

## **AC 2010-2108: EMPLOYING SIX SIGMA AS A TOOL FOR CONTINUOUS IMPROVEMENT IN ENGINEERING TECHNOLOGY EDUCATION**

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# Employing Six Sigma as a Tool for Continuous Improvement in Engineering Technology Education

## Abstract

Several members of the College Assessment Committee interested in improving the college assessment plan for continuous improvement became interested in using Six Sigma methodology not only for manufacturing processes but for learning processes in engineering technology programs. Several committee members were already active in a local coalition of industry advisors therefore it was felt that we could train educators to use Six Sigma to establish benchmarks for educational goals and objectives. Six Sigma would be piloted and used as a tool to improve the program assessment plans. The pilot project would evaluate the assessment process being used for ABET accreditation of the engineering technology programs with the goal of establishing a clearly defined closed loop continuous improvement process.

One of the areas of weakness pointed out by ABET reviewers was the lack of selected programs having a clear continuous improvement process that was working effectively and a process for evaluating lifelong learning. Since lifelong learning is an outcome that is difficult to assess but also manageable as a pilot effort, the committee decided to evaluate the college's process of assessing graduates' ability to recognize the need for and to engage in lifelong learning as the pilot focus.

The team began work in June of 2008 and decided the scope of the project would focus on improving the assessment of ABET Criteria 3h (lifelong learning) and continuous improvement in accordance with a documented process. Using the evaluators' ratings and Six Sigma tools, the team attempted to improve the process by evaluating three surveys and the feedback loop for collection, evaluation and use of assessment data.

The team met all of its intermediate project goals by improving the survey instruments and changing the administration of two of them. The final measure of the project's success will occur after programs have reviewed the results and made changes needed and have completed the assessment loop prior to the next ABET accreditation visit in 2013. An intermediate measure will include reports of the improvements and changes made annually as the data is collected and reviewed and the plan updated.

## History

Six Sigma, started in 1986 by Motorola, has been defined in numerous ways. It has been called a philosophy, a methodology, and a set of tools.<sup>1</sup> One of the more concise definitions is "a disciplined, data-driven approach and methodology for eliminating defects ... in any process -- from manufacturing to transactional and from product to service."<sup>2</sup> Six Sigma is now endemic to industry—automotive, chemical, financial, manufacturing, and retail to name a few—from American Express to GE, Advanced Micro Devices to Xerox and is credited with saving millions of dollars while improving product or service quality and customer satisfaction. It is a statistical term that measures the variation of a process.

In June of 2008 project managers met to discuss using the Six Sigma methodology for process improvement within the college. A clear plan for continuous program improvement is required for ABET accreditation so this was an appropriate area for such an endeavor. Two of members of the team met regularly throughout the year on the project with the dean's office providing management support. This paper is a summary of the team's progress to date and is organized according to the five phases<sup>3</sup> of the Six Sigma process improvement model: Define, Measure, Analyze, Improve and Control.

## **Define Phase**

The first phase of this project was to define the problem, objectives, and benefits to the college. The team defined the problem, in this case, using the ABET evaluators' report of program findings indicating a lack of clarity in the program continuous improvement plan and a weakness in lifelong learning program objectives. The evaluators' findings showed that while the assessment process has been established (ABET Criteria 3 Assessment and Evaluation states that "Each program must demonstrate that the results of the assessment of program objectives and outcomes are being used to improve and further develop the program in accordance with a documented process."<sup>4</sup>) and rubrics were being developed for evaluation, benchmarks and targets needed to be implemented to complete the continuous improvement plan and establish a continuous loop for improvement.

The team sought a solution to this finding by clearly defining a feedback loop for improving the process. Criterion 3h, demonstrating that graduates have recognition of the need for, and an ability to engage in lifelong learning, was selected because it was identified by the faculty and college administration as difficult to evaluate and because there exist survey instruments in various areas of the college that could be adapted to evaluate this criterion across all programs. One of the team members with Six Sigma experience encouraged the team to work on ABET Criterion 3h as it made for a right-sized project in terms of faculty and administrative support, probability of success, low implementation costs, and timeliness of completion. This suggestion was immediately accepted and plans made to begin the project. The hope is that this pilot will lead to more support for larger projects in the future and become a sustainable improvement component.<sup>5</sup>

While there are several tools commonly used in this phase of the project, we used a Pareto Chart, Thought Process Map, SIPOC diagram, CTQC tree and a Project Charter. The Pareto Chart, Figure 1, shows that the majority of programs evaluated by ABET during the last visit received a rating of "weakness" for Criterion 3h. The Thought Process Map, Figure 2, supports the team decision to focus on lifelong learning by illustrating several surveys currently in use as part of the assessment process but easily available for review for possible improvement. Figure 3, Supplier-Input-Process-Output (SIPOC) diagram shows the process as it was the beginning of the pilot.

Findings in examining the material in the SIPOC diagram show possibilities for improvement in the office administering the instruments(supplier), instruments lacking questions specifically addressing graduates experience regarding lifelong learning (input), inconsistency in

administration of some of the surveys (process), and adequate numbers of responses to ensure the right changes were being made (output).

The four surveys in the SIPOC diagram illustrate:

- The Alumni Survey in 2006 administered by the college Career Placement Office had a 5.7% response rate.
- The Employer Survey administered by the university co-op office had a 69.7% response rate for students in all programs included in the ABET evaluation. The Student Survey by the university co-op office does not have questions pertaining to lifelong learning and may be difficult to alter since this is a central university office.
- The college Student Services Office administered a college Senior Survey until 2008 but discontinued administering the survey due to a change in university policy.
- An individual department developed and implemented a senior survey for their program seniors and got a 75% response rate for the first administration. This survey was made available for other programs use.

