SCHOOL OF ENGINEERING

Report of Assessment Findings & Curricular Improvements
Academic Year 2011-12

Undergraduate Programs

1.0 Overview of Assessment Process & Measures:

All engineering departments (i.e. Biomedical-BE, Civil-CE, Electrical & Computer Science-EECS, and Mechanical-ME) submitted annual assessment reports of their program outcomes following the School of Engineering's (SOE) unified assessment process (UAP) adopted in 2005. As all engineering programs within SOE are accredited by an external boday, the Accreditation Board for Engineering & Technology (ABET), the UAP outlines standardized processes for SOE in order to meet the assessment criteria and program outcomes required by ABET. These program specific annual reports are available for review upon request. Details of the UAP are available upon request in Engineering. Engineering is currently going through its final year of preparations for the next ABET accreditation visit due in Fall 2013.

In addition to the SOE's unified assessment process, the University as a whole uses select data from the National Survey of Student Engagement (NSSE) to assess its general education goals. All SOE engineering programs use NSSE information to assess our seniors versus seniors at CUA and at our Carnegie Peers.

This engineering assessment report synthesizes and summarizes key aspects of the individual program reports.

2.0 Assessment Findings:

2.1 Program Learning Outcomes-Aggregate Scores

Here we summarize the key findings for each program learning outcome combining all 9 assessment processes adopted by engineering for Engineering and by Department (Table 1 & Figure 1). The expected performance achievement threshold level is 3.5 out of 5 for each of the Engineering outcomes (OC's).

In summary, the overall assessment data from Table 1 and Figure 1 show that all programs are meeting their program learning outcomes (i.e. scores $\geq$ 3.5 out of 5.0; red line in Fig.1) with the exception of ME (OC 4; OC 8). The first column in Table 1 shows a composite average score for each of the 11 outcomes for SOE. All are clearly above the desired 3.5 threshold. Additionally, looking at scores for each of the departments also shows each departments' outcome scores are above the expected threshold as well further supporting the finding that desired program outcomes are being achieved.

Table 1: Summary of SOE/program assessment by program outcome.

	SOE	BE	CE	EE	ME
OC1	**4.28**	4.15	4.13	4.61	4.24
OC2	**4.23**	4.11	3.89	4.66	4.27
OC3	**4.12**	3.94	3.96	4.33	4.25
OC4	**4.30**	4.15	4.29	4.39	4.37
OC5	**4.26**	4.04	4.25	4.4	4.33
OC6	**4.44**	4.44	4.35	4.38	4.6
OC7	**4.34**	4.43	4.2	4.37	4.34
OC8	**4.00**	4.03	3.94	3.97	4.06
OC9	**4.23**	4.18	4.04	4.4	4.28
OC10	**4.08**	4.28	4.06	3.64	4.34
OC11	**3.95**	3.87	3.88	3.9	4.15

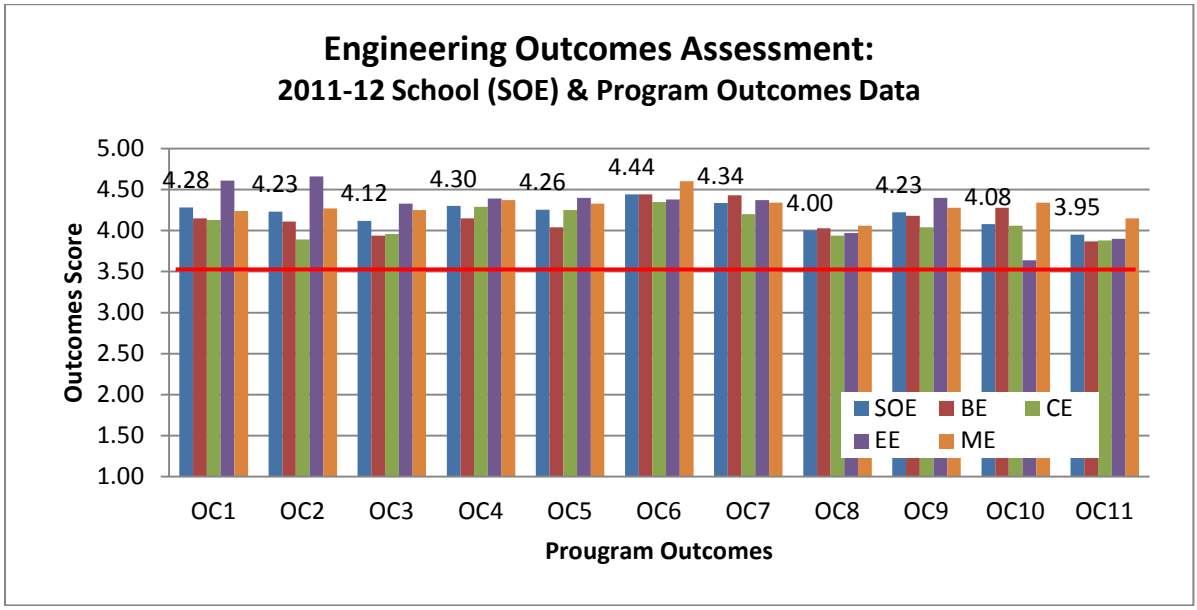

Figure 1: Bar graph of assessment scores by outcome for Engineering (SOE) and by department. Aggregate scores for SOE for each item are labeled.

