COURSE REVIEW IN THE ASSESMENT PROCESS

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Abstract
A joint program in Electrical Engineering has been created with Western Kentucky University (WKU) and the University of Louisville (UofL). The program resides at WKU with UofL faculty delivering 16-24 hours into the curriculum through distance learning methods. The focus of the new EE program is a project-based curriculum. WKU's Electrical Engineering Program has developed an assessment plan to insure a systematic pursuit of improvement. A major component of this assessment process is course review. Immediately following each semester, EE faculty conduct course review of all courses taught during the previous semester. This review is used to evaluate courses within the larger context of the program. Course review is also a place for implementation of changes due to the assessment process. The engineering faculty discuss how and where changes are needed in order to improve the program as a whole. In addition, course review is used ensure that course outcomes are being meet. If problems exist action plans are proposed to improve the courses.

Introduction

Western Kentucky University had an engineering technology program for over three decades. However, due to the growth and development of local industries it was determined that engineering technology was under serving regional needs. In 2000, the Commonwealth of Kentucky's Council for Postsecondary Education (CPE) created the Statewide Strategy for Engineering Education. WKU phased out the engineering technology program and phased in the engineering program. In the spring of 2004 WKU graduated their first cohort of engineering students. The electrical engineering program at WKU is jointly offered with the University of Louisville. The initial ABET visit for this program occurred November 2004.

The focus of the new WKU Department of Engineering is project-based engineering education. An excerpt from departmental mission statement exemplifies the focus clearly[1]:

> *"The mission of the Department of Engineering is to produce, as its graduates, competent engineering practitioners. An engineering practitioner is one who has a foundation of basic science, mathematics, and engineering knowledge, combined with practical knowledge and experience in applying existing technology to contemporary problems."*

Western Kentucky University's vision has been to develop new engineering programs that are more suitable to the relevant local industries and the students' learning styles. We have deliberately focused on building a new curriculum centered on the need for successful practicing engineers while not attempting to simply replicate existing engineering programs from other schools. Project-based learning model was adopted for this purpose[2]. Project-based learning is gaining more support in the American undergraduate engineering education[3,4]. Our Electrical Engineering program has strong emphasis on the implementation of design experiences at all levels of the curriculum. The program is committed to producing graduates who are well prepared for the start of productive, successful careers as practicing engineers. An engineering program is a living entity, not just a list of courses and syllabi organized into a catalog.

We recognize the progression of student experiences required to help students grow from "Learners" into "Observers" and "Assistants" and eventually "Practitioners". These are our "Roles of the Student"[2] in a project-based curriculum and this philosophy has shaped our development of the curriculum and departmental faculty promotion policy[5].

Development of Program Outcomes

An initial version of the program outcomes were drafted during the summer of 2002 by the program faculty. In addition, faculty members began to develop measurement tools. That work continued through the fall semester of 2002 and culminated with a review of external consultants in the spring semester of 2003. The program faculty presented the outcomes were presented to the program advisory committee in both the spring and fall meetings of the 2002-2003 academic year. The assessment process began in the fall semester of 2001 and continues.

The EE program at WKU has defined the following six Program Outcomes[1,6], shown below. The Program Outcomes are entirely consistent with the goals of the Department of Engineering. These measurable outcomes then become characteristics of the graduates that they take into their careers. Through academic experiences and appropriate training, the graduates are prepared for their careers and will enjoy success and growth in their field of endeavor. These outcomes cover the ABET criteria 3[7].

1A) EE graduates possess knowledge of core EE topics including circuit analysis, electric machines, microprocessors, and control systems, and can develop mathematical representations of systems

1B) EE graduates use their understanding of science and mathematics to support their work in solving electrical engineering problems.

2A) EE graduates plan and implement cost-effective electrical engineering designs using modern engineering equipment and software.

2B) EE graduates can effectively work with and on multi-disciplinary teams and understand the importance of teamwork in an engineering environment.

3) EE graduates are aware of trends in electrical engineering and are engaged in path of life-long learning.

4) EE graduates are committed to excellence in all professional endeavors and apply their understanding of ethics to solve engineering problems.

