Techniques for Assessment In a Successful ABET 2000 Accreditation Evaluation

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Abstract

Miami University's Manufacturing Engineering program successfully completed an ABET accreditation visit using the Engineering Criteria 2000 in the Fall of 1998. This paper will discuss the department's approach to fulfilling ABET 2000 assessment requirements. The department used a systematic approach to assessment for continuous improvement using twelve different assessment techniques. Each of the techniques and its strength relative to measuring the ABET 2000 criteria is discussed.

Introduction

Manufacturing Engineering is an ABET accredited Bachelor of Science program in the School of Engineering and Applied Science at Miami University in Oxford, Ohio. The primary mission of the Manufacturing Engineering Department is to provide quality graduates to meet societal and industrial needs. Approximately 140 students are enrolled in the Manufacturing Engineering program.

The program was accredited under the ABET 2000 criteria[1] which emphasizes establishment of program objectives and assessment of associated measurable outcomes. The approach developed at Miami University to achieve program objectives is based on, forming, reaching and maintaining our goals through a process of continuous improvement. The key to this process is assessment. The primary purpose of assessment is to provide information that will be used to improve our program. Since a variety of components are involved in a complete description of student outcomes at various stages in the academic program, it is essential that multiple measures of quality be employed.

As part of our assessment plan, we developed and implemented twelve assessment methods to assess the degree to which our graduates have achieved the discipline-oriented outcome characteristics enumerated in the ABET 2000 criteria. The methods were developed through inputs of all Manufacturing Engineering faculty, staff, student representatives and the dean's office. The twelve methods are discussed in five categories: Course Content, Customer Feedback, Graduate Surveys, Standards and Benchmarks, and Closing the Loop.

Course Content

These methods focus on students' performance during their study at Miami. The methods are an integral part of classroom activities.

1. Classroom-Process Evaluation Methods – These are faculty-developed tools to assess the achievement of course objectives and goals. As appropriate, faculty evaluate the degree to which students have achieved desired course outcomes through routine tests, laboratory performance, class participation, and final examinations. In addition, faculty evaluate education-process characteristics by using such techniques as one-minute papers, midterm and final course evaluations, and/or other techniques; by surveying students to obtain their self evaluation of whether course objectives and desired course outcomes are being achieved.

2. Portfolio Analysis. - We use a content-driven Course Portfolio to show the adherence of the course to the objectives stated in course syllabus. This type of course portfolio clearly assesses the content and design in the individual course (autonomous knowledge). Also, we use a Design-Thread Portfolio that describes student course work in a complete design sequence. We have integrated design into the curriculum through five such design sequences). The portfolio includes samples of student work from courses in the sequence and shows how the integrated design thread is implemented.

3. Pre-Post Learning of Engineering Design - Design reports generated in the freshman course, Introduction to Engineering Design, are used as a pre-learning vehicle for determining first-year students' understanding of the professional ways of knowing, reasoning, and problem solving. The design reports of first-year students are collected, evaluated and compared to the students' work in their capstone projects during the senior year. Results provide information about value added during the students' time at Miami.

Customer Feedback

These methods solicit our customers' feedback. Our primary customers are considered to be industry, employers of students, and students themselves during their time at Miami.

4. Industry Advisory Council - The Industrial Advisory Council ensures a linkage between the School of Engineering and Applied Science and business, industry, government and the health professions. This partnership helps the department learn about industry's needs and gain invaluable insight into the currency of its programs. The department affiliated members represent professionals from industry with expertise in the discipline. Issues discussed include curriculum, new initiatives, student preparedness, placement, and student recruitment and retention. These meetings provide valuable information on the quality of our students and program.

5. Employer Evaluation of Student Performance in Professional Practice - This assessment tool is based on employers' evaluations of our student on-the-job performance during students' co-op or summer internships. Some of the desired student outcome characteristics that are evaluated by the employer include planning, problem solving abilities, job knowledge, writing and oral communication, and teamwork. The evaluations give us timely feedback on student outcomes while students progress through the program. The feedback is reviewed for insights on student performance that can be communicated with the student prior to graduation; and departmental improvements that can be made.

6. Student Advisory Council - The purpose of the Student Advisory Council is to provide a mechanism for students to give constructive feedback on their educational experience. This partnership helps the department to communicate closely with the student body and learn first-hand their needs, concerns, and insight into their perception of the program. The chair meets regularly (at least three times a semester) with the student advisory council. At each meeting, issues are discussed to improve student learning and assess progress in achieving the desired student outcome characteristics and process characteristics. The chair shares and discusses student input with faculty, and collectively we address ways to implement student recommendations where appropriate. These meetings provide valuable qualitative information on the educational process of our students and program from the students' perspective.

Graduate Surveys

These methods focus on survey data collected during seniors exit interviews, graduates seeking first employment, and alumni.

7. Senior Exit Interviews and Surveys - The department chair holds a confidential exit interview with each graduating senior. In addition, the department conducts a survey of each graduating senior. A summary of the results is shared with the faculty and discussed in length during department meetings. Areas for improvement and action plans to correct problems are discussed and implemented.

