design issues
Be responsible citizens	P4.3. Behaves Ethically	**Proposal Documents:** When working with real clients, students exhibit professionalism and design with the end user in mind; Projects display characteristics of sustainability and are budget conscious

INTR Improvements made based on assessment findings

The most obvious targets for improvement in these findings are the range of abilities demonstrated in technical knowledge (**Problem Solver: Analyzes, synthesizes, and evaluates**) and written communication skills (**Communicator: Conveys ideas effectively**) across the class, as well as careful attention to detail (**Problem Solver: Think critically**). The report notes that one of the uses of these assessment findings is feedback at the individual student level at multiple times during the semester to allow students to understand and improve their own learning. The report also notes that the results will be used to guide future improvements to learning experiences in the curriculum prior to capstone, especially related to software, technical skills, and content knowledge that will better prepare students to apply those skills and tools to problem-solving in the capstone project.

Construction Management

The American Council for Construction Education (ACCE), the accrediting body for Constructon Management (CMGT), defines twenty (20) Student Learning Outcomes (SLO). The following Outcomes are applicable to the CMGT 44000 capstone:

Item #	Description	Type
1	Create written communications appropriate to the construction discipline.	(supporting course)
2	Create oral presentations appropriate to the construction discipline.	(assessed & evaluated)
3	Create a construction project safety plan.	(supporting course)
4	Create construction project cost estimates.	(supporting course)
5	Create construction project schedules.	(supporting course)
7	Analyze construction documents for planning and management of construction processes.	(supporting course)
9	Apply construction management skills as a member of a multi-disciplinary team.	(assessed & evaluated)
10	Apply electronic-based technology to manage the construction process.	(supporting course)
12	Understand different methods of project delivery and the roles and responsibilities of all constituencies involved in the design and construction process.	(supporting course)
13	Understand construction risk management.	(assessed & evaluated)
15	Understand construction quality assurance and control.	(supporting course)

For program assessment purposes, these SLOs are mapped to Course Learning Outcomes, relevant Profiles, and specific assignments that target these outcomes, as shown in the following table:

SLO	CLO	PROFILES	ASSIGNMENTS USED FOR ASSESSMENT	MEASUREMENT
#1, #2	**4**. Create a written document (**Project Binder**) (**SLO #1**) and a formal **verbal presentation** (**SLO #2**) that will be presented to faculty and the CMGT IAB	**Communicator –** Evaluates Information, Conveys Ideas **Problem Solver –** Thinks Critically, Collaborates, Perseveres **Innovator –** Creates/Designs, Confronts Challenges, Makes Decisions **Community Contributor –** Behaves Ethically	**Assignment #22 –** Assemble Binders **Assignment #8** – Compose **Presentation Outline**	**Binders** are graded based on compliance with the checklist. **Verbal Presentations** are graded based on outlines and Score Sheets completed by IAB, Faculty & Staff.
#3	**3**. Create a project estimate, project schedule, and **safety plan** directly related to the capstone project.	**Communicator** – Evaluates Information, Conveys Ideas **Problem Solver** – Thinks Critically, Collaborates, Perseveres	**Assignment #20 –** Develop **Job Site Safety Plan**	**Safety Plans** are reviewed for completeness and specific application to the capstone project. Points are awarded when **Safety Plans** are included in **Verbal**

		Innovator – Creates/Designs, Confronts Challenges, Makes Decisions **Community Contributor –** Anticipates Consequences, Behaves Ethically		**Presentation** & **Binder.**
#4	**3**. Create a **project estimate**, project schedule, and safety plan directly related to the capstone project.	**Communicator –** Evaluates Information, Conveys Ideas, Builds Relationships **Problem Solver –** Thinks Critically, Collaborates, Analyzes, Synthesizes, Evaluates, Perseveres **Innovator –** Creates/Designs, Confronts Challenges, Makes Decisions **Community Contributor** – Behaves Ethically, Anticipates Consequences	**Assignment #4 – Estimate Quantities & Costs**	Points are awarded when each student completes his/her portion of the total **Unit Cost Estimate**, and the completed **Estimate** is included in the **Binder & Verbal Presentation**.
#5	**3**. Create a project estimate, **project schedule**, and safety plan directly related to the capstone project**.**	**Communicator –** Evaluates Information, Conveys Ideas, Builds Relationships **Problem Solver –** Thinks Critically, Collaborates, Analyzes, Synthesizes, Evaluates, Perseveres **Innovator –** Creates/Designs, Confronts Challenges, Makes Decisions **Community Contributor** – Behaves Ethically, Anticipates Consequences	**Assignment #7 – Task Sequencing** **Assignment #10 –** MS Project **Schedule Durations** **Assignment #13 – MS Project Timeline**	The **Task Sequencing** assignment requires each student to review a list of construction materials/items, and place them in logical/sequential order. The **sequence** should simulate the sequence of constructing an actual building. Points are awarded based on the completion of the assignment. Each student is required to **estimate** labor hour durations & submit data to the Scheduler. Points are awarded for the completed **Schedule** and its inclusion in the **Binde**r & **Verbal Presentation**.

