

2006-663: IMPLEMENTING A SOCIETAL CONTEXT, AN APPRECIATION FOR LIFE-LONG LEARNING, AND CONTEMPORARY ISSUES INTO AN ENGINEERING MANAGEMENT COURSE

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Implementing A Societal Context, An Appreciation for Life-Long Learning, and Contemporary Issues into an Engineering Management Course

Abstract

As the University of Pittsburgh Department of Industrial Engineering prepared for its ABET visit in the fall 2005, it became apparent that its IE 1035 – Engineering Management course was a primary course for satisfying ABET outcomes (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context; (i) a recognition of the need for, and an ability to engage in life-long learning; and (j) a knowledge of contemporary issues. This paper will describe pedagogically how these elements are implemented within the IE 1035 – Engineering Management course and the other inherent benefits of doing so, i.e., making learning rigorous, relevant, and interesting.

1. Introduction

The Industrial Engineering Department at the University of Pittsburgh is not unlike most other traditional industrial engineering programs across the country. Our program begins at the sophomore year after students have completed a common freshman year. Upon joining the Industrial Engineering Department, students complete additional math courses, engineering science courses, required Industrial Engineering courses, technical electives, a set of six humanities and social science electives, and even a course in cost (managerial) accounting. Our program is designed to provide students with a breadth of subject matter within Industrial Engineering in the major core areas including probability & statistics, operations research, engineering management, human factors, manufacturing & facility design, and production operations analysis.^{7, 8} The technical electives permit students to concentrate in a particular area of interest such as operations research or engineering management or to fulfill this requirement with a breadth of courses.

As the University of Pittsburgh Department of Industrial Engineering prepared for its ABET visit in the fall 2005, it became apparent that its IE 1035 – Engineering Management course was a primary course for satisfying ABET outcomes (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context; (i) a recognition of the need for, and an ability to engage in life-long learning; and (j) a knowledge of contemporary issues.⁴ IE 1035 is a semester-long, 3-credit, required course for Industrial Engineers taken in their senior year. Specifically this course discusses modern engineering management theory as it applies to technical organizations. Topics include: the management process; project management; managing technical people; communications; managing technological change; labor relations; and engineering ethics. Babcock and Morse's *Managing Engineering and Technology, Third Edition*¹ is the primary textbook with supplemental reading primarily from the *Harvard Business Review*. IE 1035 has gained recent popularity within other engineering majors and students from departments such as Mechanical Engineering, Bio Engineering, and Electrical Engineering take this course to fulfill a technical elective requirement citing their interests in project management, engineering management in

general, and entrepreneurial interests as a primary motivator. On the first day of class, students are warned that the class requires a considerable amount of reading and writing, one team-based project, an individual project, and approximately seven homework assignments. Because this course contains a significant amount of class discussion, attendance and participation is required.

This paper will describe pedagogically how a societal context, an appreciation for life-long learning, and contemporary issues have been implemented within the IE 1035 – Engineering Management course.

2. Societal Context

ABET outcome (h) focuses on the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. The first half of IE 1035 focuses on the broad area of project management. Within this topic, many of the common project management tools used for developing a project plan such as developing a statement of work, a project charter, a work breakdown structure, a linear responsibility chart, and a Gantt chart are discussed. What better way to learn this material than by applying it to a real project setting. Beginning in the third week of the semester, students are grouped into 6-person teams with an aim at ensuring diversity with respect to gender, discipline, and academic ability. The instructor then assigns a project to the students lasting about three weeks. The project deliverables include a final project report and an oral presentation. In the fall 2005, an effort was made to assign projects that emphasized the societal context of engineering solutions. The projects included developing a project plan for:

- A toys for tots program for disadvantaged youth
- A 10-week summer camp program for children
- A local community carnival to raise money for the volunteer fire department
- A community New Years Eve celebration
- A 5K race to raise money for breast cancer
- A soup kitchen to provide meals for the homeless
- A fundraising event to raise money for Hurricane Katrina victims
- A political rally for the city's mayoral candidate

Each of these projects demonstrates the significance of project management outside solely an engineering setting and challenges the students to consider how project management affects society as a whole.

