

## **2006-53: USING EMPLOYER SURVEYS TO DETERMINE THE EXTENT TO WHICH EDUCATIONAL OBJECTIVES ARE BEING ACHIEVED**

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# Using Employer Surveys to Determine the Extent to Which Educational Objectives Are Being Achieved

## Abstract

Criterion 2 of the current ABET Criteria for Accrediting Engineering Programs requires that the program being evaluated have in place a process of ongoing evaluation of the extent to which the program's educational objectives are being attained. Many engineering programs have had great difficulty getting feedback from employers of their alumni to determine the extent to which their objectives are being achieved. This paper presents an approach to obtaining such feedback that has engaged both alumni and their employers in evaluating achievement of educational objectives. Monmouth University's Software Engineering program created a questionnaire related to its objectives and asked for employer feedback on the degree of attainment as well as other information. Because at the time of the first survey only a small number of alumni and employers were available to participate, it was important to maximize the response rate. Employers were encouraged to respond by providing each alumnus with a cover letter from the program chair, a release form that relieved the employer from liability related to the release of private information and the program's questionnaire. All of the alumni who graduated in the first class of graduates were able to use this method to convince their employers to respond. The response rate was 100%. This paper describes the program's objectives, the survey process, the documentation and the responses received from employers. It also describes the conclusions and improvements that were made based upon the survey findings.

## Introduction and Background

Since 2000 the Accreditation Board for Engineering and Technology (ABET) has been requiring engineering programs seeking accreditation to define both program educational objectives and program outcomes and to measure graduates' and students' success in achieving those objectives and outcomes. Outcomes are intended to be things that alumni of the program would be expected to achieve within 3 to 5 years of graduation while outcomes are things that students should be able to do by the time they graduate. The ABET criteria are based largely on the contents of a 1997 task force report on engineering education assessment<sup>6</sup>. Maxim<sup>7</sup> has provided an excellent overview of one software engineering program's plan to assess their program.

Criterion 2 of ABET's current criteria for accreditation of engineering programs<sup>4</sup> requires that, "Each engineering program for which an institution seeks accreditation or reaccreditation must have in place:

- (a) detailed published educational objectives that are consistent with the mission of the institution and these criteria

- (b) a process based on the needs of the program's various constituencies in which the objectives are determined and periodically evaluated
- (c) An educational program, including a curriculum that prepares students to attain program outcomes and that fosters accomplishments of graduates that are consistent with these objectives
- (d) A process of ongoing evaluation of the extent to which these objectives are attained, the result of which shall be used to develop and improve program outcomes so that graduates are better prepared to attain the objectives."

It has been the author's experience during the past several years as an ABET program evaluator that most programs seeking initial accreditation do not have a great deal of difficulty in satisfying parts (a), (b) and (c) of this criterion. However, almost all have difficulty in meeting part (d). For programs seeking initial accreditation this happens for two reasons: First, if the program has had its first graduates at the end of the spring semester the evaluation visit usually takes place during the fall semester of that same year and, because there have usually been a small number of graduates there are very few data points that could be examined even if data could be obtained about every graduate. Secondly, the employers of the program's graduates, who are usually the best source of evaluative data, are reluctant to provide in writing any data about individual employees which could be considered private information<sup>1</sup>. Blaha and Murphy<sup>2</sup> outline several principles that should be followed when creating assessment plans for an educational program. They advise taking a long-term view of assessment and not shortening the assessment cycle to show quick results for an accreditation review. This implies that programs should not seek accreditation as soon as they are eligible because they might not have sufficient data for an appropriate evaluation. Sanders and McCartney<sup>9</sup> report that programs that have attempted to use employer surveys get very low response rates. Hagan<sup>5</sup> reported that a survey of 500 employers of information technology graduates in Australia, which did not ask for private information, produced a response rate of only 14%. This implies that surveys that ask for information which could be considered private would be expected to produce much less than a 14% rate.

As an alternative to employer surveys, some programs have tried to rely on informal input from members of industrial boards who might have hired some of the graduates or, usually as a last resort, surveys of graduates from the program. The problems with these techniques are, for the first, that data are not obtained in a way that can be quantified and analyzed. Alumni surveys also suffer from some of the same problems that have been experienced in the use of student surveys for determining if students have achieved the programs outcomes<sup>8</sup>.

