ABET Assessment & Evaluation Data
Mechanical & Aerospace Engineering
2016-2017

1. **Evaluations of Student Outcomes by Instructors of Courses**
   1.1. CS1400 is changing from C language to Python.

2. **Industrial Advisory Board**

   2.1. Stay the course with C++.

   2.2. Pursue fundraising to address high student-to-faculty ratios.

   2.3. More intently pursue Aerospace Engineering.

   2.4. Employ stronger approaches to marketing and student recruitment.

3. **Student Exit Interviews and Exiting Student Surveys**

   3.1 Large Class Sizes

4. **Fundamentals of Engineering Results 2016**

   - 91% of students passed compared to 80% nationwide. Spring 2016
   - 91% of students passed compared to 78% nationwide. Fall 2016
   - 92% of students passed compared to 78% nationwide. Spring 2017

5. **Student Assessments on Student Outcomes on IDEA Surveys**

   - Nothing below 3.0

August 17, 2017

Desired Outcomes for Engineering Students in For CS 1400

Engineering students should be proficient in the following topics after completing the fundamental programming course using the Python language with NumPy and SciPy modules included.

1. **Program Structure and Organization**: Students can organize a program in a logical flow, and know how to create and use functions which return values and those that modify the data in-place.
2. **Data Types**: Students can control data types of variables and know how the precision of variables affects calculations. Full understanding of polymorphism and classes is not necessary for engineering students.
3. **Conditional Statements**: Students can construct conditional statements in an efficient and logical flow.
4. **Loops**: Students can construct loops and nested loops.
5. **Multi-Dimensional Arrays**: Students understand how to use multi-dimensional arrays and operations for arrays as included in the NumPy and SciPy modules. Knowledge of nested Python lists (lists of lists) is useful but not sufficient.
6. **Data Input/Output**: Students can write programs that read from a variety of input formats including an **unformatted** .txt file. Students can write programs that write output to a variety of formats including a **formatted** *.txt file. Students can create plot figures using libraries such as MatPlotLib. The NumPy and SciPy packages are normally used to read and write data files, including simple text data. Students should also understand the logic to read text files as text and convert that into numerical data, since the data will not always be in a standard format.
7. **Development Environment**: Students understand how to use a variety of IDE's and programming environments for composing their program. .
8. **Libraries and Packages**: Students can use libraries and packages such as NumPy and SciPy in Python.
9. **Scripting vs. Compiled Language**: Students understand the difference between a scripted language (Python, shell, Matlab, etc.) and a compiled language (C++, Fortran, etc.) as well as the pros and cons of each. Students can create a stand-alone executable from their Python script.
10. **Debugging**: Students have skills in debugging a program with and without a debugger.
11. **Scope:** Students can control the scope of variables and data in functions and packages to enforce the principle of least-privilege, and use data structures to avoid excessive global data.