The Critical To Quality Characteristic (CTQC) Tree Diagram, Figure 4, shows the specific measurable aspects of the process identified by the team to measure process improvement:

- Alumni survey response rate,
- The number of questions on each survey measuring lifelong learning,
- The creation of one senior survey, and
- An approved process flow chart.

Decisions to use these specific aspects were reviewed by the college Assessment Committee and program department faculty and were accepted as the appropriate next steps. The strength of the Assessment Committee was a membership with knowledge of the history of suppliers of the survey instruments, familiarity of ABET requirements and members in contact with past and current students. The last item listed, the approved process chart, was removed from the project after a Collegiate Restructuring Initiative (CSI) was announced which included a merging of the current college with another college at the university. The change in structure of the college would change the feedback loop and how it might change could not be predicted. The team was given permission to scale back this aspect of the project.

This evidence led the team to create the following Business Case, a general procedure following the Six Sigma format, and a Problem Statement for the project (taken from the Six Sigma Project Charter):

### **Business Case**

The majority of degree-granting programs in the college are accredited by ABET, “the recognized accreditor for college and university programs in applied science, computing, engineering, and technology, [which] is a federation of 29 professional and technical societies representing these fields.”<sup>6</sup> Failure to meet ABET accreditation requirements may lead to loss of accreditation, having significant and adverse affects on these programs. For “employers,

graduate schools, and licensure, certification, and registration boards, graduation from an accredited program signifies adequate preparation for entry into the profession. In fact, many of these groups require graduation from an accredited program as a minimum qualification.”<sup>7</sup> Hence, it is an understatement to say that maintaining ABET accreditation and achieving positive reviews from ABET evaluators are important to the college.

The 2006 findings of the ABET review of the undergoing evaluation varied among the programs. Although no program had any ABET Criteria findings in the lowest category, “deficiency,” the majority of the programs had findings in the next lowest category, “weakness,” for the same criterion, ABET Criterion 3: Assessment and Evaluation, which states that “[e]ach program must utilize assessment measures in a process that provides documented results to demonstrate that the program objectives are being met...” This is related to Criterion 4 “Continuous Improvement:... us[ing] a documented process incorporating relevant data to regularly assess its program educational objectives and program outcomes, and to evaluate the extent to which they are being met. The results of these evaluations of program educational objectives and program outcomes must be used to effect continuous improvement of the program through a documented plan.”<sup>8</sup> None of the reviewed programs had either of these criteria listed as a <sup>9</sup>program strength. Lack of a documented program assessment process that is part of a feedback loop for continuous program improvement is a systematic problem throughout the college’s programs and ranks high among the programs’ faculty and college administration as a problem to solve.

The project team is expected to adapt the surveys to evaluate ABET Criterion 3h. The team is also expected to implement techniques that will increase the response rates for those surveys with low responses and to improve the feedback loop between the programs being assessed, the entities which administer the surveys and collect the data, and the decision points in the process where changes based on the data are recommended and implemented. This will allow program assessment to be effectively incorporated in such a way as to provide documented continuous improvement leading to successful ABET reviews.

### **Measure Phase**

After defining the project, we measured the current process. Tools used were DPMO and Sigma Level calculations and a histogram. We could not perform a Measurement System Analysis.

A near perfect process works at a “Six Sigma Level,” which corresponds to 3.4 defects per million opportunities (DPMO). Figures 5 and 6 are tables that show the team’s definitions of Defects, Units, and Opportunities and the calculations for the DPMO and Sigma Level. The initial process of assessing lifelong learning shows plenty of room for improvement at a baseline DPMO of 625,000 and a corresponding Sigma Level of 1.2.

The DPMO and Sigma Level in a process are affected by how defects are defined and who or what measures the defects. To have reliable measurements, the measuring devices must have repeatability and reproducibility (R&R). In Six Sigma projects, a Measurement System Analysis (MSA) is conducted to determine the measurement R&R of a process. For this particular process, outside evaluators from other institutions are used to rate the ABET criteria for the programs. Neither the college team, nor the university, have access to ABET evaluators to

conduct an MSA. Thus we must proceed under the assumption that, for a given accreditation visit, individual evaluators would repeatedly rate a program about the same and a program would be rated similarly by different evaluators. As a sidebar, the undertaking of an MSA of evaluators by the ABET accrediting body would be an excellent opportunity for ABET to elevate its consistency.

Coding the evaluator findings as shown in Figure 7 allows further analyses. Although the finding “Observation,” on the face of it does not connote a level between “Concern” and “Strength,” the team’s reading of the “Observation” comments made by ABET evaluators and its listing under “Corrections and Improvements” in the ABET report gave evidence to such a use. The histogram in Figure 8 illustrates all evaluator ratings over all ABET-accredited programs received during the 2006 visit. In other words, the graph lumps all findings together. It shows that, thankfully, there were no “Deficiency” ratings and rating “3,” or “Concern” was the most common rating given with 12 occurrences. Looking back at the data, the team found that seven (7) of the occurrences were related to Criterion 8 which states that “associate degree programs must demonstrate that graduates are capable of...utilizing modern<sup>10</sup> instruments and research techniques ...”. Although a “Concern” rating is not as urgent to improve as a “Weakness” rating, it is worth noticing and perhaps should be investigated in another project.

### **Analyze Phase**

This phase includes analyzing the data collected and determining “root causes of defects and opportunities for improvement.”<sup>11</sup> Tools used were a Cause & Effect Diagram, Brainstorming, a 5-Why Analysis, and a variation on the traditional Failure Mode and Effects Analysis (FMEA), which we call a “Significant Factor Selection Matrix.”