Some readers might wonder why employers are so reluctant to reveal information about individual employees and whether or not they are achieving the program's educational objectives. Many readers are probably familiar with the provisions of the Federal Educational Rights Privacy Act (FERPA)<sup>3</sup> which prohibits, among other things, university employees from discussing with or providing student information to anyone

outside the university unless the student has signed a release to allow that distribution. Many of us are also familiar with the many release forms that we are required to sign to release our medical information beyond the health care provider's organization. There is no specific federal law that prohibits distribution of employee information like there is for student and patient information. However, most large employers have learned from experience via lawsuits and other forms of punishment that it is not a wise idea to release any employee information other than information to confirm employment and the dates of that employment with the organization.

As a result of these difficulties very few programs have found it useful or practical to use employer surveys to satisfy Criterion 2 (d).

During the 2000-2001 academic year Monmouth University initiated an undergraduate program in software engineering. At that time, the faculty, in cooperation with the program's constituencies, developed a set of program educational objectives that were compliant with ABET Criterion 2. We were then faced with deciding how to assess student achievement of those objectives in a way that would also be compliant with the criterion.

Based on these constraints and the experience of this author as an ABET program evaluator, watching other institutions' engineering programs struggle with how to do their educational objectives achievement evaluation, our faculty chose to use employer surveys as the primary method for assessing the achievement of the objectives that we had specified.

The next section of this paper describes our program objectives. The following two sections outline how we conducted that survey in a way that encouraged employers and graduates of our program to participate. Results of the first survey that was done in 2005 are contained in the next section. The paper ends with a description of the lessons learned, a change that we made our process and recommendations for other programs that might be considering employer surveys for this purpose.

### **Program Educational Objectives**

In 2000 the faculty established a set of educational outcomes for the program. They were first developed by the department faculty. Near the end of that academic year we surveyed all of our MSSE alumni and the members of our Industrial Advisory Committee, asking them to comment on the appropriateness of objectives and requesting suggestions for improvement. We received numerous responses and modified the objectives using that input. The resulting list of objectives follows.

The BSSE program alumni will, within the first three to five years after graduation,

1. Become members of organizations that develop or use software and/or enter graduate school.

2. Participate in teams that are responsible for the specification, design, construction, testing, deployment, maintenance or use of software systems.
3. Develop experience in additional areas of professional specialty which, when combined with their undergraduate education, will continue the path towards lifelong learning.
4. Use their engineering, communications, interpersonal and business skills to further their position in a business, government or academic environment.
5. Critically assess their engineering capabilities and acquire the additional knowledge and skills they need to maintain currency within their evolving work environment.
6. Assist their employers' organizations in achieving their business goals.

Those objectives were put in place, and remained unchanged, until 2004-2005 when the program was evaluated for accreditation by ABET. The program had its first graduates in May 2004. When we were preparing the ABET self study we did not yet have any graduates, so we were unable to gather any data about their success, or lack of success, in achieving the program outcomes. Instead of presenting data and the resulting improvements, we defined and described the process that we planned to use to evaluate the extent to which our graduates achieved those objectives and how the results would be used to improve the program outcomes. We did have six graduates in May 2004 and the ABET evaluation visit took place in October 2005.

The program evaluators recognized this shortcoming by saying the following in their exit statement.

“Criterion 2(d) requires a system of ongoing evaluation that demonstrates achievement of program educational outcomes and use of the results to improve the effectiveness of the program. The graduates of the program completed the program less than a year ago, and some of the educational objectives are unlikely to be achieved in such a short time. It is not yet possible to effectively evaluate whether or not those objectives are being achieved. The plan in place for evaluation includes performing an annual survey of program graduates and their employers during each of the first five years after their graduation.”

### **The Employer Survey Process**

The shortcoming described above was cited as a weakness. In order to resolve the weakness within the due process period, during the month of May, 2005 we surveyed the employers of the six May 2004 graduates of Monmouth University's BSSE program. We questioned the employers about the appropriateness of the program's educational objectives and the degree to which they believe that our May 2004 graduates had

achieved the program’s objectives. We also asked them for suggested additions or changes to the objectives and how the employee could have been better prepared for employment in their organization. A copy of the materials that were sent to the alumni for submission to their employers is shown in the Appendix. We sent that package to our alumni and requested their assistance in convincing their employers to respond.

