

Seeking ABET Accreditation of Manufacturing and Mechanical Maintenance Technology Programs at Yanbu Industrial College

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Abstract

This paper narrates the effort in seeking ABET accreditation by the Department of Mechanical Engineering Technology at Yanbu Industrial college (YIC). An overview of the process of ABET accreditation and the timeline of significant events prior to the on-site visit at YIC by an ABET evaluation team is presented. The focus of this paper is the lessons learned during the several years of preparation. The suggestions offered to the department by the ABET evaluation are explained and included by enumerating the assets and liabilities of the department received during the period of preparation for accreditation.

Keywords ABET, Accreditation, Mechanical Engineering

Introduction

The purpose of this paper is to highlight the lessons learned from the accreditation process. The Mechanical Engineering Technology (MET) department at YIC decided to have two programs of study accredited by ABET. The ABET team for MET at YIC and the author hope that other engineering technology departments in moderate sized colleges considering ABET will benefit from the experiences discussed in this paper.

About ABET?

ABET, stands for the Accreditation Board for Engineering and Technology. It has been recognized as the accreditation body for engineering programs in the United States. ABET originally established in 1932 as the Engineers Council for Professional Development (ECPD) [1]. ABET accreditation shows that a program has met high standards of quality. A student graduating from an ABET accredited program is recognized as qualified for professional employment in many companies. ABET accredits programs of study, rather than institutions or departments.

ABET accredits academic programs at universities and colleges preparing graduates for entry into professional disciplines of applied science, computing, engineering, and technology. It is a specialized accreditation agency that accredits post-secondary degree-granting programs. Note that ABET accredits programs at

various levels; ABET does not accredit departments, colleges, or institutions. ABET is a private, non-profit organization comprised of 29 professional societies spanning the professional disciplines listed above. ABET accreditation is conducted by four accreditation commissions at the degree levels indicated below:

1. Applied Science Accreditation Commission (ASAC), Accredits programs at the associate's, baccalaureate, and/or master's levels.
2. Computing Accreditation Commission (CAC), Accredits programs at the baccalaureate level.
3. Engineering Accreditation Commission (EAC), Accredits programs at the baccalaureate and/or master's levels.
4. Technology Accreditation Commission (TAC), Accredits programs at the associate's and/or baccalaureate levels.

ABET has currently accredited approximately 2,500 engineering, engineering technology, computing and applied science programs at over 550 colleges and universities located or chartered within the U.S [2]. In November 2006, the ABET Board of directors directed the ABET accreditation commissions to accredit programs outside of the U.S [3]. The two undergraduate programs of study Mechanical Maintenance Technology (MMT) and Manufacturing Technology (MT) at Department of Mechanical Engineering Technology, YIC are confirmed by the Technology Accreditation Commission (TAC) of ABET as the first non-US programs to be accredited [3].

Initially, programs having current ABET substantial equivalency status will be given priority when applying for accreditation. Some initial evaluations may be deferred for one or more years if the demand for evaluations exceeds ABET's resources. The evaluation team provides a report of its findings to the institution. At the next annual ABET meeting, commission members vote on the recommendation of the evaluation team and the institution is notified of the action taken by ABET.

Who Are We?

Yanbu Industrial College (YIC) is a regional Technical College which offers Associate and Bachelor degrees. It currently has about 3,300 students being taught by 313 full-time faculty members [5]. The Department of Mechanical Engineering Technology includes two associate degree programs of study Mechanical Maintenance Technology (MMT) and Manufacturing Technology (MT), taught by 48 full-time faculty members. Last year the department granted 150 degrees of which 120 were in MMTP and 30 were in MTP. Both these programs have received accreditation by ABET.

The ABET Accreditation Process—Lessons Learned

Faculty members learned from issues during the process of preparing for ABET accreditation. Without addressing these issues, the department will almost certainly jeopardize future accreditation efforts.

