# Fundamentals of ABET Accreditation with the Newly Approved Changes

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## Abstract

Recent changes to the general criteria will become effective for ABET reviews conducted in the 2019-2020 cycle. It is, therefore, important that engineering programs become aware of the changes and start revising their assessment plans to ensure a smooth transition. In addition to having a continuous improvement process that closes the loop and provides improvement that ensures a high quality education, there are many issues that programs must document and address in the self-study report. This paper will review the basic ABET Criteria that need to be fulfilled to ensure a successful accreditation visit. This will be discussed from the perspective of an institution that recently completed a successful accreditation visit and is in the process of revising its assessment processes to respond to the recent general criteria changes.


## Introduction/Background

ABET has become an international accreditation body that accredits programs in the United States and many countries throughout the world [1]. These programs are accredited under one of four accreditation commissions: Engineering Technology (ETAC), Engineering (EAC), Computing (CAC), and Applied and Natural Sciences (ANSAC). These commissions differ in several accreditation criteria while maintaining a common fundamental theme. Accreditation is associated with quality education by ensuring that graduates are prepared for professional practice or ready for further studies [2, 3]. In addition, graduation from an ABET-accredited program is a requirement for many professional engineering licensing bodies.

While the focus in recent years has been on having a continuous improvement process that closes the loop and provides improvements that ensure a high quality education, there are many other issues that programs must address to ensure a smooth accreditation visit. Such issues range from ensuring that policies and guidelines, which meet ABET criteria, are in place to proper record keeping that provides the required evidence. Understanding accreditation policies, procedures, and requirements greatly improves a program's ability to manage processes in preparation for assembling the self-study report.

A key event that institutions must take advantage of is the Institutional Representative Day. This as an important opportunity that facilitates building a strong working relationship between the institution and the visiting team chair [4].

In 2009, the Engineering Accreditation Commission (EAC) formed a task force that led to the revision of criterion 3, Student Outcomes (SOs), and criterion 5, Curriculum, and the introduction of several helpful definitions. The process took several years and employed a number of approaches to engage constituents and gain their input. Feedback was sought through presentations, meetings, panel discussions, workshops, surveys, and email communications. A

detailed history of activities that led to the revised criteria as approved in October 2017 is summarized in several publications [5, 6].

EAC approved the revised general criteria for Baccalaureate degree programs with an implementation start date of 2019-2020 review cycle. While there are a few concerns about the new criteria [7, 8, 9], the changes overall reflect the need to keep the criteria relevant and realistic [10]. It is important to note that the Engineering Technology Accreditation Commission (ETAC) has also made changes to Criteria 3, 5, and 6. These changes go into effect during the 2019-2020 accreditation cycle [11].

The revised EAC general criteria is helpful as it includes several concise definitions [12]:

- Basic Sciences: Consist of chemistry, physics, and other natural sciences including life, earth, and space.
- College-level Mathematics: Consist of mathematical topics that require a degree of sophistication, such as calculus, differential equations, probability, statistics, linear algebra, and discrete mathematics.
- Minimum Credit Hours: 30 semester credit hours of a combination of college-level mathematics and basic sciences. 45 semester credit hours of engineering topics, including computer sciences.
- Team: Consists of individuals of diverse backgrounds and skills working towards a common goal.
- Major Design Experience: Must incorporate appropriate engineering standards and constraints, and is based on the knowledge and skills acquired in earlier coursework.

It is important to note that the minimum semester credit hours is 75 credits. With a general education component of up to 45 credit hours, it is possible to design an engineering curriculum with 120 semester hours which is desired in some States.

A mapping of the new EAC Criterion 3: a-k to Criterion 3: 1-7 is available at the ABET web site [13]. A quick look at the table shows that (a) and (b) are embodied in (1) while (f), (h), and (j) are embodied in (4). There are similarities between (b) and (6), (c) and (2), (d) and (5), (g) and (3), (i) and (7), while (k) is implied in (1), (2), and (6).

This paper focuses on the new EAC general criteria by providing an overview of the changes and presenting an assessment approach to ensure a successful implementation.

**Basics of ABET Accreditation with a Focus on Recent changes**

This section summarizes the new EAC criteria and provides brief comments.