8. Job Placement Surveys - This assessment tool is based on the School of Engineering and Applied Science survey of each graduating class to determine students' success in finding suitable positions. The data are combined into a statistical profile that gives a measure of satisfaction of one of our primary customers: employers who hire our students. For example, the results show the classification of the primary employers who hire our graduates, their geographical location, and the positions (job titles) in which they utilize to our graduates. Also, the results indicate the students' success in competing in the engineering market, and earning comparable salaries to those offered to engineering students from other schools.

9. Alumni Surveys - Periodically, the department surveys its alumni through the annual alumni newsletter. The surveys track job classification, salary ranges, and postgraduate education. Also, the surveys communicate the degree of satisfaction of alumni with their preparation for the business world and recommendations for further improvement. In addition, the results enable us to reflect on our objectives, goals, and how they achieve our mission.

Standards and Benchmarks

These methods rely on external reviews and comparisons with other, similar, programs.

10. Program Reviews - Periodically, the department undergoes three different reviews to assess the process as well as the outcome characteristics of its graduates. The first review is conducted every six years by Miami University. The review measures program quality, centrality to the mission of the University, and viability. The second review is conducted by ABET. The reports from ABET visits are used for improving the process and student outcomes. External consultants comprise the third review mechanism. Their reviews are utilized to assess specific components in the program such as students, faculty, facilities, and design content and

its integration into the curriculum. Among other things, these reviews are excellent tools to measure program quality against Miami and national standards.

11. FE Examination and National Competitions - The department provides opportunities throughout the students' study to engage in national competitions and examinations. These enable us to assess student outcomes against national standards. For example, the department has participated in the National Design Graphics Competition for first-year students, sponsored by the American Society for Engineering Education. Also, students are given the opportunity to enter senior design project into contests sponsored by national organizations or to submit papers or posters at professional conferences. In addition, we encourage our seniors to take the FE examination and evaluate the results in comparison with national and State of Ohio norms.

Closing the Loop

The following method is used to monitor the process of continuous implementation and improvement. The method enables the faculty to provide consistent and effective student advising, discuss trends, analyze data, provide recommendations, establish policies, and monitor implementation.

12. Student Advising and the Miami Degree-Audit Reports System (DARS) - Our advising system utilizes DARS to assess students' academic accomplishments and development. Every semester, students' DARS are distributed to each advisor to review and check student's progress toward meeting all degree requirements. In addition, the advisor checks that the student is taking courses in the proper sequence. Based on the DARS review, the advisor generates a general letter to his or her advisees and calls them for an appointment if deemed necessary. We conduct sessions on students' advising during the first week of every month in our weekly department meetings. In these sessions, each advisor gives an update on his or her advisees, shares any problems or concerns, and presents new ideas to make the advising process more efficient, effective and productive.

Documentation for ABET

To document the assessment process in preparation for the visit of ABET evaluators; we prepared notebooks for each group of methods. Each notebook contains an executive summary of the assessment tool (method), a summary of data, a discussion and follow-up. Also, the notebook contains raw data, action plans, and specific activities that demonstrate the action taken. In some methods, we submitted only samples of data (such as minutes, petitions, work, and student and company evaluations and feedback). The rest of the data are kept in folders available in the department main office or the chair's office.

In addition to the detailed notebooks, we prepared one notebook with all executive summaries and specific information for each assessment method, such as summary tables. This allows external reviewers to learn about our assessment methods and results without the need to review all notebooks.

To further assist the evaluators, we prepared a summary of how well we believed that each assessment method provided a measure of the effectiveness of our program in meeting the

ABET Criteria 2000. Table 1 shows this summary. An assessment method that is considered high provides quantitative and/or qualitative data, consistent and constant feedback, and a built-in mechanism that helps in facilitating further improvements. A medium rating is considered a secondary method of evaluating the criteria.

Table 1. Use of Assessment Methods to Evaluate ABET 2000 Criteria

	ASSESSMENT METHODS											
ABET CRITERIA 2000	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
(a) Knowledge of math, science & engineering	high	high					high			high	high	high
(b) Design & conduct experiments	high	high	high				high			high		
(c) Design a system, component, or process	high	high	high				high			high	medium	
(d) Multidisciplinary teams	high	high	high	medium	high		high			medium	medium	
(e) Solve engineering problems	high	high	high	medium	high		high			medium	high	
(f) Professional ethics	high			medium			high			medium	medium	
(g) Communication	high	high	high	high	high		high			medium	medium	
(h) Broad education	medium			medium		high	high		high	medium		medium
(i) Life-long learning				high					high	medium		
(j) Contemporary issues	medium			high		high			high	medium	medium	
(k) Use tech, skill & modern. tools necessary. for engineering practice	high	high	high	high	high		high	high	high	high	high	

Concluding Remarks

The success in the use of these twelve methods of assessment is reflected in the attainment of ABET accreditation under the ABET 2000 criteria. This success in using and documenting the system was enabled because of the teamwork of the Manufacturing Engineering faculty, staff, students and dean of the School of Engineering and Applied Science at Miami University.

Bibliography

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