

Industrial Engineering Program Management in the ABET 2000 Environment

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Abstract

The ABET 2000 Criteria have had a major effect on the approach to Industrial Engineering Program Management. Integral components of programs that are necessary to satisfy ABET 2000 Criteria include formulating goals and objectives; developing and working a strategic plan to accomplish stated goals and objectives; and assessing the effectiveness of the plan and related activities to accomplish the goals and objectives. Demonstrating that program constituents have participated in the process is also an important part of the effort.

This paper presents an approach to program management that utilizes an Industrial Advisory Board as a cornerstone to support strategic planning and assessment activities that satisfy ABET 2000 Criteria.

1. Introduction

The 2000-01 academic year is the last year that engineering programs may elect to apply for accreditation using ABET's Conventional Criteria for program accreditation. ABET 2000 Criteria, which have been an alternative to the Conventional Criteria for several years, will become the sole ABET accreditation criteria. The Conventional Criteria are more of a prescription for program accreditation than are the 2000 Criteria, which permit greater program flexibility because of the focus on a systematic approach to engineering program management.

ABET 2000 Criteria allow much more flexibility in the curriculum. For example, qualitative factors are more important than assigned credit hours to a particular subject area. The curriculum emphasis in the 2000 Criteria is on coverage of basic information rather than specific courses. Instructional delivery methods and alternatives for evaluating learning are also different. ABET 2000 Criteria require a provision to evaluate learning and ensure that educational objectives are satisfied. The curriculum must be considered an ABET curriculum and satisfy the industrial engineering Program Criteria. Specifically, to satisfy ABET 2000 Criteria an engineering program must have the following:

- Published program educational objectives that are consistent with mission and ABET criteria.
- Process to determine and periodically evaluate educational objectives.
- Objectives based on needs of constituencies.
- Curriculum and processes to ensure achievement of objectives.
- Evaluation procedure to determine achievement of objectives.
- Results used to improve effectiveness of the program.

In addition, the program must have processes and measurement criteria to ensure that graduates have a(n):

- Ability to apply knowledge of math, engineering, and science.
- Ability to design and conduct experiments as well as to analyze and interpret data.
- Ability to design system, component, or process to meet needs.
- Ability to function on multi-disciplinary teams.
- Ability to identify, formulate, and solve engineering problems.
- Understanding of professional and ethical responsibility.
- Ability to communicate effectively.
- Broad education necessary to understand the impact of engineering solutions in a global and societal context.
- Recognition of need for, and an ability to engage in life-long learning.
- Knowledge of contemporary issues.
- Ability to use techniques, skills, and modern engineering tools necessary for engineering practice.

Broadly stated, program components necessary to satisfy ABET 2000 Criteria include the following:

- Educational Objectives: Comprehensive; defined documented, measurable and flexible; clearly tied to mission; readily adaptable to meet constituent needs; systematically reviewed and updated.
- Constituents: High degree of involvement in defining objectives and desired outcomes, assessment; and improvement cycles; sustained evidence of strategic partnership with all key constituents.
- Processes: Processes for all elements of criteria are quantitatively understood and controlled; clearly tied to mission, program objectives, and constituent needs; seen as benchmarks by other institutions.
- Outcomes Assessment: All outcomes defined; systematic evaluation and process improvement in place; all support areas involved; common sources of problems understood and eliminated.
- Results: World-class outcomes; sustained results; results clearly caused by systematic approach.
- System: Sound, highly integrated system; deployed throughout the program, college, and institution; driven by mission and objectives.

In anticipation of the ABET 2000 Criteria, the Department of Industrial and Manufacturing Engineering at Tennessee Technological University established an Industrial Advisory Board and an Academy of Distinguished Graduates in 1994. Advisory Board members represent industries in the area. Because of the age of the program, Academy members are de-facto members of the Advisory Board. The following describes the evolution of the Advisory Board and how it has/will support the Department's effort to satisfy the ABET 2000 Criteria.

2. Industrial Advisory Board

The role or scope of the Industrial Advisory Board is to provide advice and counsel to the Department of Industrial and Manufacturing Engineering on departmental activities. The Board consists of approximately twenty persons from industry. These individuals are recognized leaders in their organizations with experience in any combination of the performance, evaluation, or supervision of industrial engineering activities and who have a special interest in our program. The student chapter presidents of IIE and Alpha Pi Mu are also members of the Advisory Board.

A one-day meeting is held in the fall and spring semester of each academic year. An agenda and background information are provided to each member prior to the meeting. Additional meetings may be called as deemed appropriate by the Board or the Department. Topics addressed by the Board have included but are not limited to departmental goals and objectives, local industry needs for instructional programs (e.g., on campus, off campus, undergraduate, graduate, seminars, and continuing education), co-op programs, graduate research programs, scholarship and fellowship programs, and faculty development opportunities. Also faculty and students have received funding and summer employment from companies represented on the Board. The Board has helped with funding a department endowment.

