AC 2003-647: "WE'RE GOOD, AND WE CAN BE BETTER!" LINKING ABET EC2000 TO ENGINEERING EDUCATION EXCELLENCE

Kathy Schmidt, The University of Texas at Austin

Neal Armstrong, University of Texas at Austin

Sherry Woods, University of Texas at Austin

"We're good, and we can be better!" Linking ABET EC2000 to Engineering Education Excellence

Sherry E. Woods, Neal E. Armstrong, Kathy J. Schmidt
College of Engineering, The University of Texas at Austin

Abstract

Like many engineering institutions, the College of Engineering at the University of Texas at Austin has experienced faculty resistance to implementing ABET EC2000 guidelines. To combat this resistance, the College is marketing ABET EC2000 with the slogan, "We're good, and we can be better!" By capitalizing on both the College's historical commitment to teaching quality and the current national agendas to promote engineering education excellence and continuous improvement, UT Austin is linking ABET EC2000 expectations with faculty development efforts to promote learner-centered engineering education.

Program Outcomes in ABET's EC2000 guidelines focus attention on what skills, knowledge and abilities students will gain. A learner-centered, outcome-based approach forces engineering programs to pay more attention not only to what is taught, but also how it is taught and what students learn. At UT Austin, this emphasis is generating interest in the teaching/learning process, and ABET EC2000 is serving as a catalyst for this discussion.

This paper illustrates how we are linking ABET EC2000 to our instructional development programs and initiatives. Particular attention will be paid to the College's faculty development programs, including a new, five-day orientation for new engineering faculty, and the Faculty Innovation Center (FIC). The advantages as well as challenges in using ABET EC2000 as a catalyst for improving the overall learning experience also will be addressed.

Promoting Engineering Education Excellence

As one of the top engineering programs in this country, the College of Engineering at the University of Texas at Austin (UT Austin) has a history of promoting excellence. Over 30 years ago the College established a small teaching effectiveness program led by Dr. James Stice, nationally recognized for his pedagogical scholarship and currently a chemical engineering professor emeritus at UT Austin. This program has grown over the years, and in 1982, the College began offering teaching effectiveness seminars each spring to provide faculty with instructional tools to enhance student learning. These have expanded to twice a year and complement other teaching oriented initiatives which the College has instituted, including annual teaching recognition awards and academic development grants.

Today, national interest in promoting excellence in engineering education through practice and scholarship is gaining significant momentum and support from key players. Several top Research I institutions, including the University of Illinois, Urbana-Champaign, Penn State University and the University of Washington, have established engineering focused teaching and learning centers. And recently, Dr. William Wulf, President of the National Academy of Engineering, announced that the NAE is creating its own Center for the Scholarship of Engineering Education.[1]

In concert with this national movement, UT Austin's engineering Academic Affairs Office (AAO), administered by Associate Dean Neal Armstrong, is promoting its faculty development efforts to create a culture shift within the College. Three overlapping principles, referred to as the three learnings (Figure 1) are guiding AAO's faculty development initiatives.[2] Marketed in the context of, "We're good, and we can be better!" these principles include the following:

1. Learning Experience: Instruction should be learner-centered not simply content driven. The focus is on how classes are taught, where and how learning takes place, and how engineers learn.
2. Learning Community: Faculty should have opportunities to discuss the "business of teaching and learning." Through their interactions with peers, students and staff, faculty enhance their instructional skills to meet the needs of a diverse student body.
3. Learning Environment: Technology enhanced instruction appropriately used promotes learner outcomes and quality student/faculty interactions.

- **Enhance the educational experience through a focus on student learning**
- **Support the faculty, staff, students and other constituencies in this endeavor**
- **Foster a first-class learning environment**
- **Strive for excellence in everything we do**
- **Be the best!**

Figure 1

As they interact and impact each other, these learnings promote an educational culture in which teaching and learning are dynamic--not static--processes. The primary connection between this pedagogical framework and new ABET EC2000 guidelines is the emphasis on an outcome-based or learner-focused approach to engineering education. Although not without challenges and resistance, the College is using this connection to engage faculty in the ABET EC2000 process. Two AAO driven initiatives, the New Faculty Orientation and the Faculty Innovation Center (FIC), demonstrate the College's efforts to advance and reinforce this link.

