UNIT REPORT

Civil and Environmental Engineering BS - Final Annual Report

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Program Goal 1 and Student Learning Outcomes

Progress: Completed

Define Goal:

These program goals were defined in terms of the professional and career accomplishments of program graduates at different points in time following their graduation from the CEE program at TTU.

Specific sets of program goals were established for 1-2 years and 5 years, along with one set of program goals that applies to all stages of the student's careers, as summarized as follows:

Program Goal 1: Within the first one to two years following graduation, CEE graduates should be:

- employed by an organization that serves the profession or enrolled in postgraduate studies; and
- participating in engineering practice or in a profession that utilizes their academic foundation.

Intended Outcomes / Objectives:

Upon graduation, CEE students are expected to know and to able to:
(a) an ability to apply knowledge of mathematics, science, and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(d) an ability to function on multidisciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Program Goal 2 and Student Learning Outcomes

Progress: Completed

Define Goal:

These program goals were defined in terms of the professional and career accomplishments of program graduates at different points in time following their graduation from the CEE program at TTU.

Specific sets of program goals were established for 1-2 years and 5 years, along with one set of program goals that applies to all stages of the student's careers, as summarized as follows:

Program Goal 2: About five years beyond graduation, CEE graduates should be

- participating effectively in design processes and developing civil engineering solutions within a team setting; and
- engaged in management and leadership roles for civil engineering projects and to assume positions of greater responsibility to the profession and public.

Intended Outcomes / Objectives:

Upon graduation, CEE students are expected to know and to able to:
(a) an ability to apply knowledge of mathematics, science, and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(d) an ability to function on multidisciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Program Goal 3 and Student Learning Outcomes

Progress: Completed

Define Goal:

These program goals were defined in terms of the professional and career accomplishments of program graduates at different points in time following their graduation from the CEE program at TTU.

Specific sets of program goals were established for 1-2 years and 5 years, along with one set of program goals that applies to all stages of the student's careers, as summarized as follows:

Program Goal 3: At all stages, CEE graduates should

- exhibit their potential for a sustained productive career through life-long learning, and
- continue the professional registration process.

Intended Outcomes / Objectives:

Upon graduation, CEE students are expected to know and to able to:
(a) an ability to apply knowledge of mathematics, science, and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(d) an ability to function on multidisciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively

(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Assessment Tool 1: FE Exam

Goal/ Outcome/ Objective: All

Type of Tool: Certification Exam

Frequency of Assessment: Each semester

Rationale:

The CEE department's goal is for our students' pass rate to be at or above the national pass rate and that within each category of questions that our student's percentage correct to be greater than the national percentage correct. We recognize, however, that since we require all students to take the exam while other programs may encourage only their better students to take the exam our scores may suffer in comparison.
Based on this goal, the metrics used to evaluate our program's success are
• The ratio of our students' pass rate to the national pass rate for the exam
• The ratio of students' percentage correct in a category or questions to the national percentage correct in that category.
Our level of attainment categories for FE Exam scores are defined in Table 4-2:
Table 4-2. Level of Attainment Categories for FE Exam Scores
Excellent Ratio of TTU CEE / National ≥ 1.00
Good 1.00 > Ratio of TTU CEE / National ≥ 0.90
Satisfactory 0.90 > Ratio of TTU CEE / National ≥ 0.80
Low 0.80 > Ratio of TTU CEE / National ≥ 0.70
Unsatisfactory Ratio of TTU CEE / National < 0.70
These categories identify our goal of surpassing the national averages by setting the bar for Excellent at a ratio of 1.00. It also identifies our understanding that requiring all of our students to take the test could put us at a disadvantage by setting the bar for Satisfactory at 0.80. If our success rate is not at least 80% of the national success rate, especially if it happens more than once, we feel that changes to our program might be needed.