5) EE graduates effectively communicate technical material in an oral, written, visual, and graphical manner

6) Regional employers will employ WKU electrical engineering graduates.

The EE Program at WKU is dedicated to a continuous improvement. Assessment is an integral part of the development of the program. WKU used the development of a new program to make assessment an integral part of the program. A multi-loop assessment process is used to evaluate the overall program outcomes and objectives. This multi-loop process is shown in Figure 1 on the next page. The interior loops represent the assessment of the Program Outcomes. The inner loop represents the course review process. At the conclusion of every semester all faculty who taught courses in the program participate in course review. This includes the evaluation of survey data, rubrics, and other information. The results of the assessment loops are then combined to determine if the program outcomes and have been met.

The assessment of each outcome is achieved using a variety of measures, including

- Review of course material using rubrics
- Fundamentals of Engineering (FE) Exam
- Surveys of graduating seniors
- Survey of our Industrial Advisory Board

Faculty evaluation of outcomes takes place in two forms. Each semester, faculty members hold a course review session to review every engineering course taught in the program. The primary function of the course review is to improve course outcome delivery; however the integration of the courses across the curriculum is also discussed. The second review is performed annually, where the faculty reports and discusses the data gathered for each Program Outcome.

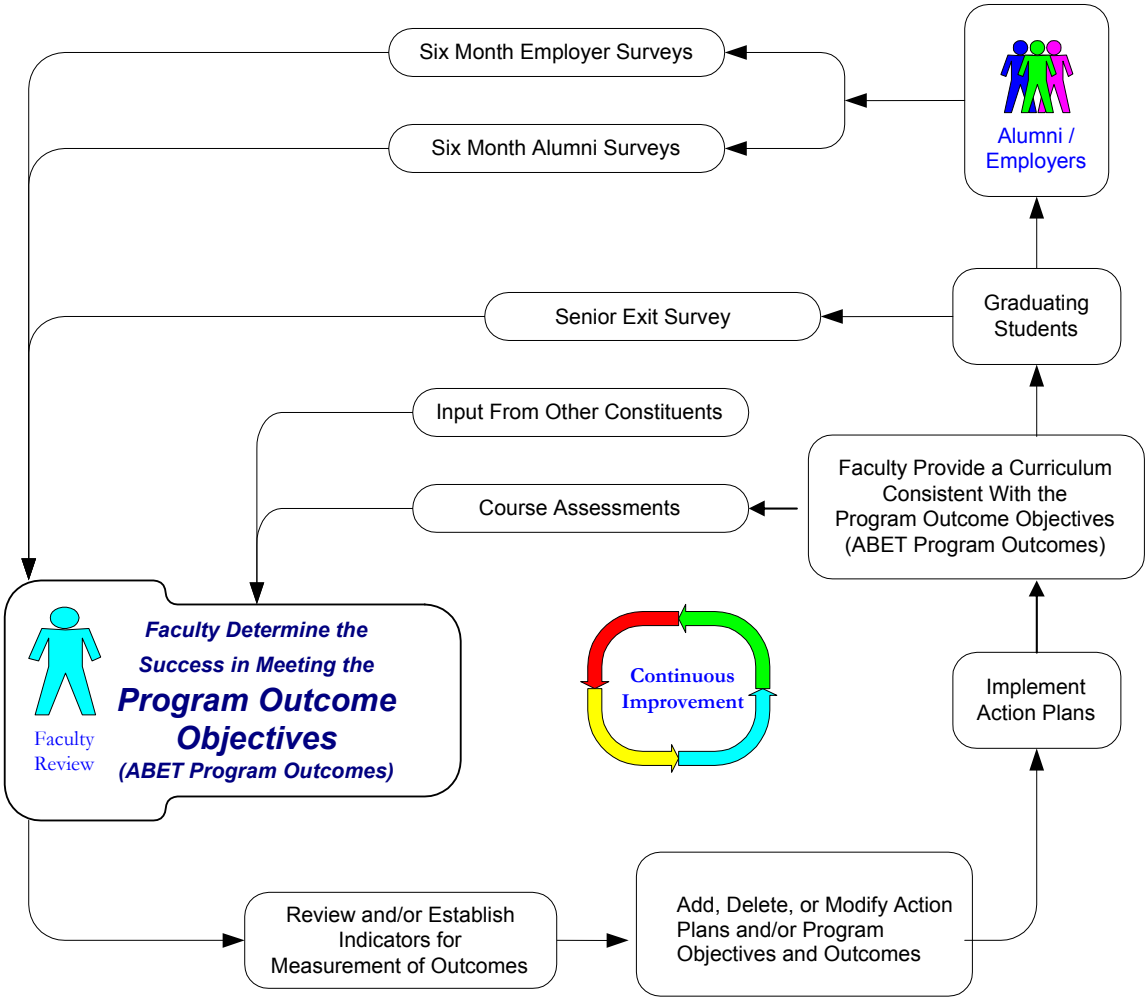


Figure 1: Detailed view of Program Assessment Process

Course Review in the Assessment Process

An integral part of program assessment is course review. Course review is a very valuable component of the assessment plan. Through this process, the EE program faculty discuss each course offered in the curriculum at least once a year. Therefore, continuity in the curriculum is easier to achieve. All program faculty participate in this process. Also, faculty are aware of what their colleagues are covering in classes. The course review process has greatly improved the quality of the WKU EE program. Faculty from UofL teaching into the program have also participated in the course review process. The results of this interaction has provided valuable feedback for improving the experience of the students and meeting the program outcomes.

