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Engineering Co-op Interns as Partners in First-Year Student Engagement, Mentoring, and Course Development

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Work-in-Progress – Engineering Co-op Interns as Partners in First-Year Student Engagement, Mentoring, and Course Development

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***Abstract* - Engineering Student Engagement Partners (ESEPs) were hired at the beginning of the 2016-17 academic year to help maximize first-year student success and to involve junior students in curriculum development for first-year engineering courses. ESEPs support students by attending lectures, providing tutoring, directing students to support services, and hosting "online rooms" to provide after-hours support. ESEPs support the instructional team by developing and focus-grouping course materials, administering extra problem sets through on-line rooms, and informing instructors of student difficulties. Finally, the ESEPs support the administration through research into best practices in first-year engineering education, curricular advancements in other schools, and novel instructional methods. Preliminary results show increases in uptake of services and instructor support from the first to the second semester. Examples of instructor-ESEP collaboration include spatial visualization aids, supplemental problem sets, and new case studies. Students are more comfortable approaching the ESEPs compared to the instructor, given the ESEPs' peer status. Instructors' perception of the program, and correlations between student use of supports and academic success will be quantified as part of a continuous improvement process.**

Index Terms – Peer mentoring, Instructional support, Retention.

BACKGROUND

Memorial University welcomes approximately 250 students into its Engineering One ("Eng One") first year, directly from high school. Eng One is common to all departments. Upon completing 11 courses within three semesters, students with sufficient academic standing are promoted to second year ("Term 3"). Academic Terms 3 through 8 alternate with 4-month mandatory co-op work placements. Approximately 70-80% of Eng One students meet the promotion requirements for Term 3; however, a certain percentage will not earn entry into their department of first choice and will voluntarily leave the program. Once in Term 3, students move through the remainder of the program as a block-promotion cohort, with significantly reduced attrition and increased peer-to-peer support and learning.

Co-op students ("Engineering Student Engagement Partners", or "ESEPs") were hired at the beginning of the 2016-17 academic year to help maximize first-year student success, engagement and motivation; and to increase Eng One students' sense of belonging to an engineering community. The ESEP program was also initiated to involve junior students in curriculum development for the four Eng One courses specific to the Faculty of Engineering.

Involving students as active participants in teaching and learning is growing in popularity. Healey *et al*. [1] suggest that successful approaches take advantage of shared engagement between students and academics seeking to learn together and enact changes to enhance student learning alongside academic teaching. Students-as-Partners initiatives are varied in practice throughout higher education institutions [2,3]. The ESEP initiative, while similar in scope to many peer mentoring programs, is multifaceted. The ESEPs support:

- **students** by attending lectures, providing tutoring, facilitating sessions on time management and study skills, redirecting students to appropriate support services, and hosting "online rooms" to provide after-hours support for lecture clarification and help with assignments.
- **the instructional team** by developing and focus-grouping course materials in collaboration with the instructor, administering extra problem sets through the online rooms, and informing instructors of specific student difficulties with assignments and lectures.
- **the undergraduate program administration** through research into best practices in first-year engineering education, curricular advancements in other schools, and novel instructional methods.

IMPLEMENTATION

To facilitate student engagement, the Faculty of Engineering and Applied Science employs a First Year Engagement Coordinator. The coordinator is responsible for a) facilitating professional learning opportunities, b) promoting instructional practices to optimize opportunities for student engagement, c) supporting curricular development and d) overseeing the ESEP initiative.

Initially ESEPs (4) were hired in the Fall 2016 semester. Each was given a lead role in supporting an individual course (Statics, Introduction to Programming, Design and Graphics,

and Circuits/Thinking Like an Engineer). After an introductory meeting with the course instructor, the ESEPs were introduced to the class. Throughout the semester, ESEPs participated in mentoring opportunities to support first term students. They provided information sessions on time management, homework practices, and exam preparation while simultaneously promoting a positive student mindset. ESEPs attended classes and tutorials to remain current with course content and concurrently provided support to students through the use of an online room available through the Engineering One website.

