Criteria 3 and 5 Implementation: How are People Actually Doing It?

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Abstract

The Criteria 3 and 5 of the ABET General Criteria were recently revised and approved by ABET. The new criteria are in effect for those programs being evaluated in the current 2019-2020 accreditation cycle. With the first accreditation cycle under the new criteria underway, this paper examines what programs are doing to meet these new changes. This paper shares rubrics, specific methods, and embedded indicators that are successfully being used by accredited programs in this early stage of the new criteria.

Introduction

The Criteria 3 and 5 of the ABET General Criteria were recently revised and approved by ABET. This decade-long effort began with the creation of a task force in 2009, the presentation of findings to the Engineering Accreditation Commission in 2014, the first reading by the Area Delegations in 2016 after significant input from constituencies, and ABET approval in 2017. The new criteria are in effect for those programs being evaluated in the current 2019-2020 accreditation cycle.

General Criteria changes occur infrequently and cause significant angst as accredited programs strive to interpret the changes and take steps to meet the new criteria. Papers already exist that describe the extent of the changes and the rationale behind them.[1] ABET has presented webinars[2], developed a frequently asked question and answer sheet[3], and created evaluator training materials[4] that attempt to clarify the new changes and the standard for attainment. With the first accreditation cycle under the new criteria underway, this paper examines what programs are doing to meet these new changes.

This paper will share techniques actually used by programs that are under review or have already converted their assessment systems to the new criteria. This paper shares rubrics that are successfully being used by accredited programs. It offers easy methods that can be used to assess the performance of teams, communication with a wider range of audiences, the learning of new material on your own using appropriate methodologies, that problems are sufficiently complex, and how social, economic, cultural, environmental and global considerations can be incorporated into a design.

This paper should be useful for any ABET accredited engineering program. The author is a PEV with 20 visits over 20 years, is currently preparing his own program for accreditation, is a member of the ASCE Committee on Accreditation and is an ASCE representative on the ABET Board of Delegates. While the advice and recommendations offered herein cannot be taken as absolute truth, it can at least be considered expert opinion. Because we are still very early in the implementation process, the definitive conclusions will be developed over the next few years as more programs are evaluated under the new criteria.

New Outcomes 1-7	Previous Outcomes a-k
1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	(a) an ability to apply knowledge of mathematics, science, and engineering (e) an ability to identify, formulate, and solve engineering problems
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	(c) an ability to design a system, component, or process to meet desired needs within realistic constraints **such as** economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
3. an ability to communicate effectively with a range of audiences	(g) an ability to communicate effectively
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	(f) an understanding of professional and ethical responsibility (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context (j) a knowledge of contemporary issues
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	(d) an ability to function on **multi-disciplinary** teams
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	(b) an ability to **design** and conduct experiments, as well as to analyze and interpret data
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.	(i) a recognition of the need for, and an ability to engage in life-long learning
Now included in criterion 5(b): a minimum of 45 semester credit hours (or equivalent) of engineering topics appropriate to the program, consisting of engineering and computer sciences and engineering design, and utilizing modern engineering tools	(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Table 1: Side-by-side comparison of the new Criterion 3 Student Outcomes with the Previous Criterion 3 Outcomes

Criterion 3 Changes

Table 1 offers a side-by-side comparison of the new Criterion 3 Student Outcomes with the previous Criterion 3 Outcomes. The new outcomes 3(1)-(7)[5] are listed in the left side column and the old Criterion 3 (a)-(k) student outcomes[6] which have been unchanged since they were adopted as part of EC2000 are in the right side column. Those words that emphasize the changes and differences between the two are bolded and in red. The history of these changes and the rationale behind them have been documented by ABET.[7,8] A previous paper[1] analyzed the effects of these changes and concluded that they were relatively minor.

This paper builds on that analysis and offers specific suggested actions that can be taken to meet these criteria changes without undo effort and without making assessment systems unsustainable. It also makes recommendations to the ABET Criteria Committee and the ASCE Committee on Accreditation for providing changes and clarification on unresolved issues encountered during this initial cycle of implementation.

Relevant Changes and Suggested Actions

- **Criterion 3(1) Complex Problems.** In the process of revising criterion 3, some outcomes were combined with the intent of simplifying the assessment process and eliminating redundancies. This works well here where student outcomes 3(a) and 3(e) were combined to create the new student outcome 3(1) which requires an ability to identify, formulate, and solve *complex* engineering problems by applying principles of engineering, science, and mathematics. The outcomes are compatible and examples of attainment are plentiful in any engineering program.

