Session #: _____

A Seminar Course for First-Year Engineering Students

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ABSTRACT

Retaining first-year engineering students and preparing them for success continues to be a challenge for many engineering programs. While a number of innovative first-year engineering experiences have been developed, many students will leave engineering programs without understanding the opportunities that an engineering degree can provide. Additionally, students may not be informed about the strategies and activities that will prepare them for a successful career. This paper describes the design of a seminar for first-year engineering students that: 1) exposes students to the different engineering disciplines to better assist them in selecting their major, 2) presents students with the continuum of different career possibilities that are available to graduates with an engineering degree, and 3) provides students with advice on how undergraduates can prepare themselves for a successful career. To ensure the course objectives were met, the seminar was designed to maximize student interaction. Therefore, the format of the seminar included faculty presentations, small group discussions with faculty and upper-class engineering students, and panels containing engineering alumni from industry and graduate school.

The course in its current format was taught for the first time in the fall 2011 semester. This paper will discuss the development and organization of the course including details about the individual seminars and the impact the course had on the students. Initial assessment from the students has been very positive. Student assessment results and how the seminar could be improved in the future are also discussed.

INTRODUCTION

The impact of first-year seminars has been studied extensively. A paper by Cuseo (2007) summarizes a multitude of these studies and identifies the positive impact of the first-year seminar. Cuseo states, "It is reasonable to conclude that there has been more carefully conducted research on, and more compelling empirical evidence gathered for, the first-year seminar than any other course offered in the history of higher education." He then goes on to identify multiple studies which support two claims. First, the first-year seminar has a positive impact on retention including persistence to completion to all academic levels (i.e., degree completion, first semester completion, first year completion, etc...). Second, the first-year seminar has a positive impact on

academic performance and achievement outcomes including cumulative grade point average at various academic levels, number of courses passed (versus dropped or failed) and percentage of students who qualify for academic honors.

Additionally, a large variety of first-year engineering seminars have been described and evaluated in the literature. In each of these examples, faculty members provide evidence that first-year engineering seminars have a positive impact on students and their persistence in obtaining an engineering degree. Standridge, et al. (2006) describes an optional first-year engineering seminar at Grand Valley State University. The content of the one credit seminar is focused on the following: 1) introducing students to their classmates, the School of Engineering, and the University, 2) familiarizing students with the profession of engineering, and 3) presenting the societal context in which engineering is practiced.

Montgomery, et al. (2003) describe and evaluate three first-year engineering seminars offered at Purdue University with different formats: 1) large lecture with faculty presenters from individual disciplines, 2) smaller group sessions led by upper-level student mentors, and 3) smaller group sessions led by a faculty member on specific engineering topics or engineering issues.

Details of additional first-year engineering seminars are also provided by Overholser (2001) and Budny (2001). Overholser describes a freshmen engineering seminar at Vanderbilt University where participation is voluntary for both students and faculty. Furthermore, faculty that volunteer for the seminar can teach any topic they choose. Budny[5] describes a freshmen engineering seminar at the University of Pittsburgh where student mentors meet weekly with small groups of first-year engineering students to assist with their transition from high school to college and to provide information on the various engineering disciplines.

The Valparaiso University College of Engineering (VUCoE) incorporates a zero-credit seminar into the first-semester engineering experience. Although first-year engineering students are accepted into the VUCoE, they do not select their engineering major until the end of their first semester. Therefore, all first-year engineering students participate in the same first-semester engineering experience. The VUCoE first-semester experience includes the engineering seminar and a two credit introductory engineering course.

The VUCoE introductory engineering course and the first-year engineering seminar share two primary goals. First, the courses strive to improve retention in the college of engineering by generating an interest in the field of engineering. Second, both courses strive to assist the first-year engineering students in the selection of their engineering major by providing the students with information on the various engineering disciplines. The introductory engineering course strives to meet these goals through the use of traditional lecture and hands-on laboratory experiences in mechanical, civil, electrical, and computer engineering. The seminar takes a different approach.

The seminar consists of section sizes of approximately 50 students that meet in a large lecture hall once a week for 50 minutes. Prior to 2011, there was little if any faculty participation in the course. The course administration and logistics were conducted by an engineering staff member. Furthermore, the seminar content was typically presented in a one-way manner with a speaker

lecturing to the students followed by a brief question and answer period. This traditional seminar style resulted in very limited interaction between the speaker and the students. The guest speaker seminars were used to provide students with information about various engineering opportunities and disciplines. Typically these guest speakers would describe their career path and projects they had worked on.

