Lessons Learned in the Assessment of Course and Program Outcomes Process

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Abstract

The University of Texas at San Antonio (UTSA) completed a successful ABET reaccredidation of its engineering programs in Fall 2004. The three programs in the College of Engineering spent a great deal of time and effort in the last few years to prepare for the reaccredidation visit. Each undergraduate program established a set of program objectives that was in line with the missions of the department, college of engineering, and the institution. In addition these objectives were consistent with the requirements for ABET accreditation under the Engineering Criteria 2000 (EC-2000). A process was developed for systematic evaluation and updating of each department's undergraduate educational objectives and program outcomes. Procedures were developed to obtain feedback from all major constituencies, evaluate the inputs, and process the collected data for assessment. A set of assessment tools was developed and was used to evaluate program objectives and outcomes. For each subject in the curriculum, the course objectives were defined and were evaluated by the faculty on a regular basis to ensure that the program outcomes were being met. A set of faculty members were assigned to each course to evaluate the course outcomes on a continual basis and their recommendations were used to make course improvements. This paper will discuss the assessment process for each course and the programs. It explains how assessment data were collected, analyzed, and used in the enhancement of the undergraduate programs. It also describes the management of the assessment process. Lessons learned from our assessment experience will be described in the paper.

Introduction

The Division of Engineering at the University of Texas at San Antonio (UTSA) was established in the College of Sciences and Mathematics (Mathematics was changed to Engineering in 1983) in September of 1982 offering Bachelor of Science (BS) degree programs in Civil, Electrical, and Mechanical Engineering (CE, EE, and ME). The first student in engineering programs graduated in May of 1984 and all three programs received their first ABET accreditation in 1986. Master of Science degree programs in CE, ME, and EE began in the Fall of 1989. In Spring 2000, the academic restructuring of the university resulted in the partition of the College of Sciences and Engineering into two separate colleges: College of Engineering and College of Sciences. Three departments were formally established in Fall 2001, replacing the old Program structure. A PhD program in Electrical Engineering began in Fall 2000. A PhD degree program in Biomedical Engineering and another in Environmental Sciences and Engineering were added in Fall 2003. A proposal for establishment of a PhD degree in ME is currently underway. It should be noted that the departments, currently, offer undergraduate degree programs only in CE, EE, and ME.

Since 1998, the undergraduate programs were involved in preparation for ABET accreditation under the EC-2000 criteria. :In the recent years the focus of evaluation visits have been heavily directed towards evaluation of two criteria: Criterion 2- Program Educational Objectives and Criterion 3- Program Educational Outcomes. These two criteria are described in the most recent ABET publication (2005-06 Engineering Criteria)[1] as:

Criterion 2. Program Educational Objectives: Although institutions may use different terminology, for purposes of Criterion 2, program educational objectives are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve. Each engineering program for which an institution seeks accreditation or reaccreditation must have
in place:

(a) detailed published educational objectives that are consistent with the mission of the institution and these criteria
(b) a process based on the needs of the program's various constituencies in which the objectives are determined and periodically evaluated
(c) an educational program, including a curriculum that prepares students to attain program outcomes and that fosters accomplishments of graduates that are consistent with these objectives
(d) a process of ongoing evaluation of the extent to which these objectives are attained, the result of which shall be used to develop and improve the program outcomes so that graduates are better prepared to attain the objectives.

Criterion 3. Program Outcomes and Assessment: Although institutions may use different terminology, for purposes of Criterion 3, program outcomes are statements that describe what students are expected to know and be able to do by the time of graduation. These relate to the skills, knowledge, and behaviors that student acquire in their matriculation through the program. Each program must formulate program outcomes that foster attainment of the program objectives articulated in satisfaction of Criterion 2 of these criteria. There must be processes to produce these outcomes and an assessment process, with documented results, that demonstrates that these program outcomes are being measured and indicates the degree to which the outcomes are achieved. There must be evidence that the results of this assessment process are applied to the further development of the program.

Engineering programs must demonstrate that their students attain:

(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 multi-disciplinary 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 in 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.

In addition, an engineering program must demonstrate that its students attain any additional outcomes articulated by the program to foster achievement of its education objectives.

This paper will give a short history on the development of the Program Educational Objectives and Outcomes at UTSA, briefly describes assessment process and tools used in the assessment process.

The University mission and strategic direction, the College mission and vision, and the department mission and goals guided the development of a set of comprehensive and well-defined program educational objectives. These objectives were based on the needs of the various constituencies of the program and were clearly tied to the College of Engineering and the University missions. A process for the systematic review, feedback and improvement was developed and implemented.

Development of Program of Educational Objectives and Outcomes

In June 1998 the Division of Engineering submitted self-study reports to ABET for re-accreditation of its programs under the conventional criteria. While preparing for the ABET evaluation visit, the Division also initiated work for future accreditations under EC-2000 criteria. The Division of Engineering organized a faculty retreat off campus in early October 1998 to focus on team building, long term planning, and brainstorming. The EC-2000 criteria were presented as an opportunity for further development and improvement of the engineering programs, as the Division had recognized that the proactive view of engineering education assessment was essential in achieving its educational mission. During this retreat the faculty presented, discussed, and documented a roadmap to EC-2000 criteria.