#7	**2**. Analyze construction documents (**contract**, **specifications**, and **drawings**) for planning and managing the capstone project.	**Communicator –** Evaluates Information **Problem Solver –** Thinks Critically, Analyzes, Synthesizes, Evaluates, Perseveres **Innovator –** Investigates, Makes Decisions	**Week #4 –** Distribution of **Construction Drawings** **Week #7 –** Several volumes of RS Means Cost Data are made available for determining **estimated** material, labor & equipment costs.	Each student receives a set of **Construction Drawings** to use while completing the **Estimating** & **Scheduling** assignments. Points are awarded when **Construction Drawings** are returned undamaged.
#9	**7**. Apply the various **roles** and **responsibilities** of a **multi-disciplinary project team** to the capstone project.	**Communicator –** Conveys Ideas, Builds Relationships, Listens Actively **Problem Solver –** Analyzes, Synthesizes, Evaluates **Community Contributor** – Builds Community, Engages Other Cultures, Behaves Ethically, Anticipates Consequences	**Assignment –** Applying Construction Management Skills as a member of a **Multi-Disciplinary Team**	The objective of this assignment is for each student to assume the **role** of a non-construction related team member, such as the **owner, architect, engineer,subcontractor** or **supplier**, and ask other group members questions, from the perspective of the **role** of the person that each will assume. Points are awarded based on the quality & context of the student's responses.
#10	**10.** Apply various **construction industry software** (Stack, Excel, MS Project, Note Vault, PowerPoint, etc.) in the overall management process for the capstone project.	**Communicator** – Evaluates Information, Conveys Ideas **Problem Solver** – Thinks Critically, Analyzes, Synthesizes, Evaluates **Community Contributor –** Behaves Ethically	**All Assignments**	All students are required to perform all assignments using **computers** & the appropriate **business** & **construction software**.
#12	**5**. Understand the different **types of construction companies** and construction project **delivery methods**, and **contracts**.	**Communicator –** Evaluates Information **Problem Solver –** Analyzes, Synthesizes, Evaluates **Innovator –** Investigates	**Week #2 – Proposal Scenario** **Week #3 – Team Formation**	Students are randomly selected and assigned to a team of (5) students. Each team represents a **General Contractor (GC), Construction Manager (CM),** or **Construction Manager at Risk (CMaR).** Each team is

				required to prepare a **Proposal** to build the Capstone Project.
#13	**8**. Identify the various **risks** associated with the construction process and how they can be controlled and/or minimized through **risk assessment**, **allocation of resources**, insurance/bonds, and **safety management**.	**Communicator –** Evaluates Information, **Problem Solver –** Thinks Critically, Analyzes, Synthesizes, Evaluates **Innovator –** Investigates	**Assignment #9 – Risk Assessment** **Assignment – Resource Allocation** **Safety Plan**	This assignment requires each student to review a list of (29) typical **risks,** and assign each risk to the primary responsible party (Owner, Architect, Engineer, General Contractor, Subcontractor or Supplier). Points are awarded according to student responses. Each team is required to develop a **Resource Allocation Chart**, and points are awarded when it is included in the **Binder** & the **Verbal Presentation.** **Safety Management** is included in the **Safety Plan,** which is described in **SLO #3 above.**
#15	**9**. Understand how quality assurance and quality control are incorporated into the management process of the capstone project.	**Communicator –** Evaluates Information **Problem Solver –** Analyzes, Synthesizes, Evaluates **Innovator –** Investigates **Community Contributor** – Respectfully Engages Own & Other Cultures	**All Assignments** **Assignment #15 – Diversity & Inclusion Plan**	All assignments are introduced to the students as tools required to ensure quality assurance and quality control in order to properly manage a construction project. Each team is required to develop a **Diversity & Inclusion Plan**. Points are awarded based on the inclusion of the plan in the **Binder** & **Verbal Presentation.** Each team is required to develop a **Waste Management Plan**.

