AC 2009-1920: ABET ACCREDITATION: RESOLVING A WEAKNESS OR CONCERN

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ABET Accreditation – Resolving a Weakness or Concern

Abstract

The Accreditation Board for Engineering and Technology (ABET) criterion for Assessment and Evaluation are discussed from the perspective of a Mechanical Engineering Technology (MET) program's experience with the ABET Technology Accreditation Committee (TAC) re-accreditation process. Specifically, the resolving of the institutional weakness related to the MET program in the 2007-08 Criterion 3: Assessment and Evaluation, (2008-09 ABET-TAC Criterion 4: Continuous Improvement). The resolution of the weakness discussed is related to the clear distinction between program educational objectives and program outcomes, the relationship of the ABET-TAC Criterion 2 [a-k] to each objective, and the assessment measures and metrics associated with each objective. An assessment methodology implemented to resolve this weakness is described along with examples of data measurement tools utilized. Advantages and disadvantages of data collection methods are analyzed in this report, given that there is not one single method of measurement that can predict program improvement. A distinction is made between the program educational objectives assessment tools: job placement data; alumni survey; employer survey; and input from industrial advisory board, and the program outcome assessment tools: course assessment; student rating of instruction; senior exit exam; senior project evaluation; and senior exit survey. Each assessment tool is discussed in relation to the criteria (or metric used), results, and use of the results for continuous improvement. Techniques to assist in gathering the data, such as the use of online survey tools are presented to lessen the burden on the assessment team, as well as plans for the future.

Introduction

The MET and EET programs were evaluated during a site visit in October, 2005 while seeking reaccreditation of their respective programs by ABET-TAC. The ABET response after the 2006 Summer Meeting was to accredit the programs to September 30, 2008, and require that a request be made to ABET by January 31, 2007 for a reaccreditation report evaluation. Also, a report describing the actions taken to correct the shortcomings identified needed to be submitted to ABET by July 1, 2007. One of the Institutional Weaknesses reported by ABET was Criterion 3: Assessment and Evaluation stating that each program had ambitious plans, but neither program had collected data from every assessment measure. Also, there were no documented examples to show that the continuous loop had been closed by way of program improvement.

The response to this assessment was that the MET program, realizing the plan was too ambitious for the available resources, decided to benchmark other institutions and then revisit the program goals and objectives re-linking them to the a-k criteria to be completed by April 28, 2006. As requested, on July 28, 2007 a Reaccreditation Report was submitted to ABET outlining the corrective actions taken for the identified shortcomings. Included in this report was an updated MET Assessment Plan, including (3) attachments: The Assessment Process Overview; The Updated List of Program

Educational Objectives with linked a-k criteria and measures; and a Summary of MET Program Improvements. These documents illustrated a simpler process that was developed and implemented in 2006-07, and how this process closed the loop for continuous improvement.

On November 27, 2007 a Draft Statement by ABET-TAC was that the Criterion 3 – Assessment & Evaluation, finding will remain a Weakness until the MET program (a) demonstrates a clear distinction between its program objectives and program outcomes, (b) demonstrates the relationship of Criterion 2 [a] – [k] to each objective, and (c) demonstrates the assessment measure and metrics associated with each objective. On January 3, 2008 it was communicated to ABET that a response to this finding would be provided at a later date.

Finally, in response to the findings, the MET Program Spring 2008 Assessment Report was submitted to ABET prior to the 2008 Summer Meeting. This report included a revised version of the previously submitted attachments, along with assessment results and analysis in a tabular format. Following the 2008 Summer Meeting the final response on August 15, 2008 from ABET was that the MET Program be reaccredited.

I believe that it is also pertinent to this discussion that within this time period from 2004 – 2008 three different MET Department Coordinators (Chairs) traded off the responsibilities of developing and coordinating the assessment and evaluation plan. The first person holding the Chair position developed the original Self Study Report prior to the site visit, the second Chair was responsible for the Reaccreditation Report, and the third Chair position developed the final Spring 2008 Assessment Report. It is also relevant to understand that each response and report was a team effort in collecting information, developing methods of assessment and evaluation, and analyzing the information, but the pulling of the material together to be presented to ABET was the responsibility of the Chair at that particular time.

The following information will be an account of modifications and improvements that were made in the reaccreditation process to move from the Weakness finding to a resolution. Also, some insight into what strategies were used by the faculty involved in assessment and evaluation activities throughout the process.