Following the retreat, faculty members in each program were provided documentation of their program objectives developed at the retreat and they were asked to review, re-evaluate, or affirm them. Each program was charged with developing and finalizing their program educational objectives.

Between 1998 and 2001 the work for determination of the program objectives continued. Using the university mission and the EC-2000 criteria as guides faculty refined and improved the existing program objectives in Spring of 1999. Each program then began to compile a list of attributes that they expected from their students by the time of graduation. In 1999, the faculty in each program approved their first version of their Program Objectives and Program Outcomes.

Constituencies the Program

The major constituencies of each program were identified:

- Students
- Mechanical Engineering faculty
- College of Engineering Faculty
- Faculty of supporting programs
- College and University administration
- Alumni
- Employers
- College Advisory Council
- Department Advisory Council

These constituencies gradually played an important role in the evaluation and improvement of educational objectives. The involvement of the constituency groups in this process gradually increased since the development of the first set of statements for the program educational objectives in 1999. Only faculty and selected student groups had input when the original set of statements for program objectives was developed. Using feedback from additional constituency groups to revise and improve the program educational objectives resulted in the current statements of program objectives. In 2002, the faculty and the program constituencies approved the current program educational objectives.

ABET Committee

In the Fall of 2000, a committee formed to coordinate of efforts for re-accreditation of the three engineering programs in 2004. The committee members were composed of three department chairs, a faculty representative from each program, the Director of Advising Center, and the Associate Dean who serves as the chair of the committee. The committee coordinates the preparation of evaluation and assessment tools. However, the processes of determination, evaluation, analysis, and improvement to program objectives and outcomes occur at the departmental level with participation from faculty.

College and Department Industry Advisory Councils

The creation of the new College of provided direct control of curricula and resource allocation for the engineering programs. It also allowed the establishment of the College Advisory Council, which was not possible under the old divisional structure. The Engineering Advisory Council was formed in Fall 2000 and the first meeting was devoted to discussion of the functions of the Advisory Council and the role the members play in providing advice, especially pertaining to ABET-EC 2000, as well as providing feedback on the quality and preparation of College graduates. The College Advisory Council The Advisory Council reviewed the 1999 program educational objectives and provided feedback to refine and improve the current educational objectives of each program in the College.

In Spring 2004 each department established its own Industry Advisory Council and a Student Advisory Council were created to assist the department in refining and improving its goals and assist in the assessment of program educational objectives.

Figure 1 shows the history of determination and evaluation of the program educational objectives for the Mechanical Engineering. It shows that the involvement of various constituency groups steadily increased in this process since the initial work in 1998. With the growth of the Division of Engineering into the College of Engineering and creation of the College Industry Advisory Council, the process was improved. The program educational objectives were reviewed and discussed during Advisory Council meetings.

Process to Periodically Evaluate Educational Objectives

During Spring 2002 the engineering programs began the task of revising and improving the 1999 program educational objectives. Feedback from student organizations and the College of Engineering Advisory Council were used in this process. Also, the results of senior students and the Graduating Student surveys were analyzed and used for revision of the program educational objectives. The faculty members in each program completed this task in Fall 2002. The program educational objectives and outcomes were also presented at College Student/Faculty Forums during the Fall 2003 and Spring 2004. They were also disseminated to freshmen students during the orientation sessions and in EGR 1303-Exploring the Engineering Profession. The revision of the program educational objectives, if needed, is scheduled for 2006.

During a period between 2002-04, a great deal of resources were directed to create a system and processes that address the needs and concerns of program constituencies, as well as the evaluation metrics by which programs to be judged. A central force moving this integrated system forward was the College ABET Committee. Starting in Spring semester 2002 each department began developing survey instruments and obtained feedback from students regarding course objectives and outcomes. The department also developed survey instruments to obtain input from other major constituencies.

The formal evaluation instruments used to evaluate the Mission and Objectives were the Senior Student survey, Graduating Student survey, Exit interview, Alumni survey, and the Employers survey. The Senior Student and Graduating Student surveys carry less weight than the other surveys since these constituencies have not yet had an opportunity to determine if the program objectives are actually suitable in their professional lives.

Evaluation Tools for Program Educational Objectives

The tools for the evaluation Educational Objectives were:

1. Alumni Survey (primary)
2. Employer Survey (primary)
3. Senior Student Survey (secondary)
4. Graduating Student Survey (secondary)
5. FE Exam (secondary)

