

Experiences with a Graduating Engineering Exit Survey at Baylor University

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Abstract

Baylor University is in the midst of preparing for accreditation under the ABET EC2000 in fall 2005. As such, the department is evaluating its assessment tools and looking at the validity of each instrument. One such tool is the Graduating Engineering Exit Survey. This tool is administered to all graduating seniors from the engineering department during the normal final exam period for their senior design capstone course (which does not have a scheduled final exam). The survey is a graduation requirement and allows the student to give feedback on the program in several areas. The first area has the student to evaluate themselves on the Expected Graduate Outcomes for the engineering program. Comments are encouraged. Another area allows the students to comment on individual faculty. Two questions are asked: "How effective was the professor in aiding me in the learning process?" and "How effective was the professor in stimulating my interest in the engineering profession?" Comments are also included. There are questions that rate the facilities and equipment as well as a series of essay questions designed to identify the department's strengths and weaknesses. Questions are also asked about attrition. The results of the survey give an interesting profile of the department and its effectiveness with the graduates.

Introduction

Assessment is one of those words that cause many different reactions in faculty, mostly negative. The assessment process, to include the improvement of courses, is seen as adding additional load to the faculty. It has the potential to take significant time depending on the types of assessments used and their application to the process. Baylor University's Department of Engineering is preparing for their first evaluation under the new ABET EC 2000 criterion. Part of that preparation is evaluating the assessment tools currently in place and determining if these tools accomplish their tasks in support of both the Program Educational Objectives (PEO) and Expected Graduate Outcomes (EGO). If tools are currently in place that will accomplish the desired result, then it is not necessary to add additional taskings. A recent evaluation of the Expected Graduate Outcomes at Baylor University mapped where the engineering curriculum supported these EGOs. While courses support the EGOs, it is often necessary to inquire of graduating students

their perception of how well the engineering program accomplished the tasks. Most universities do this through the administration of an exit survey and Baylor University is no exception. Anderson et al.¹ at the University of Wisconsin-Platteville see the exit survey data from graduating seniors as one of their nine important assessment measurement tools. Their exit survey is only one of five surveys used in their department for assessment. Gustafson and Merrill² from The Ohio State University see three surveys that are essential for assessment: exiting seniors, recent alumni, and managers/supervisors of alumni. Still others, such as Texas A&M University-Kingsville, have ten different surveys among which the exit survey is included³. The use of surveys, in particular exit surveys, should not be the only tool available. Results from the surveys must be integrated into the total assessment program⁴. The surveys must be carefully designed to achieve the desired ends. Exit surveys from different institutions are widely varied. Most, however, do include some evaluation of the ABET EC 2000 Criteria, also known as “a through k.” Many departments, including Baylor University, use the ABET wording almost exclusively to insure that the evaluation can be properly mapped^{4,5}. Most institutions, including Baylor University, also add criteria that are program specific or that emphasize values important to the institution. In the end, exit surveys are a means of assessing graduate satisfaction⁶ with the program and serve as a basis for comparison with alumni surveys^{7,8,9}. Other institutions highlight comparisons with employer surveys¹⁰.

Baylor University Assessment Surveys

The Department of Engineering at Baylor University conducts a number of surveys, mainly with the students. The only survey not administered to students is the alumni survey. All student surveys are anonymous. Since there is only one department with three degreed programs (Engineering, Mechanical, and Electrical/Computer), the courses in which to conduct the assessments must be courses that all students take. The first survey is administered to incoming engineering freshmen on their first day in the introductory engineering course to obtain profile information. The department is interested in skill levels, expectations of the program, motivation for entering the program and how they found out about the program. All of this information is important for use in retention studies. The second survey that student receive is at the end of the introductory engineering course. At this point in their career they have been introduced to the profession and the department, to include some familiarization with ABET evaluation and what accreditation means for the program. The EGOs are evaluated based on how the student feels the course accomplished its tasks. Obviously, the students have had only one course and one course alone is not able to accomplish all the outcomes. The next student survey is at the end of the Electronics Circuits course. This course is normally taken in the spring semester of the sophomore year. The idea behind these interim assessments is to track how the students’ perceptions of the department’s accomplishment of the EGOs changes. This technique was also used by Rojas-Oviedo et al. at Alabama A&M University¹¹. The next milestone course that all students must take is the Junior Design course. This course must be taken sometime in the junior year. The last student survey of EGOs is conducted during the two-hour final exam period for the Senior Design course. This course is required to be taken in the last semester of the