			Assignment #21 – Waste Management Plan	Points are awarded based on the inclusion of the Plan in the **Binder** & **Verbal Presentation**.

CMGT assessment results relative to the Profiles

The capstone assessment report summarized strengths and weaknesses observed in the assessment of each major capstone assignment, and possible future actions to address observed weaknesses. Among the more notable findings:

- The majority of senior students appear to be comfortable evaluating information and conveying their ideas (**Communicator**). However, the evaluator observed that there are always a few students who do not like public speaking and continue to feel uncomfortable about it even after completing the required speech and writing classes. It was observed that many of those same students do not communicate very well with other students, which impacted team dynamics in a negative way (**Community Contributor**).
- The complex, integrative, team project-based nature of the Quantities and Cost Estimation assignment develops students' skills as **Problem Solvers** and **Investigators**. Most students are able to start the assignment as instructed, but a few initially struggle with geometry or unit conversions (e.g. cubic feet to cubic yards). These foundational topics are supposed to be covered in prerequisite courses on estimating; upon investigation, it was found that students who struggled had generally failed to complete relevant assignments in the earlier classes. It was also noted that students who were reluctant to ask questions tended to lose valuable time trying to figure things out on their own.
- The assignments in the capstone experience closely mimic the real-world tasks (e.g. quantity estimation, task sequencing and scheduling) necessary in construction project management. Students with more real-world experience prior to capstone, either through internship experiences while a student or prior jobs in the construction industry, are therefore more familiar with these tasks and thus better prepared to meet expectations.

CMGT Improvements proposed based on assessment findings

The following possible actions were proposed to address the concerns noted above:

- Students who struggle with communication and collaboration may benefit from more detailed assignment instructions with clearer expectations laid out. It was noted that this could especially benefit international students who struggle with both interpretation and expression in English.
- Student engagement and performance on complex assignments will be carefully monitored to make sure students are making progress and getting the help they need even if they are reluctant to ask questions.
- Providing a sample assignment to give an idea of what the final product of the assignment might look like will help students with less prior industry experience meet expectations.

Future Work

The Computer and Information Technology and Computer Graphics Technology programs are revamping their program assessment processes; as part of this process they will establish Profiles mappings to their capstone experiences so that the Profiles can be assessed along with the program-level Student Learning

Outcomes. The School of Engineering and Technology will continue participating in pilots of Profiles assessment.

Applying Courses and Experiential Learning to the Record

Jerry Daday joined the E&T Undergraduate Education Committee at their September 2021 meeting to discuss the Experiential and Applied Learning Record and to encourage programs to identify existing courses or experiences that could be included. Since that visit, three programs have reported preliminary progress on adding experiences to the Record:

- The Mechanical Engineering program is discussing adding their capstone experience to the Record. The challenge they have run into is that experiences on the Record are tied to a particular faculty member rather than to the course number, and the course is currently taught by an adjunct faculty member. The Course Coordinator would be the next logical option for a faculty contact, but in this case the coordinator is the department chair, which could create logistical issues for timely review of this large class (90 students enrolled this semester) at the already-busy end of the semester. Discussion is ongoing about how best to manage the review process; while that remains unresolved, the course has not yet been added to the Record.
- The Organizational Leadership program is considering adding the Go Green Study Abroad Experience and the senior OL experiential courses (OLS 49000 Senior Research Project, OLS 49100 Internship Experience) to the Record. Information about the Record has been shared with the course coordinators of these experiences. However, as in the case of Mechanical Engineering, these course coordinators may face logistical challenges in sustaining the work: one already has significant administrative duties at the school level, and the other is moving toward retirement.
- The Music and Arts Technology department is exploring the option of adding the Music Therapy degree as a whole to the Record as a DEI experience, given the heavy focus on equity in the degree program. The program director of Music Therapy is working with Jerry Daday on how best to set it up on the Record.

