AC 2011-22: PROGRAM EDUCATIONAL OBJECTIVES: WHAT CONSTITUTES SUFFICIENT ASSESSMENT?

John K. Estell, Ohio Northern University

John K. Estell is a Professor of Computer Engineering and Computer Science at Ohio Northern University. He received his doctorate from the University of Illinois at Urbana-Champaign. His areas of research include simplifying the outcomes assessment process, first-year engineering instruction, and the pedagogical aspects of writing computer games. Dr. Estell is an ABET Program Evaluator, a Senior Member of IEEE, and a member of ACM, ASEE, Tau Beta Pi, Eta Kappa Nu, and Upsilon Pi Epsilon.

Stephen M. Williams, Milwaukee School of Engineering

Dr. Stephen Williams is Program Director of Electrical Engineering and Professor of Electrical Engineering and Computer Science at the Milwaukee School of Engineering (MSOE). He has 25 years of experience across corporate, government, and university sectors. He is a registered Professional Engineer in Wisconsin. He teaches courses in engineering design, embedded systems, electronic design, and electromechanics.

Program Educational Objectives: What Constitutes Sufficient Assessment?

Abstract

A survey of North American electrical and computer engineering department heads was conducted in 2009 to solicit responses regarding what constitutes sufficient assessment for program educational objectives. The results of this survey indicate that the current views of what constitutes sufficiency by ABET are misguided, resulting in the collection of statistically invalid data, faulty assumptions regarding the causality of a program's objectives to the career successes of their alumni, and unwarranted citations for shortcomings beyond the control of both program and institution. This paper presents a detailed analysis of the survey responses and provides recommendations to ABET for changes to the accreditation process.

Introduction

In the "Criteria for Accrediting Engineering Programs" for the 2011-2012 Accreditation Cycle[1], herein referred to as the "Harmonized Criteria," ABET defines the term "Program Educational Objectives" as "broad statements that describe what graduates are expected to attain within a few years after graduation." Furthermore, the Harmonized Criteria elaborate that "program educational objectives are based on the needs of the program's constituencies." There have been considerable difficulties observed in attempting to determine how to assess and evaluate the achievement of the program educational objectives, as evidenced in both the 2008 and 2009 ABET Annual Reports[2,3]. In its analysis of accreditation actions and trends, both Reports cite Criterion 2 (Program Educational Objectives) and Criterion 3 (Program Outcomes) as ". . . the areas in which there are the most shortcomings (deficiencies, weaknesses, and concerns)." Both Reports go on to state that "Common shortcomings related to these two criteria included the following: inadequate evidence that the process in which the objectives are determined and periodically evaluated is based on the needs of constituencies (Criterion 2); confusion between the definition of program educational objectives (Criterion 2) and program outcomes (Criterion 3); inadequate evidence of using the results of evaluation of objectives (Criterion 2) and/or assessment of outcomes (Criterion 3) to improve the program; and inadequate evidence demonstrating achievement of objectives (Criterion 2) or outcomes (Criterion 3)." Furthermore, when examined over the ten year period 1997 to 2007, the rate of NGR actions taken by the ABET Engineering Accreditation Commission fell from 78% to 67%.

A plenary session at the 2009 Electrical and Computer Engineering Department Heads Association (ECEDHA) Annual Meeting focused on determining suggestions for improving the ABET accreditation process. Subsequently, four subcommittees were formed and charged with gathering data and reporting findings at the 2010 ECEDHA Annual Meeting. The subcommittee for determining what constitutes sufficiency for assessment readily concluded that the area of program educational objectives was in greatest need of attention. To acquire meaningful data, a survey of electrical and computer engineering department heads was conducted in December

2009. The survey was designed to solicit responses regarding what constitutes sufficient assessment for program educational objectives. Elements of the survey included perceived efficacy of the relevant components of the Criteria, the various assessment modes used, survey response rates, and program modifications resulting from the evaluation of such assessment processes, in both quantitative and qualitative formats. A total of 117 responses were received from the 342 ECEDHA members to whom this survey was sent. The summarized results from this survey are presented in the following sections.

Are Program Educational Objectives of value to the program?

Under the newly-adopted Harmonized Criteria, there are four main components to the concept of Program Educational Objectives as defined by ABET, the first two components being contained under Criterion 2 while the last two components are contained under Criterion 4:

1. "The program must have published program educational objectives that are consistent with the mission of the institution, the needs of the program's various constituencies, and these criteria."
2. "There must be a documented and effective process, involving program constituencies, for the periodic review and revision of these program educational objectives."
3. "The program must regularly use appropriate, documented processes for assessing and evaluating the extent to which … the program educational objectives … are being attained."
4. "The results of these evaluations must be systematically utilized as input for the continuous improvement of the program."

The first portion of the survey dealt with ascertaining the degree to which the survey respondents believe these components are of value to their program. The results, based on a 5-point Likert scale, are presented in Table 1.