The addition of the word *complex* is not an indication that engineering problems are currently too simplistic or that something needs to change. This change was made to satisfy the International Engineering Alliance[9] where countries have agreed to accept each other's standards for engineering education through the Washington, Dublin and Sydney accords. In those agreements, a key element that separates the engineer from the engineer technologist and the engineer technician is the ability to solve complex engineering problems.

The definition of complex problem is offered in the ABET criteria[5] as:

> ***Complex Engineering Problems –*** *Complex engineering problems include* ***one or more*** *of the following characteristics: involving wide-ranging or conflicting technical issues, having no obvious solution, addressing problems not encompassed by current standards and codes, involving diverse groups of stakeholders, including many component parts or sub-problems, involving multiple disciplines,* ***or*** *having significant consequences in a range of contexts.*

The key word is "one or more" indicating that an engineering problem only needs one of these elements to be considered complex. Certainly, every student in an accredited engineering program solves problems that meet this standard, so no additional action should be required.

- **Criterion 3(2) Engineering Design Considerations.** Criterion 3(c) previously required that engineering design "meet desired needs within realistic constraints *such as* economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability". The word "*such as*" indicates that only a relevant sampling from that list needs to be included. In the new criterion student outcome 3(2), engineering design solutions must meet specified needs with consideration of public health, safety, and welfare, *as well as* global, cultural, social, environmental, *and* economic factors. This implies that they all need to be explicitly considered.

This should be approached systematically; otherwise, one of these factors will be missed. The consideration of public health, safety and welfare are covered for most civil engineering design projects through the use of codes that govern a design. Codes and standards were developed solely for that purpose.

The most straight-forward approach is to require students to separately describe the global, cultural, social, environmental and economic considerations as a graded part of their design submission. It might be helpful for the instructor to preface the assignment with some examples of these considerations on a different project. Given five separate paragraphs addressing these considerations, the instructor can use a rubric to provide a grade for each. A sample rubric might look like:

Other Project Considerations	_______/30 points
Discuss the following considerations associated with this project:	
Global considerations	_______/ 5 points
Cultural considerations	_______/ 5 points
Social considerations	_______/ 5 points
Environmental considerations	_______/ 5 points
Economic considerations	_______/ 5 points
Constructability considerations*	_______/ 5 point

Rubric:
5 points: Outstanding discussion of considerations; reflected critical thought and analysis; evidence of some outside research; innovative and deep discussion; evidence of original thought; came up with points that the instructor had not considered
4 points: Good discussion of considerations; reasonable level of thought; relevant points; articulate presentation of ideas
3 points: Reasonable discussion of considerations; shallow level of thought; left out some obvious considerations;
2 points: Poor discussion of considerations; Listed a few but did not discuss at all; pattern matching from instructor examples;
1 point: Minimum level of effort; little to no thought; just going through the motions;
* Considerations not mandated by ABET, but would still be beneficial for students to consider

The grade for this portion of the project becomes a direct indicator of student performance and can be used to quantify the extent of student attainment. The culminating design experience can be used for this requirement and works easily for those programs that have all students working on the same project under the same faculty member. For those programs where the culminating design experiences are all different and have individual faculty advisors, this requirement should also be applied to a design in another course that does have a single faculty member as a back-up. It only takes one or two faculty members that don't participate to jeopardize the credibility of the assessment.

For a program that uses a senior seminar course to meet many of the ABET criteria, that course could assist with this requirement as well. Students could be assigned to read a book or article on a complex project such as "The Great Bridge" or "The Path Between the Seas" by David McCullough. The students could write an essay on the global, cultural, social, environmental and economic considerations of the Brooklyn Bridge or Panama Canal, respectively. Such books are filled with so many examples that no two students should arrive with the same answers.

One challenge encountered with this requirement so far is distinguishing between the social and cultural considerations because many consider them interchangeable. The conjunction *and* in the criterion forces a program to consider them separately. My recommendation to the ABET Criteria Committee is to merge them together into social/cultural considerations and consider adding political considerations to the list.

- **Criterion 3(3) Communication to a range of audiences.** The previous criterion 3(d) required that students communicate effectively while the new criterion 3(3) adds the provision to communicate effectively with a range of audiences. This could cause confusion because the criterion does not specify what constitutes a wide range of audiences. An ABET webinar[2] clarified this issue the slide shown in Figure 1, which states that a program can determine its own range of audiences and the range must include at least two. As such, this addition should have little effect on the program assessment of student outcomes as most curricula have students communicate with faculty, peers within their discipline, peers outside their discipline and members of industry. The only caveat is that programs must find examples that every student completes. In every program there are some students that will communicate with members of industry, but it is trickier to find an assignment where every student does this.

