

**AC 2009-1302: THE ELECTRICAL ENGINEERING TECHNOLOGY PROGRAM
EDUCATIONAL OBJECTIVES (PEOS): ARE THEY MEASURABLE, AND HOW?**

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The Electrical Engineering Technology Program Educational Objectives: Are They Measurable and How?

Abstract

The Electrical Engineering Technology (EET) program developed a Program Educational Objectives assessment process in response to ABET accreditation requirements. Program Educational Objectives (PEOs) describe the attributes that we desire our graduates to possess three to five years after graduation¹. The BS degree program in EET will prepare graduates with the technical and managerial skills necessary to enter careers which involve the design, application, installation, manufacturing, operation and maintenance of electrical/electronic(s) systems. This paper details the PEO assessment process developed by the program, as well as the implementation process that took place in the academic year 2007-2008. An interim report submitted to ABET resulted in the resolution of the institutional weakness regarding ABET criterion 3 (Assessment and Evaluation)¹.

The PEOs are identified in line with ABET's Technology Accreditation Commission (TAC) and support the EET program mission. For each PEO, a set of indirect assessment tools has been identified and the performance criteria for each tool have been set. These indirect assessment tools⁴ can include career center job placement data, alumni surveys, employer surveys, and input from the Industrial Advisory Board (IAB).

This paper will discuss the PEOs, the process of how they are determined and reviewed, the role of the program constituencies in setting and reviewing them. Also discussed are the assessment tools, how these tools are used in the PEO assessment process, how frequently data is collected for each tool, who is responsible for data collection and analysis, and how data is used for continuous improvements. Information will be provided on the assessment process issues and challenges and can be used to help engineering technology programs seeking accreditation or re-accreditation.

1. Introduction

The curriculum of the EET program covers a broad based educational experience emphasizing practical, hands-on laboratory work, closely coordinated with theoretical classroom discussion. Students receive a solid foundation of coursework in electric circuits, digital electronics, solid-state electronics, communications, power and electrical machinery.

The EET program has developed a PEOs assessment process to fulfill ABET accreditation requirements. It is an outcome based assessment in which the PEOs should meet the need of the program constituents. PEOs describe the attributes that we desire our graduates to possess three to five years after graduation. According to ABET's definition of PEOs, "Program Educational Objectives are broad statement that describe the career and professional accomplishments that the program is preparing graduates to achieve"¹. A set of assessment tools with performance criteria has been identified for each PEO. Data has been regularly collected, assessed and evaluated against the performance criteria to ensure that each PEO has been assessed and the goals have been met¹. Results of assessments process are then utilized in continuous improvement actions.

2. EET Program Educational Objectives

The EET PEOs describe the attributes that the EET program desires the graduates to possess three to five years after graduation through both the curriculum and the academic experience¹. The PEOs support the mission of the School of Technology and the EET program. The EET program constituencies are the program faculty members, the EET IAB, the EET Alumni and their Employers. The PEOs were established based on input from the EET program constituencies and scheduled for review and update on a five year interval. When setting the PEOs, it is important to make a distinction from the Program Outcomes (POs). While PEOs describe the career and professional accomplishments the graduates possess three to five years after graduation¹, the POs are much narrower statements and describe what students are expected to know upon graduation¹. Accordingly, the set of assessment tools for PEOs will rely on both alumni and employer surveys. Table 1 shows the EET PEOs.

Table 1 Electrical Engineering Technology Program Educational Objectives¹

PEO 1	Graduates of the program will be well prepared for their first position in the field.
PEO 2	Graduates of the program will be successfully employed in a degree related job or pursuing an additional degree.
PEO 3	Employers will be satisfied with the performance of the program graduates, skills including: Effective teamwork and communication in a professional environment, and professional ethics.
PEO 4	Graduates of the program will be satisfied with their education and show the ability to continuously improve their skills and professionally adapt to changes in the field.