Background

At this University, the School of Technology (SoT) is home to six Bachelor of Science Degree Programs; Computer Network and System Administration, Construction Management, , Industrial Technology, Surveying Engineering, EET, and MET. Of the programs listed, the EET and MET are the only ABET-accredited degrees, and currently the MET program enrollment is approximately 100 students. The SoT started offering Baccalaureate degrees in 1994 and discontinued offering Associate's Degrees. With the elimination of the Associate degree option, the MET curriculum was redesigned based on extensive benchmarking of comparable university degree offerings, industry needs, and

advisory input. Table 1 provides a summary of the core courses, prerequisites/restrictions, when offered, and the number of credits.

Table 1 - Core Courses in the MET Curriculum 2008-09

Mechanical Engineering Technology Major - Required						Total: 60
Course	**Title**	**Prerequisites/Restrictions**	**Offered**	**Taken**	**Grade**	**Credits**
BA 2330 **OR**	Accounting I **OR**	SO,JR,SR	f/s/su			3 (3-0-0) **OR**
BA 3610	Operations Management	BA 2100 or MA 2710 or 3710	f/s/su			3 (3-0-0)
EC 3400	Economic Decision Analysis	UN 2002 / JR,SR / non-SBE	f/s/su			3 (3-0-0)
EET 1411	Basic Electronics	MA1030(C)	s/su			4 (0-3-2)
EET 3131	Instrumentation	EET 1411 or 2311 or 2220	s			3 (0-2-2)
EET 3700	Electrical Power, Machinery & PLC Basics	EET 1411 or 2311 or 2220 or EE 3010 / non-TEE,TEET,TEM	s			4 (0-3-3)
MEEM 2500	Integrated Design & Manufacturing	ENG 1102 & MY 2100(C) / non-ENG,EME,EBE	f/s			4 (0-3-3)
MET 1540	Materials Science	CH1000 or CH1100	s			3 (0-3-0)
MET 2120	Statics & Strength of Materials	MA 1140(C) or MA 1160(C) or MA 1161(C) & PH 1140	f			4 (0-3-2)
MET 2130	Dynamics	MET 2120	s			3 (0-3-0)
MET 2400	Practical App in Parametric Modeling	TE 1010	s/su			3 (0-2-2)
MET 3242	Machine Design I	MAT 2215 or MA 2140 or MA 2160 & MET 2130	f			3 (0-3-0)
MET 3250	Applied Fluid Mechanics	MET 2130	f			4 (0-3-2)
MET 3450	Machine Design II	MET 3242	s			4 (0-4-0)
MET 3600	Applied Thermodynamics	MET 3250 / JR,SR	s			3 (0-2-2)
MET 4200	Design of Experiments	MA 2720 or BA 2100	f/su			3 (3-0-0)
MET 4460	Product Design and Development	MET 3450 / JR,SR	f/s			3 (0-2-2)
MET 4670	Senior Project	MET 4460 / Instructor Approval / SR	f/s/su			3 (0-0-6)
MET 4999	Senior Project Seminar – P/F	SR	f/s			1 (0-1-0)
TE 1010	Technology Computer Applications		f/su			2 (0-2-0)

The present MET degree has three focus areas that students can choose electives during their junior and senior year which are: Manufacturing, Computer Aided Engineering (CAE), or Fluids and Power Systems. As a capstone experience senior year MET students from each of the focus areas are required to complete a team-based senior design project. Students progress through a two semester sequence starting with Product Design and Development presenting integrated methodologies that examine marketing, manufacturing, and cross-functional teams including concurrent engineering and projects utilizing CAD systems, and ending with a Senior Project course including evaluation and design optimization methods for efficient and cost-effective designs requiring an oral/written report. In the capstone sequence the student teams generate the design, optimize the design and document the design. Then, during the last semester the teams plan for production, manufacture and assemble components, and test their design using the skills acquired through the computer-aided engineering and manufacturing related courses taken in earlier semesters.

2004-05 Self Study Report – Assessment

In this original report there were (4) program educational objectives (PEOs), and the ABET a-k criteria were identified as the program outcomes (POs). The Alignment of the PEOs with the POs was explained in a single descriptive paragraph. The alignment of the PEOs and POs to the mission and vision of the SoT and the University was illustrated in a figure. The alignment of the curriculum to the POs was presented using the Outcomes

Mapping Matrix shown in Table 2. The matrix illustrates in each course which of the a-k are introduced and also to what degree on a scale of 1-3, which relate to; some, moderate, and significant coverage. This method of aligning the POs to the curriculum is a method that has remained in use for the present assessment plan.