- **Criterion 3(4) A Blended Outcome.** As stated earlier, the blending of two previous outcomes into one new outcome works well for Criterion 3(1). It works less well as previous student outcomes 3(f), 3(h), and 3(i) were combined into new student outcome 3(4) which requires *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.* These are not compatible and do not naturally belong in the same student outcome. The danger for a program is that they might assess one aspect of the outcome and miss the others which could result in a shortcoming that might otherwise be avoided by having kept these outcomes separate. Ethics and professional responsibility are important concepts and are muddied by including global, economic, environmental, and societal contexts into the requirements. The need for global, economic, environmental, and societal awareness also extends beyond just the areas of ethics and professional responsibility. It has been difficult for programs to find elements in the curricula that meet all of this.

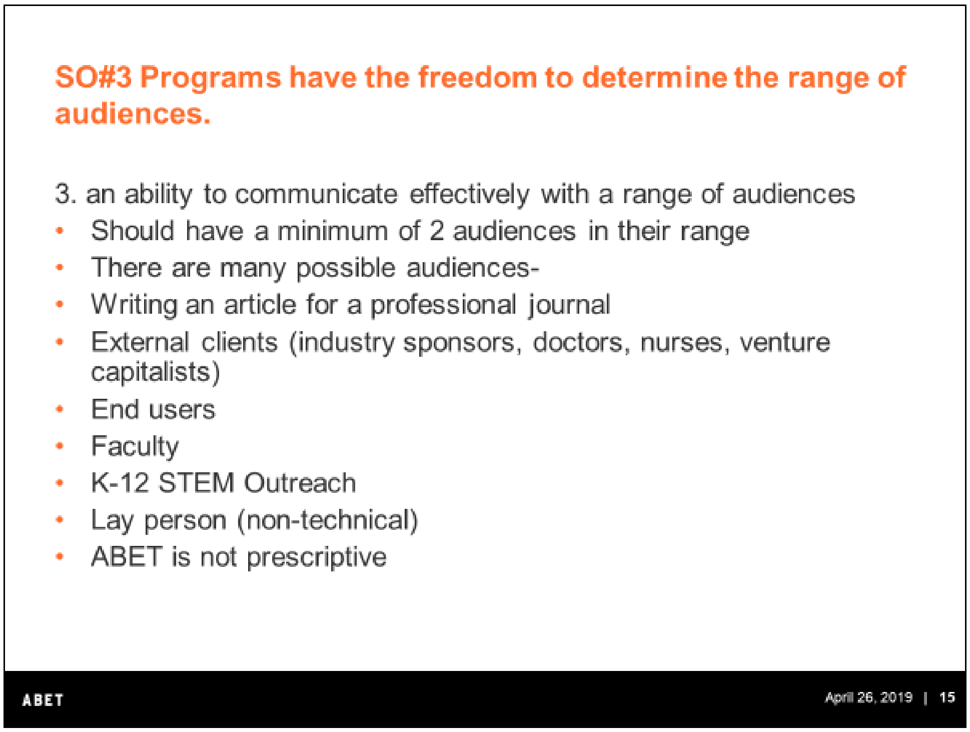

Figure 1. ABET Webinar Slide Clarifying the Range of Audiences for Effective Communication

Most programs already have documentation, direct measures and embedded indicator assignments that assess the three previous individual outcomes that were blended into this new outcome. The safest and most common solution for programs has been to continue to use those separate indicators and apply them to this new outcome. There is little to no feedback at this time to verify the merit of this approach. The intent of this outcome will become clearer over time.

Programs should also note that the criterion states, “global, economic, environmental, **and** societal” indicates that all must be assessed, and increases the likelihood of one being missed. My recommendation to the ABET Criteria Committee is to provide more guidance on what is expected for this outcome and why these outcomes were combined. It is also curious as to why outcome 3(2) included cultural considerations and 3(4) does not.

- **Criterion 3(5) Functioning on a Team.** Both the previous criteria and the new criteria require the students to work in teams. The previous requirement to function on multi-disciplinary teams has been removed, which is surprising considering the increased industry emphasis on this skill. Working across disciplines is difficult [9,10,11] and this constraint has been removed from the accreditation process.

The new criterion 3(5) adds supplemental verbiage about a *team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives*. These are integral parts of working in teams and don't really create anything new, but they do need to be assessed.

A challenge with assessing the performance of a team has always been the question of what constitutes a good team. In this case, the ABET criteria have answered that question by listing five elements that define a good team. Any program is welcome to supplement this list, but ABET has actually made the task easier by supplying at least a partial list of good team attributes. A key measure of an effective team is the degree to which the assignment was successfully completed or the degree to which they met the objectives. A good team will perform well on the assigned task and a poor team will not….for whatever reason.