The Cause & Effect Diagram (also called a Fishbone Diagram) in Figure 9 shows a multitude of factors that affect the process. The team used written Criteria 3 and 4 comments from evaluators and brainstormed to come up with factors (also known as “root causes” or “X’s”). Procedures involved in the feedback loop, students, and the survey instruments were selected as factors to pursue to improve the process using Figure 10, the Significant Factor Selection Matrix. As factors related to the feedback loop could not be pursued due to the Collegiate Restructuring Initiative, the team focused its efforts on the survey instruments.

The team attended monthly College Assessment Committee meetings from November 2008 – April 2008 and was able to work with the Committee to review and update the Professional Practices Employer Survey and the Alumni Survey to include questions relevant to assessing ABET Criteria 3h during this review, the Committee additionally updated the Alumni Survey for readability and brevity.

At the beginning of this project, the ECET department was conducting its own Senior Survey. A 5-Why Analysis (Figure 11) shows the thought process in analyzing why departments were developing their own surveys rather than using a common survey for all programs being accredited by ABET. The outcome was that the College Assessment Committee altered the ECET Senior Survey and adopted it for all ABET accredited programs in the college.

Preliminary investigation of the process showed that the Alumni Survey had only a 5.7% response rate. Both a paper copy and online version of the survey were available for alumni to use. During the February College Assessment Committee meeting, attendees brainstormed ideas to improve the response rate. Incentive ideas such as book bags and key chains were mentioned. The team further studied ways to improve the response rate of the Alumni Survey by performing a literature review of survey response and by benchmarking with Alumni Surveys at other institutions of higher learning.<sup>12131415161718</sup> Originally, a paper Alumni Survey was administered by the College Career Development Office and then in 2006 by paper with an option to complete the survey on the college's web site. The team decided that it would call the new Alumni Survey administration method a success if the response rate had a statistically significant increase from the previous year at a 0.05 level of significance.

## **Improve Phase**

In this phase the team implemented solutions aimed at correcting the problems that were defined, measured, and analyzed in the previous phases. Tools used were a Correction Action Matrix and a statistical hypothesis test to verify and measure improvement.

The team implemented an action plan to improve the surveys that included creating one Senior Survey for all ABET-accredited programs within CAS. Additional improvements included adding/updating lifelong learning questions in the Alumni Survey (Appendix A) and Employer Professional Practice (PP) Survey and the Senior Survey (Appendix B), changing the administering body for the Alumni Survey to the Director of Assessment, and updating the administering body and methodology for the Alumni Survey. The action plan relates to those factors rated most highly in the Significant Factor Selection Matrix (Figure 10), with the exception of improving the feedback loop. Further details of the action plan for improvement are in the Correction Action Matrix (Figure 12).

Using the changes just described, the improved surveys were piloted in the spring quarter of 2008. With the new College Senior Survey created by the College Assessment Committee and its new method of administration by the university's Professional Practice Office, the response rate was 56.2%. Comparisons with previous College Senior Surveys cannot be made as those response rates were unavailable but the rate is within those seen in other types of surveys studied during the Analysis Phase of the project. A new method to improve response rates in the Alumni Survey was implemented, which was created in response to the literature review done in the Analyze Phase. The team did not think that it could acquire funds for incentives and primarily used [7] to improve response rate with little cost. The Alumni Survey administration was moved from the College Career Development Office to the Director of Assessment's Office. In addition to an original mailing of the survey in June, students were also able to complete the survey using Survey Monkey on the college's web site in the Alumni area. Another change in the administration method of the survey was that follow-up postcard reminders were sent. As the team learned, the most important impact reminders have on response rate is not in their presentation but in their repetitiveness. Postcards were sent two weeks and five weeks after the original mailings. This new survey and method of administration proved successful with the rate of alumni responding nearly doubling from 5.7% in 2006 to 12% in 2009. This represents a highly statistically significant increase ( $p$ -value = 0.000). The team met its goal here. Employer

Professional Practice survey results provided valuable information indicating that 15% of those responding were enrolled in a graduate degree or some professional certification.

### Control Phase

The Control Phase of a Six Sigma project makes sure that process improvements are maintained into the future. This final phase of the Six Sigma DMAIC methodology for this process improvement project will be started once the Employer PP Survey responses are reported for the 2008-2009 academic year. The team is currently creating a control plan and writing a document of best practices and “work instructions” so that these initiatives will continue.

The team has the following plans for future improvement: improving the feedback loop when the new college structure is determined, investigate the possibility of incentives for survey completion to further improve survey response rates, further investigate if there is managerial (decanal) support, and work to improve the assessment of Criterion 8, which received many “Concern” ratings at the last ABET visit, and finally determine a new DPMO and Sigma Level annually and after the next ABET visit in 2013. The team further plans to communicate the success of this project to build momentum for continuous improvement projects in areas such as classroom assessment and retention.