3. Program Educational Objectives Assessment Tools and Timelines

The EET program developed a set of assessment tools to measure the PEOs defined in Table 1, in response to ABET Criterion 3 (Assessment and Evaluation)¹. The EET program PEOs assessment tools include the job placement date, the alumni survey, the employer survey, and the input from the IAB. Table 2 summarizes the various tools used to collect data in order to assess our PEO. The table also identifies the person responsible for collecting and analyzing the data, as well as the frequency of the assessment. Setting a timeline² will help simplify the tasks associated with the assessment process. Not every PEO needs to be assessed every semester, so it is important to have a process in place detailing the timelines for data collection of each assessment tool². Our program is moderately small in size and access to our alumni and their employers can be a very challenging task, having both the alumni and employer surveys conducted every three years will yield more robust data with increased survey response rate. The program also used both job placement and feedback from the IAB as another set of assessment tools. This will help provide a rigid assessment process by not relying solely on the alumni and employer surveys when assessing the program PEOs. Also, this will engage the IAB in periodically assessing the PEOs. A brief description of each assessment tool is provided below.

Table 2: Summary of Assessment Tools

	Assessment Tool	Responsible for Data Collection/Analysis	Frequency
PEO	Job Placement	University Career Center	Semester
	Alumni Survey	University Career Center/ SoT Staff	Triennially
	Employer Survey	University Career Center/ SoT Staff	Triennially
	Input from Industrial Advisory Board	Faculty	Annually

Job Placement Data

Data from the University Career Center on our graduates’ job placement reflects how successful our graduates are in securing a job in a related field.

Alumni Survey

The alumni survey is a written questionnaire which our alumni are asked to complete. Data will be collected every three years. The data will be analyzed and used in continuous improvement. A sample copy of the survey is included in Appendix A.

Employer Survey

The employer survey is a written questionnaire which employers of our graduates are asked to complete. Data will be collected every three years. Results of the data analysis will be used to enhance and strengthen our program. A sample copy of the survey is included in Appendix B.

Input from Industrial Advisory Board IAB

The EET-IAB assists the program in keeping current and relevant with industry. Input from the IAB is collected every year in our annual spring meeting. This input is used to make continuous improvements to the program.

4. Program Educational Objectives Assessment Results

The assessment process used different tools for different objectives. Table 3 shows the assessment tools that were employed and the achievement standard for each of the PEO. The overall achievement results for the PEOs were evaluated and the raw data collected has been processed and the final results are presented here. The Assessment Process used different tools for different PEOs. The average scores from each assessment tool used were compared to the performance criteria passing threshold.

EET Program Educational Objectives	Assessment Tools & Performance Criteria	Achieved Results
<p>PEO1: Graduates of the program will be well prepared for their first position in the field.</p> <p>PEO2: Graduates of the program will be successfully employed in a degree related job or pursuing an additional degree</p>	<p>Job Placement: 70% of EET graduates are currently employed in a degree related job as reported by university job placement data.</p> <p>Alumni Survey:</p> <ul style="list-style-type: none"> 70% of EET Alumni responding to the Alumni Survey will indicate they rate the overall quality of their EET educational experience as good or better. 70% of EET graduates responding to the Alumni Survey Questionnaire will indicate they are 1) currently employed in a position directly related to their education, 2) have accepted a job offer for a position directly related to their education, 3) have at one time worked in a position directly related to their education since graduation, or 4) are currently pursuing an additional college degree. 	<p>Fall 2007 (86%), Spring 2008 (90%)</p> <p>100% of EET Alumni rated the quality of EET education as good or better. 67% of the respondents in 2004/2005 indicated one of the four desired responses (the goal is not met here).</p>
<p>PEO3: Employers will be satisfied with the performance of the program graduates, skills including: Effective teamwork and communication in a professional environment, and professional ethics.</p>	<p>Alumni Survey: one or more abilities are listed which reflect this objective. Alumni are asked to rate the quality of preparation to demonstrate each ability they feel they received from their MTU education. For each ability relevant to this Objective, the weighted average of responses will be at least 2.80.</p> <p>Employer Survey.70% of EET employers responding to the Employer Survey will indicate they are either very satisfied or satisfied with EET graduates' performance</p> <p>The EET advisory board: will meet annually and provide feedback to improve the quality of the program, also evaluate the senior project design teams.</p>	<p>2004/2005 Alumni Survey Questionnaire Weighted average: 3.18, 10 responses, 15.2% response rate</p> <p>We cannot clearly determine the satisfaction rating of MTU BS-EET employers from the 2004/2005 employer survey results due to a survey design flaw which was corrected in the new survey.</p> <p>The EET IAB met twice during the academic year, and recommended actions are discussed in the respective IAB meeting. IAB are also part of the assessment team for senior project.</p>
<p>PEO4: Graduates of the program will be satisfied with their education and show the ability to continuously improve their skills and professionally adapt to changes in the field.</p>	<p>Alumni Survey: one or more abilities are listed which reflect this objective. Alumni are asked to rate the quality of preparation to demonstrate each ability they feel they received from their MTU education. For each ability relevant to this Objective, the weighted average of responses will be at least 2.80.</p>	<p>2004/2005 Alumni Survey Questionnaire Weighted average: 3.18, 10 responses, 15.2% response rate</p>