Standards

ABET requires that all the criteria mentioned in their manual should be fulfilled for a program to obtain accreditation [4]. All the Objectives, Outcomes and Assessments for the programs are documented, including measurable objectives and expected outcomes for graduates. The program regularly assesses its progress against its objectives and used the results of the assessments to identify program improvements and to modify the program's objectives. Standards suggested are the program requesting ABET accreditation must have documented; measurable objectives and the program's objectives must include expected outcomes for graduating students.

There are nine criteria for accrediting Mechanical Engineering Technology programs namely students, Program educational objectives, Program Outcomes, continuous improvement, Curriculum, Faculty, Facilities, Support and program criteria. To judge whether an aim is met, a set of standards is provided. The satisfaction of all standards guarantees that a corresponding aim is met. Aims and their standards must be demonstrated in the self-study report. The importance of completing the self-study report cannot be overstated. The major effort of the MET ABET team in the last three years was repeatedly reviewing and modifying the self-study report. The self-study report is an effective tool that allowed faculty members to comprehensively review the program of study and the department. Completing the self-study forced the department to establish more rigorous control over the curriculum and departmental policies.

The MET ABET team observed that the self-study report was closely examined by the visiting team to determine whether the program can be accredited or not. The team verified their findings during the on-site visitation. The team thoroughly examined all aspects of the program of study including curriculum, faculty members supporting the program of study, and administrative support. The department must ensure that all standards given in the self-study are properly addressed. ABET allows a program to develop its own standards to demonstrate that an intent is met. Since the department was applying for ABET accreditation for the first time, the faculty members did not wish to risk failure by developing standards that may not demonstrate that corresponding intents were met. Thus, the most secure way for the department was to employ standards explicitly given by ABET.

Mission, Objectives, and Outcomes

A mission is often a qualitative statement of direction for a college, or department. Objectives are characteristics of graduates of the program. Outcomes are capabilities demonstrated by students enrolled in the program. When developing the set of objectives for the program of study, the MET ABET team adopted a top-down approach. Mission statements of the college and the department were incorporated into the self-study. They were able to ensure that the department mission was well aligned with those of the college. Program objectives were written based on the department mission and outcomes were designed to demonstrate that objectives are met.

ABET requires that program objectives must be measurable [5]. That is, for any objectives written for a program, there must exist some practical way to examine whether it is achieved by the graduates of the program. Although developing objectives by employing a top-down approach appears to be a reasonable approach, in hindsight, the author believes that a hybrid approach including measurement would have produced more favorable results. The key issue here is that the objectives must be *measurable*. Even though an objective is well aligned with the mission, if it is not quantifiable, then it must be modified so that it can be measured. Measurements employed must be capable of measuring the objectives. If measurement and the corresponding objective are not fully compatible the ABET evaluation team will very likely identify the incompatibility as a problem.

Assessment

The goal of assessment is to evaluate the program of study accredited by ABET through the measurements and to look for opportunities to improve. However, the department became aware of the requirement to have at least one *direct measure* for every outcome of the program quite late in the preparation of the self-study. Consequently, preparation of direct measures was rather hasty. Not having complete support among the members of the faculty made finding appropriate measures more challenging.

Every objective must have one or more student-outcomes. Every outcome must have a direct measurement. Direct measurements are samples of students' work that had been evaluated by a jury of several faculty members or industry professionals. In MET department every program has a Program Assessment and Evaluation Committee (PAEC), which looks into every aspect of direct and indirect assessment and evaluation. The author elected to measure the discipline-related knowledge acquired by students using a comprehensive test. The comprehensive test was given in the senior design course. Rather than develop a rubric for evaluating the results of the test, a passing score was established. In retrospect, it would have been better to have defined a more granular scale.

Assessment of Program Outcomes

Assessment of the program outcomes is an ongoing process in Mechanical Engineering Technology Department programs. The PAEC looks into various aspects of assessment to ensure high levels of achievement. The program outcome assessment is concerned with finding out the extent to which our courses are delivering the right outcomes. This is done through direct and indirect assessment [5].

Assessment may be seen as the process by which we identify, collect, and analyze data that can be used to evaluate achievements. Criterion 3 of the Engineering Technology Accreditation Criteria deals with program outcomes (the 11 a-k ABET outcomes) and their assessment.

