

## Assessment Process at a Large Institution

P. David Fisher  
Michigan State University

**Abstract** - This presentation focuses on the challenges encountered at a large, diversified institution as it organized itself, developed strategies, and implemented plans for continuous improvement through outcomes assessment of its undergraduate engineering programs. Several questions are addressed, including the following. What have been the respective roles of the faculty and administration? What has been Michigan State University's critical path in transforming itself to comply with *ABET Engineering Criteria 2000* [1], [2]? What has changed in terms of the institutional self-study process? What important feedback has come from constituents? What benefits have been realized? What are some of the ongoing projects to further improve the academic programs? And, finally, how much did this effort cost?

### Introduction

In the April of 1996, I attended an IEEE-ABET/EAC Program Evaluator's Workshop in San Diego, California. For me, this was a refresher workshop since I had previously been certified by the IEEE-ABET/EAC as a Program Evaluator for electrical and computer engineering programs. Attendees were given a draft of ABET Engineering Criteria 2000 (ABET 2000), and it was discussed for about 30 minutes. Michigan State University (MSU) is scheduled for its next general review by ABET during the 1998-99 accreditation cycle. I learned at this workshop that this would coincide with the first year of the three-year phase in period for ABET 2000. I further learned that MSU would have an option of having its engineering programs evaluated under the existing criteria or under ABET 2000. Having attended a three-day FORD-MSU Continuous Quality Improvement (CQI) workshop May of 1995, I recognized the long-term benefits for MSU if it elected to transition as quickly as possible to ABET 2000.

Because we had the option of moving to the new criteria or staying with the existing one, I was confronted with a problem many other institutions will not face in the future. I had to build a consensus within my department and within the college that ABET 2000 sooner would be much better than later. Throughout the summer of 1996, I developed a good understanding about ABET 2000. I invited to campus a representative group of employers of our students. I called this our body *Employer Stakeholder Focus Group*. They reviewed ABET 2000 and urged us to go for it. During the summer of 1996, I also met with the dean and discussed with him alternative strategies for proceeding. We agreed the process should be faculty driven. This is very consistent with ABET 2000 itself and with MSU's policy of delegating curricular responsibilities to the faculty. I further believed the process should be driven by the faculty because the faculty ultimately had to buy into ABET 2000 in order to make it work at MSU. As a professor of electrical engineering and a person with no administrative position, I agreed to assume the leadership role. I agreed to keep the dean informed of my progress. I would work during the fall of 1996 within my own department to see if the faculty would buy into ABET 2000. And I would keep other departments informed by giving periodic presentations to the department chairs. So, the dean and I agreed on a near-term plan; however, we knew the outcome was very uncertain.

### Activities and Progress—Fall of 1996

During the 1996-97 academic year, I chaired the department's undergraduate curriculum committee; so, I was in a natural position to lead the discussion at the department level. At the department's fall faculty retreat, I introduced the faculty to ABET 2000, explained our option, and laid out what I saw to be the opportunities and risks for transitioning to ABET 2000 for the 1998-99 accreditation cycle. I also informed them of the Employer Stakeholder Focus Group, and its recommendation that we move forward with ABET 2000. At the close of the discussion, I indicated that this issue would become a major focus for the curriculum committee during the coming year.

ABET 2000 was a regular item on the agenda of the department's bi-weekly curriculum-committee meetings. Members of the committee, including student representatives, learned about ABET 2000. They discussed the opportunities and risks associated with moving forward to quickly with this new accreditation criteria. Draft educational program objectives were developed for both the electrical and computer engineering programs. The committee tried to identify constituent groups, assessment processes and specific assessment instruments. While some outcomes assessment had been going in the department for several years, it became clear that existing instruments would have to be modified and new ones would have to be created.

During these deliberations in the fall of 1996, it became clear that the ABET-2000 document was silent in a very important area. It made no mention of the need for *Course Learning Objectives*. We concluded that each key course in the engineering-student's program of study needed to have learning objectives associated with it. While traditional course-catalog descriptions and course syllabi each has its purpose, they were not course learning objectives. Catalog descriptions describe topics covered in a course. The course syllabi describe reading assignments, the flow of lectures/laboratories, grading policies, etc. Course learning objectives identify what students are expected to learn during the course. The committee came to realize that course-learning objectives should map into educational-program objectives. Then, the mapping would need to be assessed to determine potentially weak areas within the academic program.