The reader should note that in the attachment a statement was included which gave the graduate an opportunity to release their employer from any liability for releasing information which might be detrimental to the employee. The law generally shields employers from liability for making statements about an employee’s job performance to a person who has a legitimate need to know,<sup>10</sup> particularly if the employee has requested that the information be released. We believe that the inclusion of that statement, which was reviewed and approved by our university’s legal staff, provided the key to encouraging employers to respond.

### Survey Response and Data Analysis

The employers of all six of our graduates responded to the survey.

The following table shows the average score for the degree of agreement with statements indicating that the employee had achieved each objective during the first year after their graduation. A score of five indicates “strong agreement.” Four indicates “agreement” Three indicates “Do not know.” Two indicates “disagreement.” One indicates “strong disagreement.”

Objective Number	Average Score
1	5.0
2	4.8
3	4.5
4	4.5
5	4.3
6	4.5

Respondents made the following recommendations concerning how our graduates could have been better prepared for employment in their organizations. These have been listed verbatim from the survey responses, with specific names of our alumni excluded:

“XXXX sometimes needs to temper his/her enthusiasm for getting the job done with assessing all of the **ramifications of software changes**. However he/she has been a fast starter, and has accomplished a great deal in the 9 months that he/she has been with us.”

“YYYY is an excellent coder. However, he/she could have been better prepared for designing software. It is important to know the **difference between good and bad designs** in our field of work.”

“The only thing that Mr./Ms. ZZZZ is missing/lacking is knowledge and **experience dealing with real customers** who often want custom applications their way, not necessarily the best way.”

“**Business requirements gathering** – more background in this area would have been helpful.”

“QQQQ has been instrumental in helping to adopt current software development practices and has provided significant contributions to reengineer existing software. Currently our organization is working to adopt **software product line engineering** practices. QQQQ may have benefited from product line training provided by the Carnegie Mellon Software Engineering Institute. Through other training resources such as those taken at Monmouth University, he/she has become familiar enough with software product line practices to be an effective member of our organization.”

Respondents made the following suggestions regarding additions or changes to each objective. These are also listed verbatim from the survey responses:

- Objective 1
  - “I don’t think being a member of an organization such as IEEE helps a new graduate get started in the software field.”
- Objective 2
  - “I fully support this objective. It is essential that a new graduate/hire become a member of a team to gain experience in software development in a business environment.”
- Objective 3
  - No comments
- Objective 4
  - No comments
- Objective 5
  - No comments
- Objective 6
  - No comments

These results are based on very limited data. The strongest agreement is with Objective 1, which we knew had already been achieved by all 6 of our May 2004 graduates. All of them began their employment immediately after graduation and four, who were locally employed, had applied to our MSSE program. The weakest agreement was with Objective 5, which was stated in a way that would necessitate a longer period of time to determine whether the individual had achieved that objective.

Respondents did provide some very useful comments concerning how our graduates could have been better prepared for employment. However, each comment was made by only one respondent, so there is no confirming information from multiple respondents. We plan to combine these comments with recommendations from future surveys to look for repetition from additional respondents upon which we might make changes or improvements in the curriculum.

The recommendation for additions or changes to Objective 1 clearly shows that at least one respondent did not clearly understand the meaning of that objective. The word “organization” in that objective was intended to mean “employer.” The respondent interpreted it to mean a professional organization.

### **Improvements in Program and Objectives**

There were no surprises in the quantitative responses regarding our graduates’ achievement of the objectives with the exception that the responses were all very positive. The one that we would expect to be most quickly achieved, Number 1, had the strongest agreement. It is also one for which we already knew the answer. The one that we would expect to take the longest time to achieve, Number 5, produced the weakest agreement. Therefore, we concluded that no specific action should be taken now in response to the quantitative results.

In response to the comments about how our graduates could have been better prepared for employment we recommended that the instructors in courses where these issues are addressed very specifically insure that these topics are discussed and understood by the students in those courses. The specific courses in which these topics are addressed are:

**Ramification of software changes** – SE 312 – Software Verification, Validation and Maintenance. Changes had already been made to increase the emphasis on software maintenance.