### Tables and Figures

Figure 1, Pareto Chart

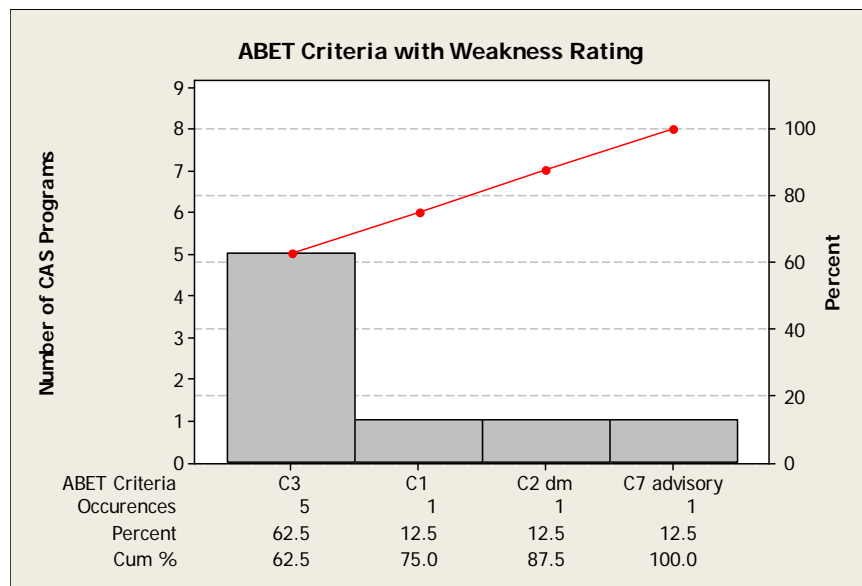
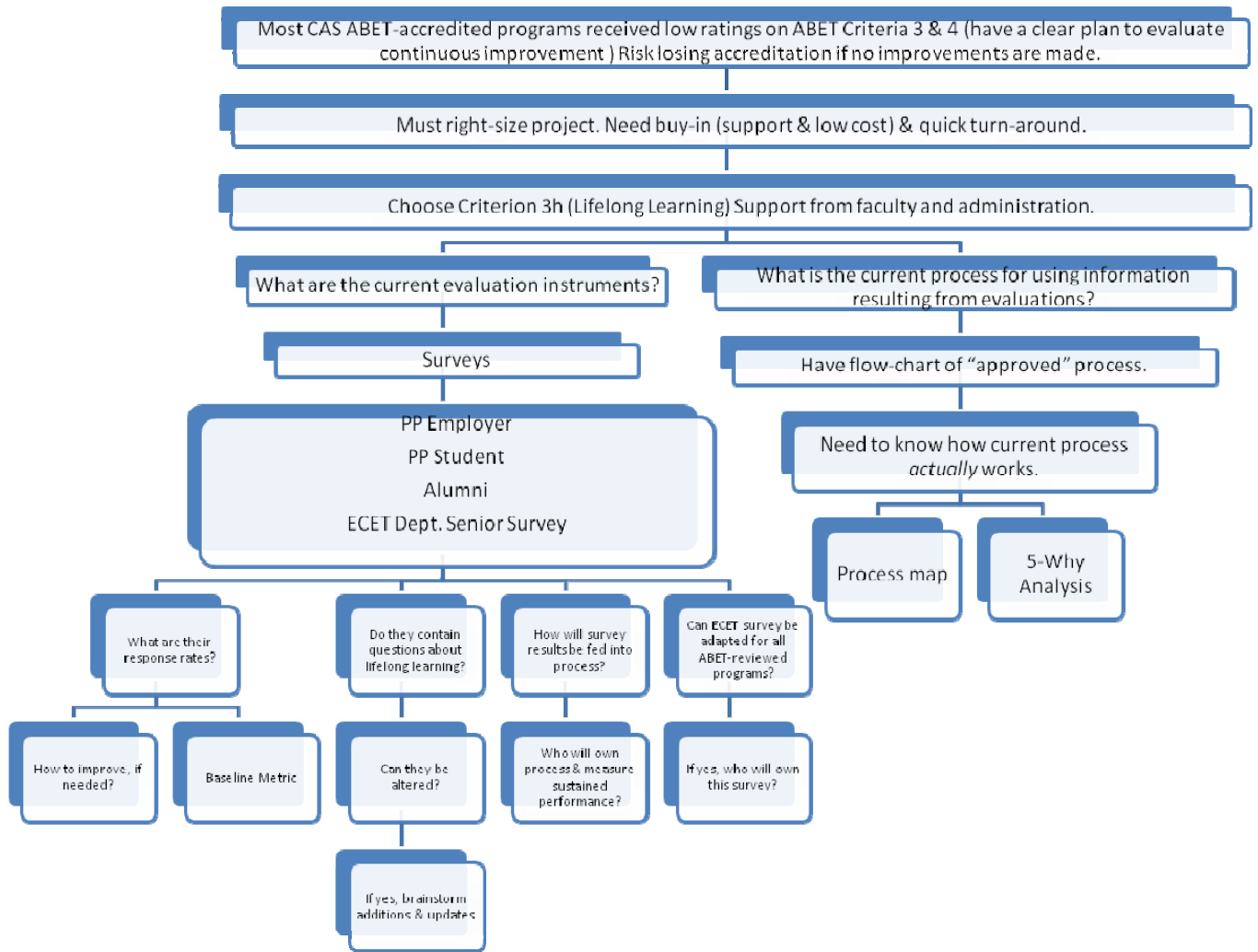




Figure 2, Thought Process Map



Professional Practice = PP

Figure 3, SIPOC Diagram  
Original Process

Supplier	Input	Process	Output
Career Placement Office	Alumni Survey	Assessing Graduates' Abilities to Recognize the Need for and to Engage in Lifelong Learning	Graduates' responses
CAS Office of Professional Practice	Employer PP Survey Student PP Survey		Employers' responses Students' responses
Student Services (until 08S)	Senior Student Survey		Seniors' responses
ECET department (08S – 09S)	Senior Student Survey		Seniors' responses

