New Courses in the Engineering Technology Curriculum

Walter W. Buchanan
Texas A&M University

Introduction

Several institutions with engineering technology programs are adding new courses to keep their programs state-of-the-art and to aid in student learning. Texas A&M University has added a new course in Six Sigma and Applied Statistics to their Electronic Systems Engineering Technology program as a result of feedback from their industrial advisory committee. An Experimental Vehicle Program consisting of new courses in their engineering technology program has been started at Middle Tennessee State University to give students more opportunity to engage in hands-on learning practices. A blended learning format for some manufacturing engineering technology classes is being started at Weber State University to increase student access and convenience while still enabling individualized learning. At Purdue University Calumet an online portfolio system has been implemented to document experiential learning, enhance student learning, increase career preparation, measure impact, and enhance recruitment and branding. And at Texas A&M small business support for product development is being used to enhance the curriculum.

Six Sigma and Applied Statistics: A New Course in Electronic Systems Engineering Technology

Six Sigma has been widely deployed in industry, service, government agencies, and other sectors. Feedback from the industrial advisory board over the past few years indicated that the curriculum needed to be enhanced through the use of statistics in engineering design and analysis in the Electronic Systems Engineering Technology (ESET) program. ESET started to develop a new course, Six Sigma and Applied Statistics, in 2012. The course materials and laboratories went through several rounds of revisions. Here is discussed the detailed contents for the lectures, laboratories, and course projects. A continuous education workshop was offered based on the materials from this course. Six Sigma Greenbelts were offered to the students in the course and the workshop participants. This course also opened doors for collaborations with industry. Several guests from industry were invited to give guest lectures for the class. Students also had a chance to work on real-world projects sponsored by industry. Six Sigma is a structured, data-driven, quality control methodology that uses statistical tools for process improvement. It has been widely deployed in industry, government agencies, health care, and other sectors as an engineering and management tool for process improvement. Extensive reviews on Six Sigma can be found in the literature. Statistics is a critical component in Six Sigma. As a part of the Six Sigma process, the use of statistics in engineering design, testing, and troubleshooting is becoming increasingly critical for companies to stay competitive in the global market. The enhancement of the education on statistics has been discussed by many educators over the last
thirty years. How to effectively teach engineering students statistics so that they can make the connection between statistics and their engineering subject has been a major research topic.¹

**Experimental Vehicle Program (EVP)-New Courses in Engineering Technology Curriculum**

The Engineering Technology department at Middle Tennessee State University consists of three concentrations in Engineering Technology, which includes Computer Engineering Technology, Electro-Mechanical Engineering Technology, and Mechanical Engineering Technology. Middle Tennessee State University also has an engineering major in Mechatronics Engineering that was established last year. Students pursuing a degree in one of these degrees are given the opportunity to fulfill class credit, electives, and/or satisfy their senior project requirement by being involved in the Experimental Vehicle Program (EVP). This unique course offers students the opportunity to engage in hands-on learning practices, and those individuals who have participated in the EVP have found this program to be instrumental in helping them further their career in the competitive job market. Middle Tennessee State University is very passionate about the success of this program and provides complete on campus engineering laboratories that facilitates a productive learning experience. This course fosters a comfortable environment where students are able to challenge their knowledge and learn invaluable skills such as collaboration, communication, and leadership. Students work together from the ground up to design, construct, and test novel vehicle designs for participation in national and international competitions. The program takes traditional classroom learning a step further, and gives the student a chance to use cutting-edge technology and design methods to create the best vehicles. Sponsors of the program find that hiring those students who have been involved with the EVP are well equipped for the challenges engineers face in their position. The students graduating who have taken this course are in high demand because of the real world experience they gain through this innovative and demanding program. The EVP continues to be recognized as the national model for hands-on engineering education.²