Since the curriculum is developed through courses, each course has to be divided into components, topics, or competencies that easily map into different program outcomes. These program outcomes, which can be measured at the time of graduation, are the means by which the program prepares our graduates to achieve the professional and career accomplishments stated in the program objectives. Direct assessment of outcomes of program courses may therefore be the best measure of the degree of achievement of program outcomes. Surveys and similar indirect measures can only provide secondary evidence and should be used in conjunction with direct measures (graded students' performance). The grades obtained by students in course quizzes, exams, assignments, etc have to be converted to levels of achievement assigned by weights reflecting learning objectives. The mapping of these course learning outcomes into program outcomes is used to obtain the degree of achievement of each student in the program outcomes addressed by a specific course.

Evaluation of other outcomes was better suited to ABET requirements. Faculty members were not, however, able to infer much about how the program could be improved based on measurements alone. The measurements produced suspicious data. The measurements showed that the work of students was nearly uniform in quality and faculty members knew from previous experience with these students that the quality of their work was clearly distinguishable.

Closing the loop

Closing the loop included collecting and organizing all data gathered in support of ABET accreditation. Such data included course displays, outcome measurements, and meeting minutes. Not all members of the faculty fully supported the effort to seek ABET accreditation and objecting members opposed the requirement to collect information about the courses that they taught. Indirect evaluation results from all constituencies are also taken into consideration for program improvements [5,6].

ABET requirements mandate that records of every class be retained. Members opposed to seeking ABET accreditation opposed this requirement. The department believe that the members of the faculty who opposed ABET accreditation did so because they did not feel the effort was justified – the benefits of ABET accreditation did not compensate for the additional effort required to seek and maintain ABET accreditation. Summarizing the measurements and making recommendations were new to the faculty.

The department has a small, informal, and collegial faculty and recording decisions formally and in writing was foreign to members. The department understanding of the ABET requirements is that any decision relative to the program of study must be recorded as proof that it is adhering to the guidelines suggested by ABET. Formal procedures must be established to measure the program's progress relative to its objectives. During the preparation period for ABET, faculty members were trained in record keeping. Many standard forms were designed for record keeping such as team work reports, Faculty course Assessment and Evaluation Reports (FCAIR), Prerequisite exemption forms etc.

Evaluation team review

The department is grateful to receive a conformation for accreditation. Faculty members were also grateful to receive suggestions for improvement. Objectives and assessment require improvement. Objectives and outcomes need to be measurable. Assessment needs to be employed to make program improvements. Faculty members need to demonstrate a commitment to scholarly activities. The consensus of the members of the faculty is that accepting the evaluation team's recommendations is in the best interest of the department and will directly benefit the students and other stakeholders of the program.

Conclusion

Seeking ABET accreditation has re-invigorated the faculty, heightened student support, and assured of the quality of the program for stakeholders. Accreditation did not come without cost. Faculty members must collect the course display information, assess outcomes, and recommend improvements to the program.

Liabilities

The primary liability is the discords caused by lack of unanimous support for seeking ABET accreditation. Not all faculty members wanted to collect data for the course displays. In the past, faculty members have had little motivation to attend conferences or engage in scholarly work. Motivating all faculty members to engage in scholarly activities is challenging.

Assets

Seeking externally recognizable accreditation motivated the faculty members to accept the additional effort required. Faculty members became confident of the quality of the programs as a result of surveying alumni. Faculty members are also gratified that graduating students have an improved opportunity to seek employment at firms that require ABET accredited degrees. Faculty members are motivated to remain current in teaching and scholarly activities.

The department is in a better position to ask for support from the upper administration for more resources to maintain currency and competency of the faculty in the program. Stakeholders recognize the accreditation as indicating the quality of the program. Students become confident that their education is current, competitive, and recognized by potential employers. The associate degree programs in the department are currently ABET accredited and the Bachelor degree is under the process of accreditation. As a whole, the process of accreditation is very challenging and fruitful.

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