Curriculum Innovation Driven by Industry Input

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Introduction

Examples are covered here of curriculum innovation driven by industry input. At Middle Tennessee State University an engineering management degree forms an innovative partnership with industry. At Florida Atlantic University the Mobile Technology Consortium (MTC) has formed through an Industry-University Alliance as well as using Motorola’s vision to impact its engineering curriculum. IUPUI is forging an industrial partnership with engineering technology capstone courses. At Rochester Institute of Technology curriculum development driven by industry input is taking place.

Engineering Management Degree Forms - Innovative Partnership with Industry

The Professional Science Masters (PSM) is a nationally recognized two-year degree that is funded by the Alfred P. Sloan Foundation and is designed to allow students to pursue advanced training in the sciences while simultaneously developing highly-valued business skills. A PSM degree prepares students for science careers in business, government, or nonprofit organizations, where workforce needs are increasing. At Middle Tennessee State University (MTSU), the PSM program has taken form as the Masters of Science in Professional Science (MSPS) degree. The newest addition to the MSPS program, Engineering Management, is designed to teach students interpersonal, management, and engineering skills needed for their success in various industry or businesses, and meets the national need for professional engineering graduates with a comprehensive degree. The last requirement of the MSPS program is an internship that polishes the student’s professional preparation. The student must complete 250 work hours at an industry in his or her chosen concentration. In addition to the individual assignments of the industry, students must compile a portfolio and give a professional presentation of their experience at the company. Oftentimes, an MSPS graduate is able to begin his or her career at the same company that hosted the internship. The Engineering Management concentration facilitates strong partnerships with the scientific industry and the corporate world. The curriculum prepares students for a career in professional science and provides scientific industries with a highly skilled workforce that can understand the related aspects of business and science. In turn, industries provide a place for the student to complete an internship and often receive a new
employee who is already trained for the job. The partnerships formed through the MSPS program benefit all parties involved: the student, university, industry, and nation.\textsuperscript{1}

**Mobile Technology Consortium (MTC): An Industry-University Alliance**

MTC is a non-profit entity that was formed in 2008 in South Florida with the intent to foster alliances between industry and university participants. The stated vision was to bridge the university wisdom with the local entrepreneurial spirit for the growth of mobile technology and user experience. The mission was to bring together systems companies, small businesses, universities, and government agencies to evolve next generation mobile technology platforms, applications, and automation. This vision and mission statements of collaboration and innovation translated to the following goals: (1) to identify common needs/topics/projects for the consortium, (2) to collect needs of the local entrepreneurs and businesses, (3) to provide a quarterly session for status updates, (4) to review “hot technology topics” to enable emerging businesses and (5) to find best students match to local businesses. True to this spirit, the first MTC gathering was held in November 2008 at Florida Atlantic University, Boca Raton, FL, as a half-day conference. It contained six university presentations on radical increase in engineering design productivity, as applied to mobile platforms. This was based on a six year long $1M+ funded project from Motorola. The conference also featured presentations on early entrepreneurial activities from three companies. The latest conference, scheduled for later part of April 2012, shows the progress we have made since those early days: the first presentation will be on a highly successful NSF funded Industry-University Collaboration Research Center (I-UCRC) that involves Florida International University (FIU), Miami, FL and FAU. The FAU center has 16 participating companies that provide a total of $1.5M in membership fees. There are presently 17 active research projects in the Center with 12 faculty involved and more than 20 graduate and undergraduate students. This first presentation will be followed by a set of presentations which represent current industry-university alliances, on topics of health care, health monitoring, mobile Apps, semantic web, mobile virtualization, and security threats to smart phones. The conference will end with an industry-university panel session on ways to improve collaborations further. It is believed that MTC has facilitated the following during four years of its existence: (1) A networking environment for South Florida companies. It has brought together people from different industries to help resolve each other’s problems; (2) Facilitation of the NSF I-UCRC center at FAU. This provides businesses with a way to research and resolve difficult problems and innovate, with a lower cost and personnel overhead; (3) Start-up of three student-led small businesses with focus on smart phone Apps; (4) Student presentations of their smart phone Apps to business leaders and venture capitalists; (5) Recruitment of best students by the local industry; (6) Mentoring of students at both FAU and FIU; (7) Expansion of MTC’s reach by holding conferences at two Miami area universities: Miami Dade College and FIU; and (8) Development of several state-of-the-art courses on smart phones and related technologies.\textsuperscript{2}