Table 1. Perceived value of program educational objectives to the program.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Having published educational objectives that are consistent with the mission of the institution and these criteria is of value to my program.	28 (23.9%)	53 (45.3%)	21 (17.9%)	7 (6.0%)	8 (6.8%)
Having a process that periodically documents and demonstrates that the objectives are based on the needs of the program's various constituencies is of value to my program.	17 (14.5%)	43 (36.8%)	31 (26.5%)	16 (13.7%)	10 (8.5%)
Having an assessment and evaluation process that periodically documents and demonstrates the degree to which these objectives are attained is of value to my program.	17 (14.5%)	35 (29.9%)	31 (26.5%)	20 (17.1%)	14 (12.0%)
The information obtained from assessing and evaluating Criterion 2 is worth the time invested collectively by my program.	4 (3.4%)	20 (17.1%)	20 (17.1%)	37 (31.6%)	36 (30.8%)

The survey data indicates that there exists general support for having published educational objectives (69.2% in favor, 12.8% against) and for having a process that periodically documents and demonstrates that the objectives are based on constituent needs (51.3% in favor, 22.2% against). However, there was a lack of majority support for having a process that periodically evaluates the degree to which these objectives are obtained (44.4% in favor, 29.1% against) and a clear majority disagreed with the premise that the information obtained in assessing and evaluating the program educational objectives is worth the time invested collectively by the program (20.5% in favor, 62.4% against), with a noticeable nine to one ratio between the "strongly disagree" to "strongly agree" responses. A common theme among the comments was the difficulty in obtaining meaningful data. Narrative feedback regarding the value of program educational objectives included:

- *"Emphasis should be on assessing the program outcomes and not the program educational objectives."*
- *"I will not use the assessment data that our program collects for ABET criterion 2 to change anything in our program. It is too sparse, unreliable, and infrequently collected to be of any use."*
- *"The basic idea is sound but the proscriptive nature of the ABET requirements is excessive. In particular, quantitatively assessing the degree of achievement in a meaningful way is futile."*
- *"All engineering programs essentially share the same 3-5 year objectives for their graduates, we want them to be functioning as engineers, and able to get into graduate school if they desire. These data are very difficult to acquire and are very subjective. A better measure for the educational process should be much closer to the educational process chronologically, i.e. at graduation."*
- *"The educational objectives are very broad statements and established with various constituencies involved. They will remain unchanged for a relatively long period. Constant assessment is not necessary and will have very little impact to the quality of my program."*

How are Program Educational Objectives assessed and evaluated?

Under the Harmonized Criteria, "assessment" as applied to the program educational objectives is defined as "one or more processes that identify, collect, and prepare data to evaluate the attainment of … program educational objectives. Effective assessment uses relevant direct, indirect, quantitative and qualitative measures as appropriate to the objective … being measured. Appropriate sampling methods may be used as part of an assessment process." The Criteria go on to define "evaluation" as "one or more processes for interpreting the data and evidence accumulated through assessment processes. Evaluation determines the extent to which … program educational objectives are being attained. Evaluation results in decisions and actions regarding program improvement." In order to determine the overall effectiveness of the assessment and evaluation process, the following set of survey questions were asked:

1. Please indicate which assessment modes your program uses, and the frequency of that mode, for collecting data.
2. In terms of the number of years since graduation, which groups of alumni does your program contact for assessment of your program educational objectives?
3. For each of the last three years, what percentage of the alumni and employers contacted responded to your request to participate in the assessment of your program educational objectives?
4. Has your program implemented any changes as a result of your program educational objectives assessment and evaluation process?

For question #4, if a positive response was received, two follow-up questions were asked:

5. Describe the change(s) made to your program.
6. Has further assessment been made to measure the effectiveness of the change(s) made?

The primary modes of assessment asked about were surveys, focus groups, and advisory boards, along with an "other" category to allow for the accounting of other assessment modes. Of the 113 responses to this question, 99.1% of the programs reported using one or more survey instruments, with 55.8% using paper surveys, 42.5% using e-mail surveys, 60.2% using web-based surveys, and 4.4% using telephone surveys. The next highest used mode was the industrial advisory board, with 87.6% of the programs indicating their use. Finally, only 43.4% of the programs reported using focus groups, with 37.2% using alumni focus groups and 33.6% using employer focus groups. Generally, for any assessment mode used, the vast majority of programs were conducting their assessment in cycles of three years or less, as shown in Table 2.

Table 2. Assessment mode data. Percentages indicate breakdown within each mode. Percentages in "TOTAL" row indicate overall use by pool of survey respondents.