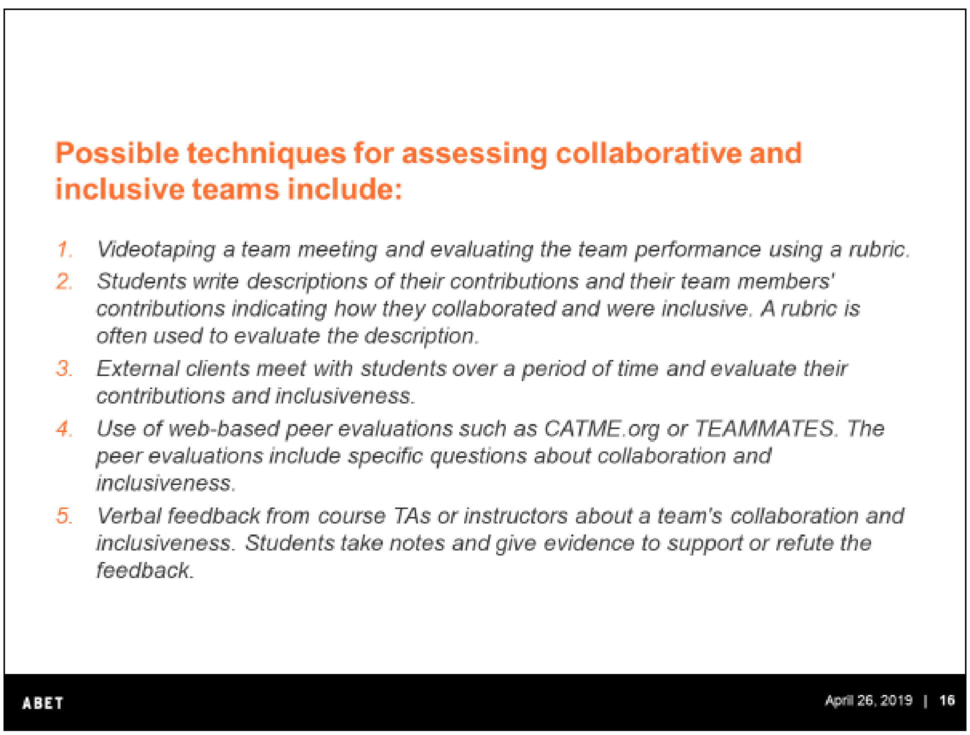

Figure 2. ABET Webinar Slide offering suggestions of assessing teams.

Figure 2 provides ABET suggestions for assessing teams[2]. The simpler approaches have involved rubrics, student feedback, and the grade on the overall team project.

On one assignment, the student team members were all given the following survey:

In the *assigned* project, you were a member of a team. Evaluate the degree to which your team accomplished the following by providing a score from 1 to 5 using the attached rubric:

Team Rating	**1**	**2**	**3**	**4**	**5**
Provided leadership					
Created a collaborative and inclusive environment					
Established goals and planned tasks					
Met the objectives					

Team Evaluation Rubrics

Leadership
5: A leader emerged who delegated well, kept everyone on track and motivated the team to efficiently accomplish the task –or- leadership was shared with an effective leader emerging as necessary taking advantage of skills as needed.
3: Leadership rotated but it was somewhat random. All recognized the challenges of leadership, so all pitched in but the effort was not terribly organized
1: A leader emerged but he/she was a tyrant, did not know what he/she was doing, alienated the rest of the group, and was viewed as lazy by the rest of the group. The leader hindered the performance of the group…..or the group floundered because nobody wanted to lead.

Collaborative and Inclusive
5: Everyone got along well and did their fair share. No person was marginalized and the group took maximum advantage of each person's skill and talent. The group was clearly greater than the sum of its parts.
3: Group had some rough spots with diverse personalities, but got past it. There were some tense moments but group still got the work done in an effective manner. One person took over and did the majority of the work because others could not be trusted or were not capable.
1: Some members of team were deliberately excluded from the effort….or excluded themselves from the effort. There was noticeable resentment in the group. Group meetings were hell and people stopped coming.

Established goals and planned tasks
5: Group established a timeline with milestones at the beginning of the project and diligently tracked the effort. Deliverable was finished ahead of deadline with no all-nighters. Everyone know what everyone else was doing. Able to adjust effectively to change
3: Made a to-do list but we never looked at it again. Got the work done, but it was a total rush at the end. Effort was hindered by some procrastination

1: Made no plans and it was total helter-skelter. Had to redo several tasks because nobody knew what anyone else was doing. Deliverable lacked a common format and was produced hurriedly at the last minute.

