Evaluating the Program Educational Objectives of an Engineering Program at a Small Institution

Ismail Jouny
Electrical and Computer Engineering
Lafayette College, Easton, PA

Abstract

This paper focuses on processes and methodologies for evaluating the Program Educational Objectives (PEO) of an engineering program according to ABET2000 Engineering Accreditation criterion. The paper will review existing processes for evaluating PEO's at the Electrical and Computer Engineering Department (ECE) of Lafayette College. These processes will be compared with those at other institutions. Lessons learned about evaluating the PEO's at Lafayette's ECE Department after four years of implementation will be discussed. The goal is to stir up debate about what works and does not work when attempting to evaluate the Educational Objectives of an engineering program at a small institution. Issues such as quality of data, timing, schedules of change, and ABET big-loop concerns will be discussed. Lafayette's Electrical and Computer Engineering (ECE) program is a relatively small program with about 20-25 graduates annually. This paper will discuss challenges faced by institutions of Lafayette's size in achieving a reliable evaluation of the ECE Program Educational Objectives.

Introduction

Much has been reported about ABET EC2000 criterion for accrediting engineering departments. The criterion entails two levels (or loops) of evaluation, a short-term level for demonstrating that the Program Outcomes are being met, and a long-term level for proving that the Educational Objectives are being achieved. Assessment processes for demonstrating the achievement of the Program Outcomes have been proposed and creatively developed by many experts in engineering, education, psychology, and other disciplines. Although they vary in their degree of success, it is by enlarge, feasible to adopt a well defined set of assessment tools and implement them to satisfy ABET's concerns. Assessment processes, though often different, are ultimately under the control of the institution, and can be implemented to the fullest as originally intended. Some institutions have even resorted to professional help in assessment processes, and others have assigned one or two faculty members to ensure the implementation of adequate assessment and feedback processes [4,5]. Faculty, staff, and administrators are becoming more comfortable with assessment tools, and getting accustomed to the notion of demonstrating the achievement of their Program Outcomes. Unfortunately, this is not the case with Educational Objectives.

There are some published papers on the subject of Education Objectives that can be used as reference tools for departments trying to evaluate their program, but not to the extent assessment tools are prevalent and successful. Program Educational Objectives (PEO)

are "*statements that describe the expected accomplishments of graduates during the first several years following graduation from the program*" according to ABET [1]. Furthermore, it is required by ABET that a program maintains "*a system of ongoing evaluation that demonstrates achievement of these objectives and uses the results to improve the effectiveness of the program*" [1]. Finally, ABET demands a periodically evaluated process in which PEO's are determined. This paper focuses on the issue of demonstrating the achievements of these objectives. The difficulty lies in the fact that PEO's are "expected accomplishments" that are evaluated after the graduates have left the institution and are dispersed geographically and professionally. It is, therefore, the institutions responsibility to demonstrate that the graduates "expected accomplishments" are indeed "real accomplishments" using reliable tools that are not affected by the geographical and professional disparity of the graduates. This involves collecting data about the graduates wherever they may be, and demonstrating that what was expected is being achieved, or else make changes to improve the effectiveness of the program. Clearly, not every graduate can be reached to evaluate his/her accomplishments, and it is not expected that institutions do so. However, it is expected that each graduate meets the designated Program Outcomes prior to graduation. It is necessary to have reliable data based on which statistically sound conclusions can be drawn. This is where evaluating the PEO's could present a bit of a dilemma for small departments with few graduates. Unless data on every graduate is complied, it is impossible to achieve a statistically reliable description of how graduates are doing. Therefore, it is imperative for small departments to know the whereabouts of their graduates, at least during the first few years out of college.

Tools for Demonstrating the Achievement of PEO's

The author has examined how large and small institutions evaluate their PEO's and found that, unlike the assessment processes, the tools devised for demonstrating the achievement of PEO's are very similar and often based on surveys. Most of the commonly used tools, some of which are used by Lafayette College's ECE Department, are:
1) Alumni surveys
2) Feedback from advisory board, or external review committees
3) Employer surveys
4) Survey of visiting industry leaders
5) Discussions with recurrent recruiters
6) Benchmarking with other institutions
7) Graduate schools surveys
8) Compile data about alumni
9) Web based bulletin boards

Although schools differ in their timing of surveys, advisory board meetings, and visits by review committees or industry leaders, the above tools are generally adopted by many large and small engineering institutions nationwide [2-5].

Alumni surveys are fairly accurate, and can be scheduled in a fashion that does not overwhelm the alumni, and yield reasonably reliable data. There are professional

surveying companies that can also help in this regard. The main issue with alumni surveys, however, is not reliability but numbers. A typical rate of return on a typical survey is in the range 20%-30%, which may yield statistically usable data for large programs, but will be futile for small engineering programs with less than 30 graduates annually. The data can still be used by small institutions such as Lafayette, but it cannot be the only source of information about the graduates. Employer surveys have the same disadvantages as the alumni surveys. In addition employer surveys are constrained by legal issues that limit how much an employer can say about an employee, and are often biased in favor of the employee because employers hesitate to talk negatively about an employee to an outsider. Graduate school surveys are also hampered by the same legal constraints. A graduate school, or a graduate advisor would be hesitant to talk about a student who is not doing well. Therefore, while surveys may work for large institutions with many graduates, they are clearly insufficient sources of data for small programs. An attempt at Lafayette's ECE Department to make an effort to contact all the alumni in order to get a 90-100% rate of return on surveys was discouraged for various reasons. Small programs can use surveys but must be careful in assigning considerable weight to the outcome of such inquiries. Although our graduates were instructed that they will be receiving surveys and that the program will need to know their opinion, return rate on surveys remained below 50% and therefore did not reach reliable levels.