Table 3: Assessed Program Educational Objectives

The overall achievement results for the four PEOs have been evaluated and the raw data collected has been processed. The final results are presented in Table 3. The average scores from questions in each tool used were averaged to get the final result for that particular PEO. That result was then compared to the performance criteria passing threshold. The results revealed no major shortcomings in assessing the EET PEOs, i.e. the overall averaged results were above the desired target. It is worth mentioning that when assessing PEO1 and PEO2 using the alumni survey, EET Alumni were asked to indicate if they are:

- 1) currently employed in a position directly related to their education
- 2) have accepted a job offer for a position directly related to their education
- 3) have at one time worked in a position directly related to their education since graduation.
- 4) are currently pursuing an additional college degree.

67% of the EET Alumni respondents indicated positively on one of the four choices. This result is not far from the 70% passing threshold, and can be interpreted as a result of not having a fully robust survey data set due to low response rate to the alumni survey. We do expect a better data set when we conduct the next cycle of alumni and employer surveys

5. Program Educational Objectives Assessment Results – Analysis

Analysis of assessment results shows that the EET PEOs have been evaluated and goals were met. Assessment results of job placement data and feedback from the IAB reflect more accurate results than the employer and alumni surveys. This could be as a result of:

- Access to program alumni and their employer is a challenging task, for the 2004-2005 cycle survey we have only 15.2 % response rate. This is because we are a small program graduating about 15-20 students per year, conducting the survey every three years will definitely help improve the survey response rate and we should get more robust data. Redesign of the employer survey to be able to measure PEO3³, the new cycle of surveys will reflect a better assessment of PEO3.

6. Conclusion

This paper provides guidance on the PEO assessment process developed and implemented by the EET program to ensure compliance with ABET Criterion 3 (Assessment and Evaluation)¹. The PEOs are identified in line with ABET's Technology Accreditation Commission (TAC) definitions as broad statements which describe the career and professional accomplishments that the program is preparing graduates to achieve. Each PEO has been assessed using a set of assessment tools. Due to the size of the program and the challenging task of accessing the program alumni and employers, a timeline has been set to identify the frequency of assessment as well as the person responsible for collecting and analyzing data, the timeline will help simplify the tasks associated with the process since not every PEOs needs to be assessed every semester. The overall average results for the four PEOs showed that targets have been met for each PEO and no major shortcomings were identified. To ensure more robust assessment data and by not relying mainly on alumni and employer surveys, we successfully utilized data from job placements and feedback from the IAB as another set of assessment tools to effectively monitor and assessed the PEOs.