senior year, whenever that occurs. The Exit Survey for Graduating Engineering Students is included as an attachment.

Exit Survey for Graduating Engineering Students

The Exit Survey for Graduating Engineering Students consists of five pages and is included as an attachment. The first page states the purpose of the survey:

“The purpose of the survey is to give our graduating students an input into the value of your engineering education for the assessment of the Baylor University engineering program. For this reason we request you take your time and answer truthfully and carefully.”

The survey is administered during the two hour exam period for the senior design course as there is no required examination. This insures that the students are available with no external conflicts and can dedicate the time to the survey. After completion, the surveys are placed in a sealed envelope by a designated student and then returned to the department administrative assistant. The department administrative assistant holds the unopened envelope until after graduation and then presents the surveys to the department chair.

The first page of the survey asks for background information. On the first page, students are asked to write information such as name, age, gender, permanent address and any future plans if known (either employment or graduate school). Since the surveys are anonymous, this first page is stripped from the survey by the department chair after the envelope is opened and used by the department administrative assistant for the alumni database.

The second page asks the students to evaluate the extent they have acquired each of the capabilities/characteristics required by the EGOs. The EGOs are phrased as a positive statement such as “I am able to...” and the students respond by agreeing or disagreeing using one of four possible choices; strongly disagree, disagree, agree, or strongly agree. Four responses were chosen to force the student to make a decision and not mark the central or neutral answer. In addition to marking the appropriate choice, the students are encouraged to make written comments.

The third page of the survey evaluates the faculty. Because of the sensitive nature of the material, this information was not available to the author for this paper. Each professor is listed and the student is requested to record the number of classes they had with each professor. The also rate each professor on a 1 to 5 scale (5 being outstanding – 1 needs improvement) on the following two questions:

1. How effective was the professor in adding me in the learning process?
2. How effective was the professor in stimulating my interest in the engineering profession?

There is also a space provided for written comments. The potential exists for students to be painfully honest about their experiences. This part of the survey could also be construed as a popularity poll for professors. If the students are honest in their evaluation, then the possibility exists for the department chair to get a good assessment of the faculty and identify any areas or professors that need improvement. As Baylor University places in importance on quality teaching, this is of utmost importance.

The fourth page asks the students to assess the faculty overall, department staff, engineering facilities overall, and the engineering equipment overall. The scale ranges from “needs improvement” to “outstanding”. The rest of the survey consists of questions or statements that the students respond to in writing. Since Baylor University is an institution with a Baptist tradition, the first questions asks students to comment on how the department contributes to the University mission of offering an academic environment in a Christian environment. The next two statements on the page ask the student to describe one or two of the best experience and one or two of the worst experiences.

The last page has four more questions/statements to evaluate in writing. The first asks what the students would change if they were Chairperson. The next two ask the students to list the two courses most useful in their engineering education and the two courses least useful. The last question deals with the topic of retention. The students are asked to comment on what helped them succeed and what they think caused others not to be successful or lose interest in engineering.