For example, one of our draft educational program objectives was the following: "...a knowledge of probability and statistics, including applications appropriate to the electrical/computer engineering program." How would we determine if program objectives were satisfied unless students were required to take courses that contained similar course learning objectives? We would need to have faculty place these types of learning objectives in appropriate electrical/computer engineering courses. They would need to teach toward these learning objectives, and then student work would need to be assessed to demonstrate that the learning objectives were being fulfilled.

Toward the end of the fall of 1996, I reported our findings to the department faculty, to the dean, to the department chairs and to the Employer Stakeholder Focus Group. With the support of the dean, I recommended to the department chairs that a college-level task force be established and be given a charge to report back to the dean no later than April 1, 1997 on the following issues.

- Should the College of Engineering seek continued accreditation of its undergraduate academic programs under ABET 2000 during the 1998-99 accreditation cycle?
- If so, what should be our strategy and plan?
- What are the opportunities, risks and costs?

During the semester break, the college-level task force was formed. It was called the ABET 2000 Task Force. The dean asked me to chair the task force, and each department chair (seven) appointed a faculty representative to sit on the task force. The Assistant Dean for Student Affairs and the Director of Cooperative Education also served as members of the task force. It is important to note that membership on this task force did not come from the college-level curriculum committee. The latter specializes in day-to-day issues. We wanted a separate task force that would serve a strategic planning function with respect to the next accreditation cycle.

### **Activities and Progress—Spring of 1997**

Beginning in the spring of 1997, activities were proceeding on two fronts—the department level and the college level with the department level taking the lead.

#### **Department Level**

Members of the curriculum committee understood the wisdom of developing course learning objectives. Even if we didn't proceed with ABET 2000, published course learning objectives for each course in the department would have the following benefits. Their existence would:

- significantly improve the student advising process,
- significantly improve course consistency from semester to semester, and
- significantly improve the interfaces among courses.

Even though there would be some start-up cost, it was understood that their maintenance would be relatively simple. So, the department faculty proceeded to develop learning objectives for each course administered by the department.

Key progress made within the department during the spring of 1997 included the following:

- Course learning objectives were developed and published for each course administered by the department [3]. It was recommended that these be used on a trial basis during the 1997-98 academic year.
- Educational program objectives were developed and published for the electrical engineering and computer engineering programs [4].
- The programs' constituent groups were formally identified.
- Work began to develop and use outcomes-assessment processes and assessment instruments. It was recognized, however, that full implementation of the outcomes-assessment processes would take another year.

- The faculty voted in favor of recommending that the department seek continued accreditation of its electrical engineering program and first-time accreditation of its computer engineering program under ABET 2000.

The progress made within the department during the spring of 1997 suggested that we were in fact on track with respect to the transition to ABET 2000 for the 1998-99 accreditation cycle.

### College Level

The ABET Task Force met bi-weekly during the spring of 1997. For me, it was déjà vu since I was now repeating at the college level what I had started a semester earlier at the department level. At its first meeting, the dean addressed the task force, gave the body its mission, and requested a response in writing no later than April 1, 1997.

In early meetings, I shared with the task force things that had been learned and accomplished at the department level. The committee decided that a good way to proceed would be to try to understand the basic differences between the ABET's existing accreditation criteria and ABET 2000. As we compared the criteria, we noted differences, opportunities, risks and costs. At each juncture, I gave them hardcopies and MS Word/ Excel files of all documents previously generated at the department level. For example, when we discussed the need to develop and publish a set of educational program objectives for each academic program, I gave them my department's draft documents for the EE and CpE programs.

The task force delivered its written report to the dean in early April of 1997 and met with him to discuss the task force's findings and recommendations. Key points made in this final report are summarized below:

*Constituent Groups:* Constituent groups for each academic program should include students, faculty, academic staff, graduates, corporate sponsors, and employers. Employers should include the employers of cooperative-education students and graduates of the program.

