

Strengthening Program-level Assessment for Environmental Engineering: Undergraduate and Graduate Focus

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Introduction

Undergraduate Environmental Engineering

program

• Holds an accreditation from the Associated Board of Engineering Education (ABET)

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- Until 2023, assessment data was collected annually for all Student Learning Outcomes (SLOs)
- Assessment data was collected for both civil and environmental engineering programs without being separated by program

Graduate Environmental Engineering program

- Not accredited by ABET
- Program educational objectives and SLOs were developed decades ago and not updated

CEE Department at-a glance

19	260	60	
Full-time	Undergraduate	Graduate	
CEE Faculty	CEE Students	CEE Students	

Motivation for the Project

- Strengthen program-level assessment process, improve its effectiveness and reduce faculty workload at undergraduate and graduate level
- Undertake in-depth assessment of one SLO.

Outcomes

- Updated curriculum maps for the undergraduate and graduate Environmental Engineering Programs
- Developed scoring rubrics for four SLOs for the undergraduate program and tested two of them during AY 2024-25
- Developed consistent Performance Indicators for undergraduate and graduate SLOs
- Revised SLOs for the graduate Environmental Engineering Program

ENGAGING FACULTY AND STUDENTS IN THE PROCESS

- Developed transparent process and facilitated discussions at program and department level
- o Used curriculum mapping to plan assessment strategies and enhance evaluation
- Helped faculty understand the assessment practice at program level and move away from using grades (a lot more work to do!)
- Motivated students to contribute to the assessment without being tied to grades
- Applied flipped curriculum map with senior environmental engineering students

PERFORMANCE INDICATORS	Mastery	Satisfactory (minor improvement needed)	Developing (substantial improvement needed)	Beginning (major improvement needed)
PI.6.1: An understanding of how appropriate tools and instruments can be used to achieve experimental goals	Accurately and fully describes how appropriate tools can achieve the experimental goals	Describes how appropriate tools can achieve the experimental goals, with minor errors or omissions	Describes how tools can achieve the experimental goals, with substantial errors or omissions	Has difficulty describing how appropriate tools can achieve the experimental goals, or does so with major conceptual errors
PI.5.2: Ability to develop focused, experimental question objective/hypothesis	Creates a focused experimental question/objective that effectively addresses the problem	identifies a well- defined question/objective but it does not completely address the problem	Identifies a poorly defined question/objective that is too general and wide-ranging or too narrow	Has difficulty developing a focused experimental question/objective that addresses the problem
P1.6.3: Collection of quartitative and/or qualitative evidence following an experimental procedure	Implements a comprehensive process to collect reasonable and replicable results	Implements a process to collect results, with some limitations in accuracy	Implements a preliminary process to collect results, with significant limitations in accuracy	Has difficulty collecting appropriate information
PI.6.4: Ability to analyze and interpret expectmental data with an understanding of limitations and uncertainties	Correctly completes necessary calculations or other data analysis procedures and interprets results appropriately	Completes necessary calculations or other data analysis procedures and interprets results with minor errors	Completes necessary calculations or other data analysis procedures and interprets results with substantial errors	Has difficulty completing necessary calculations or other data analysis procedures, or does not interpret results
P1.6.5: Determination of appropriate conclusions, implications, and recommendations based on data analysis and engineering judgment	Generates well- supported and transparent conclusions, compeling implications, and insightful	Generates adequate or incomplete conclusions and identifies minimal implications and recommendations	Generates surface- level conclusions lacking transparency, and identifies no implications or recommendations	Has difficulty generating wel- supported and transparent conclusions, implications, or recommendations

INSIGHTS INTO STUDENT PERFORMANCE THROUGH DEMOGRAPHIC ANALYSIS



Student performance is influenced by gender, ethnicity, nationality, and first-generation college status.

Female students, international students, and those who identify as white, Asian and non-Hispanic tend to achieve higher performance.

Figure 1. Student performance across courses. (A) first-generation college students (PAC= parents attended college; PNAC= parents did not attend college); and (B) by gender

RETHINKING GRADUATE ASSESSMENT

- Developed shared understanding of best practices
- Updated the curriculum map and leveraged it to plan assessment and allocate workload
- Led faculty in revising SLOs to reflect current needs and highlight program strengths

 Engaged faculty in collaborative SLOs and rubric development to distribute the workload and ensure everyone's perspectives and experiences are included