New Faculty Orientation: In addition to numerous teaching oriented initiatives targeting experienced faculty, the College in recent years has expanded its new faculty program to include

three components: (a) a new faculty orientation; (b) monthly gatherings with new faculty to discuss group initiated topics; and (c) an informal mentoring program with senior faculty assigned as mentors by Department Chairs. The new faculty orientation, in particular, is making concerted efforts to promote learner-centered engineering education.

For 22 years, the Center for Teaching Effectiveness (CTE) at UT Austin has offered a voluntary orientation for all new faculty joining the University; this four-day training addresses a variety of teaching and research topics as well as new employee logistics (ID's, health insurance, benefits, etc.). To promote the College's vision of a learning community *among* engineering faculty, AAO instituted in August 2002 a separate track for new engineering faculty that ran in conjunction with the University's overall orientation. An additional day of training was added to give the new engineering faculty more opportunities to participate in discipline-specific sessions. Based on the College of Engineering's FASTStart program at the University of Illinois, Urbana-Champaign, the goals for the UT Austin engineering track were to help new faculty:

- Manage their careers as a faculty member at UT Austin;
- Promote a student-focused learning environment:
    - What do we want students to be able to do?
    - How can we help them do it?
    - How can we know if they do?
- Participate in a culture of dialogue and a network of formal and informal faculty support.

Although the engineering track included research, tenure and promotion related sessions, particular attention was given to develop new faculty's pedagogical expertise. Topics such as aligning teaching plans with learner objectives and an introduction to the "How People Learn" model were addressed.[3] In addition, the new faculty participated in two, videotaped microteaches or mini-teaches which gave them an opportunity "to get a glimpse of their teaching by placing small aspects of instruction under a microscope" in a safe environment among peers. The microteaches also helped faculty, "become aware that a paradigm shift, from a teaching paradigm to a learning paradigm, is underway in higher education."[4] Although the new faculty did not receive specialized training with respect to ABET EC2000, outcome-based or learner-focused pedagogical strategies as well as continuous improvement processes were emphasized repeatedly during the orientation.

Faculty Innovation Center: Since the 1980's, the College has provided an instructional materials support service. This service, originally called the Instructional Media Lab (IML), was primarily used to assist faculty in the development of mediated instructional resources; however, the College wanted to expand this support and include pedagogical assistance. In the fall of 2000 with a grant from Hewlett-Packard, the College transformed the IML into the Faculty Innovation Center (FIC). The FIC supports instructional innovation by providing media and instructional development services to engineering faculty. (See http://www.fic.engr.utexas.edu.) One underlying goal of the FIC is to help College faculty become innovative, continually improving instructors who move away from faculty-centered approaches to student-centered instruction. Currently, close to a half of the UT Austin engineering faculty have accessed FIC services, which include (but are not limited to) computer visualization, online course development using Prometheus, and one-on-one instructional support consultations. The FIC efforts are designed to

enhance student learning through the appropriate use of instructional technology and good pedagogy in engineering instructional practice.

With respect to linking ABET EC2000 with engineering education excellence, the FIC is currently developing two Web-based systems that support a learner-focused approach: an electronic student portfolio project and a comprehensive syllabus tool. Created in conjunction with the Mechanical Engineering Department, the portfolio system allows engineering students to document and communicate key project and design work in a format easily accessible by others. The tool is being pilot tested and plans are underway to incorporate a student self-assessment based on ABET program outcomes. Its usage throughout the College is under discussion.[5]

The primary objective of the Web-based syllabus tool is to develop a faculty-friendly instrument that can be used to create, document, and disseminate syllabus information to multiple audiences, including prospective and current students, colleagues and accreditation agencies. To help faculty make the transition to outcomes-based instruction, the syllabus template includes a section entitled, Learner Objectives. Faculty unfamiliar with writing learner objectives (or outcomes) are provided with online help and resources to create them. In addition, the syllabus template requires that faculty identify the contribution of individual courses to their published ABET EC2000 Program Outcomes.