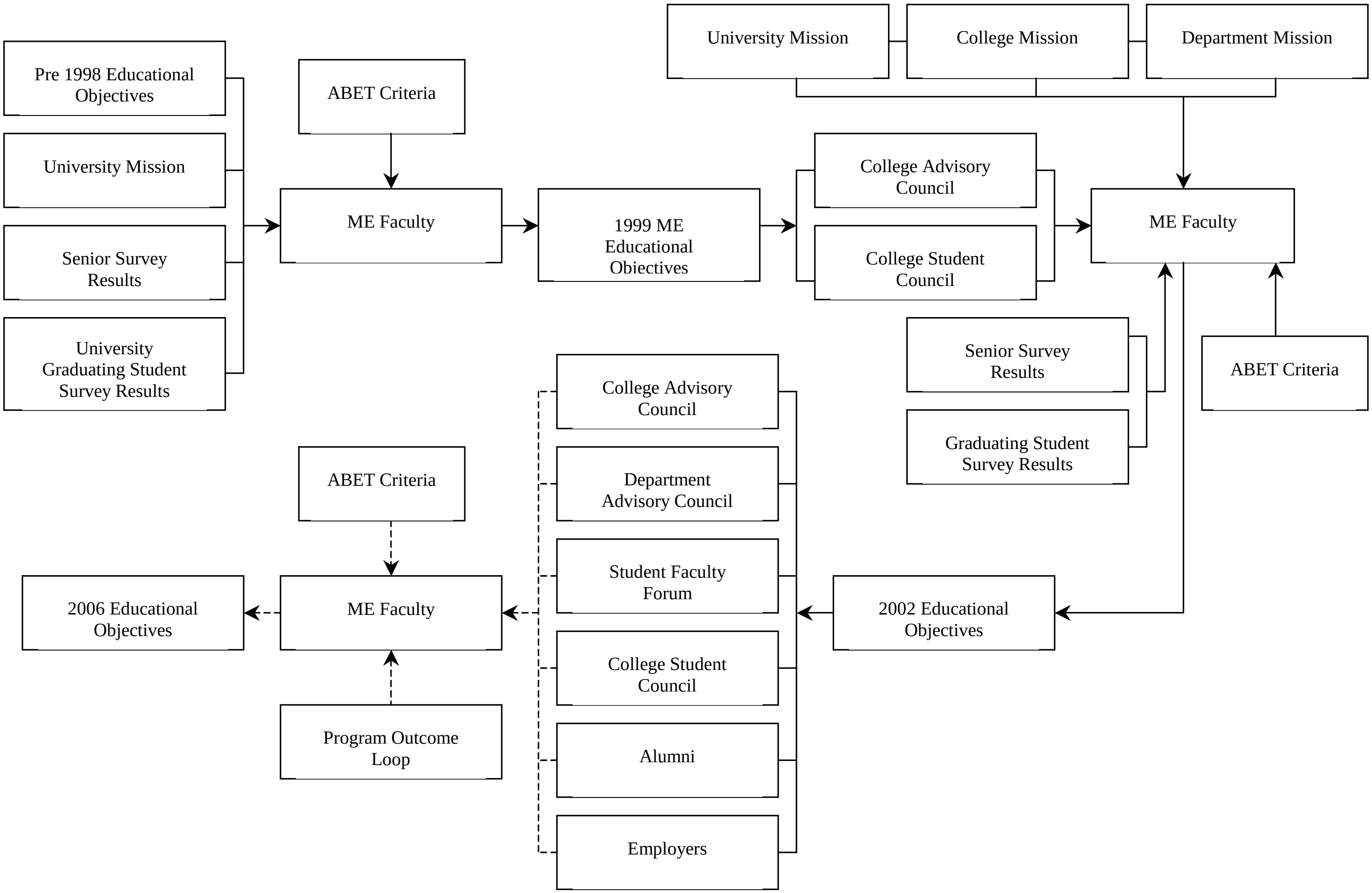

Fig. 1. History of determination and evaluation of the program educational objectives

A questionnaire was developed and mailed to alumni who graduated with a BS degree within the past five years. The alumni were asked about their GPA at the time graduation, whether they have taken or passed the Fundamentals of Engineering exam, if they have already received their Professional Engineering (PE) license, whether they have received graduate education, if they hold membership in professional societies, the type of employment, and the range of salaries, They were asked about the quality of education they received at UTSA and whether that education prepared them for a professional career. Additional questions were asked which were related to program educational objectives and outcomes. On a separate form the alumni were asked to identify their immediate supervisors with contact information.

Another survey questionnaire were developed for the employers of the graduates. This survey was sent to immediate work supervisors of the alumni. Employers were asked to rate 11 attributes describing their employees that recently graduated from the UTSA. The employers were asked to rate their employee's **preparedness** in each attribute and rate the **importance** of each attribute in preparation for engineering practice. The employers were also asked to list any strong qualities as well as knowledge or skills that may be deficient in their UTSA engineering employee.

Outcome Assessment Instruments

The assessment instruments fall into three general categories: audits, surveys, and student performance results. The feedback cycle varies for each of the instruments. While some provided immediate feedback on student progress in achieving the outcomes and allow corrective actions to be made at the beginning of each semester, others required long-term analysis over several years[2, 3].

Audits

Several types of audits are identified for assessing program outcomes.

Curriculum Audit: The curriculum audit provided information on curriculum contribution to the Program Outcomes. Each engineering curriculum was mapped to its program outcomes and it was shown whether each course makes a primary (1) or secondary (2) contribution to the POs. Other instruments, such as surveys and test results, were used to determine whether students are achieving program outcomes. Analysis is an on-going process and the curriculum is adjusted when necessary.

