Student-Directed Learning Opportunities for the Development of Life-Long Learning Skills

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Abstract – *One of the skills we aim to develop in our students is the ability to work and function as life-long learners. This paper describes two curricular initiatives designed to foster life-long learning skills through student-driven learning in a multidisciplinary engineering program. Student-directed initiatives can help build critical thinking and information literacy skills, which are essential in the information and data-rich landscape that engineers work within. The challenges and benefits in developing and facilitating these initiatives, which run counter to the more traditional pedagogical framework in higher education, are discussed.*

Keywords: Life-Long Learning, Student-Directed Curriculum, Critical Thinking

1. INTRODUCTION

One of the skills we aim to develop in our students is the ability to work and function as life-long learners; in fact, this is made explicit through the introduction of the engineering graduate attributes by attribute 3.1.12, Life-long Learning: “An ability to identify and to address their own educational needs in a changing world in ways sufficient to maintain their competence and to allow them to contribute to the advancement of knowledge”[1]. Considering the rapid development of knowledge and the career flexibility of our graduates, it is impossible to impart all of the knowledge required for an engineering career in a four-year undergraduate program; students must be confident in their ability to learn independently, and in collaboration with their peers. This paper describes curricular initiatives designed to foster life-long learning skills through student-driven learning in a multidisciplinary engineering program.

2. SELF-DIRECTED CURRICULUM

2.1 Case Study Development

In a second year, core course in technology & society studies, students are required to take a leadership role in their learning through the facilitation of weekly seminar activities and reading discussions. Students, in teams, are

also required to conceptualize and write their own engineering and society studies case study, which they use to facilitate a seminar with their classmates at the end of the course.

Students are asked, when framing their case study, to consider a historical or current event, a problem, challenge, dilemma, controversy, opportunity or issue. More specifically, the students were told that their case study must:

- Highlight the complex interactions between technology and society
- Demonstrate the need for a multi- or interdisciplinary approach to problem-solving
- Give peers an opportunity to actively engage in a topic relevant to their engineering education
- Look at an issue beyond their local city

These requirements provided students with a breadth of opportunity to explore a topic of interest, and the students took on this challenge by generating a diverse set of relevant case study topics. While many groups required consultation with the course staff to help define and refine their topic, all case study topics were the original ideas of the students in the course. Some examples include:

- The role of technology in the modern classroom
- Moral and ethical issues of biomedical technologies
- The effects of virtual reality games on human behavior
- Cooperation vs. competition in driving technological advancement
- The Gulf of Mexico Oil Spill
- Privacy in the “Age of Facebook”
- Effects of increasing connectivity on cultural identity
- Evolution of engineering strategies through history

While all of the case study topics were relevant to theories and examples explored in the course, students were required to consult original resources and explore new ideas through the project.

To showcase their case study, students were required to facilitate a 2 hour seminar with 8-12 of their classmates. Scaffolding for the development of good learning opportunities is provided to the students through weekly, active discussion seminars, which are a required component of the course in weeks 1 through 10 (the student-driven case studies are run in weeks 11 and 12). Students are also provided with direct guidance on crafting high-quality learning experiences in lecture. All group members are required to actively participate in facilitation, and the student groups develop active facilitation plans, approved in advance by the course instructor, which include debates, simulations and other active discussion-oriented activities. This approach was selected for two key reasons. First, facilitating a seminar requires the students to consider how to cultivate a good learning experience for others, which, as all those who teach know, can be an important learning experience in itself. Secondly, the facilitation approach is driven by the fact that students have other opportunities for formal presentations, but a lack of opportunities to facilitate learning and discussion as students. Facilitation is a skill that's essential within engineering and more broadly – we all run meetings, lead projects, negotiate and engage in other activities which require this skill.

2.2 Student-Directed Seminar Course

A more significant student-directed learning experience is a student-directed seminar course. Students in years 3 and 4 are offered the opportunity to propose a course topic for exploration within the area of technology and society studies. A preliminary course plan, including major course topics and assessment methods, is developed in collaboration with the faculty coordinator, and then the course is opened up to 20 students in years 2, 3 and 4. In 2010, the course theme was “technology, the non-profit sector and social change”, while in 2012, the course theme was “future studies”.

At the beginning of the course, all course participants have the opportunity to contribute to the course plan – in other words, contribute to the decision-making process around topics to explore, learning methods, and how to assess the progress of learning in the course. The beginning of the course includes an overview of the topic from the student co-coordinators and the faculty coordinator, as well as a discussion on what makes learning significant. Allowing the students more decision-making power in their learning experience empowers them to consider more deeply the meaning and applicability of what they are learning, and what a good learning experience looks like.

In the most recent iteration of the student-directed seminar course, future studies was explored through four major themes, identified by the student co-coordinators:

1) An introduction to future studies; 2) Trends; 3) Predictions and 4) Policy recommendations. Students met for four hours each week, 2 hours face-to-face and 2 hours online, using hipchat and google docs to foster ongoing collaboration. In the first theme, pairs of students took responsibility for learning about an aspect of future studies (such as historical perspectives, or a specific method such as scenario analysis or the Delphi method), documenting it in the course's google docs collection, and reporting back to the class. As the course moved forward, students explored different examples of trends, predictions and policy recommendations to apply their general understanding of the field. These explorations were supported by various assessment methods, including debates, presentations and writing assignments. The students opted to include peer editing and review as a required part of the course, and the online portion of the class allowed for collaborative document building that the students will have permanent access to.

3. CHALLENGES AND BENEFITS

There are challenges in organizing student-directed learning activities. A considerable challenge for the course instructor is related to trust and control, particularly in the case of the student-directed seminar course. The instructor must be willing to give up control over content and approach to allow for student-led learning. At times, decisions made about the course may be different than decisions an instructor would make alone. However, the instructor is still responsible for ultimately ensuring meaningful learning takes place. One must recognize the learning potential for a student in crafting their own learning experience. In examining the case study project, the large number of students engaged

These curricular initiatives encourage students to self-identify gaps in knowledge, develop strategies to address those gaps, and consider the nature of a significant learning experience, all of which can prove beneficial as a student and an engineer. Student-directed initiatives can help build critical thinking and information literacy skills, which are essential in the information and data-rich landscape that engineers work within. While each of the initiatives described have only been run twice, students have demonstrated engagement in the self-directed learning experiences, along with a bit of trepidation at times around the prospect of developing their own “learning path”, which is to be expected considering the traditional mode of curriculum delivery in higher education. Overall, students appreciate the opportunity to pursue an area of personal interest and take a leading role in their own learning pathway.

The benefits of these opportunities do not end with the students who participate – this has proven to be a knowledge-generating experience that could have further reaching impacts. For example, so far, nearly 100 engineering and society case studies have been developed, on both historical and contemporary topics. Future work may include the collaborative publication, with the student authors, of some top-quality case studies for use by other institutions and classes. With the case of the student-directed seminar, concepts from the future studies course will be added to the second year core

course in technology and society studies, making a last contribution to the curriculum as a whole.

References

- [1] Canadian Engineering Accreditation Board (2010). *Accreditation Criteria and Procedures*. Available March 3rd, 2012 from http://www.engineerscanada.ca/e/files/acc_Manual_Accreditation_Procedures.pdf.