Figure 4, Critical to Quality Characteristics (CTQC) Tree

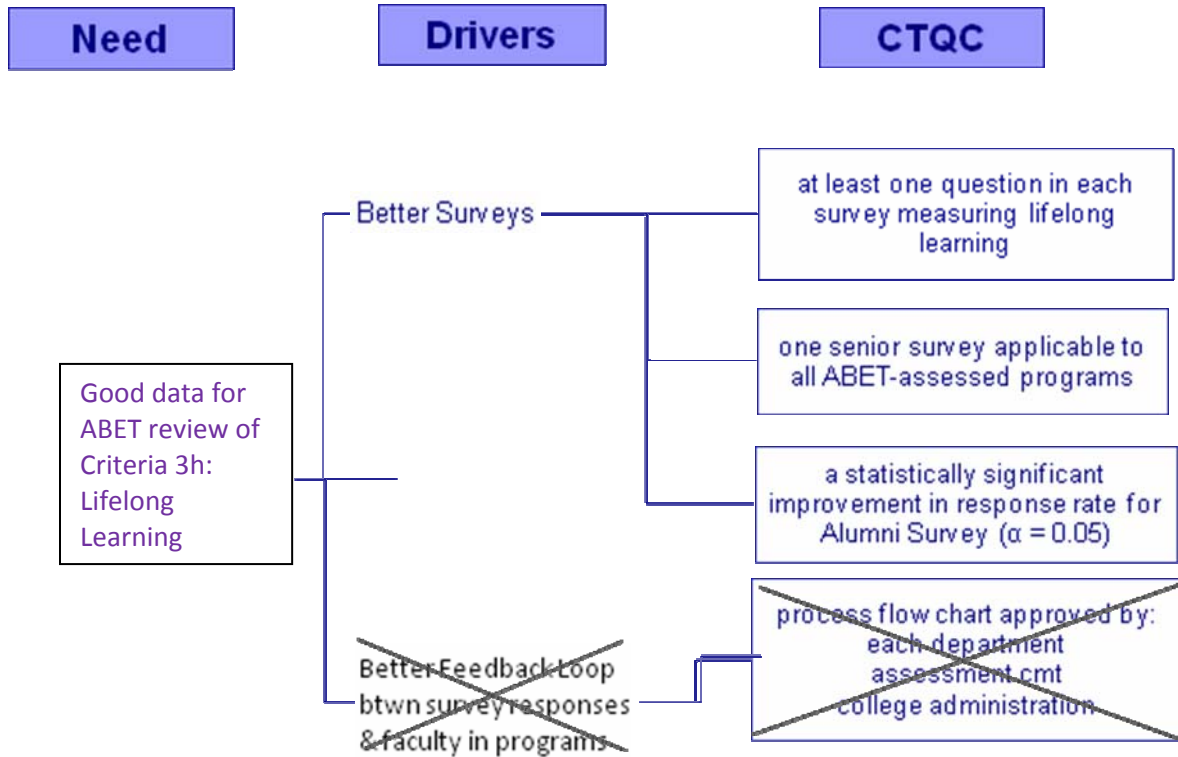


Figure 5, DPMO Definitions:

DEFINITIONS	Assessing ABET Criterion 3
<b>Defect</b>	rating of Weakness or Deficiency
<b>Unit</b>	CAS program reviewed by ABET
<b>Opportunity</b>	1 per program

Figure 6, DPMO and Sigma Level Calculations:

CALCULATIONS	Assessing ABET Criterion 3
<b>Defects</b>	5
<b>Opportunities</b>	8
<b>DPMO</b>	$(5/8) * 1,000,000 = 625,000$
<b>Sigma Level (assumed 1.5 Sigma Shift)</b>	1.2

Figure 7, Table of Evaluator Rating Codes

<b>Evaluator Rating</b>	<b>Code</b>
Deficiency	1
Weakness	2
Concern	3
Observation	4
Strength	5