We will continue to monitor progress on adding items to the Record and encourage programs to add appropriate courses and experiences. Given the logistical concerns raised about tying an experience to a faculty member who may not be able to sustain the necessary involvement long-term, we may need further discussion about a more sustainable process.

APPENDIX: Student Learning Outcomes for E&T Baccalaureate Programs

ABET student outcomes for Engineering programs:

Upon completing the undergraduate degree, our students will possess:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
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
3. an ability to communicate effectively with a range of audiences
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
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
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

ABET student outcomes for Engineering Technology programs:

1. an ability to apply knowledge, techniques, skills and modern tools of mathematics, science, engineering, and technology to solve broadly-defined engineering problems appropriate to the discipline;
2. an ability to design systems, components, or processes meeting specified needs for broadly-defined engineering problems appropriate to the discipline;
3. an ability to apply written, oral, and graphical communication in broadly-defined technical and non-technical environments; and an ability to identify and use appropriate technical literature;
4. an ability to conduct standard tests, measurements, and experiments and to analyze and interpret the results to improve processes; and
5. an ability to function effectively as a member as well as a leader on technical teams.

ABET student outcomes for Computing programs*:*

1. Analyze a complex computing problem and apply principles of computing and other relevant disciplines to identify solutions.
2. Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.
3. Communicate effectively in a variety of professional contexts.
4. Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.
5. Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.

ACCE outcomes for Construction Management:

1. Create written communications appropriate to the construction discipline.
2. Create oral presentations appropriate to the construction discipline.
3. Create a construction project safety plan.
4. Create construction project cost estimates.
5. Create construction project schedules.
6. Analyze professional decisions based on ethical principles.
7. Analyze construction documents for planning and management of construction processes.
8. Analyze methods, materials, and equipment used to construct projects.
9. Apply construction management skills as a member of a multi-disciplinary team.
10. Apply electronic-based technology to manage the construction process.
11. Apply basic surveying techniques for construction layout and control.
12. Understand different methods of project delivery and the roles and responsibilities of constituencies involved in the design and construction process.
13. Understand construction risk management.
14. Understand construction accounting and cost control.
15. Understand construction quality assurance and control.
16. Understand construction project control processes.
17. Understand the legal implications of contract, common, and regulatory law to manage a construction project.
18. Understand the basic principles of sustainable construction.
19. Understand the basic principles of structural behavior.
20. Understand the basic principles of mechanical, electrical and piping systems.

CIDA outcomes for Interior Design (A.S. and B.S.):

1. Retain a global view and weigh design decisions within the parameters of ecological, socio-economic and cultural contexts.
2. Create work through informed knowledge of behavioral science and human factors.
3. Apply all aspects of the design process to creative problem solving.
4. Engage in multi-disciplinary collaborations and consensus building.
5. Be effective communicators
6. Use ethical and accepted standards of practice, be committed to professional development and the industry, and understand the value of their contribution to the built environment.
7. Apply knowledge of interiors, architecture, art and the decorative arts within a historical and cultural context.
8. Apply elements and principles of tow- and three-dimensional design.
9. Apply color principles and theories.
10. Select and specify furniture, fixtures, equipment and finish materials in interior spaces.
11. Use the principles of lighting, acoustics, thermal comfort, and indoor air quality to enhance the health, safety, welfare and performance of building occupants.
12. Retain knowledge of interior construction and building systems.
13. Use laws, codes, standards, and guidelines that impact the design of interior spaces.

***AMTA competency areas for Music Therapy**:*

Graduates of the Music Therapy program will display competence in the following competency areas defined by the American Music Therapy Association:

1. Music Theory and History
2. Composition and Arranging Skills
3. Major Performance Medium Skills
4. Functional Music Skills
5. Conducting skills
6. Movement Skills
7. Therapeutic Applications
8. Therapeutic Principles
9. The Therapeutic Relationship
10. Foundations and Principles of Music Therapy
11. Client Assessment
12. Treatment Planning
13. Therapy Implementation
14. Therapy Evaluation
15. Documentation
16. Termination and Discharge Planning
17. Professional Role/Ethics
18. Interprofessional Collaboration
19. Supervision and Administration
20. Research Methods