Students (Criterion 1) – Students are the major focus of accreditation and everything revolves around them. This criterion involves a variety of topics, including advising, transfer credit evaluation, and verification of graduation requirements.

Program Educational Objectives (Criterion 2) - Program Educational Objectives (PEOs) are defined as "*broad statements that describe what graduates are expected to attain within a few*

*years of graduation.*" Furthermore, PEOs are based on the needs of the program's constituencies and must be consistent with the mission of the institution. Engineering and engineering technology programs typically have three to six PEOs that are developed and reviewed annually by the program constituents. Program constituents normally include employers (may be serving on the advisory board), alumni, and faculty.

Student Outcomes (Criterion 3) – Student outcomes state what students are "*expected to know and be able to do by the time of graduation.*" All engineering programs are expected to have the following student outcomes:

*"1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics*

2. *an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors*

3. *an ability to communicate effectively with a range of audiences*

4. *an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts*

5. *an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives*

6. *an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions*

7. *an ability to acquire and apply new knowledge as needed, using appropriate learning strategies."*

While additional outcomes may be articulated by the program, they are needed only if outcomes (1) – (7) do not fully produce graduates that attain the stated PEOs. It is important, however, to note that any additional student outcomes must be assessed and be part of the continuous improvement process.

Continuous Improvement (Criterion 4) - ABET emphasizes the relationship between assessment, evaluation, and continuous improvement. It describes assessment as "*one or more processes that identify, collect, and prepare data to evaluate the student outcomes. Effective assessment uses relevant direct, indirect, quantitative and qualitative measures as appropriate to the outcome being measured.*" It also explains that "*evaluation determines the extent to which student outcomes are being attained.*" The word "extent" is of major importance, as it implies there is normally room for improvement. This offers the opportunity to identify weaknesses and address them to reach a higher level of quality. ABET Criterion 4 states that "*the results of these evaluations must be systematically utilized as input for the continuous improvement of the program.*"

Curriculum (Criterion 5) - The curriculum must be designed so that it includes topics that lead to the attainment of the student outcomes and lead to the fulfilment of the PEOs. In addition to ensuring that the minimum requirements are met and an appropriate broad education component is included, it is important that the curriculum provides students with a culminating major design experience as described earlier. Furthermore, any applicable program criteria, as determined based on the program title, must be satisfied. These criteria address specific requirements in the program's areas of specialization. While it is an easy task to show that minimum requirements are met, the challenge lies in demonstrating that adequate attention is given to each curriculum component in such a way that graduates attain the desired student outcomes and the stated program educational objectives.

Faculty, Facilities, and Institutional Support (Criteria 6, 7, and 8) - Faculty plays a major factor when it comes to accreditation. In addition to teaching responsibilities, faculty members are intimately involved in student advising and counseling, program and university service, and the continuous improvement process. It is therefore important that the program has sufficient number of faculty to cover all curricular areas and provides faculty with appropriate support and professional development activities to stay current in their fields.

Adequate facilities and institutional support are essential to the success of any program. Without suitable classrooms, offices, laboratories, library and computing resources, staff and support offices, a program is unlikely to be able to provide the necessary environment to attain the desired student outcomes. Therefore, the administration must be aware of the program needs and be committed to providing the appropriate support to guarantee its success.

**Assessment, Evaluation, and Continuous Improvement**

Assessment of Student Outcomes should follow a well established process with emphasis on continuous improvement. Closing the loop is critical as it leads to improvements in teaching and learning at both the course and program level. It is important that the self-study report includes examples of improvement or clearly shows evidence that improvement was not necessary. To sustain the assessment process with minimum effort, the program should rely on simple, systematic, and effective processes [14, 15]. This includes the development of clear rubrics to assist in evaluating student performance in achieving student outcomes. While a number of courses should be used in the assessment process, the capstone design course is widely viewed as one of the most important courses. It can be used to provide evidence in support of the assessment of several student outcomes. This is the case since this course allows students to be involved in a major design experience based on knowledge and skills acquired in earlier coursework.