Based upon student feedback, student perception of the seminar, and a lack of student participation during the seminar, there were multiple areas identified for improvement. First, the seminar content did not illustrate or emphasize the myriad of careers or opportunities that graduates are prepared to pursue with an engineering degree. Secondly, the lecture with question and answer format did not excite students, particularly when the speaker was from a discipline in which they were not interested or if the speaker presented technical details of a project for which they did not have the requisite background. Third, it was difficult to assess the quality and potential areas of improvement for each seminar because seminar objectives were not defined and student surveys were not executed. Finally, there was significant room for improvement in student attendance, punctuality, participation, and professional behaviour during the seminars.

To address these issues, significant modifications to the first-year engineering seminar were implemented in Fall 2011. The purpose of this paper is to present the current first-year engineering seminar and discuss the quality and effectiveness of the seminar. The paper is organized as follows: 1) the seminar goals are presented, 2) seminar content is described, 3) seminar philosophy is described, 4) seminar assessments based upon student surveys are provided, and 5) conclusions and further suggestions for improvement are provided.

FIRST-YEAR ENGINEERING SEMINAR GOALS

There are multiple goals for the first-year engineering seminar. These goals included:

- Assisting first-year engineering students in selecting or confirming their choice of major;
- Improving retention in the college of engineering by exposing the students to the continuum of different career possibilities created by receiving an engineering degree;
- Encouraging students that determined they were not interested in a traditional engineering career to pursue an engineering degree in preparation for other careers such as medicine, law, and sales;
- Exposing students to university opportunities and services and professional development topics to help ensure their academic success and encourage their commitment to the engineering profession; and
- Emphasizing the importance of life-long learning.

FIRST-YEAR ENGINEERING SEMINAR PHILOSOPHY

Multiple changes in relation to the first-year engineering seminar philosophy were implemented in 2011. First, faculty involvement in the course was significantly increased. One faculty representative from each department participated in the development and implementation of the seminar. Their responsibilities included the development of seminar materials, introducing and moderating the seminar sessions, and contacting and coordinating with outside speakers.

Moreover, these faculty representatives served as a resource for the students that had questions about items such as the academic programs, the engineering disciplines, and career possibilities.

Second, goals, learning objectives, a session agenda, and a detailed summary of logistics were created for each seminar session. To prepare the students for participation in the seminars, pre-seminar assignments were created and assigned. For example, when guests participated in the seminar sessions, the students were required to read their biographies and generate three questions for each of the guests. Moreover, the successful implementation of the learning objectives was assessed with a student survey at the end of each seminar. As a future resource for the students and engineering faculty, binders were distributed to the students that the students used to store all seminar material. In the future these binders will be created and distributed to the students prior to their participation in the course.

Third, individual guest speakers were replaced with guest panels that were composed of one alumnus from each of the engineering departments within the VUCoE. By using panels versus individual speakers, the students were able to receive multiple perspectives on a topic. Additionally, the seminars were very interactive as the students were able to ask specific questions to each of the panellists. In all seminars that included a panel, an engineering faculty member acted as the moderator. If students did not volunteer questions, the moderator selected specific students to ask a question to encourage participation. The one disadvantage to using a guest panel versus an individual speaker is the challenge of finding more guests willing to participate in the seminars.

In addition to the interactive panel style seminars, three seminars included a very brief introduction followed by break-out sessions where the students were divided into groups of 15 to 20 students. One faculty moderator was assigned to a group. Guest faculty often moderated these smaller groups which provided the first-year engineering students an opportunity to meet engineering faculty not associated with the seminar course.

The fourth major modification to the first-year engineering seminar course was the implementation of a professionalism policy. Although the seminar is a zero-credit course, it is a required course in the engineering curriculum and the students must receive a grade of satisfactory to meet the curriculum requirements. Professional expectations including policies on attendance, punctuality, and classroom behaviour were clearly identified in the syllabus. Additionally, students were required to complete all pre-seminar assignments. If a student violated a professionalism policy or did not complete a pre-seminar assignment, they received one warning. A second violation resulted in a grade of unsatisfactory in the course, requiring the students to repeat the course to meet their curriculum requirements.

