1. **What evidence do you have that students achieve your stated learning outcomes?**

The Mechanical Engineering Program assesses its students’ learning based on the standards set forth by its external assessment governing board, ABET. The ME Program uses employer and alumni surveys, advisory board response, co-op reports, professional licensing examination results, student surveys, exit surveys for graduates, and employer surveys at two post graduation intervals, to compare with feedback from current students and course assessment data from faculty, to assess student learning. Data from outside stakeholders indicate satisfaction with graduates from the Program, including strong abilities to use technology, and good analytical skills. Graduates are consistently recognized for early contribution in the workplace.

2. **What have you learned as a result?**

There is a general satisfaction with the ME Program at UW-Platteville. A need for improved communication skills, both oral and written have a consistent presence in evaluations from outside constituencies. A small but consistent indication of a need for improvement was identified in the areas of computer based modeling and analysis. Faculty recognized that the elective approach to applied math limited their use in upper level courses.

Both students and faculty identified the 2-credit class format as a problem. Students noted inconsistencies in work load, and scheduling problems with respect to financial aid. The ME faculty were affected by the 2-credit class format in balancing faculty teaching load.

3. **Document specific changes that have resulted from your assessment efforts.**

Communication - Written communication emphasis was increased in ME 2630, ME 3040, ME 3830, ME 4720, ME 4730. Project and Lab reports are required in courses throughout the curriculum. Faculty emphasize and grade writing. Formal oral presentations are given to people within and outside of the University in ME 3730 and ME 4930.

Computer Based Modeling - GE 2030 course was developed in Fall 2009, adding 1 credit to the curriculum. This course is based in Solid Modeling, with reverse engineering, math application, and design intent. Solid Modeling is developed in a series of required courses through the curriculum.

Applied Math and programmed solution techniques are the basis of ME 3430, Intro to Numerical Methods, a new 3 credit course that will begin in Fall 2011, with algorithm development, linear algebra, and applications. All students will then take Math 4030, Statistics, providing a consistent math preparation for senior level engineering courses.
Credits for this additional course were made available by eliminating two, 2 credit courses, and a 1 credit course, and increasing two, 2 credit courses to 3 credits. The net effect requires the same number of credits for graduation, reduces the number of courses by 1, with one, 2 credit class remaining in the ME curriculum.

ABET has recently changed the assessment reporting standards, requiring a change in course learning objectives and the assessment reporting tools as well. The Mechanical Engineering Program is in the process of establishing baseline measurements such that by 2013, threshold levels will be set that would trigger automatic examinations of weaknesses within the mechanical engineering curriculum.
Mechanical Engineering Program Assessment Plan

1. **Overview**
   The mechanical engineering program has an assessment plan designed to satisfy the objectives as set forth by the accrediting board for engineering programs, the Accreditation Board for Engineering and Technology, or ABET. This means that the ME department sets forth learning objectives that are met by assessing program outcomes. These program outcomes are measured using assessment rubrics for current students in course curricula (Appendices A and B) as shown in Appendix C, with data from Spring 2010. These program outcomes are further measured by advisory board meeting summaries (Appendix D), surveys of employers, alumni, and coop students (Appendices E, F, and G). Assessment summaries (Appendix H) are compiled by the department chair that compiles and concisely details successes and challenges as perceived by faculty, students, and other core constituencies as relates to the assessment process.

2. **Mission Statement**
   The mechanical engineering department's mission is to provide an open, student-friendly environment with frequent student-faculty interaction that results in a quality undergraduate mechanical engineering education and enables our graduates to practice their profession with proficiency and integrity.

3. **Mechanical Engineering Objectives**
   1. Graduate proficient mechanical engineers with a strong background in the technical areas.
      a. Ability to apply mathematics and basic sciences to solve practical problems
      b. Solid background in engineering sciences and design
      c. Solid background in computer tools and methods
      d. Solid background in experimental methods
      e. Sufficient flexibility in curriculum so that students may pursue individual interests
   2. Graduate mechanical engineers with strong professional skills.
      a. Strong communication skills (oral, written, graphical)
      b. Team-working skills
      c. Awareness of and ability to effectively deal with the wide range of societal issues (political, economic, environmental, social, etc.) that drive engineering decision making
      d. Familiarity with the design process in a broad sense, including project planning, project management, implementation, etc.
   3. Graduate engineers who understand the need for and have the capability and motivation to pursue continual professional development.
      a. Ability to keep up to date with current engineering practices, procedures and tools
      b. Ability to successfully pursue graduate or professional study
   4. Graduate engineers who are familiar with ethics and professionalism.
a. Understanding of ethical principles and typical dilemmas faced by practicing engineers
b. Understanding of the professional conduct of a practicing engineer

5. Graduate engineers with a well-rounded education to become quality citizens.
   a. Solid liberal arts and social science background to develop connections between engineering and social and humanistic issues
   b. Support a variety of activities to enhance and broaden the students’ opportunities technically and socially

4. Outcomes
As part of previous ABET assessment preferences, the mechanical engineering department has developed its own set of desired outcomes that are measured as students progress through their academic curriculum, listed in Section a. Recently, ABET has requested that all engineering programs use their own engineering outcomes, listed in Section b. As a result, the mechanical engineering department has transitioned to measuring student achievement using ABET outcomes directly, and as an interim step, created a method for translating the mechanical engineering-specific outcomes to the ABET outcomes, as described in Section c. Appendices A and B describe rubrics used to measure mechanical engineering outcomes, and then for the 2010 – 2011 school year and beyond, the ABET outcomes. Appendix B further lists each ABET outcome and the course-specific rubric used for each outcome.

   a. Mechanical Engineering Outcomes

1. Graduate proficient mechanical engineers with a strong background in the technical areas.
   a. Ability to apply mathematics and basic sciences to solve practical problems
   b. Ability to apply engineering science to solve practical problems
   c. Ability to solve engineering design challenges
   d. Ability to apply computer tools and methods to engineering problems
   e. Ability to apply experimental methods to analyze and understand engineered systems
   f. Sufficient flexibility in curriculum so that students may pursue individual interests

2. Graduate mechanical engineers with strong professional skills.
   a. Communication skills including oral, written, and graphical
   b. Teamworking skills
   c. Awareness of and ability to effectively deal with a wide range of societal issues, such as aesthetic, economic, environmental, legal, and social, that shape engineering decision making
   d. Familiarity with the design process in a broad sense, including project planning, project management, and implementation.

