2006-2176: USING THE ASME PROFESSIONAL PRACTICE CURRICULUM WITHIN AN MET CAPSTONE EXPERIENCE

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Using the ASME Professional Practice Curriculum Within an MET Capstone Experience

Abstract:

The Capstone Experience in an Engineering Technology curriculum provides an opportunity for students to integrate both technical and non-technical skills in the solution of a complex problem. As such, in addition to reinforcing skills and knowledge acquired in earlier coursework, it is an ideal point in the curriculum to address and assess the knowledge of students as it relates to contemporary issues in the profession, professional responsibilities to society, and the need for self-study and lifelong learning for professional success. It is traditional in many engineering and engineering technology programs to supplement the Capstone Experience with lectures on professional topics, such as the design process, reliability and safety in design, and intellectual property law. In this paper, a novel way to address these issues within a Mechanical Engineering Technology Capstone Experience is presented. The novel implementation makes use of the ASME Professional Practice Curriculum (PPC), a set of on-line "short courses" developed by ASME and available to the public at no cost. By integrating these "short courses" into the Capstone Experience, students can participate in a significant professional development experience that is beneficial to both their long-term career goals and their execution of their capstone project. In addition, the on-line self-study provides an ideal format for engaging the student in the type of lifelong learning required for professional success. In this paper, a model technique for integration of the ASME Professional Practice Curriculum into an MET Capstone Experience will be presented. Survey results from the implementation of the approach will be presented, validating the role of the PPC as a valuable tool for professional development and lifelong learning.

Motivation:

The capstone experience in an Engineering Technology curriculum is intended to "draw together the diverse elements of the curriculum and develop student competence in focusing both technical and non-technical skills in problem solving"[1]. The integrative nature of the experience lends itself to instruction, demonstration, and assessment of student performance with respect to some of the required non-technical "a-k" outcomes of an Engineering Technology program[1], such as:

- An ability to function effectively on teams (Outcome *e*)
- An ability to communicate effectively (Outcome *g*)
- A recognition of the need for, and an ability to engage in lifelong learning (Outcome *h*)
- An ability to understand professional, ethical and social responsibility (Outcome *i*)
- A respect for diversity and a knowledge of contemporary professional, societal, and global issues (Outcome *j*)

In the Mechanical Engineering Technology (MET) Program at Milwaukee School of Engineering (MSOE), the Capstone Project course has been used a curricular point for both instruction and assessment with respect to these outcomes. The Capstone Project course is a 10-week effort; in addition to working on a specific project with a faculty advisor, students are also

required to attend "seminar" lectures on professional topics, which relate both to their capstone project and their development as professionals. These topics include:

- The Design/Product Development Process
- Project Management
- Use of Codes and Standards
- Intellectual Property
- Safety in Design
- Engineering Ethics
- Engineering Reporting and Presentations

These topics can be clearly linked to many of the non-technical outcomes, as shown in Table 1.

Table 1: Linking Curricular Topics with Outcomes

Curricular Topic	***Outcome***	***Reason for Linkage***
The Design/Product Development Process	*e*	*A formal design process stresses communication and cooperation among members of the team, and values contributions from all sources*
Project Management	*e*	*The ability to break down a project into components and coordinate scheduling is fundamental to effective teaming*
Use of Codes and Standards	*h, i, j*	• *The ability to locate and understand professional reference documents is a component of lifelong learning* • *Following appropriate codes is a professional responsibility* • *The development and modification of codes and standards is a contemporary professional issue*
Intellectual Property	*i, j*	• *Following intellectual property law is professional and ethical responsibility* • *Emerging issues in intellectual property law is a contemporary professional issue*
Safety in Design	*i*	*Public safety is a primary ethical responsibility of an engineer*
Engineering Ethics	*i*	*A wide array of ethical topics can be studied here*
Engineering Reporting and Presentations	*g*	*Reporting and presenting are the primary abilities required to communicate professionally*

While most of these topics receive coverage elsewhere in the curriculum, the capstone experience provides a point where the students can both reflect on these concepts as they prepare to conclude their professional studies, and to integrate these ideas into the execution of the capstone project.

In the traditional implementation of the Capstone Project course, these lectures were prepared and delivered by a faculty coordinator. Student assignments were used to reinforce these concepts and assess student performance with respect to these concepts; whenever possible, these assignments were designed to directly augment the capstone project. For example, the student assignment for the "Intellectual Property" module would be to perform a patent search related to the capstone project, while the "Codes and Standards" assignment would be to research industry standards relevant to the capstone project. These graded assignments could be used to directly assess student performance with respect to the outcomes, as well as serving to strengthen the overall capstone experience.

The nature of the MET Program at MSOE is that it is a predominantly part-time evening program. The students in the program generally work full-time in an engineering-related field, and many commute great distances to campus for their studies. In order to make the delivery of the "Professional Topics" seminars as convenient as possible for this student audience, a pilot project to deliver this material through the on-line *ASME Professional Practice Curriculum*[2] was undertaken. The *Professional Practice Curriculum* (PPC) is a series of on-line course modules offered at no charge to the public by the American Society of Mechanical Engineers (ASME). The curriculum is intended to "*help colleges of engineering guide the development of students and teach the principles of engineering practice and professionalism without overburdening an already full undergraduate curriculum*."[3] On-line modules are available in a wide variety of professional topics, which overlap substantially with the topics that were traditionally covered in the MSOE MET Capstone Project course. In addition, by providing a useful third-party resource developed and administered by the primary professional society serving the program (ASME), the use of the PPC provides a valuable instrument for instilling and demonstrating independent learning techniques in the students, a primary component of lifelong learning.

