DEVELOPMENT OF ASSESSMENT INSTRUMENTS

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Abstract

Engineering programs at the University of Alabama at Birmingham (UAB), desiring to be evaluated under ABET's new accreditation criteria in a Year 2000 visit, initiated planning three years prior to the visit. This paper (a) describes the process used to approach the EC2000 criteria and to develop assessment instruments, (b) outlines the process used in developing assessment instruments, (c) briefly describes the assessment instruments that were developed to assess the undergraduate electrical engineering program, and (d) presents an overview of the validation process used to test these assessment instruments. A web address is provided so that the reader can access the resulting work products.

The process of "designing" program assessment instruments requires the same skills needed for any major engineering design process to be successful. The process requires knowledgeable, articulate, aggressive leadership capable of moving the iterative process along in an (academic) environment that, by nature, tends to resist the making of decisions in a timely manner. The process, therefore, must be structured using a top-down approach that ensures (1) that required decisions are made early in the process, (2) that all viable alternatives are articulated and adequately assessed, and (3) that there is ample time for sufficient validation of all work products before they are deployed. In addition, extensive administration and faculty involvement is required at all steps in the design process to ensure involvement, "buy-in", and acceptance of the additional work load that will be generated for both administration and faculty once assessment instruments are deployed and feedback obtained. These steps are essential if continuing, quality enhancement of academic programs are to result from the process.

Introduction

Realizing that a choice would be available for an ABET visit in Year 2000 with respect to the current accreditation criteria or new accreditation criteria, the Engineering Faculty and administration of the University of Alabama at Birmingham (UAB) considered the pros and cons of each set of criteria during the Fall of 1997. The clear choice was to "bite the bullet" and use the EC2000 criteria since following ABET visits would require a commitment to this set of criteria. This decision was followed by the Dean appointing the previous Dean as ABET 2000 Coordinator and asking Department Chairs to select a faculty member to serve as an Undergraduate Program ABET Coordinator. The College-wide Coordinator researched the new

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criteria and began the education process for the Administration, Faculty, and Program Coordinators. This process culminated in a one-day workshop that indoctrinated the constituencies about ABET expectations under EC2000.

An ABET Planning Committee was formed, consisting of the College-wide Coordinator, the undergraduate Program Coordinators, and representatives from the Office of the Dean to guide the process for the all undergraduate programs. The Committee met at regular intervals to (a) develop a logical procedure and review the progress being made by the various programs, (b) critique program work products, and (c) motivate program faculties to make progress toward accomplishing tasks and meeting deadlines. The sharing and critiquing of program work products and the interaction with each program faculty were the keys to ensuring meaningful progress.

Process

The ABET Planning Committee began its work in the Winter of 1998 by leading the college in preparing its Vision Statement, Mission Statement, and Goals. Statement drafts, which were initially prepared by the college’s administration, received faculty and Planning Committee review. The Faculty-adopted version of each document was the result of several iterations that involved all three groups.

Following adoption of college-level documents, corresponding department/program-level documents were drafted by each Program ABET Coordinator. These documents received review by the Program Faculty, the college’s administration, and the ABET Planning Committee. Faculty-adopted program Vision Statement, Mission Statement, and Goals likewise required several iterations.

➤ **Major Iterative Process #1 Begins**

Program Objectives

The next step of drafting Program Objectives was initiated by Program ABET Coordinators. Each set was reviewed by members of the college’s administration, Program Faculty, and ABET Planning Committee. Early iterations required extensive revision after each critique. A "final" version was then adopted by the Program Faculty. As work progressed into the steps noted below, this "assumed final" version had to be amended on several occasions by the Program Faculty. It is likely that, as the continuous quality enhancement process is implemented, further revisions will be recommended by the respective program faculties.

➤ **Major Iterative Process #2 Begins**

Desired Educational Outcomes

The experience of developing desired Program Educational Outcomes was similar to the experience of developing Program Objectives. The initial draft developed by Program ABET Coordinators included the eleven outcomes specified in EC2000 Criteria 3, discipline-specific
program outcomes specified in Criteria 8, and outcomes suggested by the program’s Vision, Mission, and Goals statements.

While reviews were conducted by the college’s administration, Program Faculty, and ABET Planning Committee, the most critical review rested with Program Faculty who had the responsibility of (a) ensuring a linkage between Program Objectives and Program Educational Outcomes, (b) developing a list of techniques that could be used to achieve the outcomes, and (c) identifying program constituents/customers/clients and their respective expectations.

After the Program Faculty adopted the "assumed final" version, these documents had to be amended several times to address issues identified during the subsequent steps. It is expected that additional revisions will be required as program faculties cycle through the entire process.