Table 2 - Competency Mapping

	Course	Description	Mastery of knowledge 2a	Apply and adapt 2b	Experimental skills 2c	Creativity 2d	Teamwork 2e	Technical problem solving 2f	Communication 2g	Lifelong learning 2h	Ethics 2i	Diversity, Social issues 2j	Continuous improvement 2k	Technical expertise in engineering materials, statics, dynamics, strength 8a	Technical expertise having added technical depth in a 8b	Expertise in applied physics having an emphasis in 8c
	MET3242	Machine Design I	3		2		2	3	3				3	3		
	MET3250	Applied Fluid Mechanics	3		2		2	3	3				3			
	MET3450	Machine Design II				3	3	3	3	1	1					
	MET3600	Applied Thermodynamics	3	3				3								
	MET4200	Design of Experiments	3	3	2	1	2	2	1				1		3	
	MET4300	Applied Heat Transfer														
	MET4460	Product Design & Development	2	1	2	3	3	3	3	1	2	2	1		1	
	MET4670	Senior Project				3	3	3	3	1						
	MET4999	Senior Project Seminar	3	2	2			3		3	1		1	1	3	1
	EET1411	Basic Electronics	3	2	2		1	3								2
	EET3131	Instrumentation	3	2	2		1	3								2
	EET3700	Electrical Power & PLC Basics	3		3		1	3						2	1	
Required	CH1100	General Chemistry	2		3			2								
Math	MA1032	Data, Functions, & Graphs		3				3								
Physics &	MA1160/61	Calculus with Technology I		3				3								
Comp. Appl	MA2160	Calculus with Technology II		3				3								
	PH1140/41	Applied College Physics I & Lab	3		2			3							3	
	PH1240/1200	Applied College Physics II & Lab	3		2			3							3	
	MA2720	Statistical Methods	3	3				3								
Elective																
Courses	MET 4550	Computer Aided Manufacturing	3	2	2	3	3	1	2			1	3	2	3	
	MET4377	Applied Fluid Power	3	2	3	2	2	3	3		1	1	3	3	3	
	MET4390	Internal Combustion Engines	3	2	3	2	2	3	3		1	1	3	3	3	
	MET4400	Simulation Methods	3	2	1			3						1	3	
	MET4450	Advanced Manufacturing Process	3	2	1	1		1					3		3	
	MET4500	Lean Manufacturing, Principles, Concepts ar	3	2	1	2	2	2	2	2	1	1	1		3	
	MET4580	Facilities Planning, Layout & Process Flow	3		2	2	3	1	3				3		2	
	MET4590	Production Planning & Control	3		2	2	3	1	3				3		2	
	MET4660	Applied finite Element Analysis	3	1	2	2	2	3	2	1	2		3	2	2	1
	TE3956	Industrial Safety Management	3			2	2	3	1	2	3	1	2	1	1	
	UN3002	Co-op Education Laboratory							2	2	2	2				
	Gen Ed (28cr)								2		2	2				

The method of using Course Binders was discussed in the Self Study Report, where each course has a binder consisting of a 10 tab system maintained by the instructor of record for that particular course. In Table 3 the contents assigned to each tab are explained.

Table 3 - Course Binder Process

Tab	Label	Explanation
1	Program Outcomes Associated with this Course	The mapping between curriculum and program outcomes (Criterion 2, a-k) illustrated in Table 2 of this report is repeated here, but restricted to just the course at hand. A brief narrative explains how the course supports outcomes.