Advising Process and Enforcement of Prerequisites: Advising and enforcement of course prerequisites ensured that students are taking required courses in the proper sequence. The College of Engineering has established an advising policy requiring all students to see a faculty advisor before registering for courses. Each student provides a copy of his/her transcript that shows the completed courses with grades. A system to check prerequisites has been implemented. At the beginning of each semester, students lacking the required prerequisites are dropped administratively from the course.

Course Transfer Audit: Transfer credits from community colleges and other universities are reviewed for quality and topic coverage and approved by the Engineering Advisors, Department Chair, and the Associate Dean for Academic Affairs. Typically, Core Curriculum requirements and lower division courses such as calculus, technical (engineering) physics, and introductory engineering courses are automatically accepted, based on articulation agreements with community colleges. Transfer of upper division courses requires a careful review by the Academic Advisors, Department Chair, and the Associate Dean. The course coordinator is contacted for advice when the department chair is uncertain about the course content.

Surveys

Survey instruments for assessing the outcomes are as follows:

Course Objective Survey: This survey assesses student opinions on their success in reaching course objectives. In Spring 2002, each engineering department began to develop survey instruments to obtain feedback from students regarding the course educational objectives and outcomes. The course coordinators were asked to develop a set of comprehensive and specific objectives for each of the courses in the curriculum. During that semester each department conducted surveys in selected undergraduate courses. The course objective survey process was expanded to include all courses offered in Fall 2002.

Course objective surveys are typically conducted close to the end of the semester (12-14 week). Since Fall 2002 the course objective survey and the student rating of instruction were conducted at the same time. In Fall 2001 UTSA adopted the instrument developed by the Individual Development and Educational Assessment (IDEA) Center[4] to evaluate the quality of instruction. Questions 1-47 of the instrument are used for the evaluation of the course and the quality of instruction. This instrument also allows an option of asking 19 additional questions (questions 48-66). Starting in Fall 2002 questions 48-66 were used to assess the learning objectives for each course.

The course objective questionnaires include information on prerequisites and a list of course objectives. These are followed with a set of questions seeking student opinions on their knowledge of prerequisite topics and their success in meeting the course objectives. Students have the following choices in response to questions on the survey: 1= definitely false, 2= more false than true, 3= in between, 4 = more true than false, and 5= definitely true. An average score above 3.0 represents a collective positive attitude of respondents towards a particular question.

The results of student course objective surveys provide instructors immediate feedback on learning objectives at the end of each semester. This allows the instructor to make adjustments and improvements to the course in the following semester.

The IDEA Student Rating of Instruction Group Summary Report: This report summarizes the quality of instruction in the department and shows how the course objectives identified by instructors as essential or important relate to the student outcome for the program objectives.

Engineering Seniors Survey: A survey is conducted every semester in the capstone design course to assess the opinions of graduating seniors on their success in achieving program outcomes and on their attitudes toward the department. The results of the surveys are reviewed and summarized by the Chair and senior faculty and presented to the entire faculty at the departmental meetings.

Student Exit Interview: The department chair interviews a diverse pool of graduating students each semester. Students provide feedback on their educational achievements, quality of instruction, facilities, laboratory equipment, and future plans. They also make suggestions on how to improve the curriculum and students' campus life experience. The results of interviews are summarized by the Chair and presented to the entire faculty at the departmental meetings.

UTSA Graduating Student Survey: UTSA's Office of Institutional Effectiveness conducts surveys of all graduating students both at undergraduate and graduate levels on a regular basis. The results are summarized for each degree program, each college, and the entire university.

Student performance measures

The primary performance measures used to assess whether students are achieving the Program Outcomes include graded homework, quizzes, exams, laboratory reports, project reports, and oral presentations. The results of the Fundamentals of Engineering (FE) exam also provide additional measures.

Prerequisite Quiz: During the first week of each semester a diagnostic prerequisite quiz is given in each course to determine the proficiency of students in the prerequisite topics needed in the course. One immediate benefit of the prerequisite quiz is that the course instructor is able to use the results to adjust his/her lectures by using course topics to review those prerequisites topics which students had difficulty with. For example, in an introductory thermodynamic course integration methods of calculus could be reviewed in examples involving energy transfer by work resulting from a system moving boundary.

Student Grades: All courses in the curriculum contribute to at least one of the program outcomes. The minimum passing grade at UTSA is a letter "D." However, the engineering programs have set higher standards for the minimum passing grade for all math, science, and engineering foundation courses. Each program requires that all prerequisites to engineering courses be satisfied with a grade of C or better.

The faculty have established specific course objectives for each individual course in the curriculum. The course objectives are directly related to a set of program outcomes and hence to the program educational objectives. Each course syllabus provides information on how the course contributes to the program outcomes.

Outcome Assessment Processes

Several different tools were employed to assess each program outcome. Various assessment instruments were briefly discussed in the previous section. The assessment tools varied in complexity of what they measure and the type of information they provided. A weight of 1 to 5 is assigned to each instrument, 1 indicating low importance and 5 indicating very important. The course audit described later is the most important part of the program outcome assessment process.