Figure 8, Histogram of Evaluator Coded Ratings

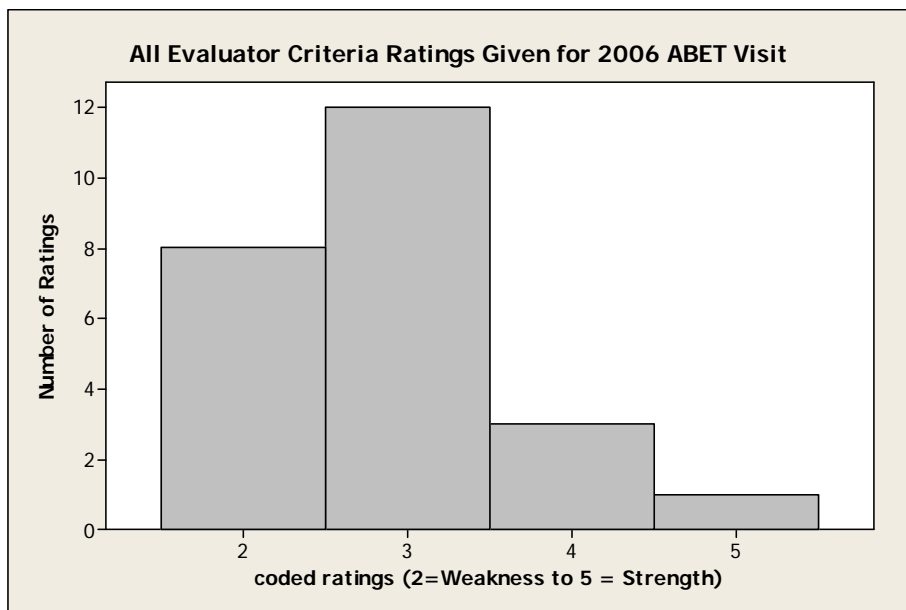


Figure 9, Cause & Effect (Fishbone) Diagram

### Cause and Effect (Fishbone) Diagram

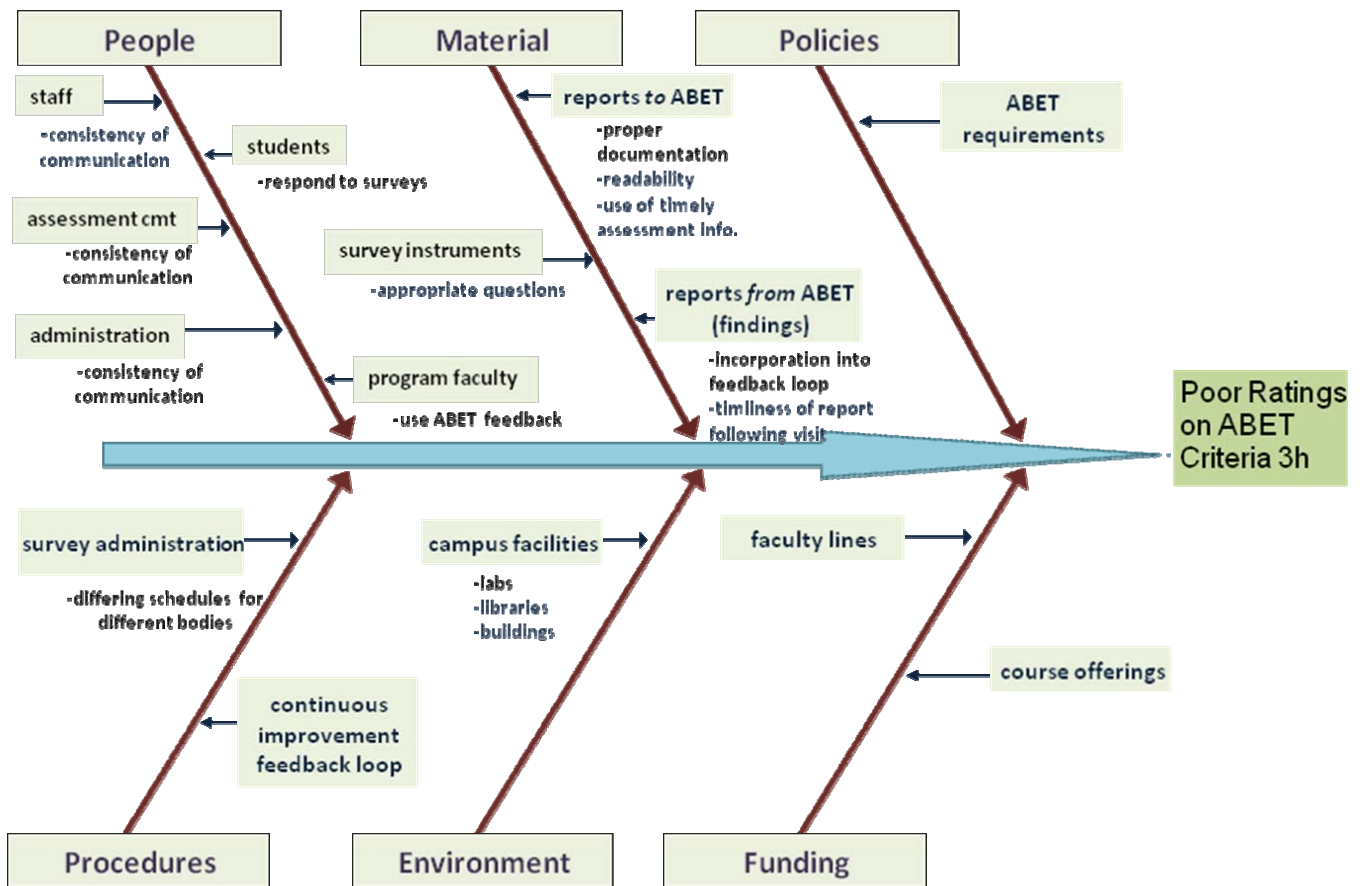


Figure 10, Significant Factor Selection Matrix

<b>Significant Factor Selection Matrix</b>					
<b>Improving Assessment of Lifelong Learning for ABET Accreditation</b>					
<b>Possible Causes (X's) for Poor Ratings on ABET Criterion 3h Applicability Rating (1 = low to 5 = high)</b>	<b>Selection Criteria</b>				<b>TOTAL SCORE (add ratings):</b>
	Covers all Programs	Low Cost To Fix	Ease of Implementation	Ability to Influence	
Consistency of Communication from Staff	5	4	5	5	19
Consistency of Communication from Assessment Cmt	5	5	5	4	19
Consistency of Communication from Administration	5	5	5	4	19
Use of ABET feedback by faculty	5	5	4	5	19
Students Don't Respond to Surveys	5	4	5	5	19
Poor Documentation to ABET	3	3	3	3	12
Report Not Readable	3	5	5	3	16
Report Doesn't Use Timely Assessment Info	4	5	3	2	14
Survey Instruments Contain Appropriate 3h Questions	5	5	5	5	20
ABET Findings Not Incorporated Well Into Feedback Loop	5	5	4	5	19
ABET Findings Not Provided in Timely Manner Following Visit	5	5	1	1	12
ABET Requirements Unclear	1	5	1	1	8
Reporting Schedule Vary Widely for Surveys	5	5	1	1	12
Poor/Nonexistent Continuous Improvement Feedback Loop	5	5	4	5	19
Few/Poor Quality Lab Facilities	1	1	1	1	4
Few/Poor Quality Libraries	1	1	1	1	4
Few/Poor Quality Buildings	3	1	1	1	6
Not Enough Faculty Lines	2	1	1	1	5
Not Enough/Not Appropriate Course Offerings	1	1	1	1	4

Figure 11, 5-Why Analysis

<b>5-Why Analysis For Senior Survey</b>	
Why does ECET department do its own Senior Survey?	<b>1</b>
There is no other Senior Survey available.	
Why?	<b>2</b>
College office stopped administering Senior Survey.	
Why?	<b>3</b>
University Admissions took over senior graduation documents and refused to continue administering the College Senior Survey.	
Why?	<b>4</b>
They say it is out of their purview.	
Why?	<b>5</b>
They want another office to take over that task. Can we get another college office to do it?	
Yes--the College Director of Assessment will take it over and facilitate through Assess. Cmt. to adapt ECET Senior Survey to all ABET programs.	<b>How</b>