In another example requiring students to consider an engineering solution within a societal context, students were assigned to read a *Harvard Business Review* case entitled *Taking the Cake*.⁶ In this case, Southland Bakery is considering radically changing their strategic plan to stop producing bakery products drenched in trans fats to address the growing concern of obesity, especially with respect to obesity in children. Students are asked to reflect upon the societal impacts of this dilemma and whether Southland Bakery has any social obligation to produce a more health conscious product. This case strikes the emotion of much of the class with opinions at both extremes, i.e., it is the company's duty to do what they can to prevent obesity, to it is the individual's responsibility to make healthy eating choices. When analyzing this case, some

students recall the recent suit filed against McDonald's by a group of teenagers who charged the company with causing their obesity.²

3. Life-Long Learning

ABET outcome (i) focuses on a recognition of the need for, and an ability to engage in life-long learning. The IE 1035 course emphasizes outcome (i) throughout the semester. During the second half of the semester, the course focuses on engineering management in general with an emphasis on planning, organizing, motivating, directing, and controlling. Within the discussion on planning, we spend a lot of time examining how organizations plan by developing a vision, mission, objectives, goals, strategies, and projects to support the aforementioned items. In class we look at the strategic plans of a couple of organizations and then for a homework assignment, the students select a company of interest (for profit or non-profit, big or small, domestic or international, etc.) and study its strategic plan. As an extension to this exercise, students are challenged to reflect upon how strategic planning is critical for themselves personally. This material is rooted in the work of Covey's *Seven Habits of Highly Effective People*.³ Specifically, students are asked to develop a personal mission statement and a five-year strategic plan. Their strategic plan must contain not only career-based objectives and goals, but also personal-based objectives and goals. This assignment requires students to ask themselves questions such as how will I maintain my technical skills and keep abreast of changing technology if I wish to advance in my career? Assessment of this assignment examines the depth, breadth, and specifically attention to life-long learning of each student's plan.

Life-long-learning is also discussed in chapter 16 of the course textbook¹ entitled *Achieving Effectiveness as an Engineer* and in Drucker's classic *Harvard Business Review* article *Managing Oneself*.⁵ A group, in-class exercise asks students to brainstorm how they will stay technically competent in engineering and the importance of professional society activity.

4. Contemporary Issues

ABET outcome (j) focuses on knowledge of contemporary issues. Perhaps one of the most frustrating factors that I deal with as an instructor for the IE 1035 – Engineering Management course is realizing that most undergraduate engineering students do not seem to have much of an idea of what is going on in the world around them – with the exception perhaps of who won last night's football game, etc. When I ask them why they don't read the newspaper or listen to the news they cite a lack of time, i.e., they spend all of their spare time doing homework. The news that is of most interest to them seems to be sports. Within IE 1035, contemporary issues are introduced weekly from the trade press such as the *Wall Street Journal*, *Business Week*, and the local newspaper. From an engineering management perspective, the world almost acts as our laboratory for exploration of the course material. For example in the fall 2005 semester, we spent a significant amount of time discussing the engineering management and project management aspects associated with the rebuilding efforts to the U.S. Gulf Coast region after Hurricane Katrina. In addition to a contemporary event, outcome (j), this topic also addresses outcome (h). The students taking IE 1035 like to hear about local news too, and appear to have more interest in domestic than international events. Perhaps this can be attributed to the fact that very few of our undergraduate students are international.

Contemporary issues are also introduced into the IE 1035 course in an assignment that asks students to study an example of how teams have either successfully or unsuccessfully been used at a company from an article published in the trade press that is one year old or less. This requires students to examine current issues affecting a contemporary organization.

5. Summary and Future Implications

IE 1035 – Engineering Management is a primary course at the University of Pittsburgh helping our program to support ABET outcomes (h), (i), and (j). This paper has shown that by carefully designing the course homework assignments, projects, in-class exercises, discussions, and case studies one can not only challenge the students' mastery of the course material, but also introduce the students to societal implications, life-long-learning, and contemporary issues critical for effectively solving engineering problems. Evidence that these ABET objectives have successfully been achieved can be seen by reviewing the end of the semester course evaluation administered by the University of Pittsburgh Office of Measurement and Teaching Evaluation (OMET). Students in the School of Engineering are asked to respond to a series of questions related to the ABET outcomes. Students rate these items using a 5-point Likert scale: 1-Not at all, 2-Very little, 3-Some, 4-A lot, or 5-A great deal. Two of the relevant questions and the resulting class average are shown below:

- *The course has improved by ability to apply knowledge about current issues (economic, environmental, political, societal, etc.) to engineering related problems.* The class mean for this question was a 4.02/5.00.
- *The course has improved my appreciation of the need to engage in life-long learning.* The class mean for this question was 3.72/5.00.

In addition to satisfying ABET outcomes (h), (i), and (j), a major consideration of the course is to make learning rigorous, relevant, and interesting. Overall, this course is enjoyed by most students who take it with 85% of the students indicating on the OMET survey that they would recommend the IE 1035 course to other students. Finally, from a longitudinal perspective, when I come across former graduates who have previously taken this course, they typically will cite it as being one of their most useful courses for successfully carrying out their career.

As an instructor my challenge will be to continually refine this course and look for opportunities to introduce societal and contemporary issues that will capture the students' attention and spark their passion for learning. Engineering is a challenging field with a rapid turnover of knowledge and technology. As educators, if we can provide our graduates with the foundation and tools for life-long learning, then we can help to ensure that they will have bright and rewarding careers.

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