2	Syllabus	The most current syllabus for the course is kept on file here. Course objectives are contained in the syllabus. The course objectives are written such that achievement of the course objectives contributes to achievement of the associated program outcomes (Criterion 2, a-k).
3	Text Citation and Study Materials	Full textbook citation (if applicable) and any additional reference materials issued to the student.
4	Homework Assignments and Samples of Student Work	Self explanatory.
5	Projects and Samples of Student Work	Self explanatory.
6	Laboratory Experiments and Samples of Student Work	Self explanatory.
7	Exams and Samples of Student Work	Self explanatory.
8	Course-level Assessments that Contribute to Program-level Assessment Plan – Performance Criteria and Most Recent Data	Behind this tab is an end of semester summary sheet organized by course objective (see sample form, Figure 1). For each course objective, an assessment instrument is named (chosen by the faculty member of record for the course) and a standard for acceptable achievement on that instrument is listed. The current semester's results are noted alongside the standard (set by the faculty of record for the course). Also noted is the average of students' self-assessment responses (5 point scale) to the question of whether or not they achieved that course objective. Finally, continuous improvement actions planned based on the current semester's learning outcome results are listed, again by course objective. A log of these continuous improvement action plans, results, AND any additional actions that did not fit the by-objective organization scheme appear behind Tab10.
9	Course-level Assessments that Contribute to Program-level Assessment Plan – Historical Data	This tab is intended to contain graphs depicting semester to semester results from the summary sheets initially filed behind Tab8. Because this binder arrangement was established during Fall semester 2004, it is likely that this tab will be incomplete for most binders. One semester's worth of historical data is expected (namely Fall 2004), but not enough data exists to justify graph creation.
10	Continuous Improvement	This tab is to be used for a running log of continuous improvement actions planned and completed.

Binder tabbed sections 8, 9, and 10 are particularly important to this assessment process. This is where the Summary of Student/Course Outcomes, shown in Figure 1, is presented along with course improvement actions. According to the assessment plan, all faculty members will conduct course assessments at the completion of each semester for the courses they taught. Data gathered during this process is used to make adjustments and improve the student learning experience. Examples of assessment methods used are: assignments, labs, exams, quizzes, and performance projects.

This method of collecting data related to specific course objectives or learning outcomes is used as the metric for how well students are performing related to POs. The acceptable achievement level selected for this performance is that 70% of the students perform at a level of 70% or better for each of the course competencies. This process remains in place today for the present assessment and evaluation plan. The course improvements are summarized each year in a Summary of Program Improvements document.

Figure 1- Summary of Student/Course Outcomes

Course Objectives ***(As found on course syllabus)***	***Relates to Program Outcome(s)*** ***(ABET Specific a-k)***	***Course Assessment Method & Metrics*** ***(How do you measure accomplishment of course objectives?)***	***Student Course Learning Outcomes***			***Course Improvement Actions***
			Standard	***Results***	***Acceptab. Y/N***	List any improvement actions that will be incorporated as a result of feedback received. These actions will go on the summary document for the MET program.
Provide the engineering student with a broad realistic understanding of the design process.	2A, degree 2 2B, degree 1 2C, degree 2 2D, degree 3 2E, degree 3 2F, degree 3 2G, degree 3 2H, degree 1 2I, degree 2 2J, degree 2 2K, degree 1 8A, degree 2 8B, degree 1	Written exams, classroom activities, homework assignments, lab team projects related to 28 week senior project matrix, and team oral project presentation.	70% of students will score 70% or better on exams, assignments, labs, and presentations.	93% > 70% on written exams 100% > 70% on assignments 100% > 70% on lab projects 100% > 70% on project presentation	Y	Limit group size to three students, Advise a project group while teaching course, chapter quizzes through WebCT, Develop GD&T module for WebCT, Strictly enforce lab due dates.

Finally, in the Self Study Report an Assessment Plan, shown in Figure 2, was provided listing each PEO and PO with the corresponding assessment criteria, results, and use of results. At this time the assessment plan was just underway and no significant data was presented to show that the data collected was being used for continuous improvement.

Figure 2 – Self Study Report Assessment Plan

Criteria 3. Assessment & Evaluation - Program Outcomes Recipients of the Engineering Technology Option in Mechanical Engineering Technology BS degree from Michigan Tech demonstrate:			
INTENDED OUTCOME	**ASSESSMENT CRITERIA**	**RESULTS**	**USE of RESULTS**
(a) an appropriate mastery of the knowledge, techniques, skills and modern tools of their disciplines	a1. 75% of the students will demonstrate mastery of course objectives relating to this program outcome when measured at the course level.*	a1. Grand Average of sample courses =90.91%	a1.See course binders for continuous improvement actions

2008 Reaccreditation Report

In the Reaccreditation report the revised PEOs were presented, changing from the previous (4) stated PEOs to a list of (6) PEOs related to the qualities, that 3-5 years after graduation from the MET program, our graduates will be capable of achieving. The a-k criteria were listed as the POs, the Updated List of PEOs were linked with the a-k criteria, and outcome assessment methods/metrics were provided for each PEO. An example of one of the updated PEOs is shown in Figure 3.