Course review is used in the outcome assessment process and was implemented after the fall 2001 semester. Immediately following each semester, the EE faculty conducts the course review process. The purpose of this review is to:

1. ensure that course outcomes are being met,
2. examine student readiness for each course (relevance of pre-requisites),

3. ensure that the material specified in the syllabus is being taught,
4. compare the integration of topics throughout the curriculum, and
5. evaluate the success of previous changes due to course review and outcomes assessment.

Each faculty member creates a course review folder for each class taught every semester. This folder will contain the following information:

1. Current syllabus.
2. Identification of the textbook(s).
3. Copies of materials provided to students.
4. Copies of examinations.
5. Examples of graded work.
6. Grade distribution.

Other material or discussion deemed important by the instructor including experiments (if applicable).

Results and Conclusions

Course review is important for improving courses and to ensure that course outcomes are being met. Course review takes approximately 15 per class. The original offering for a new course tends to take a little bit longer. In a given semester, WKU has about 12 courses in the EE program. Therefore the meeting takes about 3 hours. Faculty are encouraged to review documents prior to the meeting. This is important for the pre-requisite courses feeding into a given course. In addition, course review serves a larger purpose in ensuring that courses are integrated in a manor that program outcomes are being met. Many of outcomes are not completely provided within a single course. It is necessary to coordinate the efforts of multiple faculty members across all four years of the curriculum to assure that students are successful in developing these skills. A section of the course review report created by the instructor for EE Design I has been included.

Course: **EE101 EE Design I** **Date:** **12/12/2003**
Instructor: **Mark Cambron**

EAC of ABET Outcomes & EE Program Outcomes Related To This Course

EAC of ABET Outcomes	EE Program Outcomes
a, b, c, f, g, h, i, j, k	2a, 2b, 3, 4,5

Course Outcomes:

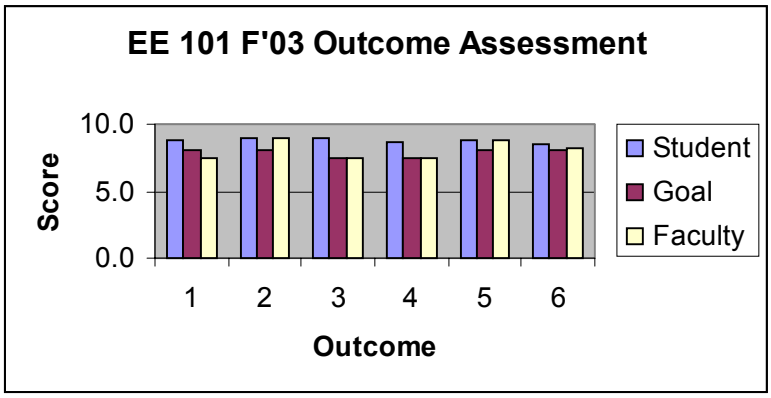
The objective of this course is to introduce first semester electrical engineering students to the process of design and to equip them with skills to be successful as they start their academic career at Western Kentucky University. Upon completion of the course, students should be able to:

