Work In Progress: Integration of Topic Modules and Organization of Session Flow for the First-Year Seminar Course in Engineering to Motivate and Sustain Student Learning

Ramakrishnan Sundaram
Gannon University, sundaram@gannon.edu

Abstract - **This paper presents the overview of course instructional material in modules and the organization of these modules for presentation in sessions of the critical entry-level course, *First-Year Seminar in Engineering*, for undergraduate engineering majors at ABET-accredited institutions of higher education. The *First-Year Seminar in Engineering* at our University is offered once each year during the fall term. The enrollment can be between 45 and 50 first-year students. In recent years, the course, which is coordinated by one engineering faculty member and taught by up to fifteen different instructors, comprises a loosely organized collection of engineering and non-engineering topics delivered in twenty eight 55-minute sessions of the semester (14 weeks of instruction). The summative assessment of the student learning outcomes has revealed glaring weaknesses in content and delivery. For the incoming engineering student to receive both the holistic university experience and the ability to learn and retain fundamental engineering principles and practices, the course is being revised through central and integrative engineering design projects with service learning components. The revised structure places emphasis on the continuity across modules and sessions to ensure (a) the sustained engagement, and (b) the highest levels of student learning and retention of concepts throughout the semester.**

Index Terms – Service learning, Course modules, Key assignments, Engineering projects

INTRODUCTION

The purpose of this paper is to illustrate the preparation and delivery of topically well-integrated and seamlessly interfaced instructional material for the critical entry-level course, *First-Year Seminar in Engineering*. The instructional material will comprise course modules presenting topics closely related to central engineering projects with service learning components. The delivery process will emphasize continuity across sessions and modules to ensure the sustained engagement, throughout the term, of the students who are enrolled in this course.

The current version of the *First-Year Seminar in Engineering*, which has approximately 45 to 50 students enrolled each fall, comprises a loosely organized collection of engineering and non-engineering topics delivered in twenty eight 55-minute sessions of the term (14 weeks). The content and delivery of this course can be revised through the use of one or more central engineering project with service learning components to motivate and sustain student learning. The design of renewable energy systems from wind and/or solar panels are possible community-based engineering projects which can serve as the central or integrating theme for the course. The students engage in hands-on team-based engineering problem-solving which will reinforce their classroom experiences.

The steps to implement the revision are as follows:

Step 1: Identify the topics and the schedule for delivery of these topics in one semester (14 weeks)

Step 2: Organize the topics in course modules for coherent flow within and across modules

Step 3: Create instructional material for each topic within the module. This includes content for learning management systems (LMS) such as *Evaltools* [1].

Step 4: Integrate the modules and session flow to form the instructional resource for the course

This paper represents work in progress to achieve the aforementioned steps. Section 2 discusses the course description and course outcomes. Section 3 outlines the topical flow and module design process. Section 4 identifies the components of the learning outcomes assessment process.

SECTION 2: COURSE DESCRIPTION & OUTCOMES

The syllabus for the *First-Year Seminar in Engineering* summarizes the course description as follows:

The First-Year Seminar in Engineering is designed to orient the new student to the University, to introduce engineering as a professional field, to connect with the Liberal Studies Core and LIFECORE, to assist in the

transition from high school to university life, and to encourage development of academic, personal, and spiritual aspects of the student's life. The First-Year Seminar in Engineering will stimulate and enhance the student's interest in and their understanding of engineering.

There are nine course outcomes as listed below. Each course outcome maps to a specific ABET-approved student learning outcome.

