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EMBEDDING ASSESSMENT INTO THE END OF COURSE EVALUATION FORM

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Abstract
At the conclusion of almost every college-level course students are asked to complete an end of semester course evaluation form. This paper describes the adaptation of this evaluation form for use as an additional assessment tool. ABET accreditation requires that degree programs implement assessment processes as a part of a continuous improvement plan. This requires that multiple assessment tools be used in addition to traditional assessment by exams, quizzes, and lab reports. The modified end of course evaluation form described in this paper fits into this continuous improvement plan very well, as it provides a reliable means of collecting longitudinal data spanning several years. The new end of course evaluation form used in the Department of Engineering Technology at the University of Arkansas at Little Rock (UALR) now contains three sections. The first two sections: "Course" and "Instructor", each contain five questions that are common to all of our Engineering Technology courses. The third section titled "Student self-assessment of course learning objectives" contains questions that are specific to the particular course. For example, in the Electronic Devices I course, which deals with analog electronics, one of the questions is: "I am capable of analyzing circuits containing diodes". This question measures the students' perceptions of whether they can analyze circuits containing diodes. If students answer this question negatively, it indicates that some corrective action may be required the next time that the course is taught. The data collected every semester also enables a longer term perspective, not always available with traditional assessment tools. This paper describes the implementation of this new assessment tool.

1. Introduction

UALR offers baccalaureate degrees in Electronics and Computer Engineering Technology (ECET) and Mechanical Engineering Technology (MET). As with all degrees accredited by ABET, these degree programs are required to implement a continuous improvement plan (CIP). ABET states that [1]:

"The program must use a documented process incorporating relevant data to regularly assess its program educational objectives and program outcome, and to evaluate the extent to which they are being met. The results of these evaluations of program educational objectives and program outcomes must be used to effect continuous improvement of the program through a documented plan."

At the core of the CIP must be the program outcomes along with ABET's general criteria 3 of 'a' through 'k'. Assessment of both of these components should be done ideally using a variety of different methods [2,3,4]. Such methods have traditionally included direct measurements such as tailored exam questions, quizzes, and laboratory assignments that correspond to specific program outcomes. Other methods include exit surveys of graduating seniors and surveys of employers'/employees' (former graduates) job satisfaction, although these are usually used to measure the broader program educational objectives. The CIP must use the results of these measurements to make positive changes to the program, in a well-documented manner. For the CIP to be successful it must be well defined and manageable. Often programs accumulate a great deal of data, but struggle to use it effectively. Other times programs identify deficiencies and make appropriate course/curriculum changes but fail to document them. In fact a program may be properly executing elements of a CIP, but could be cited for not demonstrating that it has adequately measured its program outcomes.

2. The Modified End of Course Evaluation Form

In the spring of 2009 the Department of Engineering Technology at the University of Arkansas at Little Rock modified its end of course evaluation form so as to use it as an additional assessment tool. The form previously consisted of questions related primarily to the instructor. Each course now has its own custom evaluation form. Fig. 1 shows the end of course evaluation form for the Electronic Devices I course (ECET 3405), which is a typical analog devices course dealing primarily with diodes, transistors, and op-amps. This course is a part of the ECET baccalaureate degree. For this course, students answer each of eighteen questions using a scale of 1 through 5, where 1 corresponds to "strongly agree" and 5 corresponds to "strongly disagree". The first two parts of the form are common to all courses. Part one consists of five questions, which deal with such topics as prerequisites, the course textbook, and course structure. The second part of the course focuses on the instructor and addresses such issues as: instructor preparedness, accessibility of the instructor, and the management of the course. Questions 11 through 18 on the form are related to some of the program outcomes via the learning objectives of the course and ABET's general criteria 3. The number of questions in part three of the form varies from course to course. Questions 11 through 14 address the specific course topics of: diodes, BJTs (Bipolar Junction Transistors), MOSFETs (Metal Oxide Semiconductor Field Effect Transistors), and operational amplifiers. All of the questions relate to ABET criteria, with questions 15 through 17 specifically corresponding to one of ABET's general criteria 3. Clearly, it is unlikely that all eleven of ABET's criteria ('a' through 'k') would ever all be applicable to any one course. In this case the three criteria that were applicable were used. Questions 15 through 17 correspond to ABET criteria: 3(g) "an ability to communicate effectively", 3(f) "an ability to identify, analyze and solve technical problems", and 3(c) "an ability to conduct, analyze and interpret experiments, and apply experimental results to improve processes", respectively. The remaining question seeks to measure how stimulating students found the course. The forms for other courses are similar with questions 11 onwards being related to the learning objectives of the respective courses and the appropriate ABET criteria.

Please rank your response to each statement on this page according to the following scale:

1. Strongly Agree 2. Agree 3. Neutral 4. Disagree 5. Strongly Disagree

Course

1. The course serves an important part of my degree objectives.
2. The required prerequisites are adequate and justified.
3. The course provides a balance between theory and applied experience.
4. The sequence of course topics reinforces my learning experience.
5. The textbook and reference materials, if any, are useful and adequate.