1. Evaluate professional ethical responsibilities and dilemmas.
2. Work in a team setting to devise and create functioning engineering designs.

3. Perform the basic shop functions safely: drilling and sawing.
4. Perform basic soldering safely
5. Design a webpage using standard html
6. Introduced to Matlab to visualize and analyze data,

Summary of Course Assessment

To assess course outcomes the students were surveyed. Students were instructed to evaluate their ability for each outcome using the following scale: 9-10 A, 8 B, 7 C, 6 D, 1-5 F. The results of this survey instrument, class goal (instructor target score) , and course grade based assessment (Faculty) of the course outcomes are shown below:



The faculty score for outcomes for 1, 2, 5 and 6 were based on assignment(s) related to the outcome. The faculty score on 3 and 4 represents a gut feeling. Outcome 1 has lower faculty assessment due to the fact that several students did not turn in their ethics assignment.

Student Comments from Assessment Questionnaire:

Textbook appears to be a waste of money.
Everyone was helpful and very associative
I really enjoyed working on the bug. It was a fun project. I enjoyed learning about matlab.
I didn't really understand when working with soldering.
Bug took longer than expected.
Very good experience.
Need more matlab. Instructor goes though well and teaches skills.
I wish we could have used the book more.
Look forward to learning more.
Went over matlab too quickly.

Course Outline

Num	Date	Subject*	Read*	HW*
1	8/20/03	First Day of Class --- EE Curriculum		Map out semesters to graduate, info cards, Walking Tour of Ogden

2	8/27/03	HTML		Build a Webpage
3	9/3/03	Soldering		Soldering, Practice Piece
4	9/10/03	Matlab -1, simple math, script language, graphing, histograms, statistical functions	App B	Matlab 1
5	9/17/03	Breadboards, Resistor Color Codes, Measuring Voltage, Resistance, and Current		Resistor Codes, Currents and Voltages
6	9/24/03	Matlab -2 Vectors, Matrices,		Matlab II, Pass Out Robot Kits, Pick Partners for Project
7	10/1/03	Soldering Layout, Robot Kit Hand, Overview of Components		Solder Basic Stamp Board -- Due Oct 15/Oct 17
8	10/8/03	Entrepreneurship		Buddy Steen Talk on Entrepreneurship
9	10/15/03	Pro-type Tools & Shop Safety		Safety Class Attendance, Build part
10	10/22/03	Programming the Robot	Chap 11	
11	10/29/03	Field Trip		Logan Aluminum
12	11/5/03	Ethics	Chap 14	Engineering Ethics Case Study
13	11/12/03	Programming the Robot		Body Design,
14	11/19/03	Work Day		Demonstrate Moving Forward, Backwards
	11/26/03	Thanksgiving Break		Robot Due on Tuesday
15	12/3/03	Freshmen Conference		Robot Presentations, Paper Due
F	12/10/03	Freshmen Engineering Day		Bug Competition

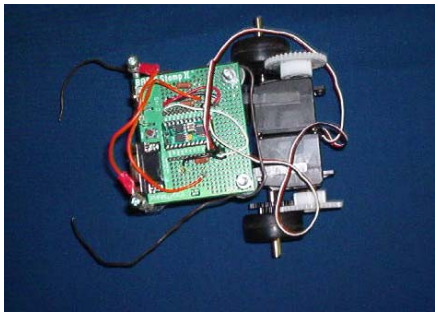
Faculty Self-Assessment

The course focus is to provide students with initial experiences in the stated outcomes and a level of familiarity with the topics. The student performance is assessed via their scores on the various course activities.

