Technology Education in the Next Century: Is the Proposed TAC/ABET Criteria Compatible?

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Introduction

American higher education in the last decade of the twentieth century faces escalating costs, uneven demographics, faltering revenues, and serious erosion of public confidence [1]. This depressing picture of academia is emerging at a time when concern over the declining competitiveness of the products of American businesses and industry has made increased productivity a national obsession [2]. All national issues that emerge in American society sooner or later seem to surface on our campuses.

The ABET accreditation process is a voluntary system that assures that graduates of an accredited program are prepared for careers in engineering and technology. Engineering Education must contribute to the development of men and women who can face new and difficult engineering situations with imagination and competence [3]. The role played by ABET in standardizing engineering and technology education can not be denied. However, if it has fulfilled its stated objectives is questionable. ABET according to its own objective statement; should encourage new and innovative approaches to engineering and technology education. Critics maintained ABET's current way of accreditation is the biggest hindrance to "new and innovative" approaches to engineering and technology education.

Background

The American Association of Engineering in the 1920's established the committee on Accredited schools and called for "more comprehensive and discriminating standards" for evaluating engineering schools [4]. Recognizing the importance of this emphasis on quality engineering education in the registration process, the National Council of State Boards of Engineering Examiners (now National Council of Examiners for Engineering and Surveying) and parallel activities in several major societies resulted in the formation of a Planning Committee. The committee drafted a plan for joint action in the development of the engineer that also called for the formation of the Engineer's Council for Professional Development (now ABET). The first statement of the Engineer's Council for Professional Development relating to accreditation of engineering educational programs was proposed by the council in 1933. It was subsequently approved by the constituent member organizations of ECPD. In 1944 the ECPD appointed a subcommittee on Technical Institutes. In October 1964, this subcommittee became a standing committee of ECPD and established a basis for accrediting programs of the technical institute type, now designated as programs in engineering technology.

Current TAC Criteria

Accreditation by Technology Accreditation Commission of ABET is based on satisfying minimum
education criteria [5]. Accreditation review is based on general criteria and program criteria. The program criteria are generally developed by various professional societies and usually amplify special requirements for different disciplines. The general criteria contain program level and course requirements. It specifies minimum total credit requirements. It also states minimum basic sciences and mathematics, social sciences and communications credit requirements. The general criteria also includes program contents and orientation, curriculum elements, faculty, technical currency, student body, administration, employment, individual advisory committee and financial support and facilities. Under faculty criteria, presently TAC requires not only minimum numbers of faculty in a program; it also specifies exact qualifications that would be acceptable. The program criteria further specify type of courses, live technical seminars and technical specialties. In some cases, program criteria even specify exact social science courses required.

Proposed TAC Criteria

Proposed criteria for accrediting engineering technology programs include students and graduates, program characteristics, faculty, facilities, institutional and external support and assessment [6]. Where applicable, each program must satisfy program criteria that amplify these criteria. Under the students and graduates subheadings the proposed criteria specify a set of attributes a graduate of an engineering technology program expected to possess. Some of these attributes are mastery of the knowledge, ability to apply current knowledge and adapt to emerging applications in mathematics, science, engineering and technology, ability to function effectively in teams and communicate effectively. Under the program characteristic subheading, there are subsections on educational objectives, curriculum, communications, mathematics, physical natural sciences, social sciences/humanities and technical content. Under faculty criterion, there is a minimum number of faculty requirements, but no specific minimum qualifications. Under assessment criterion, it states that programs must have goals that as a minimum focus on the student body served, resource allocations and other factors affecting the program. Each program is required to demonstrate achievements through various methods including student outcome assessment and employer feedback. Programs also must demonstrate that their graduates are readily accepted into the work force and are prepared for ongoing education.

New EAC Criteria

The new EAC criteria clearly states that it is the responsibility of the institution seeking accreditation of an engineering program to demonstrate that the program meets the stated criteria [7]. It has two levels of accreditation criteria, basic and advanced. The basic level includes criteria on students, program educational objectives, program outcomes and assessment, professional components, faculty, facilities, institutional support and financial resources and program criteria. The program educational objective criteria states that each program must have detailed published educational objectives and a system of ongoing evaluation that demonstrates achievement of these objectives and uses the results to improve the effectiveness of the program. A list of attributes every graduate should possess is included under program outcomes and assessment. The professional component requires specific years of college level mathematics,
Historically, education for doing engineering has been a response to workforce needs for each new technology that appeared on the economic scene [8]. Tomorrow's engineers and technologists will need both abstract and experiential learning, along with an ability to manage uncertainty and handle ambiguity, formulate as well as solve problems, work independently and in teams. They will need to help make decisions about investing considerable amounts of time, money, technical and human resources to create what has not been created [8]. Engineering and (technology) education programs should shift from dedication to course content to a more comprehensive view, focusing on the development of human resources and the broader educational experience in which the individual parts are connected and integrated. This would place primary emphasis on the development of students as emerging professionals with knowledge base and capability for lifelong learning, and make the study of engineering and technology more attractive, exciting and fulfilling throughout [9]. One of the main recommendations of the 1986 NSF workshop [10] was a vision of undergraduate engineering education can be based on the notion that the engineer's essential role in organized society is an integrative process, i.e., an emphasis on "construction of the whole". The primary goals of this educational process are therefore to develop, in as individualized way as possible, each student's integrative capability, analysis capability, innovation and synthesis capability and contextual understanding capability.

A new engineering technology education philosophy in conjunction with profound cultural changes should provide the environment for the new curricula. The Most important means for change include pedagogy, revised curricula content and a process of continuous assessment and continuous improvement. The overall goal should be to develop graduates who are professional contributors and life-long learners capable of succeeding in the current and future global and multi-disciplinary markets. A panel of engineering technologist educators [11] recommend that whenever quantity and quality compete, the major focus for change should be in quality.

Discussion and Conclusion

One of the major criticisms on the present ABET criteria is, it is too restrictive and inflexible to encourage innovative programs. The criteria are mainly procedural and pay more attention to quantitative requirements. There is no real evaluation of quality. It encourages programs to be mirror images of each other, thus discourages new and experimental programs in engineering technology. The TAC of ABET specifically, took a most conservative approach to accreditation to distinguish engineering technology programs from industrial technology type and vocational programs. In doing so the TAC specified too many actual course requirements thereby taking away student's course choices, as they are sometimes required to fulfill broader higher educational goals.

The proposed criteria overcame many of the shortcomings of the current requirements. It allows the departments to develop programs that is compatible with their missions and local
requirements. By requiring the graduates to have certain minimum attributes, the new criteria try
to have unity in diversity. The outcome-based approach of accreditation seems to be in line with
a customer certified approach. The new criteria focus more on "quality" than "quantity" or "bin
counting". The criteria emphasize well-rounded education than narrowly focused technical
education. All these factors support various reports and studies; some of those have been
discussed previously. However, some stakeholders feel the criteria is too broad and will loose
focus of engineering technology education. It also lacks enough details for national guidelines
for engineering technology education. Many evaluators feel because of the broadness of the
criteria it may be subjected to various interpretations and will create wide disparity among
different programs. It will create problems for evaluators and the departments. The EAC criteria
on the other hand have more guidelines for the departments and evaluators.

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