Input from visiting industry leaders, recruiters, and advisory board members may be used as a tool for evaluating PEO's but the results do not constitute a proof that the program PEO's are being achieved. Visitors and recruiters may speak of few graduates, and may offer general comments on the program, but their input cannot be regarded as concrete evidence that the educational objectives of the program are be achieved as expected. Small institutions should not abandon using these tools but should realize that input from these evaluators is based on limited experience and cannot be generalized. Small institutions may have fewer recruiters than their larger counterpart, and these recruiters can be local and do not reflect a national opinion of the graduates.

Bulletin boards are often not accurate and, at Lafayette's ECE Department were rarely used by alumni, and may occasionally be used by hackers, and other non-target constituencies. This leaves tool #8 which is to collect data about alumni and then extract evidence that PEO's are being achieved or not. A portfolio for each graduating class can be maintained in which updated information about the graduates can be posted. This information which can be collected by the program, alumni office, individual faculty, or visiting alumni can include the following:
   a) Place and length of employment
   b) Whether the graduate pursued a post-undergraduate degree
   c) News about the graduate success, volunteerism, contributions
   d) Is the graduate a professional engineer?
   e) Did the graduate pursue an MBA or a non-engineering degree?
   f) Did the graduate change profession? And to what?
   g) Is the graduate active in his/her community?
   h) News about the graduate's technical contributions.

i) Did the graduate maintain a good relationship with the program and the institution?
j) Did those who went to graduate school succeed in finishing their degrees?
k) Did the graduate inquire about a technical issue, a course, or even suggest a curricular change?

This information can be collected passively from visiting alumni, invited speakers, or those who request recommendation letters. Some information can be collected actively using the alumni office and their staff.

Data collected about alumni is usually raw and not directly correlated with the PEO's. However, it is possible by proper data mining to extract useful information about alums, and "connect the dots" to determine whether a PEO is currently being achieved, or changes are in need of improvement. Another tool that has worked effectively is the notion of focus group surveying. A small program should be able to reach few alumni from a certain graduating class and be able to conduct a detailed focus-group type survey of the PEO's achievement. Furthermore, and because PEO's are relatively stable over graduating classes, and are not expected to change dramatically, it is possible to use a larger focus group that include a larger number of graduates from different graduating classes, and evaluate the achievement of the PEO's using such a group. Of course, the larger the focus group, the more difficult it is to organize a meeting but graduates spanning three years should be able to meet, compare notes, and evaluate the success of the program. Departments must be careful that a focus group input is not necessarily an accurate representation of the larger picture of the graduates.

Small institutions are presented by a challenge and an advantage concerning the PEO's of a program. The challenge lies in accumulating reliable data about graduates even though surveys have a low rate of return, and employers and graduate schools are hesitant to fully disclose the whereabouts of their employees or students. The advantage lies in the small number of graduates, and the close relationship often developed between a graduate and a program. These relationships can be fostered to become a source of continued exchange of ideas between a program and its constituents, and will ultimately lead to improving the program and achieving its PEO's.

Institutions should be mindful, when choosing their PEO's that evaluating these PEO's is a crucial process in which small programs and large programs have different playing fields. A small program should not choose a PEO that can only be demonstrated by input from hundreds of graduates. Furthermore, small programs should be mindful of the value of the relationship between them and their graduates, and the significant impact it may have on the determination whether PEO's are being achieved.

Lesson's Learned

Most of the evaluation tools listed above in addition to few other creative methods were attempted at Lafayette College, Department of Electrical and Computer Engineering. Surveys returned by graduates and employers were not equal in number, and feedback

from industry visitors, invited speakers, and recruiters was not conclusive. The program now uses a multitude of tools to demonstrate the achievement of its PEO's. Unfortunately, a small program cannot rely on a fraction of the above tools, and cannot abandon some of the methods discussed above. Data collected using these various tools, regardless of its reliability, is fused together to truly evaluate whether a certain PEO is being achieved. It is also crucial that small programs remind their graduates that they will be surveyed three to five years after graduation, and that they should not hesitate to respond regardless of their situation. Alumni often receive numerous requests, newsletters, and surveys from their alma mater, but should realize that departmental surveys are particularly crucial to the success of the program from which they hold a degree.

Conclusions and Recommendations

ABET EC2000 has been in effect for about five years. A large number of engineering programs around the country has been accredited using this criterion. It is the author's opinion that evaluators will place more emphasis on closing the big loop or demonstrating the achievement of the program PEO's during the second round of accreditation under EC2000. In the first round, evaluators were more interested in seeing processes in place, and in determining whether a program is meeting its Program Outcomes. It is the author's opinion that achieving the PEO's is the ultimate proof that an engineering program is successful in meeting the needs of its constituents. Programs large and small need to pay more attention to demonstrating that their PEO's are being achieved, and that their programs are being improved to ensure that PEO's are successfully attained in future.

References
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Biographical Information
ISMAIL JOUNY: He received his BS degree in Electrical Engineering from Beirut University (with Honors) and his MS and Ph.D. degrees from The Ohio State University in 1984, 1987, and 1990 respectively. He has been with the Department of Electrical and Computer Engineering at Lafayette College, where he is currently Professor and Head of the department.