Results

Data was taken for each graduating class. The majority of students graduate in the spring. Some students, due to academic difficulties or scheduling conflicts graduate in the fall. Table 1 shows graduates in their respective semesters. The department offers three separate B.S. degrees: Electrical and Computer Engineering (ECE), Mechanical Engineering (ME), and Engineering (EGR). It is important to track the individual major as this has an enormous impact on topics such as which courses contributed the most and least to their education. While the numbers are not statistically significant, it still is important to survey the students and obtain the best information possible. Data was taken for all semesters from 1998 however, at the time of writing this paper no analysis had been done. Due to the volume of data, only some of the more recent years have been investigated. Also, some of the data has been lost due to unavoidable circumstances.

Table 1 Graduation statistics

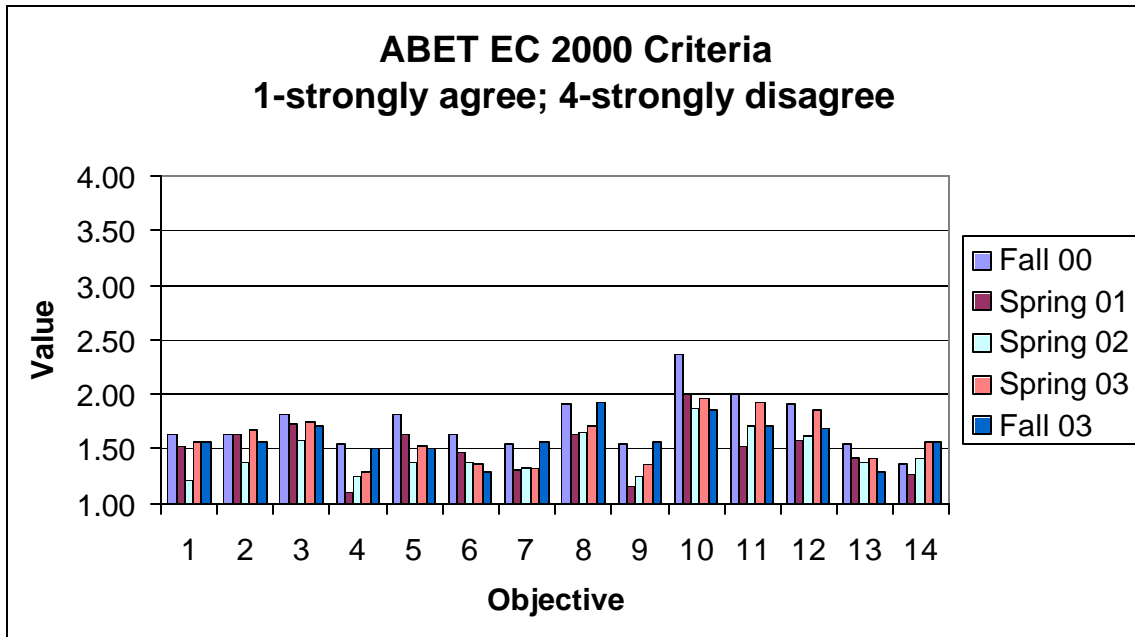
	Total	ECE	ME	EGR
Fall 00	11	4	3	4
Spring 01	19	8	8	3
Spring 02	24	11	12	1
Spring 03	28	17	7	4
Fall 03	14	9	4	1

The first survey page evaluated the EGOs which are listed below:

1. I am able to apply knowledge of mathematics, science, and engineering
2. I am able to design and conduct experiments, as well as analyze and interpret data.
3. I am able to design a system, component, or process to meet desired needs.
4. I am able to function on multi-disciplinary teams.
5. I am able to identify, formulate, and solve engineering problems
6. I understand professional ethical responsibility.
7. I am able to communicate effectively.
8. I understand the impact of engineering solutions in a global and societal context.
9. I recognize the need for, and an ability to engage in lifelong learning.
10. I have a knowledge of contemporary issues.
11. I am able to use the techniques, skills, and modern engineering tools necessary for engineering practice.
12. I have a broad spectrum of expertise and will be productive when faced with problems that transcend the boundaries of a single engineering discipline.
13. I recognize and support the fundamental principle of the code of ethics to “uphold and advance the integrity, honor, and dignity” of the engineering profession.
14. I am able to use the computer effectively in all engineering functions where it is appropriate.