FIRST-YEAR ENGINEERING SEMINAR CONTENT

The first-year engineering seminar content and format are displayed in Table 1. For the three weeks that the seminar did not meet during the semester, the seminar time period was reserved for exams for the introductory engineering course. The details of the seminars follow.

Table 1: First-Year Engineering Seminar Content.

Seminar	Title/Content
1	Dean's Message to the Class of 2015
2	Why did I choose engineering?
3	Career Center, Resumes, and Portfolios
4	Engineering Careers…First 5 Years
5	Engineering Careers…Later Years
6	Other Careers…Beyond Engineering?
7	Academia Beyond the Undergraduate Degree
8	Registration and Group Advising
9	I am a CE/ECE/ME.... What now?
10 & 11	Vocation in Engineering I & II

The first seminar is presented by the Dean of the VUCoE. The goal of the seminar is to introduce the students to the Dean, department faculty liaisons, and the engineering support staff. Moreover, the Dean provides information to the students on the professional expectations of engineers during their academic studies and their careers. The form of the seminar is a traditional lecture; however, the Dean queries the students multiple times during the presentation for their thoughts and expectations.

The second seminar provides the students the opportunity to meet faculty from each of the engineering departments. The students are separated into three smaller groups of approximately 15 to 20 students. A faculty member from each of the three disciplines rotates from group to group, providing their insight into engineering studies and engineering as a career. Additionally, they answer student questions and query the students as to their reasons for selecting engineering as a major.

Seminars three and eight expose the students to University services and resources available at the Valparaiso University Career Center and advising and registration procedures and responsibilities. Seminar three is presented by Career Center personnel who outline the resources available and provide the students with a tutorial on resume preparation and advice on the creation of an engineering portfolio. Seminar eight is presented by the Registrar who provides the students with a tutorial on the registration process. Additionally, the students meet with their assigned academic advisor in a group setting. Once a student selects a particular engineering major in the VUCoE, they are assigned a department faculty member as an academic advisor. This advisor remains with the student throughout their academic career.

Seminars four through seven include guest panels that illustrate different aspects of an engineering career. In each of the seminars, a faculty member moderates the discussion and the students come to the session with questions for the panellists. The panellists in seminar four are working in industry as engineers and have graduated within the last five years. The goal of this seminar is to provide the students with the perspective of an engineer that is early in their career. The panellists in seminar five have been in the engineering workforce for approximately ten years. They provide a perspective from an individual who is later in their engineering career. Seminar six includes panellists who have engineering degrees but who do not work in traditional

engineering careers. For 2011, the panellists for this session included a patent lawyer and a marketing manager who has also been a technical salesman and an entrepreneur. The panellists in seminar seven are students who are currently in graduate school or who have recently completed graduate school. The goal of this seminar is to introduce the first-year students to the concept of graduate school and the required qualifications and requirements to attend graduate school. An additional goal of this seminar is to introduce them to the possibility of a career in academia or research.

From the previous paragraph, it is obvious that many of the seminars require multiple guest speakers. Therefore, one difficulty that arose was finding guest speakers that were willing to travel to campus. Therefore, we implemented two ideas. First, when guest speakers did travel to campus, we leveraged their visit with an additional presentation to all students and faculty or an engineering organization. For example, one guest from Caterpillar, Inc. presented on the modern diesel engine while another speaker met with the Society of Women Engineers to provide career advice for women interested in engineering careers. Second, we used Adobe Connect to interface with guest speakers from a remote location. All speakers for seminar seven were graduate school students who answered questions from seminar participants from a remote location. A faculty moderator was required as the interface between the seminar students and the remote guests. The remote technology was very successful and will allow for a much more diverse group of guest panellists in the future.

Seminar nine occurs after the students have selected their engineering discipline. The students are separated into groups based upon their major selection. These groups meet with existing upper-level students to receive advice on academic success and have the opportunity to ask the upperclassmen questions.

Finally, the goal of seminar ten and eleven is to begin to get students to think about engineering as a vocation and what they need to do to prepare for their vocation. Seminar ten is a traditional lecture experience where the students learn about the different perspectives of what a vocation is and how different individuals see engineering as not only a career but also a calling that provides the opportunity to improve society and help people. The students are divided into smaller groups for seminar eleven. Within these groups, the students discuss with a faculty member what they hope to accomplish with their engineering education and what they feel they need to do to prepare for their vocation.