***NASM Competencies for Music Technology programs**:*

1. **Performance**. Students must acquire:
a. Technical skills requisite for artistic self-expression in at least one major performance area at a level appropriate for the particular music concentration.
b. An overview understanding of the repertory in their major performance area and the ability to perform from a cross-section of that repertory.
c. The ability to read at sight with fluency demonstrating both general musicianship and, in the major performance area, a level of skill relevant to professional standards appropriate for the particular music concentration.
d. Knowledge and skills sufficient to work as a leader and in collaboration on matters of musical interpretation. Rehearsal and conducting skills are required as appropriate to the particular music concentration.
e. Keyboard competency.
f. Growth in artistry, technical skills, collaborative competence and knowledge of repertory through regular ensemble experiences. Ensembles should be varied both in size and nature.
Normally, performance study and ensemble experience continue throughout the baccalaureate program.
2. **Musicianship Skills and Analysis**. Students must acquire:
a. An understanding of the common elements and organizational patterns of music and their interaction, the ability to employ this understanding in aural, verbal, and visual analyses, and the ability to take aural dictation.
b. Sufficient understanding of and capability with musical forms, processes, and structures to use this knowledge and skill in compositional, performance, analytical, scholarly, and pedagogical applications according to the requisites of their specializations.
c. The ability to place music in historical, cultural, and stylistic contexts.

3. **Composition/Improvisation**. Students must acquire a rudimentary capacity to create original or derivative music. It is the prerogative of each institution to develop specific requirements regarding written, electronic, or improvisatory forms and methods. These may include but are not limited to the creation of original compositions or improvisations, variations or improvisations on existing materials, experimentation with various sound sources, the imitation of musical styles, and manipulating the common elements in non-traditional ways. Institutional requirements should help students gain a basic understanding of how to work freely and cogently with musical materials in various composition-based activities, particularly those most associated with the major field.
4. **History and Repertory**. Students must acquire basic knowledge of music history and repertories through the present time, including study and experience of musical language and achievement in addition to that of the primary culture encompassing the area of specialization.
5. **Synthesis**. While synthesis is a lifetime process, by the end of undergraduate study students must be able to work on musical problems by combining, as appropriate to the issue, their capabilities in performance; aural, verbal, and visual analysis; composition/improvisation; and history and repertory.

Results. Upon completion of any specific professional undergraduate degree program:
1. Students must demonstrate achievement of professional, entry-level competence in the major area, including significant technical mastery, capability to produce work and solve professional problems independently, and a coherent set of artistic/intellectual goals that are evident in their work.
2. Students are expected to have the ability to form and defend value judgments about music, and to communicate musical ideas, concepts, and requirements to professionals and laypersons related to the practice of the major field.

***Learning outcomes for the B.S. in Organizational Leadership**:*

Upon completion of this program, students will be able to:

1. Demonstrate and apply knowledge of
    - the process and roles of leadership.
    - leadership traits.
    - leadership behavior concepts.
    - situational approaches to leadership.
    - power and influence.
    - leading during times of uncertainty, turbulence, and change.
2. Design and conduct research, as well as analyze and interpret data in order to
    - evaluate their personal leadership effectiveness.
    - evaluate their organization's effectiveness and sustainability.
    - evaluate their organization's social and environmental impact.
3. Lead an organization, or processes and functions within it that meet or exceeds desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, and sustainability.
4. Function on multi-disciplinary teams.
5. Identify, formulate, and solve organizational problems.
6. Understand professional and ethical responsibility.
7. Communicate effectively verbally and nonverbally to all size audiences.
8. Understand the impact of leadership in a global, economic, environmental and societal context.
9. Demonstrate knowledge of contemporary organizational issues.
10. Use the techniques, skills, tools and concepts necessary for effective strategic and tactical planning.

Learning outcomes for the B.S. in Technical Communication:

Students with a B.S. in Technical Communication will be able to:

1. Understand theories and principles that inform technical communication
2. Apply best practices of usability and user-centered design
3. Understand the impact of technical communication in a global workplace context
4. Understand the need for sensitivity to differences in workplace international communication
5. Clearly communicate complex technical concepts visually, orally, and in writing
6. Effectively use technology to create communication products in a variety of environments
7. Plan and manage all aspects of technical communication projects
8. Function effectively in diverse groups
9. Effectively identify, analyze, interpret, and synthesize data
10. Understand and use different style guides appropriately
11. Ethically address challenges that arise in workplace technical communication contexts
12. Metacognitively reflect on their own communication skills and abilities
13. Recognize the need to engage in life-long learning