	Paper Survey	E-mail Survey	Web-based Survey	Phone Survey	Alumni Focus Groups	Employer Focus Groups	Industrial Advisory Board
Used every year	25 (39.7%)	20 (41.7%)	27 (39.7%)	3 (60.0%)	16 (38.1%)	18 (47.4%)	67 (67.7%)
Used every other year	15 (23.8%)	6 (12.5%)	17 (25.0%)	2 (40.0%)	7 (16.7%)	11 (28.9%)	16 (16.2%)
Used every third year	20 (31.7%)	18 (37.5%)	21 (30.9%)	0 (0.0%)	12 (28.6%)	4 (10.5%)	15 (15.2%)
Used every fourth year	2 (3.2%)	3 (6.3%)	3 (4.4%)	0 (0.0%)	2 (4.8%)	2 (5.3%)	0 (0.0%)
Used every fifth year	1 (1.6%)	1 (2.1%)	0 (0.0%)	0 (0.0%)	3 (7.1%)	3 (7.9%)	1 (1.0%)
Used every sixth year	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (4.8%)	0 (0.0%)	0 (0.0%)
TOTAL (n = 113)	63 (55.8%)	48 (42.5%)	68 (60.2%)	5 (4.4%)	42 (37.2%)	38 (33.6%)	99 (87.6%)

There were no recurring themes among the comments to this section of the survey.

For those 112 programs that reported conducting alumni surveys, most employed a targeted approach directed at specific cohorts based on the number of years since graduation, whereas some programs solicited information from all alumni. The preponderance of targeted solicitations goes out to those who are three and five years removed from graduation, as illustrated by the bar graph in Figure 1.

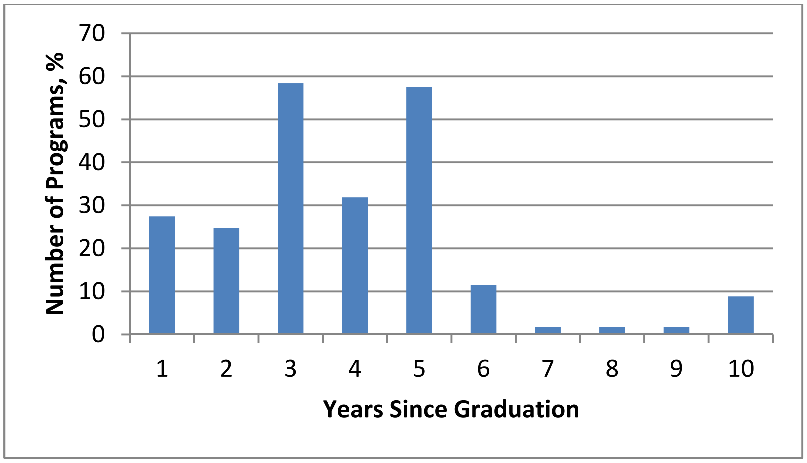

Figure 1. Breakdown of targeted cohorts for survey-based assessment.

As illustrated in Figure 2, the number of alumni cohorts targeted for assessment varies widely. While the majority of programs target one, two, or three cohorts, other programs take more of a "shotgun" approach, with some programs commenting that they send their surveys to all of their alumni, and then sorting by cohort accordingly.

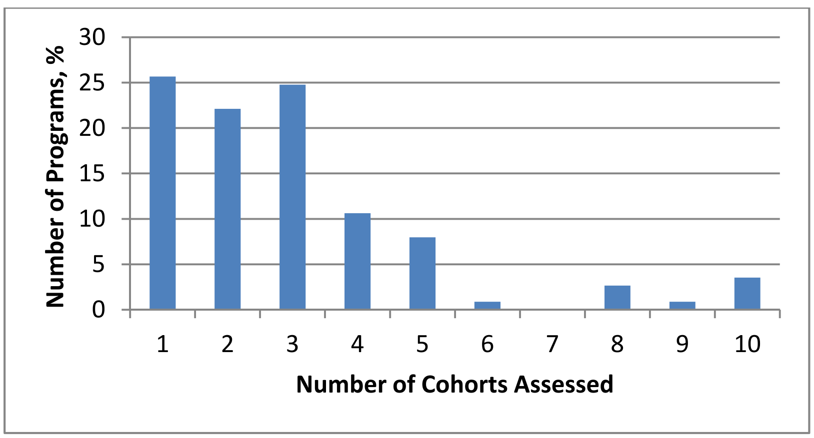

Figure 2. Breakdown of number of cohorts assessed through alumni surveys.

Of particular interest are the assessment participation rates for both alumni and employers. The programs were asked to report their response rates out of those contacted to participate in the assessment of the program educational objectives for the three academic years prior to the ECEDHA Survey (2006-2007, 2007-2008, and 2008-2009). Figures 3 and 4 respectively show the aggregate distribution of responses from alumni and employers contacted by programs over the three-year period. The data in both figures are noticeably skewed; statistical analysis shows that the median response rate for alumni participation is at 15% whereas the median response rate for employer participation is only at 10%.