The robot project was designed so that the students would learn teamwork skills, soldering techniques, basic circuit construction, and elementary programming skills. The students were placed in teams of two and given kits from which to construct their robots. The students were also provided instructions on the construction of the robot and a simple program. The students were expected to build and program their robot. Students were encouraged to enhance the design of their robot and program. The students are required to program their robots to complete an autonomous task. The objective of the design is to construct a robot that could successfully complete the course shown in Figure 2.

Figure. 2 EE Design Playing Surface.

Students are required to fabricate the robots body. The students are required to present their project at a mini-conference. In addition each team was required to write a technical report on the project. On December 10, 2003 EE 101 students competed at Western Kentucky University 2nd Annual Freshmen Engineering Day. Examples of student projects are shown Figure 3.



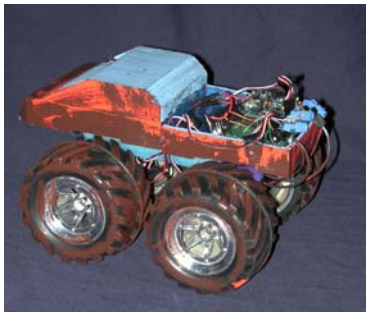


Figure3: Design I Project

The students were also asked to write/design a personal webpage. A safety course in the fabrication shop was given to all students. The students were required to cut and drill a part. These skills were used to fabricate a body for the robot. In addition a "how to" class on soldering was given and the students soldered boards for a controller on the robot project. Two classes were devoted to introducing Matlab. The students learned how to visualize data, do simple statistical calculation, and were introduced to vectors and matrices.

The autonomous robot project is wonderful freshmen level project. The addition of several deadlines enhanced the experience. In the next offering I intend to require more documentation for each subtask. I believe this will improve the quality of the final report. This semester the students were required to write a group report and give a group presentation. I also intend on adding a budget to next years project.

This course will be combined with a new EE175 next semester. EE175 is the electrical section of Freshmen Seminar. The new course will have 2 hours compared to the current 3 hours. EE101/EE175 currently has some overlap that can be removed.

Action Plan For Next Offering:

- Investigate consolidation of EE175 and EE 101.
- Incorporate a budget component in the next offering.

Action Plan From Previous Offering

- A student evaluation form was created and used in the preparation of this course.
- It was decided to keep EE 101 and ME 101 separate. Both programs have a large amount of required courses.
- The students were required to write a paper on the robot project and give presentations.

Additional Comments

WKU's Electrical Engineering Program has developed an assessment plan for continuous improvement. Course review is an integral part of the assessment process. Course review is used to evaluate courses within the larger context of the program. In addition, course review is used to close the assessment loop. The engineering faculty discuss how and where changes are needed in order to improve the program as a whole. In addition, course review is used ensure that course outcomes are being meet. If problems exist action plans are proposed to improve the courses.

Assessment of student work and the results of the Peer Review of Course Effectiveness show that students are exhibiting an improved performance. This process will continue to be a cornerstone of the program's ABET assessment plan.

Reference:

[1] www.wku.edu/engineering

[2] J. Lenoir and J. Russell, "The roles of the students in a project-based engineering curriculum," *International Conference on Practice-Oriented Education: Transforming Higher Education*, Northeastern University, Boston, MA, 2001.

[3] J. G. Harris and etc., "Journal of Engineering Round Table: Reflections on the Grinter Report," *Journal of Engineering Education*, vol. 81, pp. 74-94, 1994.

[4] F. L. Huband, "Engineering Education - An Alternative Approach," *ASEE Prism*, 1999.

[5] Promotion Criteria for the Department of Engineering, http://www.wku.edu/engineering/promote.pdf.

[6] "Electrical Engineering at Western Kentucky University," *Self-Study Prepared for the Accreditation Board of Engineering and Technology*, July 1, 2004.

[7] 2004-05 Engineering Criteria, Accreditation Board for Engineering and Technology, Baltimore. (http://www.abet.org/criteria.html)

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