Instructor

6. The instructor is well prepared.
7. The combination of lecture and visual presentations helps me better understand the course material.
8. The instructor encourages student questions and manages classroom interaction.
9. The instructor is available to students who are in need of help.
10. I highly regard the instructor's performance in teaching this course.

Student self-assessment of course learning objectives

11. I am capable to analyzing circuits containing diodes.
12. I am capable of analyzing circuits containing bipolar junction transistors.
13. I know how to use a MOSFET as a switch.
14. I am capable of constructing and analyzing basic op-amp circuits
15. This course has helped me learn to communicate effectively.
16. This course has improved my ability to identify, analyze and solve technical problems
17. This course has improved my ability to conduct, analyze and interpret experiments, and apply experimental results to improve processes.
18. This course has stimulated my interest in seeking further knowledge in this field.

Figure 1. The End of Course Evaluation Form for ECET 3405.

All of the course specific questions are related to its program outcomes (ECET or MET). The ECET program has the following program outcomes:

1. Be able to specify, design, analyze and implement hardware, software, and integrated systems.
2. Have the ability to formulate problems, design experiments, collect, analyze and interpret data, and use this knowledge to design a system, or process to meet desired needs.

3. Be able to apply knowledge gained in mathematics and sciences, and electronics and computer engineering technology, to the solutions of real-world applications using adaptive problem-solving skills.
4. Be able to communicate effectively both orally and in writing.
5. Be able to work productively in teams, including team building, management, and leadership skills.
6. Understand the importance of continuous life-long learning.
7. Recognize the importance and relevance of personal and professional ethics.

3. Use of the New Evaluation Form

A key part of the CIP is the assessment of the program outcomes and this has to be demonstrable. It is not sufficient to merely make these assessments. The new evaluation form provides a measurement scheme that can be executed systematically every semester that the course is offered. The returned data is in the form of a numerical score so it can easily be quantified and tabulated or incorporated into a data base. In terms of the program outcomes the ECET 3405 evaluation form uses questions 11 through 14 to assess program outcome 2. Question 15 measures program outcome 4. Questions 15 and 16 also assess program outcome 2. Therefore, the form demonstrates the assessment of two program outcomes, linked to ABET criteria. It must be noted that program outcomes are typically quite broad, however, the structure of this new evaluation form also provides for the assessment of specific course topics.

Consider a specific self-assessment question asked of students on the ECET 3405 form: "I am capable of constructing and analyzing basic op-amp circuits" (question 14). Students respond to this question on a scale of from (1) strongly agree to (5) strongly disagree. A negative response (especially very negative) would be a cause for concern, as it indicates that a student does not feel confident about that topic. This cause for concern should be amplified if the overall average response from all students is negative and would certainly indicate that corrective action is warranted. However, if the negative response is limited to a single or very few students then corrective action may not be required. Positive or very positive responses do not ensure that students actually have the capabilities that they indicate, but in and of themselves do not indicate a need for any action.

Each course in the Engineering Technology Department has its own spreadsheet. Each time that a course is offered the responses to the student self assessment questions are incorporated into its spreadsheet. In this way data from several years can be plotted, revealing any trends that may be present. Any negative trend over the course of several semesters, in which student responses indicate that they have become less confident in their capabilities, should be of concern.

Taken together, the semester specific responses and the longitudinal trends can serve as an indicator that corrective action, or fine tuning of the course may be required. These actions may include pedagogical changes or even a deficiency in a prerequisite course. Of course, traditional assessment methods such as quizzes, homework, exams, and laboratories should be used to confirm the conclusions drawn from the student self assessment form.

4. Conclusions

An additional assessment tool has been developed. This tool has been implemented for every engineering technology course allowing students to make self assessments and as such provides a means of measuring students' perceptions. Severely negative responses from students can serve as an early indicator that corrective action is required for a specific course. More subtle long term problems with a course may be revealed by examination of the trends in student responses over a period of several semesters. This tool is not designed to replace any existing assessment method but rather to complement them. It provides a straightforward method of collecting quantifiable assessment data. It would make any continuous improvement more robust, by making the collection of assessment data more multifaceted.

5. References

[1] ABET Accreditation Criteria for Technology, http://www.abet.org/forms.shtml#For_Technology_Programs_Only.

[2] Charles R. Lang and Hakan Gurocak, "Assessment Methods for the Upcoming ABET Accreditation Criteria for Computer Science Programs", 38th ASEE/IEEE Frontiers in Education Conference, October 22 – 25, 2008, Saratoga Springs, NY.

[3] Shaeiwitz, J. and Briedis, D., "Direct Assessment Measures", Proceedings of the 2007 ASEE Annual Conference and Exposition, June 2007, Honolulu, Hawaii.

[4] Dettman, M., "Effective, Efficient, Direct Assessment of Programmatic Outcomes", Proceedings of the 2005 ASEE Annual Conference and Exposition, June 2005, Portland, OR.

Biographical Information

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Dr. Menhart currently serves as a Professor of Electronics and Computer Engineering Technology at the University of Arkansas at Little Rock. He teaches courses primarily in digital systems design (VHDL) and microcontrollers. His current research interests include digital control and energy efficiency related issues.