**Differences between good and bad software designs** – SE 207 – Software Design and SE 485 - Software Engineering Practicum.

**Experience dealing with real customers** – SE 418 – Software Project Management and SE 485 – Software Engineering Practicum.

**Business requirements gathering** – SE 205 – Requirements Engineering and Specification.

**Product Line Engineering** – Not explicitly covered in any of our undergraduate courses, but it could be added to SE 205 – Requirements Engineering and Specification or to SE 403 - Software Process Improvement.

We should continue to watch for repetition of these comments in future employer surveys.



In response to one respondent's misinterpretation of the meaning of Objective 1 we recommended that the objective be changed to read, "Find employment in organizations that develop or use software and/or enter graduate school." This modification was subsequently reviewed with our Industrial Advisory Committee and approved by the program's faculty.

During the ABET due process period the survey and its findings were sufficient to resolve the weakness that was cited by the ABET program evaluators during the campus visit.

### **Lessons Learned**

While the employer survey produced little in the way of information that could be used to improve the program there were several lessons learned that might be of assistance to other programs. They were:

- 1) Programs should not delay initial accreditation visits waiting for sufficient data to become available to meet criterion 2. Even though data cannot usually be available at the time of the campus visit it is possible during the due process period to gather significant valid data from employers to resolve any shortcomings that might be cited.
- 2) Employers of individual alumni can be encouraged to respond to surveys by asking the alumni to provide an appropriate release, in writing, that makes employers more willing to provide what they probably consider to be private information.
- 3) Programs should not feel free to say that information cannot be obtained from the employers of their alumni for reasons of privacy. With the involvement of both alumni and employers it is possible to get sufficient employer response to meet the requirements of Criterion 2.

### **Planned Future Directions**

We plan to conduct an employer survey each year using essentially the same methods that we used the first year. It is still an open question as to whether we should survey the employers of all of our alumni every year or to survey the employers of only newly graduated alumni each year and follow-up with surveys of earlier graduates only during the third and fifth year after graduation.

### **Summary and Conclusions**

We believe that the process described in this paper for using employer surveys to evaluate achievement of program educational objectives for a software engineering program has been the first reported use in the literature for that purpose. The learnings

outlined above and will go a long way towards improving and simplifying the process of evaluating achievement. We believe that, because the data are so sparse there remains some uncertainty about the interpretation of the results, it clearly told us that employers were generally satisfied with our graduates and pointed to parts of the program where improvements might be needed in the future. We would encourage other software engineering programs to consider using similar evaluation processes and to report the results of their efforts to the broader engineering education community.

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*Department of Software Engineering*

May 3, 2005

<Title> <First Name> <Last Name>  
<Address>  
<City> <State> <Zip Code>

Dear <First Name>,

I hope all is well with you. It may be hard to believe, but it has been a year since you received your BSSE degree. As you may recall, during your senior interview I told you that we would be contacting you in about a year to help us with a survey of the employers who hired students who graduated from the Software Engineering program in May, 2004. It is now time to conduct that survey.

I would ask that you bring the attached questionnaire to your immediate supervisor or someone in your organization, who can answer the questions for us in cooperation with you.

Answers to these questions are required to achieve and maintain ABET accreditation for our Software Engineering program. We expect accreditation of our BSSE program to be announced in July, 2005. That accreditation will be retroactive to May, 2004. So, when it is awarded, it will apply to the program from which you graduated.

Because some employers may be reluctant to provide answers to these questions, we have included a form that you should complete and sign, requesting that your employer complete the questionnaire and releasing them from any liability associated with the answers they provide.

You or they should return the questionnaire in the envelope that is enclosed to me no later than May 15, 2005. If you have any questions about the attachment or anything else that I might be able to assist with, please feel free to give me a call at 732-571-4468.

We hope you are doing well and enjoying your work as a software engineer.

Thank you for your assistance and cooperation.

