

UW-Madison College of Engineering 2006-07 Annual Report on Academic Program Assessment

1. **Has your school/college assessment plan been updated in the past year?**
The college's Academic Assessment Plan for 2003-2008 remains in effect, and is appended below.
2. **Describe any assessment activities conducted in the school/college for unit-wide programmatic or curricular review.**

The undergraduate programs in the College of Engineering (plus the Biological Systems Engineering B.S. program) underwent review by the Accreditation Board for Engineering and Technology (ABET) in 2006. Each program (and the college as a whole) submitted detailed self-study reports to ABET in June, the site visit took place in September, and supplemental documents were submitted to ABET in April 2007. The Final Report is being prepared by ABET and will be voted on by ABET's Engineering Accreditation Commission in July 2007, with delivery to the UW-Madison expected in late summer or early fall. Additional information on these reports and the review process are available from the Office of Academic Affairs.

In addition to assessment by ABET, the College of Engineering receives regular feedback from its Industrial Advisory Board, convened twice each year by the Dean. The Office of Academic Affairs also conducts several other college-wide assessments, including an annual SOAR report (prepared by the Assistant Dean for Engineering General Resources), annual employment and recruiting reports (prepared by the Assistant Dean for Engineering Career Services with the Assistant Dean for Academic Affairs), and annual graduating senior surveys (known as EBI surveys, these are coordinated by the Assistant Dean for Academic Affairs). All introduction to engineering courses (which are now a required part of the curriculum, as described below) are required to provide annual assessment data to the Office of Academic Affairs, to support ABET accreditation. The Departments of Geological Engineering and Civil & Environmental Engineering (as well as Biological Systems Engineering in CALS) also use data from the Fundamentals of Engineering exam, the first of a two-part licensing process. The college's curriculum committee (APCRC) conducts periodic ad hoc assessments as well; two examples of these are described below. Examples of each of these assessment instruments and reports are available from the Office of Academic Affairs.

Three key developments in the college in the past two years illustrate the effects of these and other assessment activities.

GENERAL COLLEGE REQUIREMENTS

In 2003, the Academic Planning, Curriculum, & Regulations Committee (known as APCRC) initiated a project to update and streamline the first-year curriculum. The committee chairman noted in a June 10th report to Dean Peercy, "the curricula for the eleven [now twelve] engineering degree programs in the College present a bewildering variety of requirements for first-year students still uncertain about their career paths. Only three courses (Math 221, Math 222, and Physics 202) and a few liberal elective credits are common to all curricula." As Professor Witt concluded, "Clearly, we do not have a core curriculum."

From mid-2003 until early 2005, the APCRC gathered and reviewed data on students' confidence in their choice of degree programs (which showed that the majority of students enter the college undecided or change their intended degree at least once). In addition, the committee heard testimony from Dean Woolston and his advising staff about the challenges faced by advisors and students alike in establishing appropriate course selections during the first year. Committee members also consulted with the college's Academic Planning Council (the governing body of the college) and Operating Committee (an implementation body made up of department chairs and deans) as well as individual departments in an effort to establish a set of requirements that all students could satisfy in their first year without jeopardizing their chance of admission to any department in the college and without forcing them to take courses that would not later count toward their degree.

On 11 May 2005, following the recommendation of the APCRC and the deans, the faculty of the College of Engineering voted to adopt a set of General College Requirements (GCR) that all entering undergraduates must meet prior to applying for admission to a department. The GCR became effective for the class entering in Fall 2005. The full requirements are available at <http://studentservices.engr.wisc.edu/advising/degrees/generalcollegereq.html>.

PHYSICS INSTRUCTION

Since the college began participating in a nationwide survey of graduating seniors in 1999, the results have pointed to student dissatisfaction with instruction in physics, a finding supported by exit interviews, course evaluations, and anecdotal evidence. The APCRC has been working with the faculty teaching the introductory physics courses to explore the issues and possible solutions. Analysis of the data and interviews with students both point to physics syllabi so overloaded with topics as to make mastery of the material all but impossible – a conclusion also reached by the faculty who teach the course. The Physics Department invited three national experts on physics education (Ken Heller from the University of Minnesota, Lillian McDermott from the University of Washington, and Tim Steltzer from the University of Illinois) to discuss potential improvements to the curriculum. The department learned three key things: the UW has significantly more topics in one semester of introductory physics than our peer schools; other schools have more active learning and student engagement in their introductory physics courses, and other schools provide greater supervision and guidance of teaching assistance in these courses. In response, during the 2005-2006 school year, the Physics Department faculty surveyed every department in the CoE to determine what material might be removed from the introductory course sequence to slow the pace to a manageable one, and has committed to experimenting with removing select topics (such as two and a half weeks of thermodynamics, which is also covered in the introductory chemistry course that engineering students take) while keeping the credit level the same. The department has also hired a lab director who will provide support and mentoring to the teaching assistants. The APCRC continues to monitor progress on this issue, which is still in the early stages of resolution.