Although the Student Outcomes are generic and apply to all engineering programs, special attention is required at the program level to ensure a relevant set of rubrics. Doing so, provides an opportunity for automated data collection and assessment. There is also the potential to introduce courses that are common to multiple disciplines, which enable better data collection and interdisciplinary participation. The lower number of student outcomes may reduce the number of courses used and makes it easier to collect data. It is important to note that the new student outcomes put more emphasis on the professional component (e.g., environmental, societal, legal, political, health, safety, etc.).

Our plan is to employ an assessment process that requires the involvement of faculty, industry advisory boards (IAB), and other program constituents as needed. An Assessment Review Committee (ARC) that includes faculty members, as well as IAB members, takes a lead role in the evaluation process. Initial deliberations started soon after the completion of a recent ABET accreditation visit. The feedback from the ABET visiting team, along with the draft statement, provide an insight into improvements/changes needed moving forward. The assessment flowchart presented in Figure 1 links the stakeholders, program materials and assessment tools along with the review and decision process.

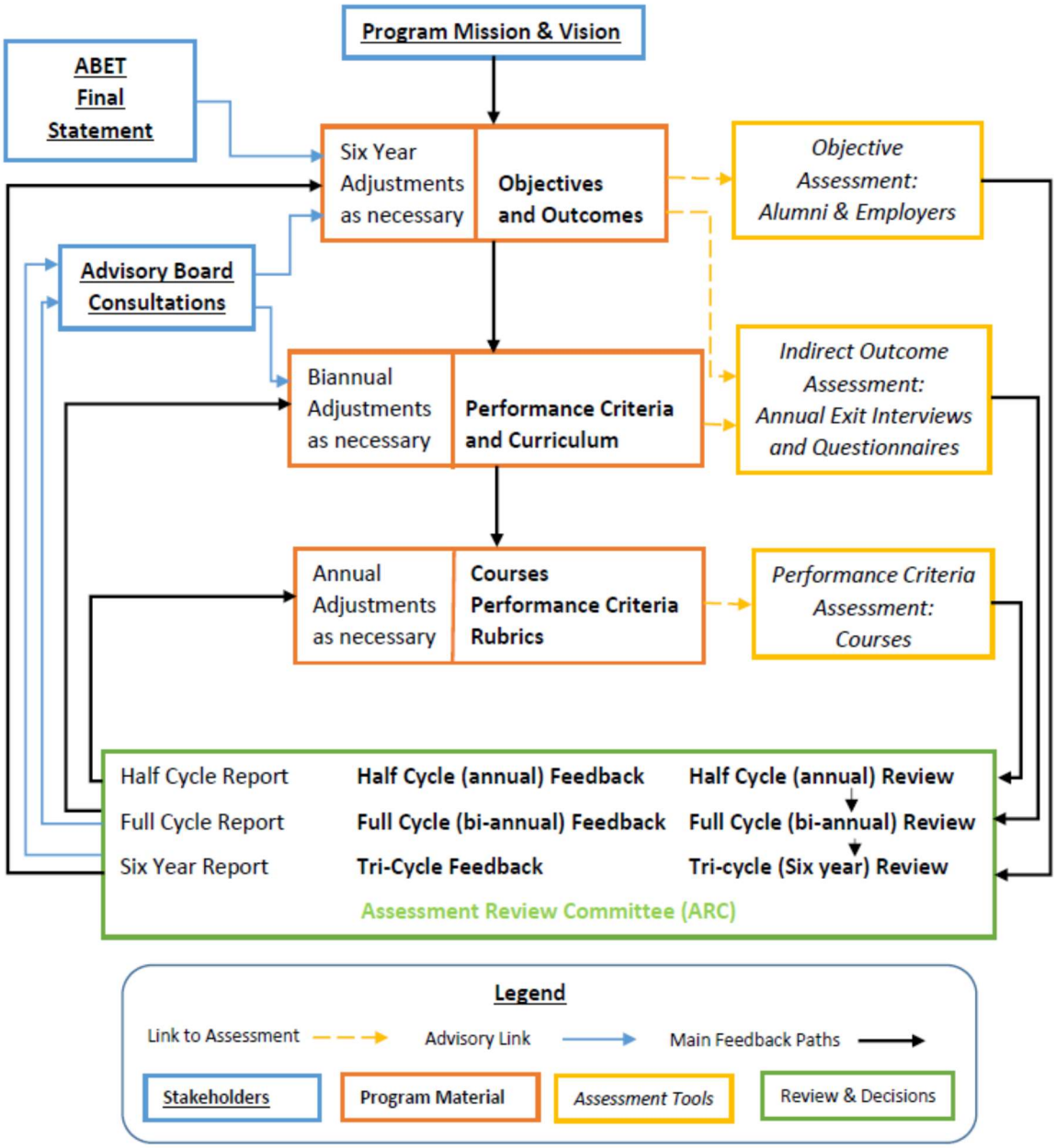


Figure 1: Assessment Process Flowchart

Our plan follows a three-step process: Act; Assess; and Evaluate, as shown in Table 1. Assessment of courses for performance criteria follows a half cycle (annual) basis. Data is collected from courses during spring and fall semesters. The Assessment Review Committee (ARC) then evaluates them. The results of the student outcomes along with recommended changes are then provided to the faculty teaching the course. Exit interviews are conducted during fall and spring semester by our IAB members.

**Table 1: Six Year Cycle, by year after ABET visit**

| Year | Task | Fall Semester | Spring Semester | Summer |
|---|---|---|---|---|
| **1** | Act | (a) 6-year report delivered to faculty<br>(b) Objective & Outcome consultation with Advisory Board (IAB)<br>(c) Plan objective, curricular, & outcome revisions | (a) Report changes to IAB<br>(b) Submit curricular changes to university<br>(c) Revise Performance Criteria & Rubrics | |
| **1** | Assess | (a) Class level assessment of Outcomes<br>(b) Exit interviews and questionnaires | (a) Class level assessment of Outcomes<br>(b) Exit interviews and questionnaires | Alumni & Employer Questionnaires or other forms of consultations with constituents |
