Extended Abstract - Integrating Innovation in the First Year Experience

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***Abstract* - Student engagement is critical to increasing learning and developmental outcomes of students pursuing higher education. The University of Minnesota Twin Cities, College of Science and Engineering First Year Experience course is entering its fourth year of offering to incoming first year students. The course objective is to assist first year students who are studying mathematics, science, and engineering transition to college by engaging them to gain vital skills such as critical thinking, time and project management, communication, diversity, and innovation. The course is designed to increase student engagement with an experiential learning component required of all incoming first year students called the Innovation Project. During the First Year Experience course, students receive information regarding major exploration, student engagement, diversity, ethics, their own Gallups StrengthsQuest results, major exploration, and the Innovation Project. These varied topics cover a wide array of transferable professional development skills vital to an individual's success as a student and as a future professional in science and engineering. A mix of discussion topics and hands-on opportunities are used to engage the student throughout the semester and offer relevance to their future careers. The Innovation Project not only excites their scientific, math, and engineering interests but also provides a space to develop strong teamwork and communication skills. This paper discusses the successes and challenges of the College of Science and Engineering Innovation Project and its integration into the First Year Experience course.**

Index Terms – innovation project, project management, student involvement,

INTRODUCTION

The College of Science and Engineering (CSE) First Year Experience (FYE) course provides students with the resources and skills necessary in order to engage meaningfully at the University of Minnesota. The FYE course's framework was influenced by Alexander Astin's developmental theory of student involvement in higher education and the eleven ABET student outcomes.

Astin's theory of student involvement suggests five tenets that are imperative to student success: student investment of physical and psychological energy; continuous engagement with multiple levels of involvement; involvement in academic work that is measurable; student learning and development relates to the quantity and quality of the student involvement in the program; and lastly, effectiveness in programs may increase students overall engagement [1]. Astin's theory of student involvement was embedded in the CSE FYE course in several ways to meaningfully engage students and assist in student development.

Through classroom lecture, discussion, assignments, and the Innovation Project, each ABET student outcome is touched upon in the FYE course. The three primary outcomes that are focused on are: a) an ability to apply knowledge of mathematics, science, and engineering; d) an ability to function on multi-disciplinary teams; and g) an ability to communicate effectively.

Overall, the intention of the FYE course is to encourage first year freshmen to think as students with advanced standing, offering them tools and opportunities to prepare themselves for opportunities that will arrive sooner than they anticipate.

METHODS

The CSE FYE course took on many forms over time. In every implementation until Fall 2013, Honors students were put into their own Honors sections. The following descriptions refer to only non-Honors course sections.

I. Round One: Fall 2010

The first implementation of the CSE FYE course was via an online course management system, Moodle, in Fall 2010. First year students were told to routinely check the Moodle site throughout the year and submit reflections on suggested experiences such as forming a study group, attending a football game, or going to a professor's office hours. Online forums intended to spark discussion on common first year courses were open to students on the Moodle but were never fully utilized by students.

II. Round Two: Fall 2011

In Fall 2011 the FYE course changed drastically into an in-person classroom course titled CSE 1001 and included a group Innovation Project (IP). Twelve instructors were recruited from CSE Student Services, Academic Advising, Career Center, and the University's Office of First Year Programs to teach 20 sections of 40 students each of the course. CSE 1001 was delivered as a hybrid that required

each class section to meet as a whole group every other week, with IP teams meeting independently during the off weeks.

The semester was divided into six "blocks" consisting of one classroom and one team meeting, or two weeks of the semester. Each block focused on a different topic: Efficiency and Effectiveness; How to Innovate; Opportunities Outside the Classroom; Advising, Registration, and Academic Policies; and Innovation Project Presentations. Because most instructors taught two sections, the bi-monthly classroom meetings were staggered so that half the sections had a block that began with classroom instruction and ended with a team meeting and the other half of the sections had a block beginning with a team meeting and ending with classroom instruction.

Students were required to complete a team report for every team meeting and an individual reflection paper for every block. Assignments and announcements were communicated using a common Moodle site for all course sections. The Moodle was moderated and updated by the CSE Student Services office.

In addition to these assignments and meetings, students were working on group IPs. Students were assigned in advance to IP teams by CSE staff based on their intended majors. Teams were comprised of four to six students. There were eight teams in each section.

Teams could choose to work on one of six broad problem categories such as "Design, prototype, evaluate, and demonstrate a new human powered machine that does something useful," or "Find a product, structure, or service at the University of Minnesota that does not work and propose a solution." The intention of the IP was to give students the opportunity to innovate solutions to real world challenges. Guidelines were provided during one 50-minute classroom session and an eight-page handout. No additional class time was given for work on the IP. Students were expected to complete the project work outside of classroom hours.

Project deliverables were (1) a 100-250 word problem statement due at the beginning of the semester, and (2) a "3-in-5" presentation at the end of the semester. The "3-in-5" format referred to three slides presented in five minutes.