Sincerely,

James McDonald, Associate Professor and  
Chair – Department of Software Engineering



Dear Employer:

We understand that <First Name> <Last Name> is an employee in your organization. Graduates of Monmouth University's Bachelor of Science in Software Engineering program, who received their degree in May, 2004 are being asked to assist us in maintaining accreditation of the program. In order for our program to obtain and maintain accreditation from the Accreditation Board for Engineering and Technology (ABET), we are required to specify educational objectives for the program and to measure our graduates' achievement of those objectives. The objectives that we specify are intended to be things that our graduates should be able to achieve within the first few years after graduation. We are seeking your assistance to insure that the objectives we have selected are appropriate for your organization and to help us measure our graduates' progress towards achievement of those objectives.

On the next few pages you will see a series of questions about the objectives and your opinion about <First Name>'s achievement of those objectives. We would appreciate it if you would take a few minutes to review these questions and provide appropriate answers. When you complete the questionnaire please return it in the enclosed envelope by May 15, 2005, to:

Monmouth University  
Department of Software Engineering  
Room B6 Howard Hall  
Monmouth University  
West Long Branch, NJ 07748

We recognize that some employers may be reluctant to provide answers to these questions because of concerns for employee privacy. To address that issue we have provided, on the next page, a form on which <First Name> requests that you complete the questionnaire and releases you and your organization from any claims associated with the release of information about their employment.

I thank you for your assistance and your cooperation.

Sincerely,

James McDonald, Associate Professor and  
Chair – Department of Software Engineering

## RELEASE AND REQUEST

I, <First Name> <Last Name>, request that you provide answers to the questions on this and the following three pages and return them to the Software Engineering Department at Monmouth University.

I release \_\_\_\_\_  
(Print the Name of Person Completing the Form)

and \_\_\_\_\_ from any liability associated  
(Print the Name of the Employer's Organization)

with providing private information that might be contained in these answers.

Employee's Signature \_\_\_\_\_ Date \_\_\_\_\_

## QUESTIONNAIRE

The following educational objectives have been specified for graduates of Monmouth University's Bachelor of Science in Software Engineering program. Please review these objectives to determine if they are appropriate for new employees that you hire in your organization. If you believe that any addition or change should be made in the objectives, please note your recommended change below each objective.

Within the first few years after graduation, the graduates of the Bachelor of Science in Software Engineering program should:

- 1. Become members of organizations that develop or use software and/or enter graduate school.**

⇒ Additions or changes in objective 1

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- 2. Participate in teams that are responsible for the specification, design, construction, testing, deployment, maintenance or use of software systems.**

⇒ Additions or changes in objective 2

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**3. Develop experience in additional areas of professional specialty which, when combined with their undergraduate education, will continue the path towards lifelong learning.**

⇒ Additions or changes in objective 3

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**4. Use their engineering, communications, interpersonal and business skills to further their position in a business, government or academic environment.**

⇒ Additions or changes in objective 4

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**5. Critically assess their engineering capabilities and acquire the additional knowledge and skills they need to maintain currency within their evolving work environment.**

⇒ Additions or changes in objective 5

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**6. Assist their employer's organization in achieving its business goals.**

⇒ Additions or changes in objective 6

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Please select the level of agreement which you believe is most appropriate for each objective.

**1. <First Name> <Last Name> is a member of our organization, which develops or uses software.**

Strongly agree    Agree    Do not know    Disagree    Strongly Disagree

**2. <First Name> <Last Name> participates in teams that are responsible for the specification, design, construction, testing, deployment, maintenance or use of software systems.**

Strongly agree    Agree    Do not know    Disagree    Strongly Disagree

**3. <First Name> <Last Name> has had experience with us in areas of professional specialty which will allow him to continue learn throughout his lifetime.**

Strongly agree    Agree    Do not know    Disagree    Strongly Disagree

**4. <First Name> <Last Name> has used his engineering, communications, interpersonal and business skills to further his position in our environment.**

Strongly agree    Agree    Do not know    Disagree    Strongly Disagree

**5. <First Name> <Last Name> is able to assess his engineering capabilities and acquire the additional knowledge and skills he needs to maintain currency within our evolving work environment.**

Strongly agree    Agree    Do not know    Disagree    Strongly Disagree

**6. <First Name> <Last Name> has assisted our organization in achieving our business goals.**

Strongly agree    Agree    Do not know    Disagree    Strongly Disagree

**Finally, please provide one recommendation concerning how <First Name> <Last Name> could have been better prepared for employment in your organization.**

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