» **Major Iterative Process #3 Begins**

**Program Assessment Planning**

Program assessment planning was a unique iterative process between the Program ABET Coordinator and the Program Faculty. Planning required (a) listing possible assessment instruments, (b) identifying outcomes that could be measured by each possible assessment instrument, (c) outlining the structure and content for each assessment instrument, (d) evaluating the ability of each assessment instrument to adequately measure the outcomes assigned to that instrument, (e) evaluating the ability of the assessment instruments collectively to adequately measure all outcomes from a variety of different perspectives (e.g. the concept of triangulation was utilized in this endeavor), and (f) selecting the set of assessment instruments that would be developed in detail.

» **Major Iterative Process #3 Ends**

» **Major Iterative Process #2 Ends**

» **Major Iterative Process #1 Ends**

» **Major Iterative Process #4 Begins**

**Assessment Instrument Development**

Each assessment instrument was drafted by the Program ABET Coordinator or an assigned faculty committee. The initial draft included (a) draft contents of the instrument, (b) a draft process for deploying the instrument (ensuring that assessment information resulted in feedback for appropriate program modifications), and (c) a draft statement concerning whether or not a performance metric would need to be set for each content item on the instrument. These documents were reviewed by the entire Program Faculty and the ABET Planning Committee. After its initial review, the Faculty of the Department of Electrical and Computer Engineering (E&CE) made the decision to appoint an ad hoc Faculty "Assessment Oversight Committee” to accomplish the early review of these documents to ensure timely adoption. This committee reviewed all assessment instruments, deployment plans, and assessment metric recommendations.
and made extensive revisions. The revised instruments, deployment plans, and metric recommendations were then presented to the entire program faculty for review, revision, and adoption.

Validation of Instruments

A specific validation plan was developed for each assessment instrument. Each plan involved testing instrument contents and a deployment strategy. Each validation culminated in recommendations for (a) instrument modifications and (b) program adjustments suggested by the assessment participants.

→ Major Iterative Process #4 Ends

Implementation of Assessment Program

Individual assessment instruments will be deployed in a formal assessment program as soon as validation is completed.

Selected E&CE Assessment Instruments

Initially, twenty-one assessment instruments were envisioned for the Undergraduate Electrical Engineering Program. The Faculty and ABET Planning Committee review brought a realization that (1) some of the planned instruments represented a duplication of effort that could be better-served by a single, more-comprehensive assessment instrument and (2) some of the planned instruments were ineffective. After significant discussions, the following thirteen instruments were selected. (A web address for accessing these instruments is provided later in the paper.)

1. Instructor Assessment of Class -- Each instructor of each course assesses student preparation for and performance in their course relative to Program Outcomes.
2. Grade Assessment -- This assessment instrument is a software program written to make use of a local student database that is maintained in the college’s Office of Academic Programs. The program will be executed on a regular basis to assess student performance in key Program Outcome areas.
3. Student Course Assessment -- Each term, each student in each course provides an assessment of the course relative to each Program Outcome.
4. Student Profile and Assessment Record (SPAR) -- A student-generated electronic record conceptualized at UAB is now being redesigned and developed as an assessment instrument by the IEEE Education Activities Department for use by engineering programs. (IEEE plans to make this program available in the Summer of 1999.) Students will be required to update

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3 Few metrics were initially recommended by the Assessment Oversight Committee. The Program ABET Assessment Oversight Committee suggested that a number of the metrics not be established until the end of the Validation Phase.
4 The validation program is in progress as this paper is being written. (ASEE EE Division publication criteria for 1999 Annual Meeting papers possessed a January 6, 1999, deadline for submission.)
5 The authors plan to document the results of the validation program, lessons learned from formal implementation of the assessment program, and describe the feedback process utilized by the faculty to facilitate the continuous quality enhancement process in a later venue.
their record on a regular basis. The database will allow reports to be automatically generated providing key information relative to each Program Outcome.

5. Alumni Survey -- On a regular basis, alumni are asked to assess how their undergraduate program prepared them for the practice of engineering. Assessment questions are directly related to Program Outcomes.

6. Employer Survey -- On a regular basis, employers of UAB’s graduates are asked to assess how the graduates’ undergraduate program prepared them for the practice of engineering. Assessment questions are directly related to Program Outcomes.

7. FE Exam Participation Data -- The results of the National Council of Examiners for Engineers and Surveyors (NCEES) Fundamentals of Engineering (FE) Exam for program graduates and upper-division students are used to assess a limited number of Program Outcomes.

8. ABET Assessment Form -- Information obtained as a result of each ABET accreditation visit is used to assess Program Outcomes.