The survey results provided a numerical rating for each category. A combined rating of the assignment grade and the student ratings provided a final score which can be measured against a pre-established standard to indicate the degree to which the student outcome had been obtained.

- **Criterion 3(6) Developing Experiments.** Previous criterion 3(b) required that students *design* and conduct experiments. This has been a challenge for civil engineering programs because civil engineers do not usually design experiments. The new criterion 3(6) more reasonably requires that students *develop* and conduct appropriate experimentation. This is more realistic and indicative of what civil engineers actually do. Given a specific situation, civil engineers will plan and set-up an experiment conducted to ASTM or other standards to determine soil classification or concrete strength or water contamination. Programs will no longer have to artificially place a design of experiment into the curriculum[13].

Unfortunately, this interpretation is not universally accepted and no ABET documentation is available to explain the difference between *designing* and *developing* an experiment. In various workshops and forums, participants have suggested that developing an experiment is actually a higher standard and harder to do than designing an experiment and there is no webinar, guidance or evaluator training to divine the intent of this criterion. It is too early in the process to conclude how this will be resolved. My recommendation to the ABET Criteria Committee is to publish guidance that will answer this question. My recommendation to the ASCE Committee on Accreditation is to get ahead of the issue and create the definition for developing experiments in the ASCE Criteria Commentary[14] that the society supports and forward it to the ABET Criteria Committee for consideration.

The previous criteria required that students *analyze and interpret data* as part of conducting experiments. The new criteria require that students *analyze and interpret data, and use engineering judgment to draw conclusions*. In reality, this should not add any new requirement for programs. Most experiments require students to prepare lab reports that analyze and interpret data. Those reports also ask students to make conclusions about error analysis, closeness to accepted results, experimental procedures, and whether the answers make sense. All of this represents using engineering judgement to draw conclusions.

- **Criterion 3(7) Acquire and Apply New Knowledge.** The previous Criterion 3(i) required a recognition of the need for life-long learning rather that the requirement to actually do any life-long learning. It was the measure of an awareness or an attitude, which could be directly measured through a survey. It could be measured by the intent to join professional societies, attain a graduate degree, or attend continuing education workshops. The new criterion 3(7) removes the word “life-long” and makes it less lofty and more specific to what students should be able to do by graduation. Students must *acquire and apply new knowledge as needed, using appropriate learning strategies*. To demonstrate attainment of the new outcome, a program should require students to learn some aspect of the curriculum on their own. Examples might include a new software program, a technical concept in an engineering class, or the use of a piece of equipment for an experimental purpose. The assignments could be prefaced with guidance on appropriate learning strategies.

The following example shows an assignment where students were required to learn on their own and the learning strategies were evaluated. The assignment was to use the structural analysis program RISA to find the reactions, deflections, maximum moment and moment diagram for a three-member indeterminate frame without any prior instruction on the program. The students completed an exercise given to faculty participants in the ExCEEd Teaching Workshop that develops a Model Learning Strategy that incorporates appropriate learning strategies[15]. The four slides for this exercise are contained in Appendix A. The students were required to submit their RISA solution to the assigned problem and write an essay that described how they learned to use RISA.

The grading rubric for the assignment was:

ARCE 352 Lab 6 Grade Sheet **Name: ______________________**

Problem 1			_____/ 30 points
RISA model of the structure		____/5	
Table showing node deflections		____/5	
Moment diagram of result		____/5	
Value and location of max. moment		____/5	
Reaction results		____/5	
Comparison to ARCE 302 homework results		____/ 5	
Problem 2			______/ 20 points
Content	____/ 8		
Format	____/ 4		
Quality of writing	____/ 8		

The scores on the 30 points allocated for Problem 1 were a direct measure of the degree to which students were able to acquire new knowledge on their own and the scores on the 8 points allocated to the content of their essay in Problem 2 was a measure of whether their learning strategies were appropriate.

The same approach would work for any assignment where students learn on their own. Culminating design experiences and project reports almost always require students to acquire knowledge on their own. Having students explicitly quantify how they acquired the new knowledge could be a graded part of the final report.

