An Evaluator's Perspective on Proposed Changes to ABET Criteria

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Abstract

ABET periodically makes changes, both major and minor, to its engineering accreditation criteria. However, the recent announcement and distribution of a draft of proposed changes to the iconic ABET a-k criteria for accreditation of engineering programs has caused heated discussion, public debate, and consternation among universities, ABET evaluators, and others concerned with the future of engineering in the United States. This paper provides an evaluator's perspective of those changes, discusses the potential timeline for change, and provides information regarding the ways in which concerned parties can provide input on the proposal..

Keywords

ABET, accreditation, outcomes, proposed changes.

Introduction

Throughout its long history, ABET has demonstrated its commitment to maintaining criteria for engineering graduates that are appropriate to the current needs of the profession. During the harmonization of criteria across the four commissions of ABET in 2009, it was recognized that the outcomes in Criterion3 had not been significantly updated since the inception of outcome-based accreditation in the mid-1990s. At that time, ABET began gathering information for a review of the outcomes, including identification of relevant constituents, consideration of requests for additional outcomes, evaluation of shortcomings related to each outcome and review of desired characteristics for engineering professionals. ABET also established a task force formed of identified stakeholder to study the issue. As part of its research, the taskforce requested that the EAC program evaluators consider the eleven a-k outcomes and which seemed to produce the most shortcomings. Data collected in the 2010-11 evaluation cycle indicated that the outcomes which produced the most shortcomings were

3(d) (ability to function on multidisciplinary teams),

3(f) (understanding of professional and ethical responsibility),

3(h) (a broad education to understand engineering solutions in global, economic, environmental, and societal context),

3(i) (recognition of the need for and ability to engage in life-long learning), and

3(j) (knowledge of contemporary issues).[1]

The task force decided that "some of the (a)-(k) components were interdependent, broad and vague in scope, or impossible to measure. As a consequence, program evaluators were inconsistent in their interpretation of how well programs were complying with Criterion 3."[1]

Timeline of the Change

During the 2012-13 cycle, ABET reached out to constituent groups for input, and received suggestions both on outcomes with which constituents had difficulty, and new outcomes which were proposed. The task force took input from all sources, and from an extensive literature survey, and grouped the outcomes into six topic areas. In July 2013, the work was presented to the full EAC, and the responsibility transferred to the EAC Criteria Committee. In July 2014, the draft was presented to the EAC, and the Criteria Committee was authorized to seek feedback from stakeholders. A draft was posted on the ABET website, and disseminated to constituent groups for comment. The comment period was slated to end on June 30, 2015.[1]

The version posted for comments was as follows:

> ABET's Engineering Accreditation Commission, A-K will be reorganized into six outcomes. Students must have the ability to:
>
> 1. Use the principles of science and mathematics to identity, formulate and solve engineering problems
> 2. Apply both analysis and synthesis in the engineering design process, resulting in designs that meet constraints and specifications (including societal, economic, environmental and other factors appropriate to design)
> 3. Develop and conduct appropriate experimentation and testing procedures, and analyze and draw conclusions from data
> 4. Communicate effectively with a range of audiences through various media
> 5. Demonstrate ethical principles in an engineering context, and
> 6. Establish goals, plan tasks, meet deadlines, manage risk and uncertainty, and function effectively on teams.[2]

Firestorm

Although ABET had sought input in advance from multiple constituent groups, and had received over 100 comments,[1] not all groups were aware of the proposed changes and not all approved of the proposed alterations.

During the 2015 American Society of Engineering Education conference, some groups such as the ASEE Ethics Division first became aware of the changes, and extensive and vociferous conversations were held regarding the proposal. Some of the discussion revolved around the meaning of the proposed criteria: What does it mean to communicate "with a range of audiences through various media"? How would one "demonstrate ethical principles in an engineering context"? Other questions concerned new material added to the criterion. In a climate where many universities are being limited in the number of credit hours they are allowed to include in their programs, the addition of what was perceived as new, primarily Industrial Engineering,

content in outcome 6, caused a great deal of consternation, as participants contemplated how more content could be possibly be squeezed into already overstretched programs and resources. However, in the Ethics Division, the primary bones of contention regarded material which seemed to have been removed from the previous version of the outcomes. The deletion of emphases on lifelong learning, understanding context of engineering solutions, professional responsibility, and knowledge of contemporary issues was seen by some as a betrayal of the principles of ethical engineering.

Shortly following the conference, the ASEE Liberation Education/ Engineering and Society Division sent an open letter to ABET protesting the changes. First on the list of issues was omission of professional responsibility from the outcome related to ethics. The deletion of lifelong learning, and removal of the qualifier "multidisciplinary" from teamwork were both seen as leaving future engineers less prepared for practice in a world where many projects require "collaboration across expertise within and beyond engineering."[3]

Based on information given in a slide presentation at the ASEE Seattle conference, it was inferred that the items that were eliminated were removed because of the difficulty that some programs had in effectively assessing these items. In "Watered-Down Gen Ed for Engineers,"[2] ABET was criticized for using this as a basis for removing emphasis areas. The argument is that just because something is difficult to measure does not mean that it is not necessary, or that it *should* not be measured. A fear among those who currently teach general education for engineers is that if ABET decreases emphasis on these areas, that they will gradually be eliminated from engineering programs, and leave engineers less prepared in the "soft" skills that are still necessary for modern engineering practice in a global, multi-disciplinary environment. This article also cited methods by which some of these "soft" skills can, in fact, be effectively measured and called on ABET to rethink its proposed changes, which it sees as a "deprofessionalization" of engineering as a field.