To ensure that students achieve the desired program outcomes, a two-tier process is employed. The first tier is implemented at the course level in the “Course Loop” (or course audit loop) as shown in figure 2. The second tier is implemented at the curriculum level in the “Curriculum Loop,” shown in figure 3. The two-tier process provides a system of on-going evaluation and continuous improvement of the program.

The objective of the first tier is to make sure that the specific course outcomes are successfully achieved, courses are updated, and instruction is properly performed. Course coordinators have the responsibility of making sure that courses are taught properly and that the course outcomes are evaluated on a regular basis. The department chair has the overall responsibility for all the courses in the program.

Course Audit Loop

The course audit loop is the heart of our evaluation process. It is a short-cycle assessment tool that provides immediate diagnostic feedback, which includes several assessments. Since Fall 2003 each engineering course has been peer reviewed every semester by a set of faculty assigned to the course. The reviewing faculty members (course peer review subcommittee) are knowledgeable about the course. They include the course coordinator and two or three other faculty who are typically on the teaching rotation for the course. It is important to emphasize that what is being audited is the course, not specifically the instructor.

The course audit loop involved the review of two sets of documents: course notebook and course portfolio.

- The course notebook contains samples of students work (graded homework, exams, projects, etc.). Three examples of student work are collected in the course notebook (one high grade, one average grade and one low grade).
- The course portfolio contains a set of documents that are permanently maintained for the course. These documents include the results and analysis of the prerequisite quizzes, results and analysis of course objective surveys, grade distributions, and all previous assessments and recommendations by the group of faculty assigned to the course.

The course peer review subcommittee reviewed all materials in the course portfolio and course notebook and provided feedback on topic coverage and on whether the course objectives are being met. The assessment of student performance in achieving the program outcomes was based on review of the materials included in the course notebook and course portfolio. Under the coordination of the department chair, the program faculty members approved any major changes in the course content. The finalized changes were reflected in the course syllabus.

The faculty members discussed the curriculum in departmental meetings or college meetings (for common courses in the college). Any curriculum changes wer reviewed and approved by the

Academic Policies and Curriculum Committees at the College and the University levels. After the approval of changes, the modified curriculum is implemented in the appropriate courses and thus the feedback loop closed.