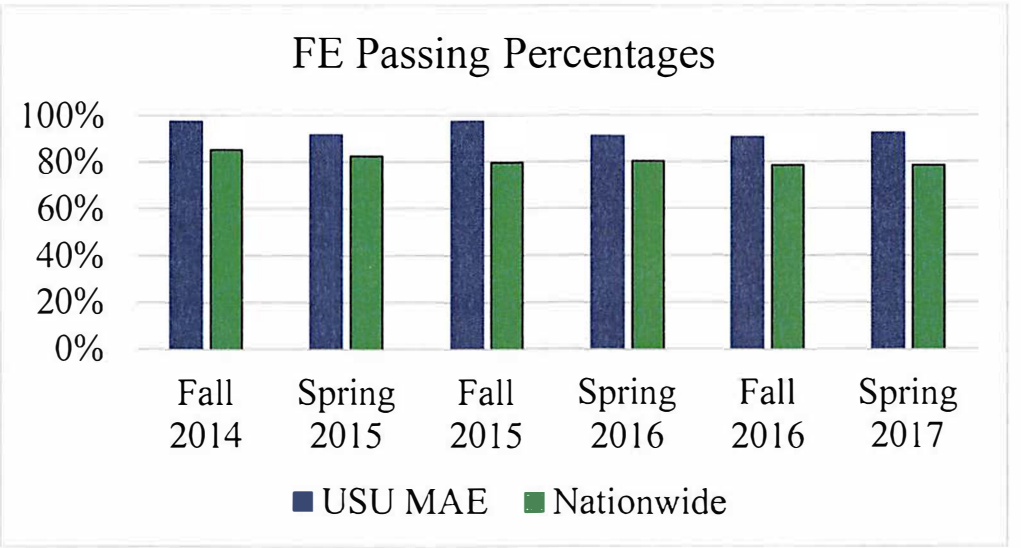


Fig. 1. FE Test Passing Percentages for MAE and Nationwide at USU 2014-2017

Table 1. FE Test Results for MAE at USU 2014-2017

	Fall 2014	Spring 2015	Fall 2015	Spring 2016	Fall 2016	Spring 2017
Mathematics	0.2	0.24	0.37	0.2	0.14	0.07
Probability and Statistics	0.44	-0.09	0.06	0.09	-0.06	0
Computational Tools	0.38	0	0.45	0.28	0.15	0.28
Ethics and Professional Practice	0.21	0.33	0.08	0.2	0.05	0.11
Engineering Economics	-0.31	-0.13	-0.32	-0.29	-0.38	-0.07
Electricity and Magnetism	0.03	-0.28	0.17	0.13	0	-0.08
Statics	0.54	0.21	0.5	0.21	0	0.16
Dynamics Kinematics and Vibrations	0.52	0.1	0.36	0.48	0.24	0.2
Mechanics of Materials	0.48	0.32	0.65	0.29	0.4	0.3
Material Properties and Processing	0.52	0	0.39	0.22	0.05	0.3
Fluid Mechanics	0.23	0.59	0	0.32	0.41	0.3
Thermodynamics	0.47	0	0.2	0.07	-0.02	0
Heat Transfer	0.41	0.27	0.57	0.05	0.33	0.32
Measurements Instrumentation and Controls	0.16	-0.1	0.12	0.03	0.14	-0.13
Mechanical Design and Analysis	0.33	0.13	0.3	0.26	0.23	0.23
USU % Pass	97%	92%	97%	91%	91%	92%
Nationwide % Passing	85%	83%	79%	80%	78%	78%

Evaluation of the Effects of Previous Improvements

A summary of the changes that have been made and evaluation of their effectiveness follows.

1. **Evaluation of Reduction in Class Size**
   We continue to find ways of educating a disproportionate number of students for the resources we have. The department has been given another slot for a professor of practice. The search is currently underway for that person. Funds have also been secured for additional adjunct faculty.
   The number of students admitted to MAE as freshman is down a little and there is an increasing number of students admitted in general engineering, hoping that they may be admitted into MAE after improving their scores. There is pressure from the dean's office to eliminate the professional program. This would mean stricter pre-requisites be applied to the junior-senior courses to keep the quality of the program up and the number of students from exploding.

2. **Introduction to Engineering Course**
   The introduction to engineering course begins fall semester. The course has been capped at 150 students and we will evaluate the results after fall term.

3. **Increase Instruction in Design and Manufacturing**
   It is anticipated that the new professor of practice can help in this area.

4. **Altering the Aerospace Emphasis**
   The requirements to receive an aerospace engineering emphasis were approved and incorporated in the university catalog. The requirements are more flexible and allow more topics to be counted in the emphasis.

5. **Probability & Statics**
   No action has taken place this past year. The FE scores remain a concern.

6. **Improve cross-pollination with other engineering disciplines.**
   A new power systems course has been added in EE that MAE students can take. MAE students take the computer science courses instead of MAE teaching programming. However, efforts to have joint capstone courses is hampered by the departments varied requirements.

7. **Emphasize project-type work in the undergraduate curriculum.**
   Every 4000 and 5000 level MAE course requires a design project.

8. **Addition of an Aerospace Structures course to the aerospace program.**
   We are currently searching for 4 new faculty members. It is anticipated that the new faculty member will be able to either teach this course or off-load another faculty member so that they can teach it.