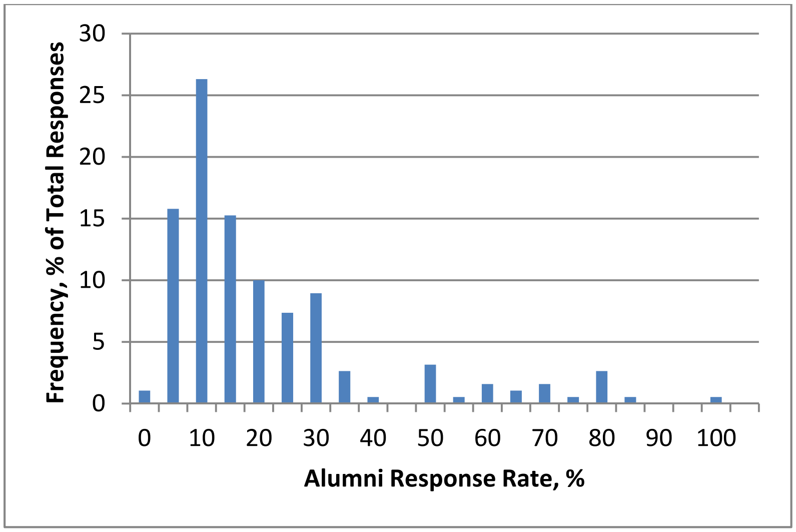

Figure 3. Aggregate alumni response rate, 2006-2008 Academic Years.

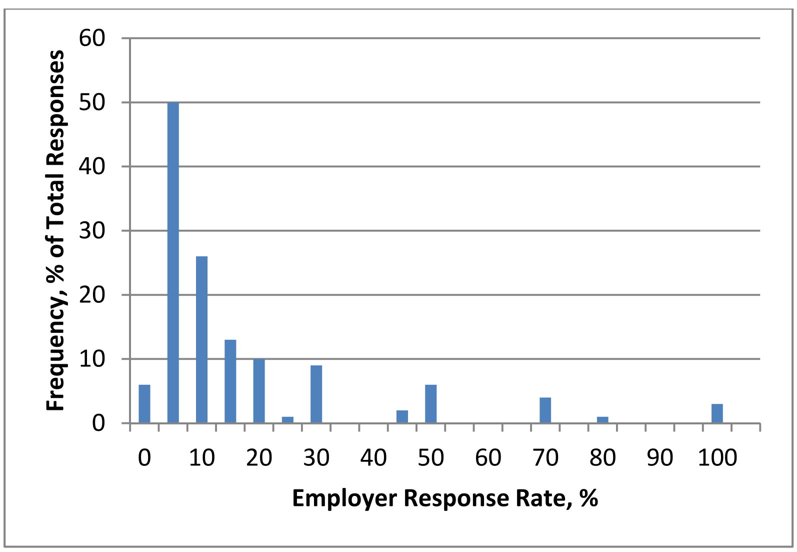

Figure 4. Aggregate employer response rate, 2006-2008 Academic Years.

Comments regarding the performance of such surveys included the following:

- *"It is difficult to collect information from alumni and their employers and yet this is a critical component of the mandated process."*
- *"After ten years in the field only less than 10% come back and talk to you."*
- *"Tremendous change occurs in peoples' lives in the five years after graduation. I believe there is very little, if any, correlation between our ABET criterion 2 survey results and the undergraduate program."*

Finally, programs were asked if they had implemented any changes as a result of the assessment and evaluation of their program educational objectives. There were 44.4% of the programs that indicated they had made some changes due to this process. An analysis of the qualitative follow-up responses to this question indicate that 26 respondents made program changes, nine respondents made changes to their program educational objectives, and three made changes to their assessment process. The comments on program changes included the following:

- *"A senior course in digital design was added to the curriculum as a result of employer input."*
- *"Added another class in mathematics because of marginal success in the area of technical analysis."*
- *"Increase in importance of design in the curriculum and changes to the capstone sequence. The data was open-ended comments from alumni and survey responses showing alumni were dissatisfied with the level of design in the curriculum."*

Regarding changes made to the program educational objectives:

- *"We modified our program educational objectives based on the feedback received from our industrial advisory board members, alumni and their employers."*

One comment was provided regarding changes to the assessment process:

- *"External Advisory Board was created, and their input is now being used in the assessment."*

It is worth noting that only 38.3% of the programs reporting changes have conducted further assessment to measure the effectiveness of the change(s) made.

Are programs in compliance with the Program Educational Objectives?

The ECEDHA Survey was also used to solicit information regarding the results from each program's last ABET accreditation visit with respect to their program educational objectives. Specifically, respondents were asked if they had received a shortcoming with respect to Criterion 2 and, if so, to comment upon the degree and nature of that shortcoming. Table 3 presents the results from the 106 responses received to this question; overall, 48.1% of the programs reported the citation of a shortcoming.

Table 3. Reported shortcomings regarding program educational objectives.