**Blended Learning Course Redesign for Manufacturing Engineering Technology**

Weber State University is trying a “blended learning” format for some manufacturing engineering technology classes in the fall of 2015 that have traditional face-to-face classes. Blended learning, also known as hybrid or mixed-mode classes, can increase student access and convenience while still enabling individualized learning and engagement if designed properly. Engineering technology courses taught in this format at Weber State University will be characterized by the fact that at least twenty percent of the course will be moved online to replace at least one face-to-face classroom session per week. These efforts involve extensive course redesign. The intent is to have students spend more time working individually and collaboratively on projects and activities while faculty spend less time in formal lectures and more time interacting and guiding students. Here will be described the application of blended learning best practices to the senior capstone project planning and cost estimating class. The basic course structure will be shared, illustrating which parts of the engineering technology course material is felt to be better suited for online and which parts should be retained in the face-to-face setting. The mix of synchronous and asynchronous activities and projects, and which common technologies are found to be effective in promoting student to student, student to
instructor, and student to material interactions will be illustrated. The tools and formats chosen for both formative and summative student learning outcome assessment will also be discussed, as will some of the pitfalls encountered in the course redesign.  

**Integrating On-line Portfolios in Engineering Technology Courses**

Purdue University Calumet has implemented an on-line portfolio system during the 2014-2015 academic year. The implementation was to meet the following short-term and long-term goals, 1) documenting experiential learning, 2) Enhance student learning, 3) increase career preparation, 4) measure the impact, and 5) enhance recruitment and branding. About two hundred students have participated from the College of Technology. The system allows students to capture their project related works and experiences into an online portfolio that can be shared with potential employers. The implementation of on-line portfolio integration in technology courses that require teamwork, and faculty coordination of several teams and their activities are discussed. Digital Portfolios are a valuable assessment tool for students and educators alike. There are many advantages to having e-portfolios. Use of digital portfolios in the classroom helps expand the number of techniques that students and teachers can both use to further students’ education. These portfolios can add pictures, videos, audio, etc., to the typical learning style while also allowing students to track their progress over a large span of time. Whereas paper portfolios can be easily misplaced or thrown out, online portfolios will remain available and can be easily accessed by students, parents, and teachers. Further, online portfolios allow students and teachers to “make connections among disparate parts of the curriculum, gain insights leading to improvement, and develop identities as learners or as facilitators of learning. Institutions are beginning to use these portfolios to teach students along with using them as a means for communication between the student and school faculty. Education World states that the digital portfolio also allows a different way to access previous works. The user can modify the contents of the digital portfolio to meet specific goals. For example, a student can link a piece of work to a statement describing a particular curriculum standard and to an explanation of why the piece of work meets that standard. That reflection on the work turns the item into evidence that the standard has been met. Given the numerous advantages of using the digital portfolios, these are still not being implemented widely because of accessibility and ease of use of the current practices. Further concerns regarding digital portfolios are security issues and the program cost. Electronic portfolios may need to be saved in different formats. Therefore, the concern is different computers can only open certain files, and unless a student knows ahead of time, some computers may not be able to open some documents. The University of Hawaii Manoa has experienced a few issues with e-portfolios. These include, time to learn the software, resistance to change, on-going IT support needed for faculty and students, cost and maintenance of software, associated training, and privacy and security. Further, developing and creating of electronic files takes time. However, most sources indicate that the advantages regarding these digital portfolios greatly outweigh the disadvantages.

**Small Business Support for New Product Development**

Over the past eight years the electronics-based programs in the Department of Engineering Technology and Industrial Distribution at Texas A&M University have gone through multiple changes. First, the electronics and telecommunications programs merged into a single entity.
Second, the new program was rebranded as Electronics Systems Engineering Technology (ESET). Finally, through an investment of faculty effort and internal financial support, the curriculum was refocused to emphasize the development of embedded intelligence-based products and systems. Today the ESET program is known by industry and government agencies for its production of graduates with expertise in the development and support of products and systems that integrate embedded intelligence, communications, and electromechanical systems; and the ability to support external entities with rapid prototyping and applied research in the area of new product development and implementation. As part of this new focus the ESET program now combines faculty expertise and undergraduate education to support small businesses with great ideas that often lack the personnel, the know-how, and the financial support to implement their next big product. Here is discussed the ESET program in more detail, giving the recent examples of efforts in the area of small business support, a discussion of the educational value and lessons learned, and finally a presentation of next steps.5

Bibliography