Figure 3 - Updated List of Program Educational Objectives

Mechanical Engineering Technology: Program Objective #3

Mechanical engineering technology graduates will work in cross-functional teams providing expert knowledge as technologists.

Strategies and Actions	Outcomes: Criterion 3. a-k & Criterion 8 a, b, c Graduates will have:	Outcomes Assessment Methods/Metrics	
		Direct	Indirect
Evaluate the senior project design and build projects for application of skills obtained in earlier core engineering class work and their ability to perform as a team. Utilize the yearly binder process to assure that adequate focus is	a. An appropriate mastery of the knowledge, techniques, skills and modern tools of the discipline b. An ability to apply current knowledge and adapt emerging applications of mathematics, science, engineering and technology c. An ability to conduct, analyze and interpret experiments and apply experimental results to improve processes d. An ability to apply creativity in the design of systems, components or processes appropriate to the	• Peer review by industrial advisory board • Peer review by faculty • Outcomes of senior design completion • Peer evaluation rubric utilized in senior project • Peer evaluation rubrics utilized in MET courses.	• Exit survey • Alumni Survey

given to teamwork in course materials.	program objectives e. An ability to function effectively on teams f. An ability to identify, analyze and solve technical problems g. An ability to communicate effectively h. A recognition of the need for and ability to engage in lifelong learning I. An ability to understand professional, ethical and social responsibilities j. A respect for diversity and a knowledge of contemporary professional, societal and global issues k. A commitment to quality, timeliness and continuous improvement		

The part of this documentation that perceivably caused the ABET response of a continued Weakness is that several PEOs were listed with PO's aligned which had no bearing on that particular PEO. Also, the measures that were listed were not consistent with the separation between measuring outcomes from the current students verses the evaluation of student characteristics 3-5 years after graduation. The example shown in Figure 3 shows one of the PEOs that was commented on by the ABET reviewers where all a-k criteria were shown as aligned, but clearly they do not all relate to the PEO describing the capability to work in teams. Also, some of the methods and metrics used for assessment were not measuring the capabilities of students 3-5 years after graduation. For example, the evaluation of senior design projects and rubrics in MET courses are measurements of POs, but are not appropriate for measuring the PEO listed.

It is important to note here that training provided by ABET through the online webinars, such as "Defining Program Outcomes" by Gloria Rogers[1], and periodic "Assessment Tips With Gloria Rogers" published on the ABET website[2,3] were very helpful in making this distinction between PEOs and POs more evident to the MET Program Assessment Team.

MET Program Spring 2008 Assessment Report

In this assessment report the main focus was to illustrate the distinction between PEOs and POs and the assessment measure and metrics associated with each objective. Also, to illustrate the program improvements that had been implemented over the past year in response to the data gathered. The first table presented in the report, shown in Figure 4, is a matrix of the relationship between the PEOs and the POs, which illustrates that not every PEO is related to each PO.

Figure 4 – PEO/PO Matrix

		Program Educational Objectives - PEOs					
Program Outcomes (ABET C.2 a-k, C.8 a-c)		1	2	3	4	5	6
PO1	An appropriate mastery of the knowledge, techniques, skills and modern tools of the discipline (ABET 2.a)	X					
PO2	An ability to apply current knowledge and adapt emerging applications of mathematics, science, engineering and technology (ABET 2.b)	X					
3	An ability to conduct, analyze and interpret experiments and apply experimental results to improve processes (ABET 2.c)	X					
4	An ability to apply creativity in the design of systems, components or processes appropriate to the program objectives (ABET 2.d)	X					
5	An ability to function effectively on teams (ABET 2.e)	X	X	X	X		
6	An ability to identify, analyze and solve technical problems (ABET 2.f)	X	X	X			

Next, a table was provided as a summary of the assessment tools, shown in Figure 5. A brief description of each tool was provided for further clarification. This makes it very clear that the distinction between the PEOs and the POs is that the PEOs are measured using indirect measures such as placement data and surveys of employees and alumni.