FIRST-YEAR ENGINEERING SEMINAR COURSE EVALUATIONS

The course assessment results are shown in Table 2 for each seminar. At the end of each seminar session, approximately 90 students were required to complete a short survey. They rated the success of the seminar in meeting the provided objectives. Since each seminar had a varying amount of objectives (i.e., two to four), the numbers in the associated column in Table Two are the average rating of all the objectives for that particular seminar. Students also evaluated whether they felt the seminar was beneficial, whether the format of the seminar was appropriate, and provided an opinion on whether the seminar should be offered again in the future. As can be seen from the overall averages at the bottom of Table 2, the students provided positive responses to all survey questions (every response except one was 4.25 or above). These responses validate

the effectiveness of the individual seminars and the students' belief that the seminars were beneficial. A more detailed inspection of the student survey results shows that the Vocation in Engineering seminar should be investigated for potential improvements. While the students agreed that the Vocation in Engineering seminar should be offered again, compared to the other seminars, their response was the lowest for "Were the objectives achieved?" and "Was the seminar content beneficial?"

Table 2: First-Year Engineering Seminar Assessment Results.
Assessment Result Scale: 1 (Completely Disagree) to 5 (Completely Agree)

Seminar	Title/Content	Were Seminar Objectives Achieved?	Was the Seminar Content Beneficial?	Was the Seminar Format Appropriate?	Should the Seminar Be Offered Again?
1	Dean's Message to the Class of 2015	4.58 (0.65) [1]	4.52 (0.76)	4.62 (0.63)	4.65 (0.68)
2	Why did I choose engineering?	4.40 (0.80)	4.57 (0.81)	4.42 (0.87)	4.53 (0.92)
3	Career Center, Resumes, and Portfolios	4.43 (0.67)	4.60 (0.62)	4.31 (0.83)	4.61 (0.57)
4	Engineering Careers…First 5 Years	4.53 (0.64)	4.80 (0.50)	4.49 (0.66)	4.78 (0.50)
5	Engineering Careers…Later Years	4.42 (0.71)	4.66 (0.56)	4.45 (0.73)	4.73 (0.53)
6	Other Careers…Beyond Engineering?	4.44 (0.72)	4.38 (0.76)	4.06 (0.92)	4.48 (0.72)
7	Academia Beyond the Undergraduate Degree	4.58 (0.65)	4.52 (0.76)	4.62 (0.63)	4.65 (0.68)
8	Registration and Group Advising	4.58 (0.64)	4.71 (0.53)	4.49 (0.72)	4.78 (0.50)
9	I am a CE/ECE/ME.... What now?	4.59 (0.59)	4.70 (0.51)	4.71 (0.48)	4.74 (0.59)
10 & 11	Vocation in Engineering I & II	4.25 (0.82)	4.36 (0.90)	4.40 (0.80)	4.52 (0.85)
	Overall	**4.48 (0.71)**	**4.58 (0.69)**	**4.46 (0.76)**	**4.65 (0.68)**

[1] Each cell contains: Average (Std. Deviation)

CONCLUSIONS

This paper describes a seminar course for first-year engineering students that: 1) exposes students to the different engineering disciplines to better assist them in selecting their choice of major, 2) presents students with the continuum of different career possibilities that are available with an engineering degree, and 3) provides students with advice on how to prepare for a successful career. The objectives of the seminar course are to improve student retention, provide

students with information to help them select an engineering discipline, and expose the students to professional development topics and university services that will help them be successful. To assist in meeting the course objectives, the seminar was designed to include faculty presentations, small group discussion with faculty and upper-class engineering students, and panels containing engineering alums from various industry and graduate school positions. Assessment results based on student surveys were positive.

In the future, multiple improvements to the first-year engineering seminar will be investigated. To expand the pool of guest speakers, remote connection technology will be incorporated to a greater extent into the course. Additionally, more techniques to improve student interaction during the seminar will be investigated and incorporated. Finally, an effort will be made to include more faculty in the seminar sessions, allowing the first-year students to become familiar with the engineering faculty and their area of interests.

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