Figure 12, Corrective Action Matrix

<b>Corrective Action Matrix</b>					
<b>Action</b>	<b>Champion</b>	<b>Implementation Target Date</b>	<b>Effective? (yes, no)</b>	<b>Measure of Effectiveness</b>	<b>Current Status</b>
<b>Create one Senior Survey</b>	assess cmt	Jun-09	yes	document	complete
<b>Change Administering Body for Senior Survey to Prof. Practice Office</b>	Westheider	Jun-09	yes	document	complete
<b>Add/Update Lifelong Learning Questions in Alumni Survey</b>	assess cmt	Feb-09	yes	document	complete
<b>Add/Update Lifelong Learning Questions in Employer PP Survey</b>	assess cmt	Feb-09	yes	document	complete
<b>Add/Update Lifelong Learning Questions in Senior Survey</b>	assess cmt	Feb-09	yes	document	complete
<b>Change Administering Body for Alumni Survey to Assessment Office</b>	Westheider	May-09	yes	statistical test	complete
<b>Update Administration Methods: paper/web and two reminders</b>	Westheider	May-09	yes	email verification	complete

## APPENDIX A

### ALUMNI INFORMATION FORM - Confidentiality will be maintained with all information

Name: _____ Phone: _____	
Address: _____	
City: _____	State: _____ Zip: _____
Email: _____	
Year and quarter of Graduation: _____	Final CAS Degree: Associate Bachelor (circle one)
Major(s): _____	Minor: _____
When were most of your classes: Day Evening (circle one)	
Did you co-op while at CAS? Yes No (circle one) If yes, number of co-op quarters at CAS: _____	

### EMPLOYMENT - Confidentiality will be maintained with all information.

Please indicate your current employment information and your employment information for the past five years.  
***(Salary will only be used to calculate averages by major and will not be identified by company or person.)***

**Current Company:** \_\_\_\_\_ **City, State:** \_\_\_\_\_

**Dates of employment:** \_\_\_\_\_

Company at Graduation: \_\_\_\_\_ Dates of employment: \_\_\_\_\_

Title at Graduation: \_\_\_\_\_ Salary at Graduation: \_\_\_\_\_

Company at Graduation: \_\_\_\_\_ Dates of employment: \_\_\_\_\_

Title at Graduation: \_\_\_\_\_ Salary at Year One: \_\_\_\_\_

Company at Graduation: \_\_\_\_\_ Dates of employment: \_\_\_\_\_

Title at Graduation: \_\_\_\_\_ Salary at Year Two: \_\_\_\_\_

Company at Graduation: \_\_\_\_\_ Dates of employment: \_\_\_\_\_

Title at Graduation: \_\_\_\_\_ Salary at Year Three: \_\_\_\_\_

### ADDITIONAL EDUCATION

Please indicate any additional education, certifications/licensures, or continuing education courses you have pursued since graduation from the College of Applied Science.

University: \_\_\_\_\_ College (if applicable): \_\_\_\_\_

Major: \_\_\_\_\_ Degree: \_\_\_\_\_

Full-time: \_\_\_ Part-time: \_\_\_ Evening: \_\_\_ Day: \_\_\_ Graduation Date or Projected Graduation

Certification/Licensure (type): \_\_\_\_\_ Date Received: \_\_\_\_\_

Continuing Education Course(s): \_\_\_\_\_ Date(s) Taken: \_\_\_\_\_



Please circle one answer in white section and one answer in shaded section for each statement.

	Assess yourself on each attribute					Importance to your career				
	Improvement Needed		Area of Strength			Not Important		Very Important		
Participates in Continuing Education/Expanding Skill Set/Professional Development.	1	2	3	4	5	1	2	3	4	5
Possess Good Communication Skills.	1	2	3	4	5	1	2	3	4	5
Functions Effectively on Teams Exhibiting Good People Skills.	1	2	3	4	5	1	2	3	4	5
Understands Budget/Finance for Projects.	1	2	3	4	5	1	2	3	4	5
Employs Critical Thinking and Problem Solving Skills.	1	2	3	4	5	1	2	3	4	5
Demonstrates Ability to Manage Projects and Associated Project Documents.	1	2	3	4	5	1	2	3	4	5
Exhibits Discipline Specific Skills.	1	2	3	4	5	1	2	3	4	5
Demonstrates Ethical and Social Responsibility and Personal Integrity.	1	2	3	4	5	1	2	3	4	5
Demonstrates Ability to Coordinate and Integrate Work of Various Allied Professional Disciplines.	1	2	3	4	5	1	2	3	4	5
<b>(AET ONLY)</b> Integrate Architectural Design Theory/History in the Built Environment.	1	2	3	4	5	1	2	3	4	5

Of the attributes listed above, list any that you feel your education at CAS did not adequately support:

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List the 2 courses that had the greatest impact on your career and why?.

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List the 2 courses that had the least impact on your career and why?