TRANSFORMING UNDERGRADUATE EDUCATION

In 2003-04, the college's Operating Committee (made up of department chairs, associate deans, and the dean) undertook a review of the changing nature of engineering practice and its implications for undergraduate education, relying heavily on national reports on the increasingly interdisciplinary nature of engineering practice and the need to prepare students by providing them with expertise outside of their chosen degree program. These activities took on renewed focus in the summer of 2005, when a team of administrators and faculty from the college were invited to participate in a National Academy of Engineering workshop called the Engineering Education Leadership Institute (EELI). One outcome of that workshop was the creation of the CoE 2010 Task Force, which serves as a catalyst for a variety of innovations in the college and its curricula. In May 2007, the Task Force announced 11 awards totaling \$500,000 to teams of faculty and staff in response to a call for proposals to Transform Undergraduate Education. Additional information on these awards is available at <http://www.engr.wisc.edu/2010/>. Each project is required to contain an assessment plan, and the Task Force has applied for University Assessment Council funding to assess the impact of the projects overall.

3. Describe the assessment activity in your academic programs and departments.

All of our academic programs have active assessment plans. The undergraduate plans are shaped in large part by accreditation requirements and thus have some commonality. Graduate plans are less uniform. Departments continue to work toward satisfying ABET's detailed requirements. The central activity over the past year has been to prepare for and undergo the ABET review described above. As noted in our Assessment Plan for 2003-08, the college encourages departments and programs to develop plans that are appropriate to their needs and resources (in part because ABET accredits programs, not colleges). That said, all of the programs in the college conduct exit surveys (including the EBI survey and often a supplemental department-specific survey), alumni surveys (samples are available at <http://www.engr.wisc.edu/faculty/assessment/members/worksheets.html#ExampleAlumniSurveys>), and advisory board reviews. Programs are encouraged to conduct detailed analyses of their students' performance in Capstone Design courses as well, to complement the new analysis of introduction to engineering courses. As noted in earlier reports, a key challenge in educational assessment and curricular evolution is to ensure that the two activities are complementary and that groups involved in one are apprised of the other – existing data must be available to (and used by) groups considering curricular changes in a timely fashion, and information on potential curricular changes must be provided to (and used by) groups designing assessment plans.

4. Describe plans for academic assessment activities for the coming year in your school/college.

Given the intensive ABET review of the past year, the coming year will be relatively quiet. The routine assessments described in #2 above will continue to be conducted, and the college will encourage on-going departmental assessment. In addition, the college will provide input as

requested by the committee preparing the campus re-accreditation documentation for the North Central Association of Schools and Colleges.

College of Engineering Academic Assessment Plan, 2003-2008

1. Description and overview of the school/college or unit

The College of Engineering houses 8 academic departments, which offer 12 undergraduate degree programs, 21 masters degree programs, and 14 doctoral programs. First-year undergraduate students enter the college via Pre-Engineering, a unit of the Office of Academic Affairs, and then apply to a degree program. The college accounts for approximately 10% of the students on campus; we have roughly 4500 students registered in the college: roughly 3500 of them in undergraduate programs and about 1000 of them in graduate programs.

The Biological Systems Engineering Department, which offers BS, MS, and PhD degrees, is located in the College of Agriculture and Life Sciences, but cooperates with the COE on such issues as student recruiting, curriculum planning, assessment, and accreditation.

2. Administrative structure for assessment, including external forces such as accreditation.

Resources for assessment, audiences for assessment also could fit here.

Each department in the college has an assessment representative and/or an assessment committee, which is responsible for setting the department's priorities and plans related to assessment. In some cases, this committee overlaps with the curriculum committee. Administrative staff in most departments assist faculty with assessment activities. The associate and assistant deans for academic affairs coordinate efforts across the college and advise departments on their plans and on data collection and analysis.

The college participates in two types of formal external reviews. 1) Each department undergoes a complete program review once every 10 years, conducted by a team of colleagues from the COE and elsewhere on the UW campus. These reviews cover administration, undergraduate and graduate studies, research activity, outreach and strategic planning. Program reviews are conducted under the guidance of the associate dean for academic affairs. Our college dean receives reports of the reviews, which are distributed by the dean to the faculty of the reviewed department who are then asked to respond to their report. Following each internal review an external review is conducted with a committee of three faculty from the respective discipline, from peer institutions chosen by the associate dean of academic affairs. The combined reviews are then shared with the dean of the college of engineering and the dean of the graduate school and action items are developed for improvements in the departments and the major at the undergraduate and the graduate level. Changes are tracked by the college administration and result in alterations to the department strategic plans.