| **1** | Evaluate | | | Half cycle evaluation of Outcomes by ARC |
| **2 & 4** | Act | Half cycle report: by faculty | | |
| **2 & 4** | Assess | (a) Class level assessment of Outcomes<br>(b) Exit interviews and questionnaires | (a) Class level assessment of Outcomes<br>(b) Exit interviews and questionnaires | |
| **2 & 4** | Evaluate | | | Half & Full cycle evaluation of Outcomes by ARC |
| **3 & 5** | Act | (a) Full cycle report by faculty<br>(b) Consultation with IAB | | |
| **3 & 5** | Assess | (a) Class level assessment of outcomes<br>(b) Exit interviews and questionnaires | (a) Class level assessment of Outcomes<br>(b) Exit interviews and questionnaires | Alumni & Employer Questionnaires or other forms of consultations with constituents |
| **3 & 5** | Evaluate | | | Half cycle evaluation of Outcomes (ARC) |
| **6** | Act | Half cycle report: by faculty | | |
| **6** | Assess | (a) Class level assessment of outcomes<br>(b) Exit interviews and questionnaires | (a) Class level assessment of outcomes<br>(b) Exit interviews and questionnaires | |
| **6** | Evaluate | | | Half cycle evaluation of Outcomes & Sixth year evaluation of Objectives, Outcomes, and ABET Report by ARC |

PEOs, exit interviews, and graduating student questionnaires are reviewed on a full cycle (bi-annual) basis by ARC and alumni and employer surveys are reviewed every six years.

Other helpful data includes student evaluations collected during internships where students and their supervisors submit three sets of periodic evaluations. These include questions (along with relevant rubrics) used to measure the degree by which interns have achieved satisfactory accomplishments related to relevant student outcomes. These include communication skills (old outcome g, new outcome 3), lifelong learning (old outcome i, new outcome 7), and multidisciplinary teamwork (old outcome d, new outcome 5).

## Conclusion

Due to the newly adopted ABET EAC general criteria, it is important that engineering programs become aware of the changes and start revising their assessment plans to ensure a smooth transition. While accreditation is normally viewed as a tedious process, understanding the basic requirements and having a systematic process in place simplifies the task. This paper described the basic requirements that need to be fulfilled to ensure a successful ABET visit and presented an assessment flowchart and time table to illustrate a sample implementation approach.

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