9. SACS Assessment Form -- Information obtained as a result of each Southern Association of Colleges and Schools (SACS) accreditation visit is used to assess Program Outcomes.

10. External Advisory Board Assessment -- Annually, the program’s External Advisory Board is asked to assess how the undergraduate program prepares graduates for the practice of engineering. This assessment by a group of alumni and employers is accomplished in a process that differs from the Alumni Survey and the Employer Survey.

11. Annual Faculty Assessment -- Annually, the E&CE Faculty accomplishes a detailed assessment of personal involvement in ensuring that Program Outcomes are accomplished.

12. Annual E&CE Faculty Retreat -- Each year, at its annual retreat, the E&CE Faculty accomplishes a specific assessment against two Program Outcome. The Annual Retreat is also the time when the faculty reviews and discusses all of the feedback obtained from the assessment process to decide on program changes or assessment process modifications.

13. Senior Design Presentation Assessment -- Program seniors are required to accomplish either a substantive individual design thesis project or a substantive group design project. A major, exhaustive, public examination is required in both cases. Students are assessed in this setting relative to all Program Outcome.

**Validation Process for Selected E&CE Assessment Instruments**

Each assessment instrument is being validated through a specific protocol.

1. Instructor Assessment of Class -- This assessment instrument was tested at the end of Fall Term 1998. Several modifications were made to the instrument as a result of this test.

2. Grade Assessment -- The software program that will serve as this assessment instrument is in the process of being coded. The instrument will be tested during Winter Term 1999\(^6\) (a) to validate the quality of the program itself and (b) to validate the adequacy of the application as an assessment instrument.

3. Student Course Assessment -- This assessment instrument was tested at the end of Fall Term 1998 with the test resulting in several modifications to the structure of the form and the manner in which results will be evaluated.

\(^6\) The university is presently on a "term system" with semester credit being award for classes that are scheduled in a quarter format. The university is scheduled to convert to a traditional semester system format beginning Fall Term 2001.
4. **Student Profile and Assessment Record (SPAR)** -- Although this IEEE assessment product has not been completed and released, UAB E&CE students and faculty are involved in an ongoing evaluation of the product as it is being developed. Student and faculty feedback is providing significant guidance to the development team to ensure that the final product accomplishes its intended purpose.

5. **Alumni Survey** -- The college administration has mailed this assessment instrument to all alumni and responses are being received. Evaluation of the form will be accomplished during Winter Term 1999.

6. **Employer Survey** -- The college administration has mailed this assessment instrument to a cross-section of employers and responses are being received. Evaluation of the form will be accomplished during Winter Term 1999.

7. **FE Exam Participation Data** -- The results from two previous FE Exams were used to test this form. The instrument was found to be acceptable as designed.

8. **ABET Assessment Form** -- Data from the previous ABET accreditation visit was used to test this assessment instrument. The instrument was found to be acceptable as designed.

9. **SACS Assessment Form** -- Data from the previous SACS accreditation visit was used to test this assessment instrument, and the instrument was found to be acceptable as designed.

10. **External Advisory Board Assessment** -- A meeting of the External Advisory Board is being scheduled for the latter part of Winter Term 1999, and this assessment instrument will be tested at that time.

11. **Annual Faculty Assessment** -- This assessment instrument will be tested during Spring Term 1999 in conjunction with the administration’s annual evaluation of faculty performance and used as a part of that evaluation process.

12. **Annual E&CE Faculty Retreat** -- An E&CE Faculty Retreat has been scheduled in February 1999, and this assessment instrument will be tested at that time.

13. **Senior Design Presentation Assessment** -- This assessment instrument was tested at the end of Fall Term 1998. Both the form and the process for deploying the form were changed.

**Web Site Containing ABET Work Products**

All assessment-related documents for the UAB Electrical Engineering Undergraduate Program may be viewed at the following web site. http://www-ece.eng.uab.edu/saeedh

**Summary**

This paper (a) described the process used at UAB in the E&CE Program to develop assessment instruments, (b) outlined the process used in developing assessment instruments, (c) briefly described the assessment instruments that were developed to assess the undergraduate electrical engineering program, and (d) presented an overview of the validation process being used to test these assessment instruments. First, the process required knowledgeable, articulate, aggressive leadership capable of moving the iterative process forward. Second, the process required extensive administrative and faculty involvement to ensure involvement, "buy-in", and acceptance of the associated workload. Finally, the process used a top-down approach ensuring that (1) major decisions were made early in the process, (2) all viable alternatives were articulated and adequately assessed, and (3) there was ample time for sufficient validation of all work products before deployment. A web address was provided so that the reader can access the
resulting work products. This web site will be kept up-to-date as suggested changes to the instruments and/or procedures are made.

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