2) The Accreditation Board for Engineering and Technology (ABET) conducts a site visit once every 6 years to review undergraduate degree programs as well as the resources available to support those programs (faculty, classrooms, labs, computer and library facilities, etc.). ABET's accreditation criteria for engineering programs require that each program have published and measurable educational objectives and student outcomes – both established with the input of relevant constituents – and documented assessments of those objectives and outcomes. In addition, ABET requires that programs provide evidence of the use of assessment data to improve the program (i.e., feedback loops). Academic departments are responsible for compiling the necessary program-level assessment and documentation for each ABET visit. The associate and assistant deans for academic affairs prepare college-level documentation, provide consultation and data to programs, and also coordinate the visits.

In addition to these program reviews and ABET visits, the college and its departments obtain ongoing feedback from advisory boards. Each department has a Board of Visitors (or similarly named group) and the college has an Industrial Advisory Board – board members are active in the engineering profession in some way (via industry, government, academia) and may or may not be UW alumni. These boards meet on campus every 12-18 months and offer assessments and advice related to curricula, research, facilities, management, hiring plans, and more.

3. *Overview of current practice - what you assess and how you assess it. Link to existing reports (but not repeating contents of annual reports).*

The college of engineering is committed to the following mission, objectives, and outcomes.

COLLEGE OF ENGINEERING EDUCATIONAL MISSION:

To educate and prepare men and women to contribute as engineers and citizens through the creation, integration, application and transfer of engineering knowledge.

EDUCATIONAL OBJECTIVES:

The COE recognizes that our graduates will choose to use the knowledge and skills they have acquired during their undergraduate years to pursue a wide variety of career and life goals and we encourage this diversity of paths.

Whatever path graduates choose, be it a job, postgraduate education, or volunteer service, be it in engineering or another field, we have for our graduates the following objectives:

1. That they will exhibit strong skills in problem-solving, leadership, teamwork, and communication;
2. That they will use these skills to contribute to their communities;
3. That they will make thoughtful, well-informed career choices; and
4. That they will demonstrate a continuing commitment to and interest in their own and others' education.

EDUCATIONAL OUTCOMES:

Upon graduation, students shall have the ability to:

- Apply knowledge of math, science and engineering within the major;
- Design, conduct, analyze and interpret engineering experimental results;
- Identify, formulate and solve engineering problems;
- Design a system or process to meet desired needs;
- Function on diverse teams and provide leadership as needed;
- Use the techniques, skills and engineering tools needed for engineering practice;
- Communicate by oral, written and graphic modes;
- Draw on their liberal education to provide knowledge of contemporary issues;
- Recognize the need for and ability to engage in on-going learning;
- Understand professional and ethical responsibility;
- Understand the impact of engineering in our global society.

As noted in the earlier discussion of ABET, each program in the college has adopted its own discipline-specific objectives and outcomes that are compatible with those of the college (and with those laid out by ABET).

The college and its departments formally assess both our “process” (curricula and pedagogy) and our “product” (student learning and achievement). We conduct these assessments using a variety of tools, including concept inventories, course evaluations, capstone design course reviews, exit interviews, exit and alumni surveys, licensing exam results, and advisory board visits. As important as these tools are for stimulating discussion in the college, the data they provide are not the sole impetus for changes to our academic programs. The feedback we receive from students, alumni, industry, and our academic peers provides us with valuable information, but the

experience and judgment of faculty and staff are crucial, determining factors in any decisions affecting our students and their education.

4. *Directions for improvement, further development, inquiry, or closing of gaps.*

Since 1999, a variety of developments – including new accreditation criteria, new deans, a new strategic plan, and a major NSF-funded curriculum initiative – have stimulated the introduction of many new assessment activities in the college. Our primary challenge in the coming years, particularly in light of new budget constraints and the changing size of our student body, will be to sift and winnow these activities to determine which are providing us with indispensable information and which are too cumbersome or costly to continue. New assessments may take the place of those that fall by the wayside.

The COE, like the campus, is committed to allowing for variation across departments so that each discipline may select those tools and mechanisms that are most appropriate and useful given their needs, and to ensure that faculty have ownership of their programs and their data. Such diversity presents challenges, however, in terms of coordination and efficiency – it is difficult to create or maintain even an inventory of the assessment activities in the college, much less a coherent overall picture of the findings. Our secondary challenge, then, will be to continue to seek a balance between vitalizing autonomy and sensible interdependence.

5. *Assessment agenda for the future, in about a 5 year time-line (assessment activities or goals for the next five years or so.)*

YEAR	SCHEDULED REVIEWS	COE-WIDE ASSESSMENT ACTIVITIES
2003-04		Review/Update Department Strategic Plans, Goals, Objectives, Outcomes
2004-05	ABET Reviews for ChE, GLE, CMPE, BME	Review/Update Department Assessment Plans
2005-06	Program Reviews for BME and CEE	Preparation/Documentation for Fall 2006 ABET visit
2006-07	ABET Visit and Responses	Review of COE Assessment Plan
2007-08	Program Reviews for ECE and MSE	
2008-09	Program Reviews for EP and ME	Preparation for NCA Accreditation Visit
>2009	NCA Accreditation Visit Program Reviews for ChE and IE (2009-10) Program Review for GLE (2011-12)	