III. Round Three: Fall 2012

The number of instructors increased from twelve to twenty in Fall 2012 to eliminate the blocking system of Fall 2011. Instructors included professional staff from CSE's offices Academic Advising, Student Services and Career Center as well as the University's Housing and Residential Life and Orientation and First Year Programs. Sections met in class on a weekly basis throughout the semester. Undergraduate teaching assistants were assigned to each section to support the connection of the course content to application as a student. Assigned homework was reduced from Fall 2011 for multiple reasons including allowing for more time to focus on the IP.

The Fall 2012 implementation attempted to create a line of separation between the in-class component of CSE 1001 and the IP. Each instructor controlled a classroom Moodle page for their own section and the IP had a separate comprehensive Moodle page controlled by one faculty member. All the information regarding the IP was communicated through emails and brief videos posted on the IP Moodle by the faculty coordinator. Little classroom time was reserved for the project.

Students were given a list of 25 IP topics and asked to rank all in terms of preference. Students were assigned to project groups based on their course section and project preferences. The possible project topics were more specific than in Fall 2011, such as "Design and Build an Audio Speaker," and "Easy to Raise Wind Turbine."

Each project was sponsored by a local company or a CSE student organization. Throughout the semester, teams were mentored by industry professionals or upper division undergraduate students based on each project's sponsorship. Teams were expected to meet for two hours a week outside of class to work on the IP and communicate independently with their mentors.

Project deliverables included two presentations: (1) mid-way through the semester, with topics including project proposal, design review or damage control; and (2) at the end of the semester, with either product launch or request for continuation as a topic.

IV. Round Four: Fall 2013

The upcoming Fall 2013 implementation will not include honors specific sections. A total of 25 sections of 40 students each will be offered due to this change and to the increasing class size of CSE. The first seven weeks of the semester will be devoted to traditional FYE topics, such as student engagement, leadership, diversity, career exploration, etc, with no mention of the IP.

Faculty instructors will be employed in all sections during the last seven weeks of the semester and will be focused on the IP. To support this initiative, among others, the College is hiring a part-time faculty position, the 3M Chair in Experiential Learning. This person will be charged with developing the curriculum for the IP. As such, the details of the IP curriculum for Fall 2013 have not been set. It will likely include topics focused around basic design concepts and research to support experiential learning and will continue to focus on team building in groups of 5 students.

RESULTS

The CSE FYE course offerings have been met with mixed reaction. Many students do not focus on the content of the FYE course because it is viewed as less crucial to the advancement of their degree program than their math- and science-based courses. The sections that have provided the most positive feedback are based around major selection and career services. Major selection is a key topic for many

of these students, as most entered the college largely undecided on a major or choosing between multiple majors.

While qualitative student feedback has been varied, quantitative surveys show that students' confidence in their abilities to navigate the University has increased. Students' understanding of how to work in a team has grown, along with their understanding of and passion for STEM disciplines.

The IP has also been met with mixed reaction. Some students relish in the opportunity to design and prototype, while others are not able to see the relevancy of the project to their eventual careers. As such, many projects are lackluster and do not showcase true innovations. In the Fall 2011 semester, many groups chose projects that were relevant to their present situations. These included campus buses, biking around campus, and residence hall rooms.

The Fall 2012 semester projects were more diverse, but many designs and solutions were poorly researched and routine. Though CSE attempted to provide a support network of mentors, either professional or upper division undergraduate engineers, many teams experienced difficulty communicating with their mentors.

There have been positive results as well. We have seen improvements in the groups' ability to communicate their goals and ideas throughout the course of the semester. In Fall 2012, initial project presentations were lackluster and in some cases very disjointed. Some PowerPoint presentations were poorly organized and difficult to follow. The final presentations showed great improvement. Flow and conciseness improved. Students appeared to be better prepared for the presentations.

Some groups displayed greater understanding of the engineering design process and research. Many teams were able to prototype their designs and the projects that did not provide physical prototypes often offered rough schematics and design specifications. Groups with abstract projects were often able to provide solid research findings to support their theoretical solutions.

Teamwork also improved throughout the semester. Many teams became very close and developed strong relationships over the course of the semester. They showed great collaboration and communication in the completion of their project.

DISCUSSION

Continued iterations of this course will search for a balance between engaging experiential coursework and support for the freshman experience. More work will be done to improve the experiential learning piece of the course during Fall 2013.

A key desire is to offer project topics that resonate with students and that push students to move outside of their comfort zones. Too often in the past, groups limited themselves to what they felt was achievable in their current state. Ideally, students will explore solutions that are beyond their current abilities and knowledge into true innovation.

Another complication with the IP is the range of the freshman class. This range refers to both academic and applied abilities as well as interests. CSE offers majors in engineering, mathematics, and physical science disciplines. To create a project that is stimulating and engaging for such a range of students is a unique challenge.

From its first appearance, the IP has caused the most confusion and difficulty for students and instructors. The new faculty position will offer a comprehensive plan to address student's interests and push their comfort levels in innovative design and research. This position will also offer consistency so that program strengths can be leveraged rather than redesigned from the beginning. These changes will provide new benefits to the students and instructors.

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REFERENCES

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