New Criterion 5 Sections	Previous Criterion 5 Sections
The curriculum requirements specify subject areas appropriate to engineering but do not prescribe specific courses. The program curriculum must provide adequate content for each area, consistent with the student outcomes and program educational objectives, to ensure that students are prepared to enter the practice of engineering. The curriculum must include:	The curriculum requirements specify subject areas appropriate to engineering but do not prescribe specific courses. The **faculty** must ensure that the program curriculum devotes adequate attention and time to each component, consistent with the outcomes and objectives of the program and institution. The professional component must include:
(a) a minimum of 30 semester credit hours (or equivalent) of a combination of college-level mathematics and basic sciences with experimental experience appropriate to the program	(a) one year of a combination of college level mathematics and basic sciences (some with experimental experience) appropriate to the discipline
(b) a minimum of 45 semester credit hours (or equivalent) of engineering topics appropriate to the program, consisting of engineering and computer sciences and engineering design, and utilizing modern engineering tools.	(b) one and one-half years of engineering topics, consisting of engineering sciences and engineering design appropriate to the student's field of study. The engineering sciences have their roots in mathematics and basic sciences but carry knowledge further toward creative application. These studies provide a bridge between mathematics and basic sciences on the one hand and engineering practice on the other.
(c) a broad education component that complements the technical content of the curriculum and is consistent with the program educational objectives.	(c) a general education component that complements the technical content of the curriculum and is consistent with the program and institution objectives.
(d) a culminating major engineering design experience that 1) incorporates appropriate engineering standards and multiple constraints, and 2) is based on the knowledge and skills acquired in earlier course work.	Students must be prepared for engineering practice through a curriculum culminating in a major design experience based on the knowledge and skills acquired in earlier course work and incorporating appropriate **engineering standards** and multiple realistic constraints.

Table 2. Side by Side Comparison of the New Criterion 5 Requirements with the Previous Criterion 5 Changes

Table 2 compares the side-by-side changes for the Criterion 5 Curriculum requirements[5] for the previous and new criteria. The new requirements are in the left column of the table. The previous Criteria 5 requirements, which had not changed since they were adopted as part of EC2000, are in the right column. The most relevant changes are highlighted in bold red print. The new criteria put more emphasis on what the curriculum will provide as opposed to the faculty.

- **Current tools and technology.** As also shown in Table 1, the previous student outcome 3(k) which requires students to use the techniques, skills, and modern engineering tools necessary for engineering practice, has been eliminated as a student outcome and has been moved to Criterion 5 where utilizing modern engineering tools is included in the description of Engineering Science. A program will no longer need to demonstrate that students are able to use these modern tools; they must merely demonstrate that they are included in the curriculum.

- **Definition of a year.** The most substantive and beneficial change occurs in the new Criterion 5 where a year is defined as 30 semester hours. This is a vast improvement over the previous dual definition which defined a year as the lesser of 32 semester hours (or equivalent) or one-fourth of the total credits required for graduation. This existing criterion has proven difficult for many programs to meet and many found themselves adding math or science courses that they did not want to meet this criterion.[16] Furthermore, the amount of math and science that an engineer needs should rightfully not depend on the number of total units in the program. By lowering the definition to a common 30 semester hours, the standard is fairer, more attainable, and provides more flexibility for an engineering program.

- **Engineering standards.** While the requirement to incorporate engineering standards into the culminating experience is in both the previous and new criteria, it has been an area of interest on recent ABET visits. While civil engineering designs are almost always based on codes and standards, other disciplines have received shortcomings in this area recently for not incorporating engineering standards into culminating design experiences.

- **Computer science.** Computer science is explicitly included in Criterion 5 as an engineering topic. The reason is to clarify that computer science is not a basic science and can therefor not be included as such in the 30 semester units needed of math and basic science.

- **Engineering Design Definition.** The previous Criterion 5(b) included a definition of design (not included in Table 2). An expanded definition of design has been moved to the Definitions section at the beginning of the EAC General Criteria.[5] Both definitions are shown in Table 3. The new definition provides a list of constraints that should be considered in design. The definition states that the list is for illustrative purposes only and the conjunction at the end of the list is "*or*" unlike the design considerations listed in Criterion 3(b).

New Engineering Design Definition	Previous Engineering Design Definition
Definitions Section	**Criterion 5(b)**
Engineering design is a process of devising a system, component, or process to meet desired needs and specifications within constraints. It is an iterative, creative, decision-making process in which the basic sciences, mathematics, and engineering sciences are applied to convert resources into solutions. Engineering design involves identifying opportunities, developing requirements, performing analysis and synthesis, generating multiple solutions, evaluating solutions against requirements, considering risks, and making trade-offs, for the purpose of obtaining a high-quality solution under the given circumstances. For illustrative purposes only, examples of possible constraints include accessibility, aesthetics, codes, constructability, cost, ergonomics, extensibility, functionality, interoperability, legal considerations, maintainability, manufacturability, marketability, policy, regulations, schedule, standards, sustainability, or usability.	Engineering design is the process of devising a system, component, or process to meet desired needs. It is a decision-making process (often iterative), in which the basic sciences, mathematics, and the engineering sciences are applied to convert resources optimally to meet these stated needs.