9. **Establish an industry cooperative agreement program.**
   A comparative study of other universities and their programs was performed.

   Conclusions Include
   - Universities are extremely diverse with regard to coops and internships.
   - Universities with large internships/coop programs have 1) a staff that run the program, and 2) enough flexibility in the curriculum that students can leave for a semester w/o getting a year behind.
   - The department does not yet have sufficient resources to effectively run an internship/coop program.

10. **Advising with respect to career planning.**
    This is being addressed in MAE 1010 Introduction to Engineering

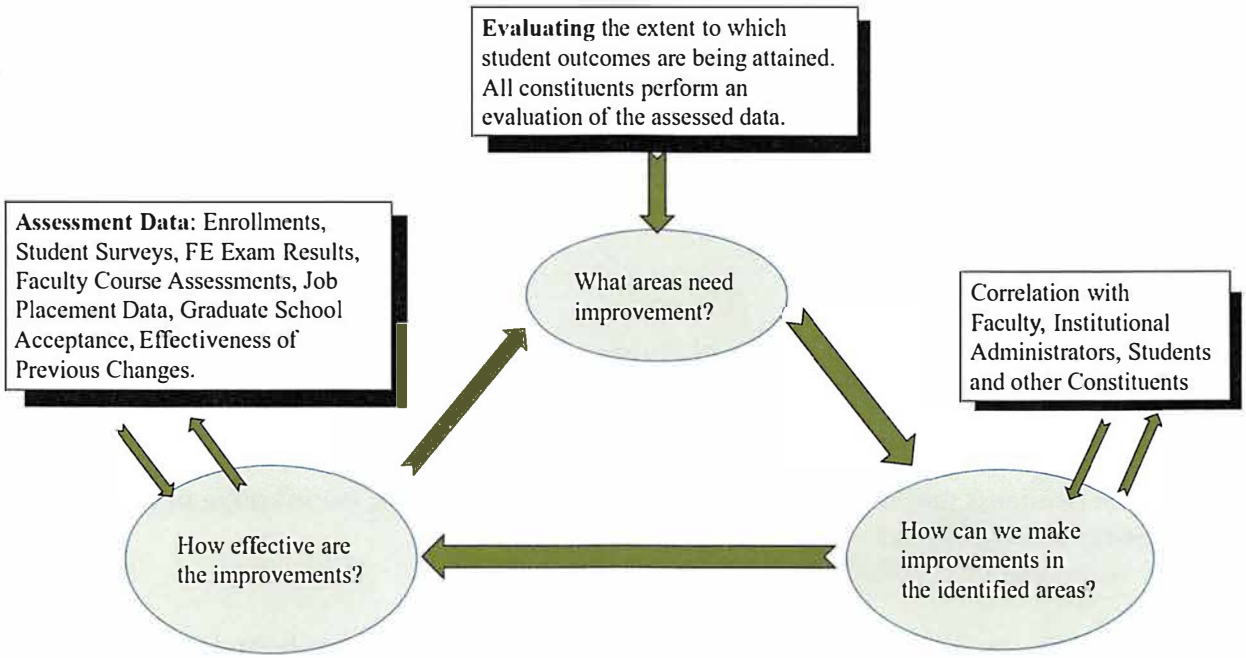
11. **3a3: Students understand alternate approaches to solving engineering problems, in order to help choose an effective approach.**
    No data has been collected.

12. **3b3: Uses appropriate tools to analyze data and verifies and validates experimental results including the use of statistics to account for possible experimental error.**
    No evaluation of this has occurred this past year.

13. **3g1: Students apply the correct technical style and format appropriate for the audience.**
    A writing center has been opened for engineering students. Faculty are using the center for their courses. The department of MAE is the primary customer of the writing center.

14. **Engineering Economics:** An effort to teach using the terminology in the FE manual has been made in MAE 3600. Evaluations of FE test scores will be monitored.

ABET Process



Assessment Data

FE Exam Results: All MAE students are required to pass to graduate. The areas on the FE exam are mapped to the student outcomes.