*Operating Principles for Criteria 3—Programs Outcomes and Assessment:* The task force recommended that the following operating principles guide the overall assessment process.

- Striving to develop and improve an academic program represents a continuous process.
- An educational program objective is acceptable only if outcome measures exist to demonstrate progress toward, including achievement of, the objective.
- The assessment instruments must be compatible with the intent of ABET Engineering Criteria 2000.
- The assessment of educational outcomes requires the involvement of the constituents.
- Different assessment instruments may serve different purposes; however, the set of all assessment instruments must provide adequate coverage of the stated program educational objectives.
- Assessment involves sampling various populations. The sizes of the samples and the sampling frequencies must be justified.
- All surveys should be consistent with MSU's policies related to research involving human subjects.

- The cost of the ongoing assessment process must be budgeted, monitored, and maintained at a reasonable level.

*Assessment Instruments:* Consistent with the above assessment operating principles, the task force identified the following possible assessment instruments: student portfolios, course portfolios, surveys from students returning from cooperative-education assignments, surveys of graduating seniors, student transcripts, surveys of graduates two years after graduation, employers of cooperative education students, employers who interview our students for employment and our corporate sponsors, and, finally, employers two years after a graduate begins to work for the employer. The task force recognized that some of these instruments already existed but would have to be revised. Others would have to be developed. Still others, such as student portfolios, might not be used at all. Recall, one of the operating principles previously stated: "Different assessment instruments may serve different purposes; however, the set of all assessment instruments must provide adequate coverage of the stated program educational objectives." We recognized that developing assessment instruments would become an iterative process. We needed to determine the best assessment instrument(s) for each educational program objective.

*Accreditation Recommendation:* The task force unanimously recommended that the College of Engineering proceed with plans to have its undergraduate engineering programs reviewed during the 1998-99 accreditation cycle under *ABET Engineering Criteria 2000* [1].

*Future Activities:* The task force concluded its report by identifying the following issues that would need to be addressed once ABET made its decision as to whether or not Michigan State University would be accepted for review using Engineering Criteria 2000 during the 1998-99 cycle.

- The faculty will have to develop and publish educational program objectives for each academic program. This should be done in consultation with other constituent groups. It is further recommended that these not be placed in university-level publications but rather be published at the department and college level and be placed on the web for the general public to view.
- The faculty will have to demonstrate that the specific educational program can meet these educational program objectives. This would be a pencil-and-paper study to demonstrate that fulfilling the actual academic program requirements can lead to the achievement of the educational program objectives.
- Assessment instruments will have to be developed and implemented to obtain feedback on educational program outcomes. Different assessment instruments may serve different purposes; however, the set of all assessment instruments must provide adequate coverage of the stated program educational objectives. A sample set of assessment instruments currently used within the College of Engineering are provided in Appendix E of this report.
- The possibility of requiring the use of student portfolios as an assessment tool in the future needs further study. This study might include benchmarking the use of these portfolios at other institutions that have had more experience with them.
- The possibility of formally documenting and assessing student co-curricular activities in the future needs further study.

- A timetable will have to be developed to complete the required institutional self study.

This report was also shared with the departments, the college's administrative group, and the Employer Stakeholder Focus Group. The recommendations were approved across the college, and the dean requested that ABET review MSU's programs during the 1998-99 accreditation cycle under ABET 2000. ABET approved this option in June of 1997.

### **Activities and Progress—Summer of 1997**

During the spring of 1997 the leadership role shifted from the department level to the college level. The college-level task force, the department chairs and the deans all recognized that a high degree of college-level coordination would be required during the coming year in order to complete the work on developing and implementing outcomes-assessment processes, prepare the self studies, and prepare for the ABET site visit in the fall of 1998.

Two important ABET documents were downloaded from their website: *ENGINEERING CRITERIA 2000: Program Self-Study Instructions (1997-98 Pilot Visits)* and *ENGINEERING CRITERIA 2000: Manual of Evaluation Process (1997-98 Pilot Visits)* [5], [6]. Although these would most likely change for the 1998-99 accreditation cycle, we elected to study them closely and to develop a plan for completing the self-study reports by May 1, 1998.

The following was accomplished during the summer of 1997 through bi-weekly meetings of the college task force.