Figure 5 – Assessment Tools

	Assessment Tool	Responsible for Data Collection/Analysis	Frequency
POs	Summary of Course Outcomes	Faculty	Semester
	Student Rating of Instruction	Center for Teaching, Learning & Faculty Development	Semester (All courses)
	Senior Exit Survey	SOT Staff	Semester
	Senior Project Evaluation	Faculty	Annually
	SME certification Test	SME	Semester
	Benchmarking	Faculty	Triennially
PEOs	Job Placement	University Career Center	Semester
	Alumni Survey	University Career Center	Triennially
	Employer Survey	University Career Center	Triennially
	Input from Industrial Advisory Board	Faculty	Annually

Most of the categories of data collection listed here are common to most assessment plans, but the methodologies may be somewhat innovative. One of these innovative methods used here by the Assessment Team was to create the surveys on an internet website: www.PollDaddy.com. This low cost subscription internet service allows the data to be collected digitally and reported in a consistent manner without the costs of duplication of several pages and cost of mailings. Email was used to contact employers with the help of the University Career Services and Alumni Relations to contact former

students. Notice that these measures are not collected every year, because the collection of this data still takes significant amount of time to analyze.

The Student Rating of Instruction (SRI) used here is an early student feedback mechanism prior to student graduation. This is a 20 question instrument with each question rated on a 1-5 scale with 1 as "Strongly Disagree" and 5 as "Strongly Agree". Items 1-18 are intended to be formative in nature and are based on contemporary "best practice" models derived from higher education research and reflection. Items 19 and 20 are intended to elicit responses from students as to their overall assessment of instruction. Student input is used to improve teaching and learning techniques used in the classroom as well as to improve curriculum and laboratory facilities. Typically, instructors will utilize the SRI instrument 10 optional questions to have students rate the overall achievement of the course objectives, which are correlated to the POs in the binder process. The 10 optional questions on the SRI are not to be used for merit or tenure/promotion decisions, and are very helpful for the continuous improvement action plan.

Next, an Assessment Analysis of POs, shown in Figure 6, was used to indicate the a-k criteria being used to evaluate graduates, the methods used to evaluate the criteria, the metrics, and the Results/Actions implemented to address the data. The Summary of Course Outcomes, (shown in Figure 1), is the method of measurement used in this analysis. The metric used for this assessment is that 70% of the students perform at a level of 70% or better for each of the course competencies mapped to the a-k criteria. The 70% level of achievement correlates to the 2.0 GPA in their major required courses required for graduation.

Figure 6 - Assessment Analysis of POs

Program graduates will be capable of:	Program Outcome Assessment		
	Methods	Metrics	Results/Actions
a. An appropriate mastery of the knowledge, techniques, skills and modern tools of the discipline b. An ability to apply current knowledge and adapt emerging applications of mathematics, science, engineering and technology c. An ability to conduct, analyze and interpret experiments and apply experimental	• Summary of Course Outcomes • Analysis includes input from both Program Outcome and Program Educational Objective assessment methods. • Targets all criterion 2 a-k & criterion 8 a-c	• 70% of students will score 70% or better on the assessment metric for each of the course objectives that are correlated to the program outcomes.	• Course Binders have been updated. • Course level assessment indicates progress at an acceptable level. • List of Course Improvements have been generated for the 2008 academic year for areas in need of change.

results to improve processes	• Student Rating of Instruction • Targets all criterion 2 a-k & criterion 8 a-c	• Rating of Instruction above a 3.5 average for Q 1-18, Q 19 & Q 20.	• Average rating for Fall 2007 & Spring 2008 was 4.3 • Course improvements include items based on student feedback.

Also, the Assessment Analysis of PEOs, shown in Figure 7, was used to indicate the a-k criteria aligned with this PEO, the methods used to evaluate the criteria, the metrics, and the strategies, progress and results implemented to address that data. At the time of this report not all the survey data had been collected, but the plan was communicated for the collection of the data.

Figure 7 - Assessment Analysis of PEOs

Program Educational Objective #1: Mechanical engineering technology graduates will utilize their technical knowledge to collaborate in the improvement and creation of products and technologies that are viable and sustainable.

During the first 3-5 years after graduation our graduates will demonstrate:	Strategies, Progress, and Results	Educational Objective Assessment	
		Methods	Metrics
a. An appropriate mastery of the knowledge, techniques, skills and modern tools of the discipline b. An ability to apply current knowledge and adapt emerging applications of mathematics, science, engineering and technology c. An ability to conduct, analyze and interpret experiments and apply experimental results to improve processes	Strategies: Offer courses in the MET program area that require excellence in technical knowledge and application. Continuous improvement of program curriculum. Progress: Alumni and Employer Survey conducted in 2003, and Advisory Board Input Fall 2008. Alumni and Employee survey conducted May 2008. Results: IAB action items updated for 2008, Recent Alumni and Employer survey have no results to date.	• Alumni Survey • Employer/ Recruiter Survey • Advisory Board Input	• 70% of survey respondents rate this objective at a level above average performance. • Advisory board members unanimously support the need for these qualities in graduates.