A-K questions attached to IDEA Surveys: Student Outcomes assigned to each course are evaluated by students on the course evaluation.

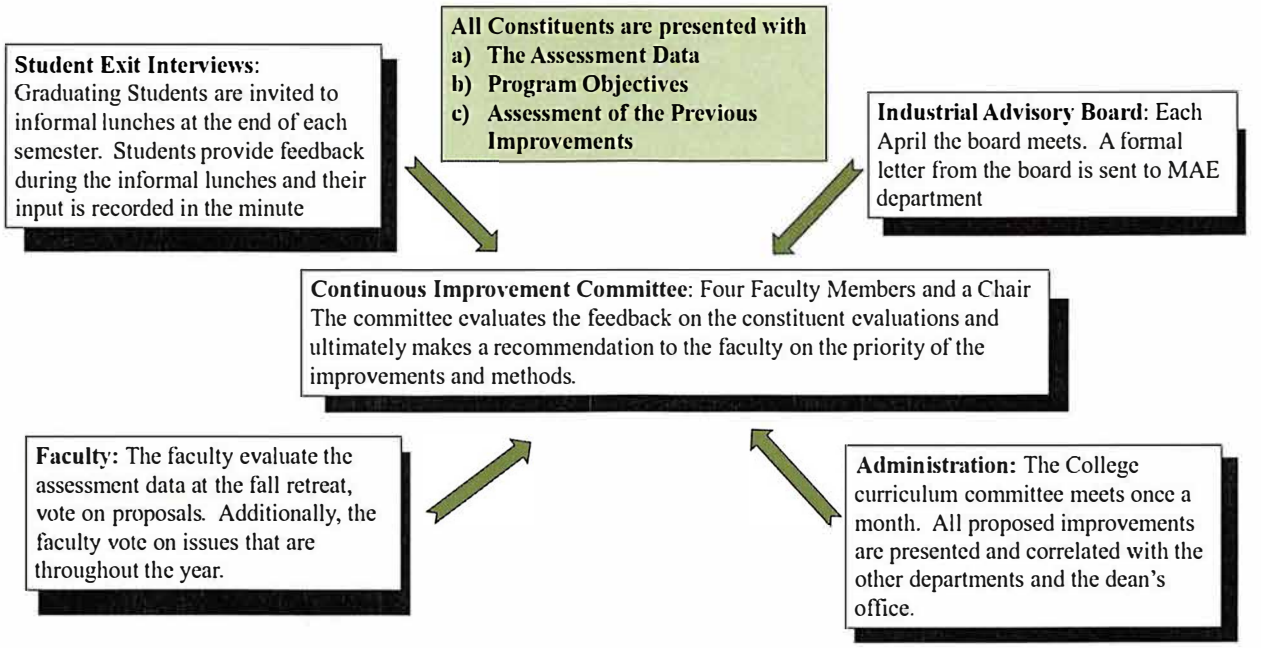
Faculty Course Assessments: Course Instructors evaluate the performance of students in meeting the student outcomes assigned to the course.

Post Graduate Activities: Student placement in industry, nationals labs and in graduate programs.

Enrollment Data: Graduation rates, retention rates, freshman enrollments, transfer students, course GPAs, Math & Science GPAs, course enrollments.

Assessments of Previous Changes: Data that illuminates the effectiveness of previous improvements.

Evaluation


All Constituents are presented with
a) The Assessment Data
b) Program Objectives
c) Assessment of the Previous Improvements
Student Exit Interviews: Graduating Students are invited to informal lunches at the end of each semester. Students provide feedback during the informal lunches and their input is recorded in the minute
Industrial Advisory Board: Each April the board meets. A formal letter from the board is sent to MAE department
Continuous Improvement Committee: Four Faculty Members and a Chair The committee evaluates the feedback on the constituent evaluations and ultimately makes a recommendation to the faculty on the priority of the improvements and methods.
Faculty: The faculty evaluate the assessment data at the fall retreat, vote on proposals. Additionally, the faculty vote on issues that are throughout the year.
Administration: The College curriculum committee meets once a month. All proposed improvements are presented and correlated with the other departments and the dean's office.