- We decided what portions of the self study would be prepared in the Office of the Assistant Dean for Student Affairs and what portions would be the responsibility of the individual departments.
- We developed model faculty CVs that would be used throughout the college.
- We reviewed the evaluation process and assessment criteria ABET program evaluators would use to evaluate our academic programs [6]. We agreed to begin mock evaluations of our own programs using to evaluate our own programs on a bi-monthly basis to assess of level of preparedness, as well as deficiencies in our academic programs. We did this by completing the following tables contained in [6]: *Table A-1: Level of Implementation -- Criteria 2000*, the *PROGRAM DEFICIENCY AUDIT* and the *EXPLANATION OF DEFICIENCIES*. We shared our findings with each other and with our respective curriculum committees and faculty; however, the results were not shared with others because of the sensitive nature of the findings. Individual academic programs did begin to take action on their program-specific deficiencies.
- We identified some areas for improvement in our college-level service courses and established a plan for improvement. We formed a team of people who would actively seek ways to improve the service courses within the College of Engineering. A \$450,000 proposal (with an additional \$455,000 in matching MSU funds) was submitted to the GE Fund to help seek ways to improve these service courses. This proposal was fully funded, and the project commenced on January 1, 1998.
- We continued to develop and refine outcomes-assessment instruments and determined which would best be administered at the college level and which should be left to individual departments. Assessment of students in specific courses and at specific levels in the program would take place at the department level; however, an assessment of college-level service courses and external service courses would take place at the college level. Senior exit surveys would be conducted at the college level with optional additional surveys conducted at the department level. Surveys of alumni would be conducted at the college level, again with optional additional surveys being conducted at the department level. The college would also

be responsible for all surveys related to cooperative education. Employer feedback would be sought both at the college and department levels with the college effort focusing on large employers who cut across departmental boundaries.

- The Employer Stakeholder Focus Group met to review our progress and plans and to provide us with additional feedback. They were very pleased with progress made during the past year. It had only one disagreement with what was being proposed in the way of outcomes assessment; namely, they recommended that samples of student work related to the major engineering design experience be sent out for external review by the employers of our students. To date, this difference of opinion has not been resolved.

### **Activities and Progress—Fall of 1997**

#### **Department Level**

At the beginning of the fall of 1997, a department-level ABET task force was mirroring the mission and activities of its college-level counterpart. This would free up the department curriculum committee to continue to function in its normal mode. The department-level task force was composed of the Director of the Computer Engineering Program, the associate department chairs in the Department of Electrical Engineering and the Department of Computer Science, a member of the department curriculum committee who had worked on the previous ABET self study, and myself. I would chair the task force.

The department-level task force was charged with planning for and preparing the program-specific self-study materials, while using the college-level guidelines.

At the fall of 1997 retreat, the faculty were provided with an update on the progress and plans for the coming year's ABET-related activities. Although the task force would be preparing the body of the self studies, it was pointed out that individual faculty members would need to become involved with the following:

- the preparation of individual faculty CVs;
- the preparation of laboratory plans;
- the preparation of required course support material, which ABET called the course "syllabi;"
- the collection and organization of student work for course portfolios;
- the review and revision of course learning objectives and educational program objectives;
- the evaluation of the existing programs and the development of plans to improve them.

During the fall of 1997, the task force monitored college-level activities. The faculty produced CVs, collected student work and continued to review and revise course learning objectives.

#### **College Level**

The college-level task force continued to review existing outcomes, to review and revise outcomes-assessment instruments and to review and revise outcomes-assessment processes.

Through feedback from students, faculty, alumni, and employers, the task force identified some areas of common concern related to all academic programs. For example, there appeared to be a major disconnect between the faculty in the College of Engineering and the faculty in the Department of Probability and Statistics. There was no communication and outcomes in the area of probability and statistics and their application to engineering problems appeared weak. Representatives from both sectors met to discuss the apparent problem. This resulted in the development of (yet another task force) to identify and address all problems. Another paper in

this session address the plans, activities and accomplishments of this task force and its impact on the undergraduate engineering programs [7].

It was decided that no actual work would be done on the self-study reports until ABET published its 1998-99 self-study instructions.