PO & PEO Assessment Results

Results of the assessment measures, (described earlier as Assessment Tools in Figure 5), were presented in appendix format in the Spring 2008 Assessment Report. The results for the POs included data collected during 2007-08, and the PEOs for the past two years and most recent Alumni and Employer survey data analyzed, which was from 2003.

Additional data supplied to ABET in the Spring 2008 Assessment Report in appendix format were the following: List of Continuous Improvement Actions; MTU Student Rating of Instruction Instrument; Course Competency Mapping Matrix; and the Alumni and Employer Surveys. These documents along with assessment data shown in tabular format illustrated evidence of the implementation of the assessment plan over the past two to three years.

Discussion

Assessment and Evaluation, or Continuous Improvement in ABET 2008-09 terminology, is not a last minute end of the semester task as anyone involved in the process knows very well. The tools presented here are probably not a surprise to the reader, but using the tools in the correct manner is what is important to understand. From experience in going through the process of having a system where all the tools were in place, but were not being used in the correct manner gave the understanding of how to measure specific outcomes related to Program Outcomes, POs of current students, and the very different measures of Program Educational Objectives, PEOs relating to qualities of graduates 3-5 years after leaving the program.

Another important lesson learned is to communicate the assessment plan thoroughly with all faculty members involved in gathering and analyzing the assessment measures. Especially, close attention is necessary to control the quality of course level assessment of POs. Constant review of the mapping matrix of POs and course objectives is required as course material is updated and changed.

By far, the more difficult measures are the PEOs in respect to the measurement tools chosen in this assessment plan. Even with the automated internet survey tool used there is no way of predicting what type of a response rate to expect from employers and alumni. Industrial advisory board and career placement data are a more reliable source of feedback, but also have shortcomings. The advisory board members respective companies are representative of a small percentage of the total number of companies that graduates are employed.

Conclusions

Be clear in the definition of PEOs and POs, how they are aligned and what tools are used to measure each. Follow the assessment plan and use of tools with documentation of the data illustrated in tabular format to document progress. Also, the use of internet survey

tools to collect data rather than the expensive and time consuming paper format surveys can be very advantageous.

The Assessment tools used to measure POs need to be unobtrusive enough that it does not disrupt the normal educational process, and not be a burden to the instructor of record. Creating a matrix of course objectives related to POs, and having a method in place to evaluate that course objective does not add an extra level of assessment just to satisfy the accreditation purpose. Then, the additional information necessary is the evaluation of the areas where students are not achieving to the level set as the metric and reflection on how to correct that in the future.

Recommendations and Plans for the Future

Incentives for students to take part in the Senior Exit Survey can be used to increase the response rate. For instance, the student can be given a small token of recognition for graduating from the program, a plaque or t-shirt with the program logo, if they submit confirmation that they have completed the online survey. Also, the exit exam may be an optional part of the curriculum, but if it is incorporated into a class and made mandatory it can increase the amount of data collection. If an outside exam through a society like SME or NAIT is used, the grading and analysis of results is provided by that service, which makes the data collection easier.

During the next several years leading up to the next accreditation report an additional piece of data to supplement the tools proposed is to choose some of the more difficult to measure criteria, and use rubrics to rate observations of students throughout the semester. For instance, these rubrics can be used for criteria like “Teamwork” or “Respect for Diversity” which are difficult to measure in a quiz, test, homework assignment, or even in a group project. The rubrics may or may not be used in the course grading, but at the end of the semester each instructor will tally the scores and the data will be displayed in a table compared to a metric for that criteria.

A caveat here is that these measurements of affective type criteria be measured on a cyclical basis so as to not overwhelm the instructor with several assessment criteria in one semester.

Bibliography

1. Rogers, G., Defining Program Outcomes, 2008 webinar CD, ABET Inc: 2008.
2. Rogers, G., The Language of Assessment: Humpty Dumpty Had a Great Fall. Assessment Tips With Gloria Rogers, Communications Link is a publication of ABET Inc; retrieved from www.abet.org on March 2008.
3. Rogers, G., Making a List and Checking It Twice. Assessment Tips With Gloria Rogers, Communications Link is a publication of ABET Inc; retrieved from www.abet.org on April 2008.