Level of Shortcoming	Responses
None	47 (44.3%)
Observation made	8 (7.5%)
Concern cited	24 (22.6%)
Weakness cited	25 (23.6%)
Deficiency cited	2 (1.9%)

The nature of the reported shortcomings were analyzed, and then classified into one of three categories. The first category constitutes those shortcomings that are correctable by the program. Some of the 24 reported shortcomings in this area are:

- *“Objectives were not consistent with the requirements. Objectives were not adequately evaluated.”*
- *“The wording of our objectives was found to be focused more on what a student learns during their undergraduate experience than on what they are to accomplish after graduating.”*
- *“He stated that some of the objectives looked like outcomes.”*
- *“In 2006 visit (our first under EC2000) we were cited for not involving our constituencies in the formation of our PEOs. We spent the 9 months (final statement from visit received in fall of 2007) involving our constituencies in rewriting our PEO's and reported them back to ABET in our required interim report of July 2008. Received ABET's final statement on the 2008 report in fall of 2009 in which we were cited for having not assessed our PEOs (that we just spent the previous 9 months creating). We are now facing another interim report due in July of 2010 where we are expected to show compliance by demonstrating we are using our assessment plan. ABET is spending more time reading and evaluating our report than they are giving us to actually implement changes. This process is broken.”*

The second area is where the shortcoming is not correctable by the program, but can be successfully addressed at some higher level within the institution. A comment made by one of the two programs reporting a shortcoming in this area was the following:

- *“Concerns were "Institutional"... mainly lack of institutional support.”*

The last area is where the shortcoming is outside of the control of both program and institution. Out of the ten responses that could be classified into this category, there were three identifiable sub-classifications. The first is with regards to surveys, as one cannot force an alumni or an employer to respond to such as request; consequently, a program can easily have a low response rate, as evidenced by the data presented in Figures 3 and 4. Unfortunately, programs have been hit with shortcomings by their program evaluators because of issues with their survey response rates. Comments received from the survey respondents citing a shortcoming in this area included the following:

- *“PEVs for CompE and EE both mentioned that while we have a process in place to assess and evaluate PEOs, the returns on surveys sent to alumni and employers are minimal. Avoided being cited with a "concern" only because we have been looking at other ways, such as Facebook, to track alumni in order to increase our rate of return. We were encouraged to explore additional methods to strengthen the collection of survey data for Criterion 2.”*
- *“Alumni surveys and industry advisory board comments were noted. Not evident how a significant portion of the gathered data was used to improve the program. The type of quantitative survey data seen as limited in ability to provide insight into specific areas for program improvement. Lack of useful data hindered the program’s effectiveness in identifying potential areas for improvement.”*
- *“The original survey was a paper copy mailed to alumni and employers that resulted in non-significant statistical data. We subsequently implemented a web-based survey and the alumni response has improved. We still get a low response to the employer survey.”*

Another sub-classification involves differences in the interpretation of the program educational objectives between the program and the ABET Program Evaluator performing the site visit:

- *"Evaluator did not understand what we had done. Did not look at our supporting data. Came in with a preconceived idea of what we should have, did not find it and never made any attempt to reconcile what we had done with criterion requirements. We had three survey instruments (departmental, e-mail w/ alumni, mail solicitation from Dean's office), advisory board reports, and revision history documented in the university bulletin."*
- *"It was stated that our Objectives were too focused on current students and not on our alumni. However, our stated objectives were word for word the same as they were in 2003 (they were clearly stated and reflected our objectives at that time so why change them?). I also note that Criterion 2 has not changed since 2003. It was therefore strange that our Objectives have now garnered a weakness when they were just fine in 2003. I believe this underscores a weakness in the Accreditation process in which the published Criteria are too open to interpretation by the specific visiting committee. Programs should be consistently assessed against clearly stated written criteria."*
- *"Complained about wording of the objectives. Oddly, the same wording had been considered OK by ABET in 2000 and 2003 without complaint, so apparently something changed this time. Weakness was that objectives said things like "prepared to engage in graduate work" and "prepared to pursue a professional career," while the evaluator wanted "ARE engaged in graduate work" and "ARE pursuing professional careers." Why a few words are considered a weakness rather than a simple editing job, baffles us."*

Finally, the third sub-classification in this category involves initial accreditation visits to new programs. This is a problematic area due to the nature of the accrediting process, where a program is eligible for ABET accreditation upon graduating a student from the program. If a program applies for accreditation as soon as they are eligible, then there does not exist a body of alumni from the program who are sufficiently removed from graduation (*i.e.,* three to five years out) upon which to properly evaluate the degree of attainment of the program educational objectives. However, some programs report being cited for an item that is impossible for them to assess:

- *"Since we are a new department with new programs and only a few recent graduates just employed a year or two or three, we had no data as we did not launch any surveys due to such a small sample size. In a reply to the report, we described our process to begin this year of surveying employers and alumni and provided a draft version of our survey instruments. That was sufficient to move the weakness to a concern. However, since we had no data as evidence, the concern recently reverted to a weakness. We are addressing this issue now by moving up our date to distribute surveys, obtain feedback, discuss with our departmental advisory council, distill the data to see if improvements need to be made and identify areas for improvement, and then determine actions to be taken for achieving the improvement."*

What are the views of Program Evaluators regarding Program Educational Objectives?