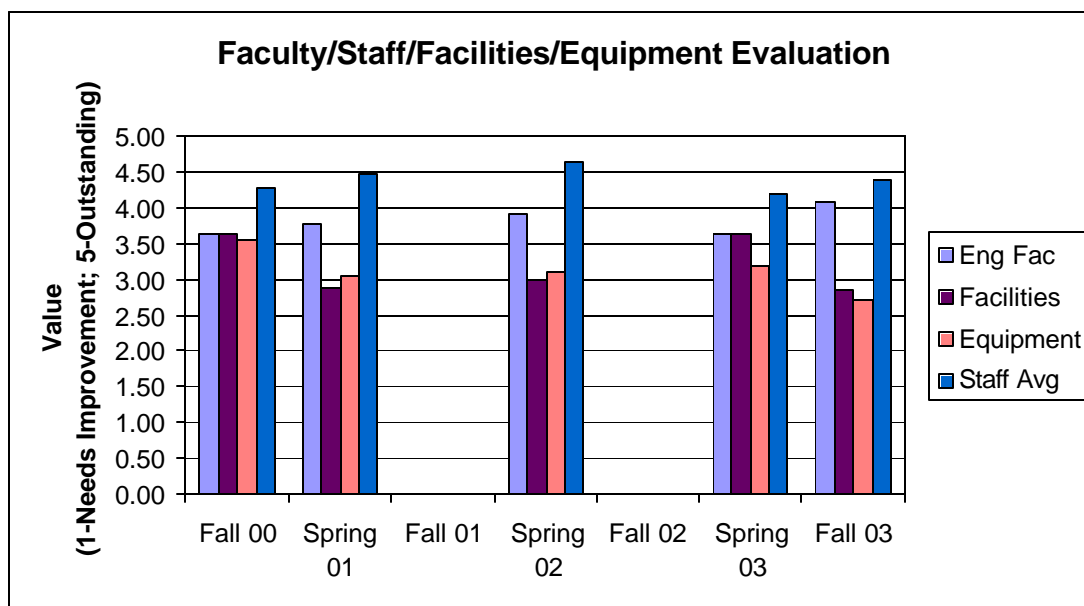
Figure 1 shows the compilation of the results for these semesters for all graduates. A low score on the graph is a better score. Most scores are between 1.0 to 1.5 and clearly show the students have a good perception about their education in the engineering program. Several EGOs had numbers close to 2.0: EGOs 8, 10, 11 and 12. EGO 8 is a subject that is not explicitly taught in most traditional engineering programs. The responses would indicate that the students did not understand how this topic was integrated into the curriculum. Some students commented it depended on the class. Other comments about adding more “real world” experiences were also given by the students. This is clearly an area in which the curriculum can improve. EGO 10 covers a similar topic, contemporary issues. The students commented that exposure to this topic should be increased in the curriculum. They also said some professors are doing a better job than others. The survey could identify an opportunity to learn from faculty that are already incorporating contemporary issues into their classes. EGOs 11 and 12 generally reflect the confidence and exposure to situations that the students experienced. The comments centered on possible software packages that were not part of the program that might be useful in industry. Not every software package can be taught but the faculty should evaluate software periodically to determine its general use in industry.

Figure 1 Expected Graduate Outcomes



The faculty evaluations were not considered in this paper due to privacy concerns. The next quantifiable data set was the Faculty/Staff/Facilities/Equipment evaluation shown in Figure 2.