Table 3. ABET Definitions of Engineering Design Under the New and Previous Criteria

Current Status

At the time of writing this paper, the first round of ABET visits was completed in Fall 2019 and those programs evaluated are going through the due process period where they are addressing any shortcomings cited at the exit interview prior to the ABET annual meeting in July. Programs have submitted reports to team chairs and the final accreditation status will be decided at the annual meeting. Meanwhile, those programs going through the second cycle of the new criteria are writing their self-studies in preparation for ABET visits in Fall 2020.

As such, there has been little feedback on the results of the first visits under the new criteria. Those results, when revealed, may not be decisive because ABET guidance for those undergoing first visits under the new criteria was to be reasonable and lenient.[4]

Personal experience as an evaluator indicates that was the case. The enforcement for those undergoing the second visit will be stricter and the new criteria should be in full effect for those who are third into the breech. This is an evolving process and it will take several years before all of the standards of enforcement and true intent of the criteria will be known.

Nevertheless, it will be interesting to follow the trends in shortcomings due to the new criteria. Table 4 reflects the ABET shortcomings received by all reviewed programs in the 2018-19 academic year[17]. The rows on the table show which criterion or other self-study chapter was the source of these shortcomings. The shortcoming are broken down by Deficiencies (D), Weaknesses (W), and Concerns (C). The table also shows the number of shortcomings at the various stages of the ABET review process: completion of the team visit (Draft), end of the 30 day review period (30 days), and end of the due-process period which is the ABET in July when final determinations are made (Final). The effect of the new criteria in the 2019-20 report will most likely be seen in the Criterion 4 shortcomings. Criterion 3 Student Outcomes lists the new outcomes but the assessment of those outcomes will be reflected in Criterion 4 Continuous Improvement.

Shortcoming Level		D	W	C	Total
Criterion 1	Draft	3	33	29	65
	30-day	0	3	12	15
	Final	0	4	8	12
Criterion 2	Draft	1	75	33	109
	30-day	1	17	13	31
	Final	0	10	12	22
Criterion 3	Draft	0	4	3	7
	30-day	0	0	2	2
	Final	0	0	2	2
Criterion 4	Draft	5	103	24	132
	30-day	1	59	21	81
	Final	1	37	19	57
Criterion 5	Draft	26	64	17	107
	30-day	12	35	14	61
	Final	4	15	12	31
Criterion 6	Draft	0	15	50	65
	30-day	0	8	40	48
	Final	0	4	35	39
Criterion 7	Draft	0	10	22	32
	30-day	0	4	14	18
	Final	0	4	10	14
Criterion 8	Draft	3	10	54	67
	30-day	0	5	37	42
	Final	0	1	28	29
Program Criteria	Draft	3	21	14	38
	30-day	0	9	5	14
	Final	0	4	5	9
APPM	Draft	4	27	1	32
	30-day	1	2	0	3
	Final	1	4	0	5
Masters Level	Draft	0	0	0	0
	30-day	0	0	0	0
	Final	0	0	0	0

Table 4. Results of the 2018-19 Accreditation Visits

Conclusions

The conclusion reached in previous papers still holds. The changes in Criterion 3 and 5 are relatively minor and programs that have been accredited under the previous criteria should not have to struggle to meet the new criteria. There will be some changes in the assessment process and this paper has attempted to highlight those and suggest reasonably efficient ways to accomplish this. For reasons stated, this is an initial interim paper because we are early in the process of adopting the new criteria. More definitive guidance will come forth in the next few years as the results are reported and lessons are learned.