Since the Board's inception, it has conducted confidential interviews with students related to the department's strengths and weaknesses and presented summary results of those interviews to the faculty. In 1995, the Board participated in a curriculum review with department faculty. The curriculum review included first identifying a list of the knowledge/skills that industrial engineering graduates should have, based on the experience of the Board members, and then identifying course and competency gaps. If a topic was on the list of needed knowledge and skills but not covered in the curriculum, the topic was placed on the list of gaps. Likewise, if the interviews of students uncovered areas of weakness in competency according to the list of needed knowledge and skills, those areas were also put on the list of gaps. Several curriculum changes were incorporated as a result of that review to address the items listed as gaps. In 1997, the Board began conducting a student survey that includes questions aimed at assessing how well the program goals are being met, and some changes have been made to the curriculum based on the student survey as well. Other interaction of the Board with students includes an executive summary presentation by senior design teams during one meeting each year. These presentations help the Board to gain an understanding of the scope and quality of the capstone design projects.

To focus their efforts, the Board recently established standing committees within the Board. At the request of the department, a standing committee has been charged with the responsibility to assist the department with developing a procedure whereby the Board can support efforts to achieve accreditation based on the ABET 2000 Criteria. Although the Board has been actively involved in the department's planning activities, this approach will formalize the role of the Advisory Board as an integral part of the ABET 2000 accreditation process. This will also ensure an active participation in the strategic planning process by three important program constituents: alumni, industry, and current students.

3. Strategic Planning

The Department, with assistance from the Advisory Board and a consultant with academic planning experience, has completed some preliminary planning activities. Stakeholders have been identified and a SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis has been conducted. A draft of the department's vision, values, and mission statement has been completed. Preliminary work to update goals and objectives has begun. A draft of the planning cycle shown in Figure 1 was presented to the Advisory Board during the fall 2000 meeting. The Board approved the concept of the planning process, and a subcommittee was charged with completing details of the process. Details are embodied in Figure 2 and discussed in the following section.

In this approach, the department works with the Advisory Board's ABET Subcommittee throughout the year on program planning, development, and assessment criteria. The department is responsible for implementation and monitoring. Results of these efforts are presented to the Advisory Board at the regularly scheduled Board meetings. As shown in Figure 1, the Advisory Board will continue to conduct surveys and student interviews as part of the spring meeting. Results of the survey and interviews are part of the assessment. The ABET subcommittee is investigating other Board activities that may be used for assessment. For example, Board members could assist with evaluating the senior design projects by independently assessing the program outcomes as defined in the ABET 2000 Criteria and presented in section 1.

As shown in Figure 2, the department's planning activities reflect the mission statement and goals for the University and College. In addition, environmental factors such as market trends and departmental opportunities for funding and research are considered.

4. Program Assessment

The department is actively evaluating alternatives for curriculum metrics. At the present time, the primary tools assessment tools are the exit interview by the Department Chair and the interviews/surveys conducted by the Advisory Board. The College requires that all graduates participate in the Fundamentals in Engineering Examination. Results are examined and discussed by the faculty. Although students are not required to enroll at this time, an exam review for students who are scheduled for the exam, is now offered by the College and the Department. Results of the exam are monitored, and curriculum changes have been made to improve the student performance on the exam.

As shown in Figure 1, the Advisory Board is an active participant in closing the planning cycle loop. Assessment metrics for goals and objectives and preliminary monitoring data, including exit interviews and surveys, will be presented and discussed during the fall Advisory Board Meeting. During the spring meeting there will be an assessment and reconciliation of performance characteristics of the program. Depending on assessment results, the conclusion may range from a recommendation that the department continue with implementing and monitoring the current plan to a recommendation that there be re-examination on any combination of the goals and objectives, assessment metrics, and/or course contents and the relationship to ABET 2000 Program Outcomes.

5. Conclusions

The ABET 2000 Criteria provide much more program flexibility because of the focus on a systematic approach to engineering program management. However, the department must document that a systematic approach has been developed and implemented. It is incumbent upon the Department to be efficient in such an endeavor. In the Department of Industrial and Manufacturing Engineering at Tennessee Technological University the Industrial Advisory Board and Academy of Distinguished Graduates have a history of participating in the department's strategic planning activities. The department has requested that the role and scope of that participation be expanded to include shared responsibility for ABET 2000 accreditation.

The department has a good starting point for strategic planning because of the previous work by the Board. However, developing effective assessment metrics that address both the program goals and ABET 2000 Criteria is a major challenge. The assistance of the Advisory Board is seen as critical to the effort.