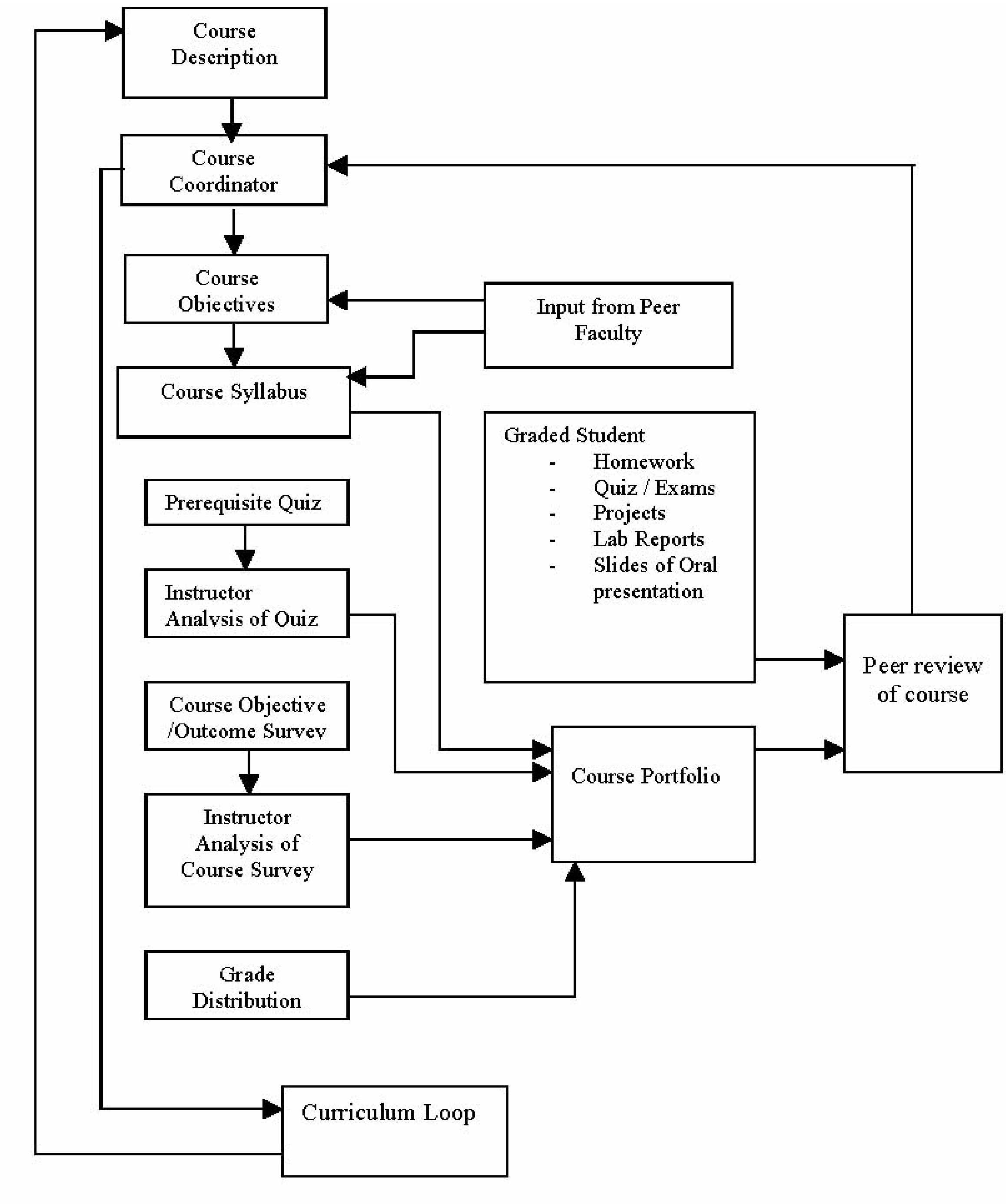

Fig.2. Course Audit Loop

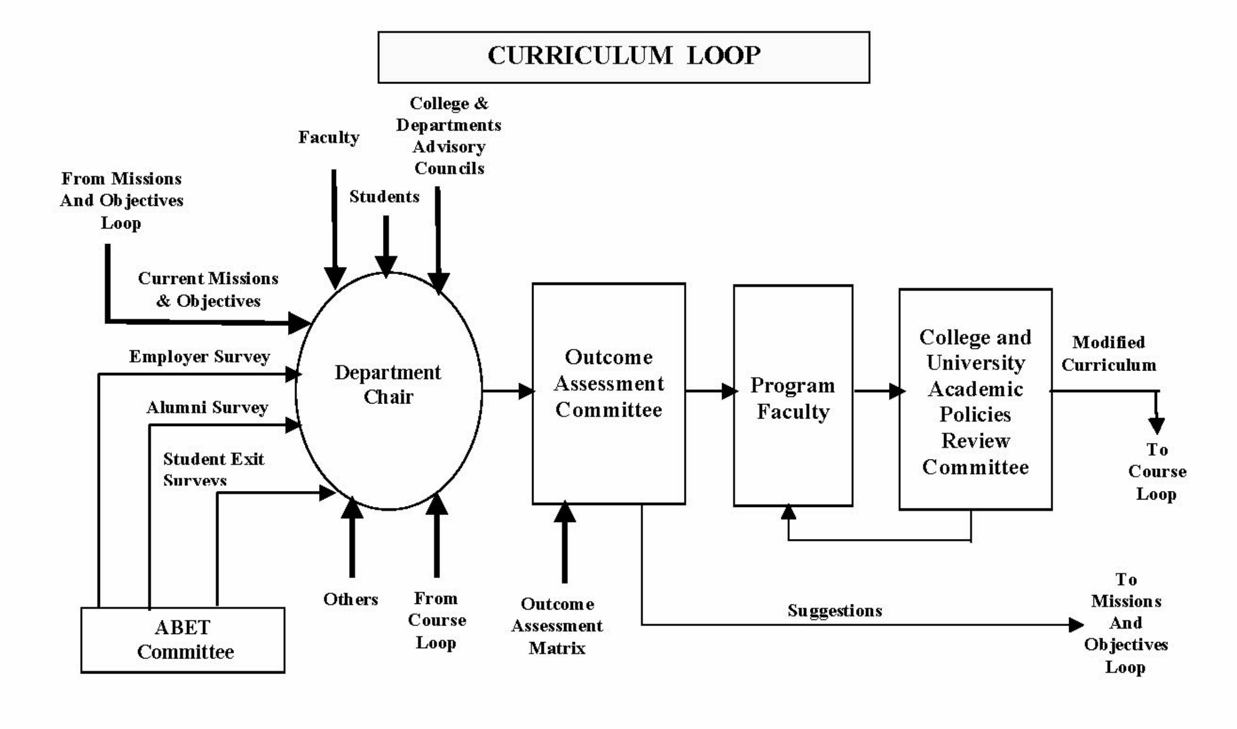

Fig 3. Curriculum Loop

The course portfolio contents are:

Course Syllabus: The course syllabus is important for several reasons. It is the initial contact with the student that clearly defines how course objectives are tied to the program outcomes. The syllabus sends a clear message to the student that time has been spent to plan the course and there are instructor expectations from students. It also relays to the student that the information being disseminated and tested through the course is a fundamental building block to the entire engineering education. The content of the course syllabus was maintained as consistently as possible over multiple terms. This allowed for a useful evaluation of the teaching methods and instruction tools.

Grade Distribution: This data assisted the course peer review subcommittee members in making a judgment on whether the course makes contributions to the achievements of the defined program outcomes. The objective is to demonstrate that the students who pass the course are achieving the program outcomes defined in the course syllabus. A positive shift in grade distribution might indicate that changes made in the instruction of the class had been successful when the same instructor teaches the course.