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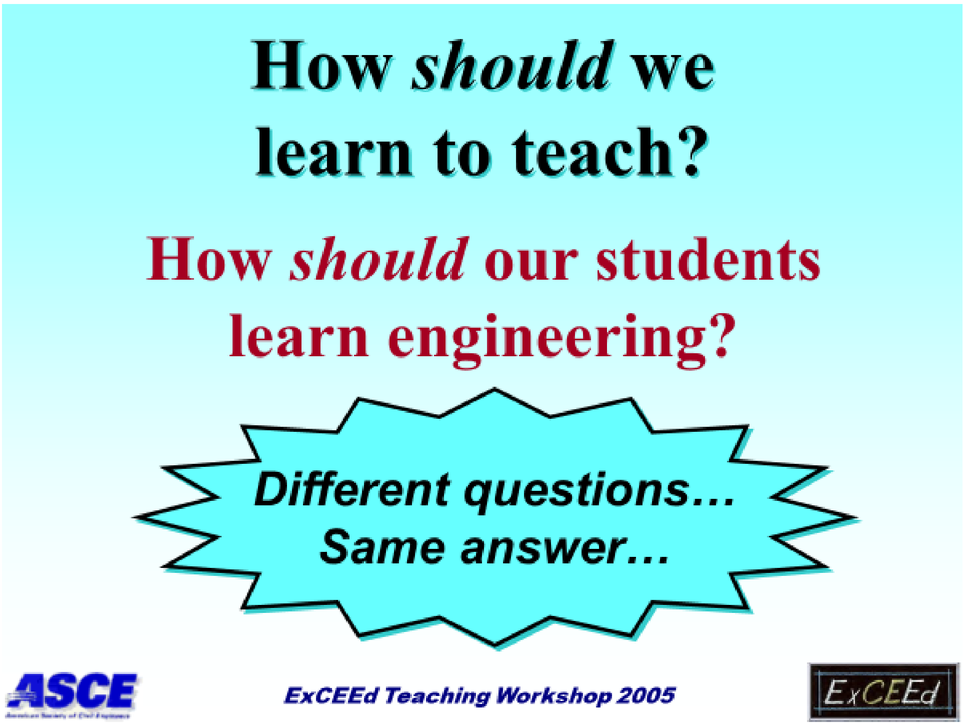
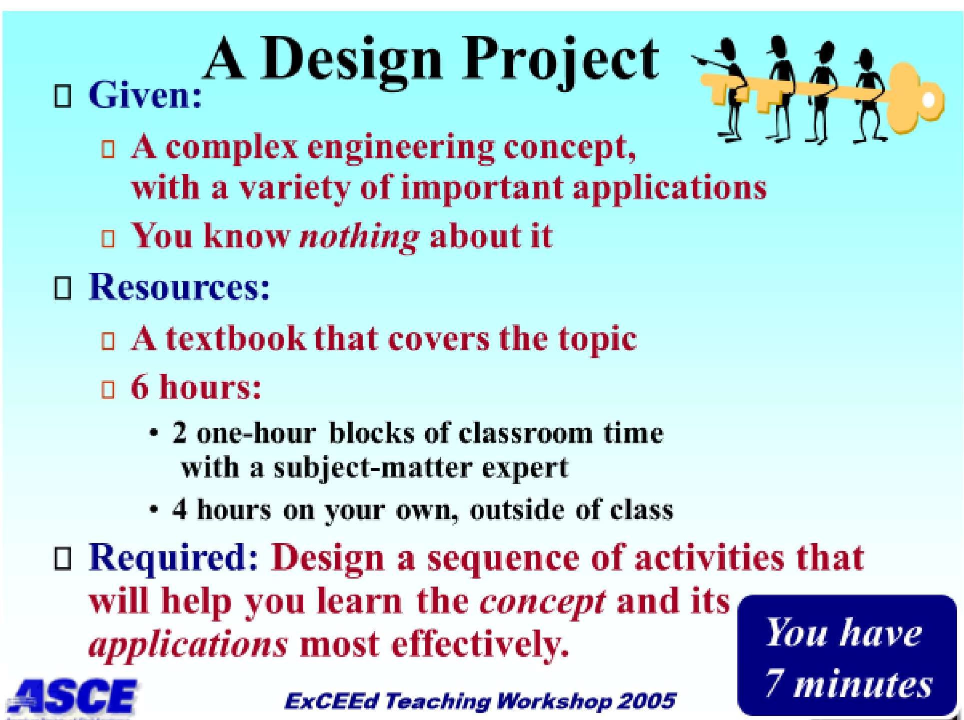
Appendix A:

Four Slides from the ExCEEd Teaching Workshop That Can Be Used to Introduce Students to Appropriate Learning Strategies

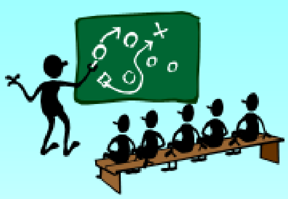




Some *Possible* Activities

- Read the textbook.
- Receive a lecture on the concept from the expert.
- Watch the expert solve an example problem.
- Describe your own understanding of the concept to the expert, and get feedback on how well you really understand it.
- Discuss the concept with your peers.
- Solve a practice problem with assistance from the expert.
- Solve a practice problem on your own, then get feedback from the expert on how well you did.
- Solve a practice problem with your peers.

A Model Instructional Strategy



- Provide an orientation:
  - Why is this important?
  - How does it relate to prior knowledge?
- Provide learning objectives.
- Provide information.
- Stimulate critical thinking about the subject.
- Provide models.
- Provide opportunities to apply the knowledge:
  - In a familiar context.
  - In new and unfamiliar contexts.
- Assess the learners' performance and provide feedback.
- Provide opportunities for self-assessment.