As the ECEDHA Survey was being distributed to department chairs, it was assumed that some of these chairs either are, or have been, ABET Program Evaluators; accordingly, a set of questions were constructed to solicit their inputs regarding their observations of other programs. Out of 106 responses to this question, only 15 respondents (14.2%) indicated performing service as an evaluator, with an average of 5.33 site visits per evaluator being reported. While the smallness of this sample raises into question the statistical validity of the following responses, they are still of interest and can provide insight into areas for further research.

Five categories were identified as potential areas of difficulty with the evaluation of the program educational objectives, as shown in the first column of Table 4; the evaluators were asked to indicate in what area(s) they had personally observed such difficulties in programs that they had visited. A sixth category, "Other", was included, but was not selected by any of the 14 responding evaluators.

Table 4. Evaluator-observed difficulties with program educational objectives.

Category	Observed
Insufficient survey response rates	36%
Insufficient attempt at data collection	50%
Insufficient assessment of data	57%
Program outcomes and objectives are too similar	64%
Lack of understanding of the intent of the Criterion	71%

It is interesting to note that the "insufficient survey response rates" category is an area outside of the control of both program and institution; accordingly, it is difficult, if not impossible, for a program to take appropriate corrective action to address such a shortcoming. Similarly, an "insufficient attempt at data collection" is to some degree a reflection on the paucity of assessable items regarding program educational objectives (PEOs). Another point of contention is "lack of understanding," as this is indicative more of a difference of opinion between program and evaluator; it is possible for the program to be correct, and the evaluator incorrect, in the interpretation of the criteria, yet the shortcoming still occurs because of that disconnect. Among the problems specifically mentioned in the comments made by the responding program evaluators are the following:

- *"The degree to which these PEOs were attained was not demonstrated in several cases."*
- *"The PEOs were not PEOs as defined by ABET Criterion 2 but looked more like PO* [program outcomes]. *They did not understand the PEO and the measurement was not appropriate."*
- *"Every program I have evaluated has had issues with criterion 2."*

The evaluators were also asked the degree to which they agreed with the following statement: "Criterion 2 has had a positive impact on the continuous improvement of the programs that you have evaluated." It is worth noting that none of the 14 respondents to this question strongly agreed with this statement. While a plurality was of neutral opinion to this statement, only three respondents (21%) agreed with this statement.

Finally, the program evaluators were asked qualitatively as to what type of constituent feedback they had observed that had an impact on effecting program improvements. The following responses were provided:

- *“The most useful information has been specific comments on issues that survey respondents and others provide, outside the structure of the alumni/industry surveys. This includes perceived shortcomings in the program from their perspective.”*
- *“The faculty listens carefully to the employers of their graduates. Alumni who are employers as well have a very significant impact.”*
- *“Many employers are pleased with the process we go through in program improvement. They often wish that students were more familiar with the ABET program assessment process since is it so similar to many industrial QC/QM processes.”*
- *“Deficiencies in student learning.”*
- *“Engaged faculty provides the best feedback for continuous improvement. Cluster or industrial advisors, discussions at regional and national Department Heads meetings are the best sources for continuous improvement of programs.”*
- *“Input from our advisory board regarding strategic plan and overall goals of our degree programs.”*
- *“Advisory boards have the most impact. Generally their discussions are taken seriously by the programs and the boards represent the constituents reasonably well.”*
- *“Not much. Usually a few comments from industry advisory board members about particular course content (or lack of it) that relate directly to their company.”*
- *“Strong employer feedback is better than "feelings" of alumni from surveys.”*

It is worth noting that there is a theme exhibited here that connects many of these responses: program improvements are being effected due to the qualitative-type feedback obtained from advisory boards and employers associated with the program.

What were the respondents’ conclusions regarding Program Educational Objectives?

The final quantitative survey question was the following: “Does the current structure of having program objectives and constituent feedback provide for program improvement, or are there better ways for this to occur than adhering to Criterion 2?” Of the 104 respondents to this question, 60% indicated that they believe there are better ways than the current structure. A recurring theme among the comments is the long time delay involved with the process of gathering enough data to instigate a change, implementing the change, and measuring the results of that change several years after it was implemented. Among the comments received are the following:

- *“By the time an alumnus is surveyed (3 years out) we have normally made multiple changes to the program based on interaction of faculty with industry and new technology.”*
- *“Program improvement occurs in shorter time loops than data from three to five year graduates allows. We do look for general trends among our constituents in industry and academia, but this collected information is anecdotal.”*