2.2 Summary Data for Program Outcomes Assessment By Process

Process 1-FE Exam: From NCEES reports of the October 2011 Fundamentals of Engineering (FE) exam results, the largest group of SOE seniors ever took FE Exam (n=75). Of these, the 46.1% passed the FE Exam (compared to average pass rate of 37.8±4.5% between 2008-10). Students scores on this metric have been dramatically improving over the past few years from a low of 29% in 2008. Evaluating each of the 13 topic areas covered in the morning portion of the FE exam revealed topic scores have improved over since 2008, consistent with the increasing pass rates overall. Since curriculums vary widely by department and not all curriculums contain

all topics covered by the FE, interpretation of these results are best when done at the department/program level and not as an aggregate at the School-wide level.

Process 2-Course Review with Instructors: Annual course reviews were conducted by the Chair in consult with individual instructors. Due to concerns about the increasing amounts of core undergraduate level courses being taught by part-time lecturers and adjuncts, SOE began hiring clinical professors (i.e. professors in practice) to stabilize instruction in foundational engineering course. This has had a positive effect overall and the clinical faculty have received some of the highest teaching evaluations in the School. This clinical faculty (Dr. J. Abot) received Engineering's 2012 Kaman Teaching Excellence Award. Two additional clinical faculty were hired for AY 2012-13 and preliminary feedback is quite positive from students. Overall, aggregate scores of all courses reviewed for each year for this process do not indicate any areas needing monitoring and review.

Process 3-Program Senior Survey: Seniors students met with department chairs and were surveyed using Form 5 (Program Graduating Senior Questionnaire). Overall, seniors are quite satisfied with their engineering programs from academic advising, administration support, full-time faculty, curriculum, etc. There continues to be frustration with the strict guidelines for selection of liberal studies courses within the school. In general for the School, all scores from this process were above the 3.5 out of 5.0 threshold. Some common feedback from all graduating seniors relates a need for increased exposure to "design of experiments/interpretation of data" (PO2), "design solutions" (PO3), "modern engineering tools" (PO 11). In Spring/Summer 2012, SOE made significant strides in addressing these issues by renovations to and creation of an interdisciplinary engineering design center (McCarthy Building). This space is already being used for multi-level engineering design projects (freshman design, junior design, and senior design) and has implemented new machine shop, CAD/CAM, etc. experiences into the curriculum.

Process 4-Alumni Survey: For CE, EE, CS, and ME, alumni were re-surveyed during AY 2011-12. BE conducted surveys of its alumni survey during AY 2010-11. In general, alumni are surveyed every 3-5 years. All results from all departments showed results were above the expected 3.5 out of 5.0 threshold level.

Process 5-Employer Survey: For CE, EE, CS, and ME, alumni were re-surveyed during AY 2011-12. BE re-surveyed employers of graduates during AY 2010-11. In general, alumni are surveyed every 3-5 years. All results from all departments showed results were above the expected 3.5 out of 5.0 threshold level. It should be noted that response rates from employers of graduates are extremely low (~1-3% at best).

Process 6-Senior Design: Following the rubrics established by SOE's UAP and using Form 10 (A-D), student senior design projects were assessed by internal and external reviewers. For biomedical (BE), electrical (EE), computer science (CS) and mechanical (ME), assessment data showed all outcomes were well above the 3.5 mark. In 2011, CE students suggested a collaborative senior design project between CE and Architecture may be beneficial. The department is exploring this option. The ME Advisory Board was extremely complimentary of this year's ME design projects. In May 2012, SOE held its 4th Annual Engineering Design Day showcasing design projects by all graduating seniors in a conference style format. This event was very well attended hosting roughly 200 students, faculty, alumni, and external guests.

Process 7-Student Course Evaluations: Student course evaluations are conducted by the University for all undergraduate level courses each semester. This method has been adopted as a part of the outcomes assessment process since before 2001.