### **Activities and Progress—Spring of 1998**

In February of 1998, ABET released its self-study documents for the 1998-99 accreditation cycle [8], [9]. We immediately downloaded the files and searched for and identified differences between the earlier version. Although the basic accreditation criteria had remained the same, we discovered that the institutions were now explicitly being asked to prepare more self-study documentation, especially in the area of documenting the outcomes-assessment processes, the results of the outcomes assessment and the plans to further improve the curriculum.

#### **Department Level**

During the spring of 1998, the department-level task force oversaw and guided the final stages the self-study process. Required tables were completed by the appropriate administrators or their secretaries. A model course "syllabi" was developed that met ABET's self-study requirements for Appendix 1B and was distributed to the faculty, and the faculty completed them [8]. A faculty meeting was held early in the semester to share with the faculty results of the outcomes-assessment process. Faculty input was solicited so that recommendations for program improvement could be drafted. During the latter part of the semester, a second faculty meeting was held, where faculty had the opportunity to discuss the findings and recommendations contained in the self-study report.

The department continued to develop and refine its assessment instruments and administer them to the appropriate constituent groups. For example, graduating seniors were surveyed and the results of this survey compared with cohort surveys from previous years.

#### **College Level**

College-level activities mirrored those that were taking place at the department level, and each appeared to be in sink with the other. The Office of the Assistant Dean for Student Affairs prepared the college-level tables and boiler-plate materials needed for the self study. This office also work with support colleges and department to prepare course syllabi—e.g., mathematics, physics and chemistry courses. The task, at its bi-weekly meetings, continued to assess program preparedness, progress in completing self studies and other issues.

### **Summary and Conclusions**

This paper was submitted to ASEE on March 15, 1998; so, the self-study process was not yet been completed. We expect to have all required faculty input needed to complete the self studies by May 1, 1998. Copies of the self studies will be sent to ABET and to our evaluation team around September 1, 1998. At this time, we see no significant problems in meeting these deadlines. Moreover, we have full confidence that we will be able to demonstrate to our ABET program evaluators that all of our academic programs are in full compliance with *ABET Engineering Criteria 2000*.

Preparing for ABET 2000 was a very challenging and yet rewarding experience. We began in April of 1996 with a first glimpse of this new criteria. During the fall of 1996 we saw the



department faculty develop an understanding of the significance of it. In the spring of 1997, this understanding was transmitted to other departments in the College of Engineering through the college-level ABET Task Force. By the end of the spring of 1997, the faculty in the college were in full agreement that we should make an immediate transition to ABET 2000. Constituent groups were formally identified and immediately became involved. Educational program objectives, course learning objectives, and outcomes-assessment instruments were all developed during this short time interval. Outcomes-assessment processes were developed, implemented and refined throughout 1997. During the spring of 1998, the actual self-study document was prepared and final preparations were being made for the fall of 1998 ABET site visit.

The principal cost of this process to transition to ABET 2000 can best be measured in faculty time. Between April of 1996 and October of 1998, I estimate that I spent approximately 25% of my time on this effort. Between January of 1997 and October of 1998, I estimate that the eight other members of the college-level task force spent approximately 25% of their time on this effort. Between September of 1997 and October of 1998, I estimate that each of the seven academic departments had the equivalent of one faculty member working half-time on this effort. On a twelve-month basis, the total effort took approximately 5.5 people-years: 0.75 people-years for me to coordinate the overall effort, 1.25 people-years total for the remaining people on the college-level task force and 0.5 people-years for each of the seven academic departments.

### Acknowledgments

The achievements described in this paper would not have been possible without the significant contributions made by the various members of the college-level and department-level ABET task forces and by the Employer Stakeholder Focus Group.

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### Bibliographic Information

P. DAVID FISHER is a professor of electrical engineering at Michigan State University. He received his B.S. and Ph.D. degrees from the University of Pittsburgh and Johns Hopkins University in 1963 and 1967, respectively. Both degrees were in electrical engineering. He is a member of ASEE, IEEE Education Society and ACM. He is an IEEE-ABET/EAC program evaluator and has been certified to evaluate EE and CpE programs against ABET 2000.