- *“There are things we control in the undergraduate curriculum and preparation of our students, but what happens to them 3-5 years post-graduation is often more tied to who recruits the alumni and what is going on in the regional economy, rather than anything we can "change" by tweaking our program. The Objective assessment is so loosely tied to our day-to-day operation that it really is pretty much a waste of time.”*
- *“The delay until attainment of "objectives", as defined by ABET, is so long that it has little relevance to the program requirements. This delay results in objectives that, in order to be attainable, are necessarily general and non-focused.”*
- *“Not really a yes or no answer at this time, low response rate precludes full implementation. More cost efficient techniques are needed.”*
- *“I don't know a better way, but constituent feedback gets a low return and I am not convinced that the vocal minority provides representative feedback.”*
- *“We don't feel that we get any benefit from evaluating Criterion 2, but we do not know how to measure Criterion 2 any better.”*
- *“Constituent feedback has proved useful, especially through Advisory Board. Measure what graduates are doing "after few years" does not seem beneficial.”*
- *“In a small program formal evaluation does not significantly impact what we do.”*

Survey respondents were also given a final opportunity to share any additional comments, praises, and/or criticisms that they had regarding the use, assessment, and evaluation of program educational objectives. Among the responses received were the following:

- *“There appears to be a disconnect in the concept of assessment of students (dynamic complex human beings) years after graduation with any direct causality back to curriculum components.”*
- *“One problem that I have not yet encountered but envision as possible is that assessments and evaluations are made on PEOs that are changing from time to time (continuous improvement) and thus it is difficult to establish a meaningful statistical basis for comparisons.”*
- *“We recently had a successful ABET re-accreditation visit. Meeting Criteria 2 was very time-consuming and provided no benefit other than accreditation. Criteria 2 should be eliminated.”*
- *“Emphasis should be on teaching students the fundamentals of the discipline and not on broadly defined objectives that are largely vague and subject to interpretation and manipulation. Evaluation of the Program Outcomes is far more effective.”*
- *“Basically a useless metric.”*
- *“The assessment data for ABET criterion 2 is difficult to obtain, but that is not center of my concern. I believe the expectation for a program to assess the degree to which graduates meet a set of objectives is unrealistic and unproductive because of the tremendous changes that occur in their lives in those three to five years.”*
- *“Even if I had a statistically valid ABET criterion 2 data set (which I and most programs do not have), the six to eight year delay in collecting data after making a program change renders a low correlation between the program change and the data.”*

So what constitutes sufficient assessment of Program Educational Objectives?

To answer what constitutes sufficient assessment of program educational objectives, let's revisit the four main components within the Harmonized Criteria that embody ABET's concept of Program Educational Objectives:

1. "The program must have published program educational objectives that are consistent with the mission of the institution, the needs of the program's various constituencies, and these criteria."

The results from the ECEDHA Survey indicated support for the general concept of having such Objectives that are consistent with institutional mission and constituent needs.

2. "There must be a documented and effective process, involving program constituencies, for the periodic review and revision of these program educational objectives."

The Survey also indicated support for having a process involving program constituencies, and that some of the processes, such as the use of advisory boards, were effective in obtaining qualitative feedback useful for the improvement of the program's curriculum. However, the greatest source of feedback reported leading to changes in the actual program educational objectives came not from any one particular constituent group, but from the comments of ABET Program Evaluators as a consequence of accreditation visits.

3. "The program must regularly use appropriate, documented processes for assessing and evaluating the extent to which … the program educational objectives … are being attained."

This is the component causing the greatest amount of difficulty. Most (99%) programs reported using one or more survey instruments to assess the attainment of their program educational objectives, yet the median response rate to alumni surveys was reported as only 15% and to employer surveys as just 10%. This low degree of reporting renders the data statistically insignificant. Also, there is a concern that a skewed minority of respondents (*i.e.*, those who choose to respond) could drive program change as a result, taking decision making out of experienced faculty hands and placing it into a questionably unreliable numerical assessment process. However, if it were possible to obtain satisfactory response rates, then there are still other issues to deal with. First, there are external factors that significantly affect the state of the alumni in the intervening three to five years after graduation to the extent that the assessment data become noncausal with respect to the program's curriculum. As expressed in one of the survey comments:

> *"I believe that the university's job of training future engineers ends once a student graduates."*

Through the curriculum, the program provides the educational foundation upon which the graduate builds his or her career; hopefully, it is a solid foundation grounded in the principles expressed in the Student Outcomes of the Harmonized Criteria. However, the subsequent structure of that engineer's career is influenced far more by other factors (such as employer-required training upon entrance to the company, attended workshops, graduate studies, significant life changes, mentoring, short courses, and experiential learning) than it is by the program from which the alumni graduates, or from anything conceptually expressed through a program educational objective. A second point of contention is that, for the assessment and evaluation of program educational objectives, there exists a long time constant that exceeds other shorter system time constants that do affect results, such as university institutional and curricular changes, university personnel changes, or changes in the economy. This long time constant for effecting change in the program educational objectives includes:

(a) detecting a problem via the collected assessment data,
(b) creating and implementing a solution plan, and
(c) assessing the effectiveness the solution.