References:

- [1] “ Criteria for Accrediting Engineering Technology Programs,” Technology Accreditation Commission, ABET, Inc., Baltimore, Maryland, 2007.
- [2] G. Rogers, “Establishing Timelines and Responsibilities – An Example,” From Assessment Planning Flow Chart©2004, Gloria M. Rogers, Ph.D
- [3] Rogers, G., Surveys and Questionnaires: Do They Measure Up?. Assessment Tips With Gloria Rogers, Communications Link is a publication of ABET Inc; retrieved from www.abet.org , January 2008.
- [4] G. Rogers, “Direct and Indirect Assessments: What Are They Good For?,” *Community Matters*, August 2006.

Appendix A: Alumni Survey
Electrical Engineering Technology
Program Educational Objectives Survey
- Alumni -

Thank you for taking time to respond to this survey for EET alumni. Your ideas and opinions are very important to our programs and our efforts to continuously improve these programs. You may use available blank space at the end for comments.

Alumni Name: _____
 Company or Organization: _____
 Position: _____

<i>Please answer the following General Questions</i>	<i>Ratings</i> (1= Very dissatisfied), (5= Very satisfied)				
Based on your work experiences since obtaining your undergraduate degree in EET, what is your impression of the overall quality of your educational experiences that you received at the EET Program?.	5 <input type="checkbox"/>	4 <input type="checkbox"/>	3 <input type="checkbox"/>	2 <input type="checkbox"/>	1 <input type="checkbox"/>

Listed in the next table are several statements about skills and knowledge you may have had to use for your employer. On a scale from (1= Very dissatisfied) to (5= Very satisfied), please rate your satisfaction on how well the EET program has prepared you to apply these skills at your work place. You may use available blank space at the end for comments.

<i>Skills and Knowledge</i>	<i>Ratings</i> (1= Very dissatisfied), (5= Very satisfied)				
Ability to solve electrical/electronics design problems using methods, tools, and skills of your specialization.	5 <input type="checkbox"/>	4 <input type="checkbox"/>	3 <input type="checkbox"/>	2 <input type="checkbox"/>	1 <input type="checkbox"/>
Ability to utilize computers and software in a technical environment	5 <input type="checkbox"/>	4 <input type="checkbox"/>	3 <input type="checkbox"/>	2 <input type="checkbox"/>	1 <input type="checkbox"/>
Ability to plan, organize, and complete a design task	5 <input type="checkbox"/>	4 <input type="checkbox"/>	3 <input type="checkbox"/>	2 <input type="checkbox"/>	1 <input type="checkbox"/>
Ability to continuously learn new skills and knowledge.	5 <input type="checkbox"/>	4 <input type="checkbox"/>	3 <input type="checkbox"/>	2 <input type="checkbox"/>	1 <input type="checkbox"/>
Ability to communicate effectively orally.	5 <input type="checkbox"/>	4 <input type="checkbox"/>	3 <input type="checkbox"/>	2 <input type="checkbox"/>	1 <input type="checkbox"/>
Ability to communicate effectively in writing.	5 <input type="checkbox"/>	4 <input type="checkbox"/>	3 <input type="checkbox"/>	2 <input type="checkbox"/>	1 <input type="checkbox"/>
Ability to work successfully as a member of a team.	5 <input type="checkbox"/>	4 <input type="checkbox"/>	3 <input type="checkbox"/>	2 <input type="checkbox"/>	1 <input type="checkbox"/>
Ability to take initiative.	5 <input type="checkbox"/>	4 <input type="checkbox"/>	3 <input type="checkbox"/>	2 <input type="checkbox"/>	1 <input type="checkbox"/>
Ability to integrate mathematics and science into your work.	5 <input type="checkbox"/>	4 <input type="checkbox"/>	3 <input type="checkbox"/>	2 <input type="checkbox"/>	1 <input type="checkbox"/>
Understanding and appreciation of ethics and professionalism as related to your work.	5 <input type="checkbox"/>	4 <input type="checkbox"/>	3 <input type="checkbox"/>	2 <input type="checkbox"/>	1 <input type="checkbox"/>
Awareness of value of considering diversity and differences in cultures in your work.	5 <input type="checkbox"/>	4 <input type="checkbox"/>	3 <input type="checkbox"/>	2 <input type="checkbox"/>	1 <input type="checkbox"/>

Appendix B: Employer Survey

**Electrical Engineering Technology
Program Educational Objectives Survey
- Employer -**

Thank you for taking time to respond to this survey of the quality of our EET graduates. Your ideas and opinions are very important to our programs and our efforts to continuously improve quality of our graduates. If you or someone from your organization would like a representative from the EET program to contact you regarding this questionnaire or any other important issues relative to the quality of its academic programs, please indicate the appropriate point of contact.