Assessment Tool 2: Senior Exit Interviews and Surveys

Goal/ Outcome/ Objective: All

Type of Tool: Focus Group
Survey

Frequency of Assessment: Each semester

Rationale:

The Senior Exit Survey is given to all graduating seniors during the last few weeks before graduation. It allows each student graduating from the BSCE program to provide feedback regarding ABET Student Outcomes, the BSCE program, the CEE department, and the student's activities while at TTU. The Senior Exit Survey uses the same 1-4 Agree/Disagree scale discussed in the previous section. Most of the questions on this survey are objective-centric questions, so they are typically analyzed and presented individually.
As with the Instructional Outcome surveys, the CEE department's goal for instructional outcome student surveys is for all students to at least Agree with the survey statement or combination of statements. The same types of issues exist for Senior Exit Surveys as for Instructional Outcome surveys.
Based on this goal, the metric used to evaluate our program's success is
• Average score on individual questions
Our level of attainment categories are defined in Table 4-9:
Table 4-9. Level of Attainment Categories for Senior Exit Surveys

Excellent Average Rating ≥ 3.00
Good 3.00 > Average Rating ≥ 2.75
Satisfactory 2.75 > Average Rating ≥ 2.50
Low 2.50 > Average Rating ≥ 2.00
Unsatisfactory Average Rating < 2.00

Assessment Tool 5: Course Surveys

Goal/ Outcome/ Objective: All

Type of Tool: Survey

Frequency of Assessment: Each semester

Rationale:

Before identifying goals related to this Instructional Outcome Student Surveys, some background information is warranted. As was noted above, Instructional Outcome Surveys are administered to students in every undergraduate course. These surveys provide different types of data for use in different contexts. For example, in the context of continuous improvement of a particular course, poor performance on a particular question can indicate the need for the faculty to revise how a particular topic is covered. In the context of evaluating performance in a particular outcome, two data analysis methods are used depending on the type of questions asked and the outcome being evaluated.

Some survey questions are outcome-centric, allowing the use of average question results in evaluating a particular outcome. An example of an outcome-centric question is given below:

• The content of this course improved or confirmed my ability to use techniques, skills, and modern engineering tools necessary for engineering practice.

Results from this question could be used to evaluate outcome k) which addresses student use of techniques, skills, and tools.

Other survey questions are content-centric, not only making them applicable to certain outcomes, but also making it reasonable for the results from multiple questions to be combined when evaluating a particular outcome. Examples of content-centric questions are given below:

• I can determine the length of vertical curves to satisfy sight distance requirements, drainage requirements, comfort requirements and aesthetic requirements.

• I can determine the length of vertical curve required to connect two grades on an airport runway.

• I can obtain estimates of the following characteristics of traffic streams: flow, time-mean speed, space mean speed, headway, delay.

In this particular case, results from the first two questions could be combined to help evaluate outcome c) which addresses student ability to design, but the third question is unrelated to design so it would not be appropriate to combine the results of the third question with the first two.

Students are presented with the same options regardless of question type, namely 1 = Strongly Disagree, 2 = Disagree, 3 = Agree, and 4 = Strongly Agree. Some older surveys also have a “not applicable” choice, but our ongoing revision process is working to remove this as it occasionally led to errors in calculation of question statistics. To the best of our knowledge, all such calculation issues have been corrected for this document.

Given this background, the CEE department’s goal for instructional outcome student surveys is for all students to at least Agree with the survey statement or combination of statements. There are several issues related to such survey questions. Among these, students do not always remember work from early in the semester when they take the survey at the end. Also, students may use such surveys as retaliation for poor grades instead of honestly evaluating the course. These and other issues can prevent attainment of the goal.

Based on this goal, the metrics used to evaluate our program’s success are

• Average class responses on individual questions

• Average class responses across multiple related questions

Our level of attainment categories are defined in Table 4-7:

Table 4-7. Level of Attainment Categories for Instructional Outcome Student Surveys

Excellent Average Rating ≥ 3.00
Good 3.00 > Average Rating ≥ 2.75

Satisfactory 2.75 > Average Rating ≥ 2.50
Low 2.50 > Average Rating ≥ 2.00
Unsatisfactory Average Rating < 2.00

Assessment Tool 6: Average Course Grades

Type of Tool: Rubric

Frequency of Assessment: Each semester

Rationale:

The CEE department's goal for student course grades is for all students to gain enough knowledge and skill to earn a B or better in all courses. We recognize, however, that increasing demands on students such as the requirement to work while in school and the increase of non-traditional students with family responsibilities in addition to school can prevent students from always being able to earn such marks.