1. Comprehend the basic topics in mathematics, science, and problem solving tools common to the engineering fields
2. Comprehend the engineering design process and problem solving techniques
3. Comprehend how economic, environmental concerns, health and safety, communication, social concerns impact engineering
4. Demonstrate the ability to conduct experiments and analyze data
5. Demonstrate the ability to analyze one of the following LIFECORE dimensions including related activities and presentations: Intellectual (Quest for Knowledge), Life Planning (Balance), Cultural (Appreciation), or Political (Leadership)
6. Demonstrate the ability to relate the following two elements of Catholic social teaching to their own lives: (a) the affirmation of the fundamental rights and responsibilities of every person, (b) the protection of the dignity of work and the rights of workers
7. Demonstrate the ability to analyze what they learned from their engineering service learning experience
8. Demonstrate effective electronic communication and collaboration skills, including the ethical use of computing software and Internet technologies
9. Demonstrate the ability to evaluate personal study habits and develop goals to improve those habits

The student performance in each course outcome is measured by the pre-selected assignment, called the *key assignment*. The course outcomes and the corresponding student outcomes are assessed by the construction of the EAMU vectors and their application to the *key assignment*. The construction of the EAMU vectors used for course assessment applies the following scoring in all cases: **Excellent** (E) is scoring 90 or better of the total points possible, **Adequate** (A) is 75 or better, **Minimal** (M) is 60 or better, and **Unsatisfactory** (U) is anything below 60.

SECTION 3: COURSE MODULES AND TOPICS

Figure 1 illustrates the course modules and timeline of the course for 30 sessions during the term (15 weeks at 2 sessions per week). There are 7 course modules which group the topics as shown in the colored boxes.

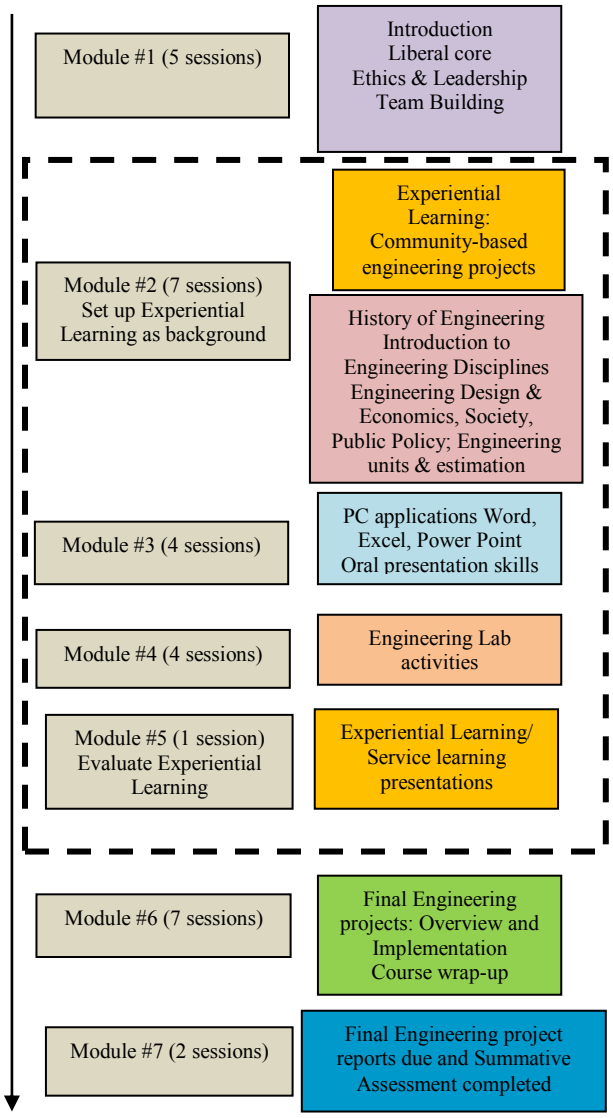

FIGURE 1
COURSE MODULES AND TOPICS

The dotted box indicates the set of modules applied to engineering projects with service or experiential learning components [2].

SECTION 4: ASSESSMENT

The assessment methods used within each module comprise report writing, problem-solving activities, and homework assignments whose goal is to focus the student learning toward the central engineering project. The students are assessed in both individual and team-based problem-solving which emphasize professional and societal concerns.

REFERENCES

[1] *Evaltools*^{R}: A Web-based Assessment tool (http:www.makteam.com)

[2] Tsang E. and Zlotkowski E. (eds.), "Projects that Matter: Concepts and Models for Service-Learning in Engineering," AAHE Series on Service-Learning in the Disciplines, 2007.