As an aggregate of courses, most assessment data for this process from BE, CE, CS, EE and ME were above the expected threshold of 3.5 out of 5. However, at an individual course level, several sections of CSC 113 received low evaluation scores. Some other sections of courses taught by adjuncts also were flagged for monitoring. In AY 2011-12, the School will re-evaluated its utilization of adjunct faculty for core undergraduate at the lower division levels and made a determination to replace part-time faculty with full-time clinical (i.e. non-tenure track) faculty, wherever possible. During Summer 2012, two new clinical assistant faculty were hired to specifically address core freshmen/sophomore level courses such as CSC 113, ENGR 102, ENGR 106, ENGR 201, and ENGR 222. Early indications and feedback from students have shown a high level of satisfaction for these courses in Fall 2012.

Process 8-SOE Senior Survey: Annually, the Dean has conducted surveys of all graduating engineering students utilizing Form 6.

Process 9-Advisory Board Survey of Seniors: As part of Engineering's UAP, senior students in each program are interviewed by their respective department's advisory board who then complete Form 3 of the UAP. Results from BE, CE, EECS, and ME show that results from this process are above the expected 3.5 threshold.

3.0 Curricular Improvements Resulting from Assessment Results

As a result of our assessment data, the following curricular changes have been made. For each change, processes used to identify weak areas are denoted in parentheses.

1) School-wide changes by Engineering:
   a. ENGR 401 (Senior Seminar) continues to be improved to prepare students for the FE Exam. Review for the FE Examination has been an expanded emphasis for this offering. Results from the October 2012 examination is not yet available. (Process 1)
   b. During summer 2011, the ad-hoc committee for UG core curriculum chaired by Dr. J.S. Brown submitted a follow-up report (first version, Spring 2010) focusing specifically on the core engineering curriculum and the impact of FYE on engineering programs. In general, the report reinforces that engineering's core curriculum remains adequate to address future training of our students. The committee's suggestion to provide more "free" liberal studies electives for engineering students is currently being evaluated by SOE. A proposal will be submitted in Spring 2013.
   c. In May 2012, SOE hosted its 4th annual school-wide Engineering Senior Design Day. In all, approximately 200 attendees (students, faculty, alumni external guests) attended the event. This day has become very successful in showcasing to the University community the accomplishments of engineering students. (Process 6)
   d. Two new clinical faculty members were hired during Summer 2012 to address teaching of core undergraduate engineering courses. From past experience, having full-time clinical faculty as opposed to part-time lecturers is more beneficial for achieving student

learning outcomes, student-faculty interaction, overall student satisfaction, and is expected to be positive towards increasing student retention.

   e. Due to a dramatic surge in student enrollment over the past 2 years in engineering, course offerings at the lower division have been expanded (i.e. more sections) as well as increased frequency of offerings to both Fall and Spring semesters. This Fall/Spring offering for core courses such as ENGR 104, ENGR 106, and ENGR 201 has been implemented over the past few years. For AY 2012-13, this will be expanded to include other core courses such as ENGR 102, CSC 113, PHIL 362, MATH 309.

2) In biomedical engineering:
   a. BE will monitor issues related to senior design (BE 497) and senior research project (BE 494) to address student concerns related to modern tools (PO 11-modern tools, PO 2-design experiments/data interpretation, and PO 3-engineering design).
3) In civil engineering:
   a. The department will expand its senior design course into a two-semester sequence (CE 520/CE 521), incorporating aspects and integration of "modern tools" (PO 11) into their curriculum.
4) In electrical engineering & computer science:
   a. EE has replaced one adjunct professor (for CSC 113) as a result of departmental findings of poor instruction based upon instructor evaluation (Process 2) and student evaluations (Process 7).
5) In mechanical engineering:
   a. The department will continue to monitor the ME 441/442 Senior design projects courses. An attempt will be made to increase the complexity of projects as well as incorporating aspects of robotics, mechatronics, and controls. (Process 6)

4.0 Overall Summary of Assessment and Program Improvements:

Overall, a review of the unified assessment processes (UAP) adopted by the School of Engineering (SOE) to assess its students shows that SOE is meeting its 11 program learning objectives. Each engineering program has used the data from the various assessment processes to make curricular changes for continuous improvement.

Additionally, since 2007, the School of Engineering has utilized information from the National Survey of Student Engagement (NSSE), in addition to the existing unified ABET processes, to assess the our students ability to meet the University's general education goals. A review of the 2011 NSSE data for engineering seniors (from the previous year) shows students:

1. exceeded CUA's and Carnegie Peers in the category related to "proficiency in oral and written communication."
2. exceeded CUA's and Carnegie Peers in the category related to "critical thinking and reasoned analysis."
3. exceeded CUA's and Carnegie Peers in the category related to "understanding of scientific and quantitative reasoning."

4. scored below CUA and Carnegie Peers in the category related to “ability to find information effectively using appropriate resources and technologies, critically assess information, and utilize it in ethical/legal ways.”
5. scored below CUA and Carnegie Peers in the category related to “demonstrating knowledge of different cultures and religions.”

In summary, as a whole, our assessment reveals that the School of Engineering is achieving its desired learning outcomes.