Both the New Faculty Orientation and the FIC demonstrate the College's commitment to promoting engineering education excellence and the continuous improvement theme of, "We're good, and we can be better." Yet, associating these efforts with meeting ABET EC2000 requirements is, at times, a double-edged sword. The following section will examine both the advantages and challenges of linking ABET EC2000 with engineering education excellence and continuous improvement.

Advantages and Challenges of Linking ABET EC2000 with Educational Reform

The approach promoted at UT Austin is to link ABET EC2000 expectations with the College's historical commitment to excellence and the current national agenda to encourage engineering education reform. In general, the advantages of this approach can be describe as "riding the wave" of a paradigm shift.

- Common Denominator: Reform in engineering educational practices is receiving national attention: numerous engineering institutions are establishing teaching and learning centers; the NAE has established a Center for the Scholarship of Engineering Education; and the National Science Foundation is providing significant funding for engineering oriented Centers for Learning and Teaching. UT Austin is capitalizing on the common denominator between these efforts and ABET EC2000 guidelines: the focus on a learner-centered environment.
- Impetus for Change: Within conservative institutions like universities, change happens slowly; often times a policy shift is required to make significant change occur. The idea of promoting a learner-centered or outcomes based environment is not new,[6] but the "requirement" to do so is. ABET EC2000 is forcing engineering programs, even highly ranked programs like UT Austin, to document not only what is taught but also what

students are actually learning. Resistance is occurring and is to be expected, but without a policy change, this paradigm shift would be less likely to occur.

- Learning Community: Regardless of a faculty member's opinion about ABET or the value of accreditation, the new ABET EC2000 guidelines are generating valuable discussions among faculty, students, alumni and employers. These discussions are critical to the change process, because as stakeholders of the learning community, they have the power to change or maintain the status quo of engineering education. These discussions also directly support the College's efforts to promote the three learnings model.

Although the benefits of linking ABET EC2000 with engineering education excellence are numerous, this approach has proven challenging at UT Austin for several reasons.

- Faculty Responsibilities: The demands placed on university faculty to excel in research, teaching and service are considerable. Add to the list ongoing responsibilities (versus once every six years) for ABET EC2000, and faculty resistance is understandable. Few educational experts would disagree with the underlying value of ABET EC2000, but the challenge lies in changing faculty perspectives. Historically, many faculty at UT Austin have viewed ABET accreditation as a bureaucratic necessity unrelated to engineering education excellence. Even with the extensive publicity ABET EC2000 has generated within the engineering community, this perception continues to persist. Our strategy at UT Austin is to promote the educational value of the new ABET EC2000 process in a way that justifies faculty time and resources.
- ABET EC2000 Workload: A change in the workload associated with the new accreditation procedures was anticipated at UT Austin; however, it is proving to require significantly more time and documentation than the previous ABET process. To institutionalize ABET EC2000 (and thus educational reform), engineering programs must find a way to make the accreditation process doable, meaningful, and sustainable. Although we expect accreditation related tasks to become more manageable once processes are in place, the challenge lies in convincing faculty *now* of the benefits tied to ABET reforms. Until that occurs, the overall impact of ABET EC2000 and the College's efforts to promote a learner-centered environment may be limited.

Impact of "We're good, and we can be better!" Approach

Challenges notwithstanding, the College's approach of linking ABET compliance with its commitment to engineering education excellence has resulted in at least two positive outcomes. One, more faculty are actively involved in the continuous improvement process; and two, effective mechanisms have been established to share and discuss constituent feedback.

Preparations for accreditation under the new criteria began in 2000 with an ad-hoc committee; in September 2001, the College established a standing Accreditation and Assessment (A & A) Committee to provide College and Departmental leadership for all accreditation-related assessment efforts. The A & A Committee has two representatives from each Department and meets monthly to share resources and best practices. In addition, four of the six engineering departments at UT Austin have working faculty/staff committees (with five to eight members each) to drive accreditation and continuous improvement efforts. Unlike concerns commonly

expressed by ABET and others that 5 percent of the faculty are doing 95 percent of the work, one CoE faculty member estimated that two thirds of faculty in his Department are actively engaged in the ABET EC2000 process.