In this paper, the pilot implementation of the Capstone Project course using the PPC will be detailed. Specific modules employed for instruction and student assignments used for assessment will be described. Student feedback on the pilot implementation will be offered, and compared with student feedback from the traditional implementation of such a course. Lessons learned during the initial implementation will be offered.

Implementation of the Pilot Offering:

The pilot offering of the "Professional Topics" seminars using the PPC was implemented in Fall 2005. While the PPC was used to supplement certain topics in earlier offerings of this course, this marked the first time that the PPC was used as the exclusive means of delivery for a number of the professional seminars. There are a wide variety of modules available through the PPC (42 exist at the current time) in a wide variety of professional topics[4]. In the pilot implementation, the following modules were used:

- Project Management
- Patent Law
- Effective Technical Presentations
- Engineering Ethics

The structure of the weekly implementations was as follows:

- The course web page was updated with some instructor-created background material, setting the context for the professional topic to be studied within the structure of the capstone project
- A link from the course webpage was provided to the appropriate ASME Professional Practice Curriculum module
- A link to a written assignment was provided, requiring the students to:
    - Provide written answers to some questions based on the module (demonstration of *knowledge*)
    - Relate the topic to their specific capstone project (demonstration of *application*)

These written assignments provided a 15% component of the overall capstone project grade, but were also used as a tool to directly assess student performance with respect to Outcomes *e*, *g*, *i*, and *j* (as per Table 1). The remaining 85% of the course grade was based on the final report and presentation of the capstone project work. An example of the course web page and an example written assignment used for the Project Management module are shown in Figures 1 and 2.

The pilot implementation was developed based on the following advantages:

- On-line delivery of these topical materials serves the needs of the student population; all of the students in the course were part-time evening students, and many commuted significant distances to campus.
- Review of the PPC materials shows that they are of very high quality, and are developed by experts in the field.

In addition, the fact that the PPC is developed and maintained by ASME is seen as an advantage. ASME is the primary professional society that serves students in an MET curriculum. For some of the students in the program, the use of the PPC may be the first significant interaction that they have with ASME. By providing them with exposure to the resources available through ASME, the students are exposed to an additional avenue of professional growth and lifelong learning that they might not otherwise consider.

Week 2

At this stage, you should have a project topic/advisor, and have composed a written Project Statement (which is due on 9/13). Now that your project has been defined, it is useful to consider various techniques to aid you in the completion of your Capstone Project.

This week's "virtual lecture" topic is in the area of Project Management. The ability to *plan*, *schedule*, and *control* a project will serve you well both in the Capstone Design course (which has firm deliverables and a fixed deadline!), and also in your professional career and an engineer, manager, or technologist.

The "virtual lecture" that we will use has been developed by the ASME as part of their Professional Practice Curriculum, a series of on-line "short courses" intended for use by students and professionals alike.

Your tasks for Week 2 are as follows:

1. Use this link to find the Professional Practice Curriculum module on Project Management. Complete the module.

2. After completing the module, complete the written assignment on Project Management. This link will lead to the written assignment.

Please Note: This written assignment is intended to supplement the work you are doing on your Capstone Project! You should be continuing with normal project work in addition to this assignment!

Figure 1: Sample Course Webpage

MT-4901 Capstone Project
Fall 2005

Assignment #2: **Project Management**

After completing the Project Management Module of the ASME Professional Practice Curriculum, answer the following questions:

1. According the module, what are the three basic goals for any project?
2. In project management, what is the significance of the acronym *POWER*?
3. What is a *WBS*? Demonstrate by creating a *WBS* for your capstone project.
4. Describe *CPM* and *PERT*, and contrast their use as project scheduling tools.

Provide written answers to these questions as an e-mail attachment to musto@msoe.edu by Tuesday 9/20.

Figure 2: Sample Course Assignment

Survey Results for the Pilot Offering:

To assess student opinion of the on-line delivery method using the PPC, a brief survey was conducted. Results for the on-line delivery method can be compared with results from a similar course (the Mechanical Engineering Senior Design Project course), which covered similar "professional topics" and ran during the same term with the same instructor. The survey involved two aspects of instruction: the quality of the delivered information, and the level of interest generated by the delivery. The results, which are summarized in Table 2, indicate a preference for the on-line delivery method. While these results may not have great statistical significance (the sample size was less than 10 students in both cases), they do indicate that the on-line delivery method is a viable alternative for the "professional topics" component of an MET curriculum.

Table 2: Results of the Student Survey

	Professional Topics Information was Clear and Understandable		Professional Topics Information was Interesting	
	Traditional Method	On-Line Delivery Method	Traditional Method	On-Line Delivery Method
Strongly Agree	21%	50%	29%	43%
Agree	67%	37%	57%	43%
Somewhat Agree	12%	13%	14%	14%
Disagree	0%	0%	0%	0%
Strongly Disagree	0%	0%	0%	0%

Conclusions:

The survey results from the pilot offering indicate that on-line delivery of the "professional topics" component of the curriculum using the ASME Professional Practice Curriculum is an effective method delivery. In addition to these survey results, anecdotally the students expressed positive comments on the quality of the on-line materials, the relevance of the materials to their professional lives, and the convenience of the on-line delivery style. The feedback from the pilot implementation indicates that the on-line delivery mode using the ASME Professional Practice Curriculum is a useful and important component of professional education within an MET Capstone experience.

Bibliography:

1. *Criteria for Accrediting Technology Programs* (2005-2006), ABET Technology Accreditation Commission, ABET Inc.
2. http://www.professionalpractice.asme.org/index.htm
3. http://www.professionalpractice.asme.org/ppc_pages/registration.htm
4. http://www.professionalpractice.asme.org/ppc_pages/courses.htm