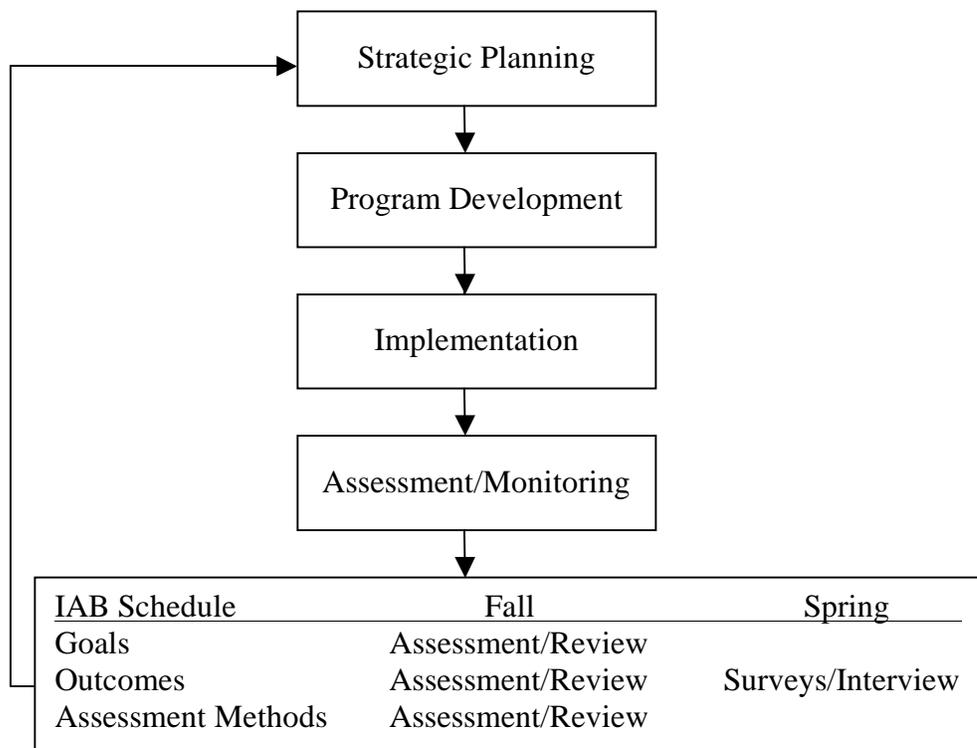


Figure 1: Department Planning Cycle

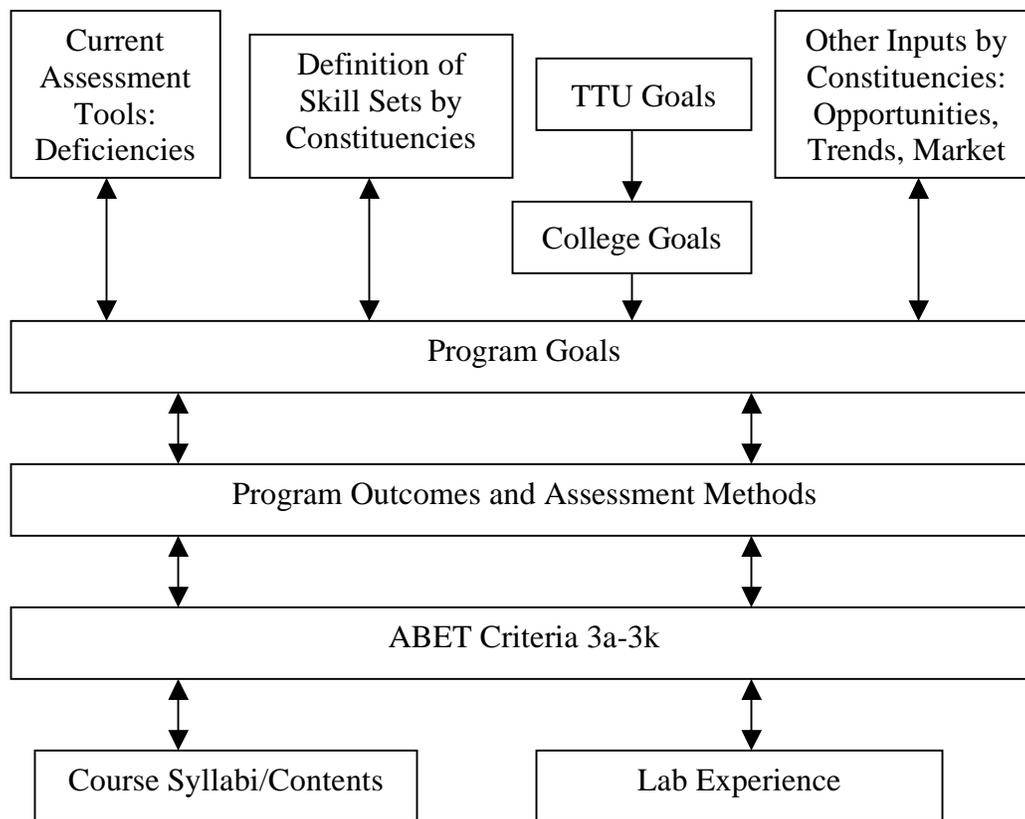


Figure 2: Planning Tools

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