Figure 2 Evaluation of Faculty/Staff/Facilities/Equipment



The data show that the students are generally pleased with the overall faculty. The staff consistently rate high which reflects the willingness of the staff to help the students in all aspects of their educational experience. Facilities and equipment rank relatively lower. The department is aware that space and budget are limited. The students have limited space to study in the building. Steps have been taken to improve existing areas such as renovation of the student lounge. Another complaint about facilities is always computers. There are never enough and they are not good enough. The department has a plan to replace computers periodically. The faculty and administration should give the students a “state of the department” presentation to keep them informed.

The rest of the survey deals with specific questions which presents the problem. In order for the written comments to be useful, the comments must be read and collated. Reading each comment gives insight into what the student perceptions are concerning the program. The question dealing with Christian environment brought very positive responses. The faculty is perceived as a fine, Christian faculty willing to help in any way. Several commented that the department was a good example for the campus while other said that the level of Christian environment was just right. Most recognized the difficulty of integrating faith in into the engineering curriculum. It must be a natural topic that fits with the subject. The best and worst experiences tended to be courses that contributed the most and least to their education. There were comments on many individual professors and how they had helped during their academic career. Other comments talked about bad experiences with professors or how some professors were not as good as others. For some it was an opportunity to vent but most gave honest, constructive comments. Classes and experiences that were positive included the Junior and Senior design courses and many of the elective courses. Students saw the connection with their vocation through these courses. Classes and experience that were negative centered around professors who, in the students’ opinion, taught poorly or required classes in engineering taught by the other engineering specialty (i.e. electronic circuits for ME students and Dynamics/Statics for ECE students). The question about what changes would be made if the student was a Chairperson reinforced some things seen on the first page of the survey. Students feel more industrial experience is necessary in the department for “real world” experiences. Several of the new faculty have addressed this concern by have some connection with industry. The last question addressed what qualities enabled the students to complete the program. Most of the comments highlighted the discipline necessary to get the job done and the commitment to completing the degree. Students who left the program did not have the vision.

Conclusion

Surveys have an important place in the assessment of an engineering program. The problem with surveys is compiling the data. The exit survey used by Baylor University has some quantifiable information but most of the questions are very subjective. It is difficult for written comments to be useful as they are subject to interpretation. In fact the difficulty with written comments had prevented the surveys from becoming useful until this analysis. After reading the comments some very useful insights are gained.

These insights can then be used in affirming or changing the program as necessary. Many of the issues addressed by the students have already been improved. Others are beyond the immediate control of the department. What is clear is that more must be done to emphasize the importance of assessment and feed back for the program to grow and improve. If this can be instilled in the students while at Baylor, when they graduate they will be more willing participants in the survey process as alumni.

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Baylor University
Department of Engineering
Exit Survey for Graduating Engineering Students

The purpose of this survey is to give our graduating students an input into the value of your engineering education for the assessment of the Baylor University engineering program. For this reason we request you take your time and answer truthfully and carefully.

Name _____		Date _____	
Degree / Major:	BSECE	BSME	BSE
Sex:	M	F	Age _____
Permanent Address _____			

Future Plans – If known										
Full-Time Employment	Graduate School									
Company _____	Institution _____									
Company Address _____	Degree _____									
_____	Major _____									
_____	Financial Assistance:									
Job Title/Description:	_____									
_____	Other									
Salary Range										
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**Baylor University
Department of Engineering**

Please assess to what extent you have acquired each of the following capabilities/characteristics during your entire experience in the Baylor engineering program. Consider your experiences from the time you entered Baylor to the present. Please indicate your major and include written comments.