Course Objective Survey and Analysis: A critical item used in the analysis of the course is the student course survey. The key in terms of the portfolio audit is whether the survey data was analyzed and acted upon. The continuous improvement program requires that the course coordinator take the extra steps to analyze the data and formulate an action plan to address any item that receives an average score of less than the defined threshold number (3 to 3.5 on a 5 point scale). Therefore, the course portfolio contained a summary of the course objective survey questions and scores, as well as a Course Survey Review and Action Form. The form identified the following:

- items on the questionnaire receiving a low score
- a comment by the instructor from that term as to the most probable reason for the low score
- a proposed action that will potentially increase the score in the next term

Prerequisite Quiz and Analysis: Also included in the portfolio was an analysis as to whether the students have any difficulties with the prerequisite topics needed in the course. A prerequisite quiz was administered within the first two weeks of class and the instructor analyzes the results. The instructor took actions during the term to resolve students' difficulties in prerequisite topics. For instance, if the quiz denotes a problem with integration skills, then a possible action would be demonstrating integration within the context of solving example problems. The recommendations requiring adjustments in prerequisite courses wer conveyed to the appropriate course coordinator and discussed in faculty meetings.

Critical Evaluation Documents: The final component of the portfolio was any document that clearly denotes how evaluation within the class was conducted. Examples are forms used to evaluate design reports and presentations.

Faculty Course Peer Review and Assessment: The examination of the materials in student notebooks and information in the course portfolio best represents the continuous assessment process and course improvement each program had implemented. Each course portfolio is a binder containing the items discussed earlier in this section. It is stored at a central location that can be easily accessed by the course coordinators and reviewers. During the 2003-04 academic year all information in the portfolio were updated at the end of each semester for the courses taught during that semester.

Each course peer review subcommittee reviewed the portfolio and collected student notebooks. The course assessment rubric form was designed and used in this assessment process. After reviewing the contents of the course notebook (samples of students work) and the course portfolio (materials such as surveys, prerequisite quiz, results, and the analysis for each) the reviewer assigned an appropriate score for each item on the form. Contributions of the course to the desired program outcomes are assessed and appropriate scores were recorded on this form. The scores were averaged for each item on the form. A threshold value of 3.0 (out of 4.0 points) was expected for the primary contributions to course outcomes and a threshold value of 2.0 were expected for the secondary contributions to designated program outcomes. The course coordinator prepared a short summary report for the course. If the average scores for the program outcomes were below the expected threshold values, the course coordinator made recommendations for the corrective actions. The recommended corrective actions were acted upon at an appropriate level to ensure the achievement of program outcomes.

Lessons Learned

Fall 2004 ABET accreditation visit was the first time that our engineering programs were being evaluated under EC-2000 criteria. As result, the faculty spent a vast amount of time and effort in preparation for this visit. Many hours of manpower were spent for the development of the program objectives, program outcomes, development of assessment tools; collecting data, and analyzing survey results. Even though we had a successful ABET accreditation visit, we erred in some areas as described in the following paragraphs.

Development of Program Educational Objectives and Outcomes: As described earlier, the first program educational objectives and outcomes were developed in 1999. The original program educational objectives consisted of a set of general statements that supported the University, College, and the Division of Engineering missions. The program outcomes were identical to the statements of ABET criterion 3. (a-k). In 2000 a group of faculty attended several workshops offered by ABET[5, 6]. In these workshops we were instructed that we should not list the ABET criterion 3 (a-k) as our program outcomes. It was suggested that each institution's outcome statement should contain two or more attributes listed in ABET criterion 3 (a-k). As a result we modified the statements for program education objectives and outcomes. As an example, the latest program educational objectives (PEO) and program outcomes (PO) for the mechanical engineering program is listed below:

PEO A: The graduates of the program are expected to have the ability of applying the fundamentals of mathematics, sciences and engineering to quantitatively analyze problems.

POs for PEO A: Students in this program will develop the following abilities through their undergraduate education in this department:

A-1 to use the principles from chemistry, physics, statistics, and mathematics in engineering applications
A-2 to use computer-based tools for engineering applications
A-3 to identify, formulate, and solve engineering problems

PEO B: The graduates of the program are expected to have innovative design skills, including the ability to formulate problems, to think creatively, to synthesize information, and to communicate effectively.

POs for PEO B: Students will develop the following abilities through their undergraduate education in this department:

B-1 to formulate design problem objectives, constraints, and synthesize problem information
B-2 to develop creative and innovative designs that achieve desired performance criteria within specified objectives and constraints
B-3 to communicate effectively through written, oral, and graphical presentations (technical reports and presentations)

PEO C: The graduates of the program are expected to have the ability of using modern experimental techniques; collect, analyze, and interpret experimental data; and effectively communicate the results.

POs for PEO C: Students will develop the following abilities through their undergraduate education in this department:

C-1 to design and conduct experiments to analyze and interpret experimental data
C-2 to use modern engineering tools, software, and laboratory instrumentation
C-3 to communicate effectively through written, oral, and graphical presentations

PEO D: The graduates of the program are expected to develop diverse skills needed to be successful engineers.