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I would be interested in the following after graduation (check all that apply):

- Attending Future Tech Expos
- Serving as a judge for future Tech Expos
- Serving on the Industrial Advisory Board
- Checking the alumni site on the department website to keep up with news updates on alums and departmental events
- Participate in alumni events. Specific suggestions:

## Appendix B Senior Student Survey

*Instructions: Please answer all questions. Some questions may have more than one response that applies to you – in that case, please check all that apply. Also, please feel free to add written responses.*

1. I will earn the following degree(s) in \_\_\_\_\_ (Qtr/Year)

- BS in AET
- BS in CET
- BS in EET
- BS in IT
- BS in MET

2. I enrolled at CAS in \_\_\_\_\_ (Qtr/Year) as

- A freshman
- A transfer student from another college at U.C.
- A transfer student from another university

3. After graduation, I plan to (check all that apply)

- Pursue a master's degree in a technical field within five years;  
provide specific information if possible \_\_\_\_\_
- Pursue a master's degree in a non-technical field within five years;  
provide specific information if possible \_\_\_\_\_
- Go to graduate school eventually but have no definite plans yet
- Take the Fundamentals in Engineering (FE) Exam as a first step to becoming professionally licensed
- Join a professional society in my field in order to network with other engineers
- Subscribe to professional journals in order to keep current in my field
- Attend professional workshops and conferences to stay current in my field

4. During my time at CAS, department faculty members were helpful in answering questions about scheduling courses, co-op, and other advising issues

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree
- No Opinion

5. To schedule classes, I (check all that apply)

- Met with my assigned academic advisor
- Met with another faculty member in the department
- Met with an advisor in Student Services
- Referred to the degree plan on the website or to the college bulletin
- Other \_\_\_\_\_

6. I took some courses before completing the required pre-requisite courses

- Yes Specify if possible: \_\_\_\_\_
- No

7. I took courses before completing pre-requisite courses because (check all that apply)

- My academic advisor or other faculty member recommended that I do so
- I decided to do so
- The course I needed wasn't offered for \_\_\_\_\_ number of quarters
- There were time conflicts among courses because I was off schedule
- Other \_\_\_\_\_
- N/A

8. I am satisfied with the experience that I gained during my co-op work experience

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree
- Not Applicable, co-op was not required for me

9. The curriculum for my degree has prepared me well for a job in my field following graduation.

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree
- No Opinion

10. What topics in the curriculum were particularly helpful in your co-op job and/or will be useful in your career?

11. What topics not currently in the curriculum would have been helpful in your co-op job and/or would be useful in your career?

12. The lab equipment is well-maintained and suitable for teaching course concepts.

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree
- No Opinion

13. Specific suggestions for improving lab conditions and/or equipment:

14. Did you utilize any of the following services offered by Career Placement? (check all that apply)

- Attended college's Career Fair
- Requested to be added to the Senior job search database
- Had your resume sent to companies
- Had your resume reviewed
- Participated in any on campus interviews with companies
- Requested information regarding average starting salaries
- Inquired about other career, job search or resume information

15. How often did you utilize the Student Services Office?

- Several times per quarter.
- Once per quarter.
- As needed throughout the academic year.
- Never

16. For what purposes did you utilize the Student Services Office? (Check all that apply)

- Degree Audit
- General Ed requirements
- Graduation
- Meeting with an advisor
- Transfer credits
- Records concerns/issues
- Registration issues
- Career/Job/Resume Information
- Admissions
- General forms
- Other (please specify) \_\_\_\_\_

17. I would be interested in the following after graduation (check all that apply)

- Attending future Tech Expos
- Serving as a judge for future Tech Expos
- Serving on the Industrial Advisory Board for the department
- Checking the alumni site on the department website to keep up with news updates on alums and departmental events.
- Participating in alumni events. Specific Suggestions:

18. Please add any other comments or suggestions about your experience as CAS.

***Non-Transfer Students: Skip to last page  
Transfer Students: Continue to next page***

***The Following Set of Questions are to be answered by transfer students only. All non-transfer students should skip to the last page of this survey.***

19. I am generally satisfied on how I have been advised as a transfer student

- Yes
- No
- No Opinion

20. I transferred into my department with

- An associate degree in my major
- An associate degree in a somewhat related field
- An associate degree in an un-related field
- No degree but some credits in related field
- No degree but some credits in an unrelated field
- Other (please be as specific as possible) \_\_\_\_\_

21. When initially starting at CAS, I expected to graduate within

- 1 year
- 2 years
- 3 years
- 4 years
- 5 years
- Don't know

22. The number of years to graduation from when I started at CAS will be

- 1 year
- 2 years
- 3 years
- 4 years
- 5 years
- 6 years

23. When I arrived at CAS, Student Services provided me with a list of required courses for my major and indicated which ones were completed from my transfer courses

- Yes
- No

If No, please comment:

24. I received my transfer report in a timely manner

- Yes
- No

If No, please specify how long the process took and make other comments:

25. Student services informed me of who my academic advisor in my department was and advised me to see my faculty advisor to plan my schedule

- Yes
- No

26. Did you read the online transfer orientation?

- Yes – If Yes, was it helpful?    Yes    No
- No

27. My first quarter at CAS (check all that apply)

- I met with an advisor in Student Services
- I met with my assigned department academic advisor
- I met with another faculty member in my department
- I did not meet with an academic advisor because I had no idea who my academic advisor was.
- I did not meet with an academic advisor because I felt capable of planning my own schedule.

28. In my first quarter, my department academic advisor (check all that apply)

- Gave me good advice on what courses to take
- Seemed to choose courses at random based on what was offered that quarter
- N/A

29. On some occasions, my department academic advisor recommended that I take courses before completing pre-requisite courses because (check all that apply)

- He/She felt I could perform well in the course and felt it would shorten my time to completing the degree
- He/She seemed totally unaware of pre-requisites and was just trying to fill out my schedule
- Not applicable because I never took any courses without meeting pre-requisites
- Not Applicable because I never met with an Academic Advisor

30. I registered for courses that I later found out I was not required to take

- Yes
- No

If Yes, please specify which courses and provide details of the situation

31. List any suggestions you have for improving the advising procedure for transfer students.

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