Company or Organization: _____

Title: _____

Position: _____

Total number of EET graduates that you currently supervise: _____

Based upon your professional experience and opportunities to observe EET graduates from the Michigan Technological University and from other institutions, what is your impression about the overall quality of the EET- Michigan Tech graduates?

Marginal Fair Satisfactory Good Excellent

Listed in the next table are several statements about skills and knowledge expected of all EET graduates. On a scale from (1= Very dissatisfied) to (5= Very satisfied), please rate your satisfaction on how well you would rate the performance of our graduates that you supervise. You may use available blank space at the end for comments.

<i>Skills and Knowledge</i>	<i>Ratings</i> (1= Very dissatisfied), (5= Very satisfied)				
Ability to solve electrical/electronics design problems using methods, tools, and skills of his/her specialization.	5 <input type="checkbox"/>	4 <input type="checkbox"/>	3 <input type="checkbox"/>	2 <input type="checkbox"/>	1 <input type="checkbox"/>
Ability to utilize computers and software in a technical environment	5 <input type="checkbox"/>	4 <input type="checkbox"/>	3 <input type="checkbox"/>	2 <input type="checkbox"/>	1 <input type="checkbox"/>
Ability to plan, organize, and complete a design task	5 <input type="checkbox"/>	4 <input type="checkbox"/>	3 <input type="checkbox"/>	2 <input type="checkbox"/>	1 <input type="checkbox"/>
Ability to continuously learn new skills and knowledge.	5 <input type="checkbox"/>	4 <input type="checkbox"/>	3 <input type="checkbox"/>	2 <input type="checkbox"/>	1 <input type="checkbox"/>
Ability to communicate effectively orally.	5 <input type="checkbox"/>	4 <input type="checkbox"/>	3 <input type="checkbox"/>	2 <input type="checkbox"/>	1 <input type="checkbox"/>
Ability to communicate effectively in writing.	5 <input type="checkbox"/>	4 <input type="checkbox"/>	3 <input type="checkbox"/>	2 <input type="checkbox"/>	1 <input type="checkbox"/>
Ability to work successfully as a member of a team.	5 <input type="checkbox"/>	4 <input type="checkbox"/>	3 <input type="checkbox"/>	2 <input type="checkbox"/>	1 <input type="checkbox"/>
Ability to take initiative.	5 <input type="checkbox"/>	4 <input type="checkbox"/>	3 <input type="checkbox"/>	2 <input type="checkbox"/>	1 <input type="checkbox"/>
Ability to integrate mathematics and science into his/her work.	5 <input type="checkbox"/>	4 <input type="checkbox"/>	3 <input type="checkbox"/>	2 <input type="checkbox"/>	1 <input type="checkbox"/>
Understanding and appreciation of ethics and professionalism as related to his/her work.	5 <input type="checkbox"/>	4 <input type="checkbox"/>	3 <input type="checkbox"/>	2 <input type="checkbox"/>	1 <input type="checkbox"/>

Awareness of value of considering diversity and differences in cultures in his/her work.	5 <input type="checkbox"/>	4 <input type="checkbox"/>	3 <input type="checkbox"/>	2 <input type="checkbox"/>	1 <input type="checkbox"/>
Awareness of the importance of safety issues related to his/her work.	5 <input type="checkbox"/>	4 <input type="checkbox"/>	3 <input type="checkbox"/>	2 <input type="checkbox"/>	1 <input type="checkbox"/>

Comments:

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Thank you for taking the time to answer our questions. Your feedback is tremendously valuable to us!