Major _____	<small>(check one box per question)</small>	<small>Strongly Disagree</small>	<small>Disagree</small>	<small>Agree</small>	<small>Strongly Agree</small>
1. I am able to apply knowledge of mathematics, science, and engineering.	<input type="checkbox"/> SD	<input type="checkbox"/> D	<input type="checkbox"/> A	<input type="checkbox"/> SA	
<hr/>					
2. I am able to design and conduct experiments, as well as analyze and interpret data.	<input type="checkbox"/> SD	<input type="checkbox"/> D	<input type="checkbox"/> A	<input type="checkbox"/> SA	
<hr/>					
3. I am able to design a system, component, or process to meet desired needs.	<input type="checkbox"/> SD	<input type="checkbox"/> D	<input type="checkbox"/> A	<input type="checkbox"/> SA	
<hr/>					
4. I am able to function on multi-disciplinary teams.	<input type="checkbox"/> SD	<input type="checkbox"/> D	<input type="checkbox"/> A	<input type="checkbox"/> SA	
<hr/>					
5. I am able to identify, formulate, and solve engineering problems.	<input type="checkbox"/> SD	<input type="checkbox"/> D	<input type="checkbox"/> A	<input type="checkbox"/> SA	
<hr/>					
6. I understand professional ethical responsibility.	<input type="checkbox"/> SD	<input type="checkbox"/> D	<input type="checkbox"/> A	<input type="checkbox"/> SA	
<hr/>					
7. I am able to communicate effectively.	<input type="checkbox"/> SD	<input type="checkbox"/> D	<input type="checkbox"/> A	<input type="checkbox"/> SA	
<hr/>					
8. I understand the impact of engineering solutions in a global and societal context.	<input type="checkbox"/> SD	<input type="checkbox"/> D	<input type="checkbox"/> A	<input type="checkbox"/> SA	
<hr/>					
9. I recognize the need for, and an ability to engage in lifelong learning.	<input type="checkbox"/> SD	<input type="checkbox"/> D	<input type="checkbox"/> A	<input type="checkbox"/> SA	
<hr/>					
10. I have a knowledge of contemporary issues.	<input type="checkbox"/> SD	<input type="checkbox"/> D	<input type="checkbox"/> A	<input type="checkbox"/> SA	
<hr/>					
11. I am able to use the techniques, skills, and modern engineering tools necessary for engineering practice.	<input type="checkbox"/> SD	<input type="checkbox"/> D	<input type="checkbox"/> A	<input type="checkbox"/> SA	
<hr/>					
12. I have a broad spectrum of expertise and will be productive when faced with problems that transcend the boundaries of a single engineering discipline.	<input type="checkbox"/> SD	<input type="checkbox"/> D	<input type="checkbox"/> A	<input type="checkbox"/> SA	
<hr/>					
13. I recognize and support the fundamental principle of the code of ethics to "uphold and advance the integrity, honor, and dignity" of the engineering profession.	<input type="checkbox"/> SD	<input type="checkbox"/> D	<input type="checkbox"/> A	<input type="checkbox"/> SA	
<hr/>					
14. I am able to use the computer effectively in all engineering functions where it is appropriate.	<input type="checkbox"/> SD	<input type="checkbox"/> D	<input type="checkbox"/> A	<input type="checkbox"/> SA	
<hr/>					

(check one box per question)

Needs Improvement Acceptable Outstanding

Please rate the engineering faculty overall.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Please rate the department staff overall: secretary (Ms. Kerr)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Please rate the department staff overall: electronic systems manager (Mr. Hromadka)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Please rate the department staff overall: machinist (Mr. Gerik)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Please rate the engineering facilities overall: building, classrooms, labs, etc.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Please rate the engineering equipment overall: computers, lab instruments, etc.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

In what ways and how successfully does the Department of Engineering contribute to the University mission of offering academic excellence in a Christian environment?

Describe one or two of your best experiences in the Department.

Describe one or two of your worst experiences in the Department.

If you were the Chairperson of the Department of Engineering, what would you change about the department or curriculum and how would you change it?

List two engineering courses you feel were the most useful for your engineering education. Briefly explain.

List two engineering courses you feel were the least useful for your engineering education. Briefly explain.

The engineering classmates you are graduating with represent a fraction of the number that began with you in the freshman year. Give your perspective as to what factors or attributes allowed you to succeed in engineering and what factors or attributes caused others not to be successful or to lose interest in engineering.