**Forging the Industrial Partnership with Engineering Technology Capstone Courses**

The strategic focus of manufacturing has changed significantly over the past decade. Modern business theory has sharpened the technological focus of a manufacturer on its core strengths, and relegated other engineering tasks to suppliers. Adopting this strategy has been shown to clearly improve competitive advantage over rivals. At the same time, the current economic
climate has leaned technical staff to the point of only servicing the most crucial engineering projects. Many continuous improvement ideas are left subserviced, or abandoned altogether due to lack of technical resources. Capstone courses for Engineering Technology education are designed to demonstrate the student’s ability to define the requirements of an engineering problem, develop its solution, and deliver a design that resolves the issue. These senior design projects are usually case studies prepared by the instructor or projects devised by the students themselves. While these projects fulfill the educational objectives of the capstone intent, they often lack the experience of designing something that will actually be built. There is very little emotional attachment to their work; none of the benefits that come from providing something that is actually needed by someone. Here is compared the results of two capstone course approaches; one using case studies and student projects, and another that implements continuous improvement projects with industrial partners. It details the types of projects, organization of the teams, experiential results of the students and industry partners, learning outcomes and effect on employability. One aspect of the discussion with industry partners includes impressions of the actual performance of the Engineering Technology student viewed with respect to traditionally-educated Engineering students. It is attempted to benchmark the effects of interacting with an industry partner’s technical staff on the capstone course experience.

Impact of Motorola’s Vision on Florida Atlantic University’s Engineering Curriculum

Motorola Mobility funded FAU during the past decade to develop a methodology to radically increase their engineering design productivity. The project, entitled One Pass to Production (OPP), had the stated objective of a design cycle of 24 hours. Motorola’s internal evaluations concluded that FAU approaches could reduce the time period to three months, an improvement of seven fold, over the then time frame of 18 to 24 months. Here is documented the effort to incorporate those principles in a different context, viz., teaching project oriented courses. ABET encourages team projects in engineering curriculum to expose students to real world challenges. However, such courses tend to have multiple challenges for professors and students alike, resulting in poor results. The process leads to state-of-the-art team projects that are successfully completed in a reliable, timely, efficient, and methodical manner. Engineering productivity is enhanced by Design Reuse (in our case, via platforms, libraries, components, and standards). Use of Open-source, by providing transparency to underlying architecture and code, allows for a faster learning curve, innovation, multiple perspectives, and reduced cost to all. These are the norm for innovation and high productivity in every field that has embraced these principles. The overarching goal here has been to educate students from high school level to graduate level in various advanced areas of high tech, in a synergistic manner that is cognizant of their strengths and needs, while realizing a pipeline of engineering products that are potentially marketable. One particular field, viz., Smart Phone App development, has achieved maturity: Graduate students use their intellectual maturity and knowledge to develop advanced Android components in the fall semester; In the spring semester, undergraduate students use their technical savvy and programming skills to incorporate these components into their Android App platforms; and during the summer semester, in a three week session, high school students, utilize their creativity, imagination, and artistic skills to develop marketable Apps from these platforms. FAU has successfully repeated this cycle two years in a row. FAU has 26 marketable Apps. It expects to put some of them soon on the market. Visit android.fau.edu to see the results. More than 100K visits have been recorded for this site. From a productivity perspective, high school
students (with entry level skills) achieved in three weeks what typical undergraduate students achieve during a regular 15 week semester, a potential improvement of about ten fold. FAU has begun involving students and professors from non-engineering disciplines this semester, at the undergraduate level, to encourage even truer real world experience in project work. It has started adopting a similar approach to robotics and semantic web domains as well. Results may be noted at their respective websites: robotics.fau.edu and semanticweb.fau.edu. The former involves the development of low cost robots to draw geometric art and eventually play multiplayer floor games (based on board games, say, Tic-Tac-Toe, and Chess), while the latter involves intelligent reuse of information on the web. There are potential ways to combine the three areas to lead to other project oriented courses. Reuse and Open-source tools make the process predictable and productive. Some students have even leveraged their learning to start small businesses.4

Curriculum Development Driven by Industry Input

Design for Six-Sigma has been a Best Practice staple for many years in industry and has proven valuable in providing quality products. Companies such as Johnson & Johnson and Xerox have teams that are specifically tasked with training, certifying, and implementing DFSS into their work force. It has been estimated that it costs over $8,000.00 in industry to train and certify an employee for a Green Belt in Six-Sigma. In academics, traditional training of Six-Sigma techniques have been from specifically designed courses that describe the hierarchy of the process and work down into the tools used in each phase of the process. This certainly is an effective technique to introduce the concepts of DFSS, but suffers from a disconnect between academic and direct applications. The Mechanical Engineering Technology program is working with its industrial advisory board to implement a Design for Six-Sigma approach directly into the core courses of the MET program. The focus is upon the course content and solution of the problem while implementing the set of DFSS tools and its process to aid in the solution of the problem. Here is discussed the implementation process used to integrate the Design for Six-Sigma tools into several upper-division MET courses and the results experienced by the students and industry. It will also discuss the impact experienced on the course projects and the faculty overseeing them.5

Bibliography