In the spirit of continuous improvement, the College has greatly enhanced its efforts to solicit and share constituent feedback. Highlights of assessment results (taken from recently instituted student, alumni and employer surveys) are now regularly being shared through several mechanisms, including constituent meetings, a faculty email newsletter and a College website. For instance, over 15 ABET EC2000 related presentations have been made within the last two years to Departmental Visiting Committees, student organizations, faculty and Department Chairs. Visiting Committees, in particular, have proven to be a valuable source of constituent feedback about educational objectives, program outcomes, and student work. Another successful mechanism established for sharing constituent feedback is "Closing the Loop," a faculty email newsletter created in 2002 and published two to three times a semester. The goals of Closing the Loop are to increase faculty awareness about the ABET EC2000 process and to generate faculty interest in assessment results. The constituent input shared in the newsletter has motivated several Departments to make improvements in specific areas, such as student advising and teaching quality. Finally, the College established last year an ABET and Continuous Improvement website. This resource provides helpful accreditation information as well as specific assessment results. The website can be found at: http://www.engr.utexas.edu/abet/index.cfm.

Summary

The policy changes associated with ABET EC2000 are significant in that they require engineering programs to demonstrate learner-center, outcomes-based assessment processes. These changes mirror the educational reforms being endorsed by leading educational experts.

Like many engineering institutions, the College of Engineering at UT Austin is experiencing faculty resistance to implementing ABET EC2000 processes. In an attempt to limit this resistance while reinforcing the underlying principles of ABET EC2000, the College has implemented faculty development initiatives that promote a paradigm shift from teacher-centered to learner-centered engineering education. The slogan, "We're good, and we can be better!" is a deliberate attempt to recognize the achievement of past and current excellence while encouraging continuous improvement.

Although faculty resistance is occurring (and is to be expected until the new criteria are more accepted), ABET EC2000 provides a unique opportunity to institutionalize the educational change envisioned by the College. What remains to be seen is if the College can alter faculty perspectives about ABET to achieve this goal.

Bibliography

1. Wulf, W., "The Urgency of Engineering Education Reform," Main Plenary Address, *ASEE Annual Conference and Exhibition*, Montreal, Quebec, Canada. June 16-19, 2002.

2. Ward, D., "A Vision for the Future: Priorities for UW-Madison in the Next Decade," University of Wisconsin-Madison Office of News and Public Affairs. April 1995. http://www.news.wisc.edu/chancellor/vision/4.html.
3. Bransford, J., Brown, A., and Cocking, R. (editors). *How People Learn,* National Academy Press, Washington, D.C., 2000.
4. Schmidt, K., Armstrong, N., Woods, S., "ABET EC2000 and Learner-Centered Education," *The 2nd National Conference on Outcomes Assessment for Program Improvement*, Pittsburg, PA. October 31-November 1, 2002.
5. Schmidt, et al.
6. Stice, J., "A First Step Toward Improved Teaching," *Engineering Education*, 66, February 1976, pp. 394-398.

SHERRY E. WOODS
Sherry Woods is Director of Special Projects in the College of Engineering at The University of Texas at Austin and has major responsibilities in creating and promoting the College's continuous improvement and faculty development efforts. She currently works closely with and provides major support to the College's Assessment and Accreditation Committee, which is made up of engineering faculty members from each program area and chaired by Associate Dean Armstrong.

NEAL E. ARMSTRONG
Neal Armstrong is Associate Dean for Academic Affairs in the College of Engineering at The University of Texas at Austin, the Zarrow Centennial Professor in Engineering, and a Professor of Civil Engineering. He is also a licensed Professional Engineer and Diplomate of the American Academy of Environmental Engineers. The College's ABET activities are coordinated through his office.

KATHY J. SCHMIDT
Kathy Schmidt is the manager of the Faculty Innovation Center for the College of Engineering at The University of Texas at Austin. In this position, she promotes the College of Engineering's commitment to finding ways to enrich teaching and learning. She works in all aspects of education including design and development, faculty training, learner support, and evaluation.