Articles such as "The Wrong Solution for STEM Education" castigated ABET for reducing emphasis on "on students' knowledge of contemporary issues, educational scope intended to produce understanding of engineering in global and societal contexts, professional responsibility, and lifelong learning, among others." The authors speculated that the rationale for eliminating such items from the criteria was fueled by the difficulty that some cited in measuring such "soft" items.[4]

Changes Currently Proposed

Responding to concerns voiced by various groups and to input provided through the anonymous survey instrument which was open until June 30, 2015, the EAC Criteria Committee revised the changes recommended for Criterion 3 to the following, which was introduced and approved for future consideration by the EAC at its July 2015 meeting:

> 1. An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.
>
> 2. An ability to apply both analysis and synthesis in the engineering design process, resulting in designs that meet desired needs.

3. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

4. An ability to communicate effectively with a range of audiences.

5. 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.

6. An ability to recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately.

7. An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty.[5]

These changes were approved for consideration by the Engineering Area Delegation at the meeting in Fall 2015. This approval led to the release of the proposed changes for public comment.[6]

Discussion of the Proposed Changes

Some outcomes seem to have changed little compared to the original a-k. The first of the new outcomes seems to be a simple combination of a and e in the previous formulation. By tying applying knowledge of principles of math, science and engineering to the formulation and solving of engineering problems,[5] this could streamline the assessment of these items by allowing them to be assessed together rather than separately.

The second outcome of the new version roughly mirrors the previous outcome c regarding ability to design a component, etc. within constraints, but specifies both analysis and synthesis in the process, and does not specify examples of constraints to be considered. While in the past, programs have demonstrated design on relatively small projects, the requirement to include both analysis and synthesis may necessitate assessment of this outcome on more major projects such as the capstone required in criterion 5.

Some things which had been omitted in the original draft have now been restored. Professional responsibility has been restored to the outcome, as has consideration of impact of "engineering solutions in global, economic, environmental, and societal contexts." [5] This addresses two of the major concerns raised in the protests discussed above.[3,4] However, the outcome no longer specifies that students must have the broad education necessary to understand these contexts. This could be interpreted either as an omission, or an addition of latitude for programs to define how students could reach the necessary understanding.

The current draft does not require teamwork be multidisciplinary, and ties teamwork to planning, scheduling, and other items which can be regarded as Industrial Engineering content. Programs under credit-hour limits may struggle to find a place for the new content, and tying teamwork to this content may significantly change how and where teamwork is included in programs.

One item in the new formulation may be easier for programs to assess than the previous criterion. While many programs had difficulty in measuring "lifelong learning," and even argued that it was not something that could be measured at the time of graduation, "ability to

recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately"[5] seems easier to quantify, and also seems to better capture the essence of what is actually necessary for engineering practice. While "lifelong learning" is a noble goal, the new version is better at identifying what that would look like in a professional career.

One item which still seems to be omitted from the new criterion is knowledge of contemporary issues. Programs will need to consider whether this is somehow subsumed by global and societal contexts, or whether it still needs to be included.

Some items may need additional elucidation. Programs may wrestle with how to measure "engineering judgement" or what constitutes "a range of audiences."[5] Stakeholders can either provide comments to ABET on how or whether these should be defined, or ABET could leave programs free to define these according to the needs of their own constituents.

The Way Forward

ABET has clearly indicated its willingness to respond to the concerns of its constituents. Based on the comments received during the comment period which ended on June 20, 2015, ABET has both changed the proposed criteria to alleviate some of the issues identified in the response to the 2014 version, and has extended the deadline for comments to allow for a fuller interchange of ideas before any changes are actually mandated. ABET has also sent letters to constituents inviting them to not only comment, but to share information on the proposal and invite comments from any and all interested parties. The new deadline for input is June 30, 2016. Comments, concerns, and suggested changes should be submitted anonymously through the survey at https://www.surveymonkey.com/r/CRIT35R2. If, after the end of the extended response period, the comments do not justify substantive changes, ABET can choose to proceed with the process as planned. This could mean that the changes could be approved at the Fall 2016 meeting of the ABET Engineering Area Delegation. ABET could then choose to proceed with the altered outcomes in the 2017-18 accreditation cycle, or could determine that a phase-in period is necessary, given the nature of the proposed changes. If the comments received by the June, 2016 require more extensive alterations in the proposal, ABET will return the proposal to the EAC Criteria Committee, and the EAC, for revision, with a goal of introducing a revised version at the July, 2017 EAC meeting.[6]

Concluding Thoughts

ABET accreditation is seen as critical to the success of many engineering programs, both in the United States and worldwide. Changing established criteria can be a serious and anxiety-producing matter, and deserves the careful thought and consideration of those involved with engineering programs currently accredited, and those planning to seek ABET accreditation in the future. While ABET has demonstrated its willingness to respond to concerns, it is incumbent on those whom these changes can affect to provide thoughtful input through the means ABET has provided, while there is still adequate time to contribute to the process. If after careful evaluation of the proposed changes in light of programs and the needs of constituents, all of the affected programs provide input to the process, engineering education can only benefit from this exercise.

References

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