POs for PEO D Students will be introduced to the following issues through their undergraduate education in this department and gain:

D-1 an ability to work in teams to solve multi-faceted problems
D-2 an ability to understand and contribute to the challenges of a rapidly changing society
D-3 an understanding of ethical and societal responsibilities of professional engineers
D-4 an understanding of the need for lifelong learning and continuing professional education

As we were preparing the self-study report, we had to map the program outcomes into ABET criterion 3 (a-k). We questioned the logic of not listing criterion 3 (a-k) as our program outcomes. As we investigated this further, we found out that ABET now encourages programs to list criterion 3 (a-k) as their program outcome and add few additional outcomes unique to their program. We also realized that some the statements for our program educational objectives were awkward. They seem to represent a combined statement of several outcomes. Since the evaluation of program educational objectives operates on a long-term cycle and they cannot be changed frequently, we have decided to review and modify these statements in 2006.

Faculty Participation: Active participation of faculty is essential for an implementation of the assessment process described in this paper. The demand on faculty time for teaching and conducting research usually makes the ABET accreditation matters a low priority. However, if faculty members are encouraged to play a role in the development of the assessment tools and procedures, they will become more eager in participating in the evaluation process. Therefore regular faculty meetings are necessary to continually engage faculty in this process.

Constituencies: When we began the process of developing program educational objectives and outcomes, we considered a long list of constituencies, which included parents, high school students and teachers. Since all these constituencies must participate in providing input in the development and evaluation of program educational objectives, very early in the process we realized that the number of constituencies should be limited.

Development and Use of Survey Questionnaires in the Assessment process: Since 1998, as we were preparing for the accreditation visit, we developed several survey questionnaires for the evaluation and assessment of program educational objectives and outcomes. In addition we relied on other surveys, which were conducted by the university, or existed before 1998. All the survey results provided important information about the department, the college, and the university. However, as we were preparing the self-study report, we realized that not all results were useful for demonstrating whether the students are meeting the program outcomes or graduates are satisfying the expected program educational objectives. For example UTSA's Office of Institutional Effectiveness conducts surveys of graduating students for both undergraduate and graduate programs on a regular basis. Even though these results provided useful information about the program, they could not be directly tied to the program outcomes; therefore, they will be eliminated as a program outcomes assessment instrument in the future. The Exit Interview questionnaire provided the department chair with useful information regarding the operation of the department. However, the results could not be directly related to the program outcomes. The questionnaire was modified to include questions related to program outcomes.

Collection of Data and Analysis: All workshops we attended warned institution about collecting data without knowing how to use them for the evaluation and assessment of the program educational objectives and outcome. More data is not always better[7]. If the assessment question is not clearly defined and the outcomes and performance indicators are not measurable, then the results will be useless. Program outcomes must be clearly defined with limited number of performance indicators. The data collection should be focused and efficient. For example in the two years prior to our scheduled accreditation visit we decided to assess all courses in our curricula every semester. As was described earlier, the course assessment included an elaborate process of data collected from surveys and prerequisite exams, and their analyses. Even though we collected data for four semesters, in most cases we were able to complete analyses of prerequisite exams, course objective surveys, and peer review process only for two cycles. The question we asked ourselves was that whether is necessary to assess each course in the curriculum every semester or should we limit the assessment only targeted courses. An assessment of tollgate courses is a more efficient way of producing information for the assessment of program outcomes.

Alumni and Employers Surveys: During the 2003-04 spring semester engineering programs sent 650 survey questionnaires to the alumni who had graduated in the last five years. A form was also included in the survey package, where the alumni were asked to identify and provide contact information for their immediate supervisors. Only seventy five (75) completed surveys were returned. A separate survey questionnaire was sent to 70 employers (immediate supervisors of the alumni); 58 were completed and returned. One problem we encountered was that more than half of the letters sent to alumni were returned by post office. Obviously, we need to establish a more accurate database for our alumni. One solution is to create a permanent e-mail address for our alumni. Currently, UTSA provides each student with an e-mail account. The university has attempted to communicate with students through this e-mail account. We have proposed to the University to allow students to maintain their e-mail accounts after graduation.

Preparation of Self Study Report: Our experience is that the preparation of the self-study report should start as early as possible. We recommend a self-study report should be drafted at least two years prior to scheduled visit to allow sufficient time for adjustments needed to modify the survey questionnaires and analyzing the results.

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Biography

AMIR KARIMI
Amir Karimi is a Professor of Mechanical Engineering and an Associate Dean of Engineering at The University of Texas at San Antonio (UTSA). He received his Ph.D. degree in Mechanical Engineering from the University of Kentucky in 1982. His teaching and research interests are in thermal sciences. He has served as the Chair of Mechanical Engineering twice; first between 1987 and 1992 and again from September 1998 to January of 2003. Dr. Karimi has served on curriculum committees at all university levels and has been a member of the University Core Curriculum (1993-95 and 1999-2003). He is the ASEE Campus Representative at UTSA and is the current ASEE-GSW Section Campus Representative. He chaired the ASEE-GSW section during the 1996-97 academic year.