Based on this goal, the metric used to evaluate our program's success is

• Combined average grade point average (on a 4-point scale) in a particular courses for graduating seniors

Our level of attainment categories are defined in Table 4-4:

Table 4-4. Level of Attainment Categories for Average Course Grades
Excellent Combined GPA ≥ 3.00
Good 3.00 > Combined GPA ≥ 2.75
Satisfactory 2.75 > Combined GPA ≥ 2.50
Low 2.50 > Combined GPA ≥ 2.00
Unsatisfactory Combined GPA < 2.00

These categories match our goal and demonstrate our commitment to high standards. These high standards can be seen when comparing our goal to either the university requirement of a combined minimum GPA in-major of 2.0 to be eligible for graduation or the typical pre-requisite requirement of at least a D = 1.0 (or sometimes C=2.0) to move on to the next course.

Modifications and Continuous Improvement

Program Changes and Actions due to Results:

Based on information gathered through evaluation of Student Outcome metrics, additional sources of information, faculty review and input, and Advisory Board reviews and input, the CEE department regularly makes program changes intended to improve our performance and better prepare our students.

Based on the results for Outcomes (a)-(k), only the overall FE score continued to be of concern. Faculty discussed was initiated in Fall 2015 to qualify and/or quantify the decrease in overall pass rate. Likely a combination of many factors, particularly a large increase in international student enrollment, overall FE pass rate continues to be monitored. In Fall 2017, the FE Review course (CEE 4940) was reformatted to force student review instead of relying on independent study. Results indicate an improvement in the overall FE pass rate.

In addition, beginning Fall 2018, ABET criteria were modified from (a)-(k) to (1)-(7), possibly simplified assessment. Thus far, the old criteria have been mapped to the new. The CEE ABET committee is currently reevaluating the metrics used by the department (see attachment) as many of the criteria now have too many metrics.

Link to Assessment:

Attached Files

2017-18 Metrics.xlsx

Link to Flight Plan: Improve Undergraduate Student Experience
Create Distinctive Programs and Invigorate Faculty

Improvement to Assessment Plan

Improvements to Assessment Plan:

In order to make the department's Continuous Improvement Process as effective as possible, the CEE Chair and CEE ABET Committee examines the performance of the measurement tools being used, as an integral part of its yearly review of assessment data. If changes are needed to improve existing tools, these can be made by the committee itself with input from CEE faculty. The CEE department has initiated several changes in the continuous improvement process. Schedule changes were discussed above, this section presents changes other than the schedule.

More Program-Level and Student Outcome Centered Assessment Processes

Previously, the CEE department relied heavily on course-level assessment via Student Instructional Surveys to assess the BSCE program. While the course assessments are considered important for instructors, a decision was made by the CEE Faculty in Spring/Fall 2013 to use only select course assessment data as supporting evidence for the Student Outcomes. At the same time, more direct assessment measures were added, such as student grades in specific courses and/or on course assignments. The FE Exam continues to be a significant assessment tool and changes to the exam format are not expected to change how the tool is utilized.

In conjunction with this improvement process, Instructional Surveys for CEE 2110 will be slightly modified to ask for a students' major such that only CEE student data is tabulated for assessment of Outcome 3a. This will first be utilized at the end of Fall semester 2014.

Revision of Student Course Instructional Outcome Surveys and Use of Online Surveys

In association with the above change, a new online Student Instructional Survey was piloted in Fall 2013 and Spring 2014 to ask, in addition to the course content questions, specific questions related to the Student Outcomes. The purpose of this was two-fold: to reduce calculation errors in survey results and to ask students more directly about our program-level performance.

In Spring 2013, it was discovered that average for some questions reported to faculty on the Student Instructional Surveys was incorrect. This appears to have resulted from calculation errors such as calculating a "No Response" as a zero. In some cases, this resulted in a faculty response to their Instructional Survey when in fact the average for the specific question was actually above the 3.0 threshold. Thus, the use of online surveys is intended to minimize calculation errors by allowing for automatic computational of the individual assessment data.

As with many online survey efforts, there is concern that response rates will fall. To date, no issues with response rate have been noted, but if this problem occurs then other automated methods (like auto-scored bubble forms) that avoid the need for manual calculations will be considered.

Employer Survey

Over the years, the response rate to the Employer survey has steadily dropped to the point that the number of surveys received from employers is too small to be useful or have statistical significance. This appears to be a nationwide trend, as employers grow more and more reluctant to respond to surveys of this type due to concerns over the potential for a possible legal action by an employee. The ABET Committee therefore discontinued the use of the Employer Survey in Fall 2013.