3. Graduate engineers who understand the need for and have the capability and motivation to pursue continual professional development.
   a. Ability to effectively apply information gained from sources that are beyond the normal course presentation.

4. Graduate engineers who are familiar with ethics and professionalism.
   a. Understanding of ethical principles and typical dilemmas faced by practicing engineers
b. Familiarity with the laws pertaining to the professional practice of engineering and the responsibilities of engineers.
5. Graduate engineers with a well-rounded education to become quality citizens.
   a. Solid liberal arts and social science background to develop connections between engineering and social and humanistic issues.
   b. Support a variety of activities to enhance and broaden the students’ opportunities technically and socially.

b. ABET Outcomes
(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 to 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

c. The mapping of mechanical engineering outcomes to ABET outcomes are shown in Table 1.

**Table 1: Mapping ME Outcomes to ABET Outcomes**

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5. **Mechanical Engineering Constituencies**
   The major constituencies of the mechanical engineering program are the students, alumni, faculty, employers, and advisory board.

6. **Assessment Tools**
   While the stated program objectives are intended to be achieved five years after graduation, assessment tools used in this process include both post-graduate and mid-curricular measurements. These tools include:
   - Course assessments
   - Faculty interviews
   - Alumni surveys
   - Coop reports
   - Employer surveys

7. **Assessment Timeline, Reporting, and Feedback**
   The department has committed to an annual assessment retreat, during which the assessment committee reports on assessment results, and any triggers that may have been raised. Some data is collected on a semester basis, whereas other data is on a multi-year basis. Therefore, certain assessment tools are reported on a yearly basis, such as course assessments and coop reports, which are collected every semester. Alumni and employer surveys are reported at the next assessment meeting opportunity.
   Data that is collected on a yearly or semester basis is evaluated annually. A measurement that is found to be 5% below its moving average value is triggered for a study of that performance and the assessment committee determines if this measurement/objective warrants a curricular change, measurement change, further observation, or is an anomaly and can be disregarded.
   However, while data is collected every year, and is needed at this point to establish a baseline (particularly for collaborative and streaming video programs), not every objective is assessed each year. Rather, the ten learning objectives are assessed as shown in Table 2.

   **Table 2: A Schedule of Detailed Assessment for Each ABET Objective**
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For the year in which the objective is assessed, records from the preceding three years are examined closely for historical trends – is this an objective that we are maintaining or gaining ground? Is this a trend that is exhibiting degraded performance? For this examination, each objective is examined, and changes can be triggered by any of the following criteria:

- If a statistically-significant performance decrease is found over the previous three years
- Senior-level coursework performances indicate an average satisfactory objective mastery of less than 90%
- Alumni and employer “agree/strongly agree” responses fall below 75%
- Alumni and employer “disagree/strongly disagree” responses are above 10%
- Average coop report responses are below 3.75

If any of these criteria trigger a further examination, all data that measures an educational objective is examined and the issue is further studied (with perhaps additional data collection) and the assessment committee advises the larger mechanical engineering department of a low response and a recommended course of action, whether it be further observation, modification to the methods used to collect data for that objective, changes to instruction to improve instruction on that particular objective, or a larger-scale curricular change.

8. **Program and Process Improvement**

Based on the evidence gathered (Appendices A through G) a curricular change was made to

- Add a new course, ME3430 “Introduction to Numerical Methods”, to address the computational algorithms shortcoming noted in assessment. This new course also includes an applied math emphasis, which ABET has included as a mechanical engineering curriculum requirement.
- A computer based modeling course, GE2030, was added in Fall 2009 to additionally address graphical communication deficiencies. The course includes instruction in Solid Modeling and includes project learning and a significant design component.
- The math elective was replaced with a mandatory statistics class, MATH4030 so that students have consistent mathematical preparation as they progress through the curriculum
- Written communication requirements is increased in ME2630, ME3040, ME3830, ME4720, and ME4730. To further emphasize communication skills, project and lab reports are required more frequently throughout the curriculum. Formal oral presentations are required for ME3730 and ME4930, and these presentations must be addressed to both faculty and clients
- Eliminate most 2-credit courses from the curriculum by eliminating ME3630, PHYs2410, and ME3730 from the required curriculum, and changing ME3830 and ME4730 from two credits to three-credit courses.
ME3430 will first be offered in the fall 2011 semester, so the assessment of these learning outcomes will be measured for the next three years and then evaluated for its relative success. The relative success of this new curriculum will also be closely monitored and it is anticipated that in three years enough data will have been collected to objectively evaluate these changes.

Changes were also made to our course learning objective assessment reporting tools to better predict these types of curricular deficiencies. A three-year assessment cycle was established and begun in the 2010-2011 academic year to assist in closing the loop on assessment and ensuring that educational objectives are met. ABET has also recently changed their assessment reporting standards, which caused a rewrite of course learning objectives and the assessment reporting tools as well. These changes are also reflected in the assessment cycle.