The time constant for such a process is six to eight years or longer, depending on the solution plan. If there is a genuine concern regarding certain non-foundational issues that manifest themselves through professional practice, then steps should be taken through those entities that do play an active role in the graduate's professional life, such as requiring licensure and/or mandating continuing education requirements through either professional societies or employers. It is not appropriate to saddle an academic program with the singular responsibility of ensuring that graduates achieve a set of program educational objectives when that program no longer has an active role in the professional life of its graduates.

4. "The results of these evaluations must be systematically utilized as input for the continuous improvement of the program."

While in principle this component is not an issue of contention, it is clear from the results of the ECEDHA Survey that there is often a disconnect between programs and evaluators as to what results constitute sufficiency, even though this is not explicitly called for by the Criteria. Programs are expected to collect quantitative data using surveys that measure the extent to which the program educational objectives are being attained; however, the results often suffer from low rates of return, thereby raising concerns regarding statistical relevancy. Additionally, systematic processes have been successfully implemented involving employers and advisory boards where these constituents' qualitative comments have been used as the basis for program improvement; however, these have not been considered appropriate as they do not measure the extent of compliance. The purpose of the assessment and evaluation process is to effect programmatic change to better the foundation upon which an engineer's career rests; as long as feedback loops involving a program's constituency groups are in place and can be shown as providing appropriate input for the continuous improvement of the program, the specifics of how this is accomplished outside of the institution should not be raised as a citable issue.

Conclusions and recommendations for improvement

The results of the ECEDHA Survey have shown that the assessment data obtained from conducting alumni and employer surveys are of limited value due to both low response rates and the lack of causality. Additionally, the Survey demonstrated that having a process that involves soliciting the qualitative input of employers and alumni is adequate for effecting programmatic changes. The authors of this paper strongly believe that the Harmonized Criteria should reflect that this level of activity on the part of the program – the systematic collection and analysis of qualitative responses from such resources as advisory boards and employers of the program's graduates – is what constitutes sufficiency. Accordingly, the following points are the authors' recommendations for improving the assessment and evaluation process for program educational objectives:

1. Remove that portion of the Criterion 4 requirement specifying that the program must regularly use an appropriate, documented process for evaluating <u>the extent to which</u> (emphasis added) the program educational objectives are being attained. The results of the ECEDHA Survey indicated that the attempt to collect quantitative data in this area suffers from low response rates that are beyond the program's control and produce little, if any, benefits relative to the costs involved in collecting the data. Without a statistically relevant response, it is impossible to truly ascertain the extent to which a particular cohort is achieving the program educational objectives a few years after graduation. Even if a sufficient number of responses could be gathered, the lack of a clearly discernable causal relationship, relative to the other professional influences affecting an alumni's career, to the program's curriculum and educational objectives renders this data meaningless. By removing the "extent" clause with respect to the program educational objectives, the resultant modification to Criteria 4 would properly reflect the necessary sufficiency for compliance with the overall intent of the Criteria: to monitor program effectiveness and to implement program improvements.

2. The results of the Survey have provided ample evidence that programs have been cited for items outside of both their and their institution's control. As it is the authors' contention that this is not a valid reason for hitting a program with a shortcoming, these "shortcomings" should be properly identified so that the ABET Program Evaluator training and instructional materials can be adjusted accordingly such that programs are no longer unfairly penalized. Currently the only data publically available regarding shortcomings is the breakdown of where, by criterion, shortcomings are observed. The information that is needed for improving the accreditation process is not <u>where</u> a shortcoming is observed, but the reason <u>why</u> the shortcoming was cited, as there are occasions where shortcomings are cited for things that are not under the control of either the institution or the program. Accordingly, a mechanism should be developed, at either the Commission or lead society level, that classifies each reported shortcoming into one of three categories:

    a. Shortcomings that are actionable by the program.
    b. Shortcomings that are outside the control of the program, but are actionable by the institution.
    c. Shortcomings that are outside the control of both program and institution.

This information should include the findings by criterion and by shortcoming, both before and after due process. This recommendation is meant to encourage the establishment of a systematic review of the results of the accreditation process per Commission and/or programmatic area; essentially, asking ABET to take a more active role with the "closing the loop" analysis on their accreditation processes so that each Commission and/or lead society can see what is and what is not working from their perspective, then take action accordingly.

3. Practices that satisfactorily meet the intent of the Criteria should be communicated to all ABET-accredited programs. This can be performed through such means as inclusion of this information within the Annual Report and/or presentations at the ABET Symposium. Additionally, ABET Program Evaluator Training should be updated to include the findings of this study, including that alumni and employer surveys suffer from low response rates and that new programs should not be cited for lacking data that is impossible to obtain.

Given the sentiments expressed by the 117 electrical and computer engineering department heads who responded to the December 2009 ECEDHA Survey and the subsequent analysis and recommendations presented within this paper, it is hoped that a dialogue with ABET can be broached on these topics, and thereby both improve and streamline the assessment and evaluation processes involving program educational objectives.

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