The online room sessions are help sessions available through Memorial's Desire2Learn technology learning management system. These sessions were offered during the evenings to complement other support structures available during the day. Initial qualitative data regarding participation in online rooms shows that students' use of this resource was helpful in clarifying course content and in responding to questions on course assignments.

In addition to mentoring students, ESEPs collaborate with instructors to create supplementary materials to improve course understanding. This collaborative effort among ESEPs and instructors provides a necessary student voice in active engagement and community building.

RESULTS

Initial ESEP program results are encouraging. ESEPs have actively established themselves as valuable resources in promoting student engagement and in fostering a sense of belonging for Eng One students. Currently, the ESEP role encompasses the following four pillars: peer mentoring, establishing a sense of community, curriculum development and enhancement, and student-instructor partnership.

I. Peer Mentoring

Students responded positively to ESEPs and reported the help provided to be "A+" and "absolutely great". ESEPs continue to refine their peer mentoring role through continuous interactions with students either face-to-face or online.

Interaction through the online room is building momentum as a forum where ESEPs can provide assistance to Eng One students. Online room availability was extended in the Winter 2017 semester and was simultaneously expanded to include practice problem sets. Increasing use of the online room, as measured by frequency and duration of visits, suggests this service has value to Eng One students. The uptake of this resource has increased since its initiation in the Fall 2016 semester, as shown in Figure 1.

II. Establishing a Sense of Community

To promote a sense of belonging among the Eng One student population, ESEPs created and maintained an Engineering One website (Figure 2). This website serves as a "landing place" for Eng One students where they can access information to facilitate understanding the first year program structure and availing of social and academic supports.

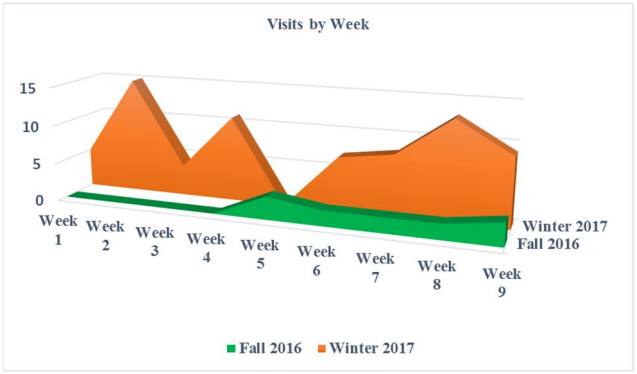

FIGURE 1
ONLINE ROOM VISITS

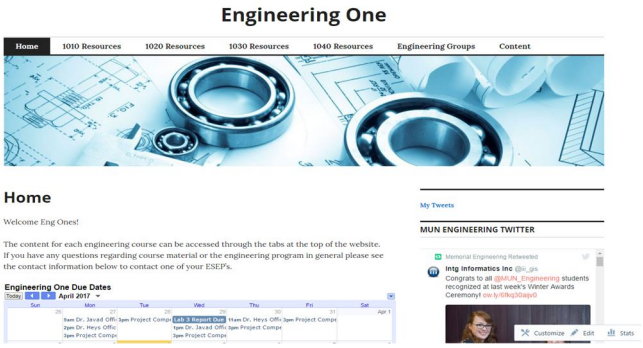

FIGURE 2
ENGINEERING ONE WEB SITE

ESEPs are responsible for providing dates of course deliverables, disseminating information regarding upcoming opportunities such as departmental educational sessions, and providing resources to encourage independent learning. Table I details site visits by resource type. Prior to the formation of the web site, Eng One students could only access individual course shells or instructor web sites with inconsistent formatting. We feel this led to a perception of Eng One as a collection of disparate courses that must be done before students can truly "get into Engineering". The web site is part of a process to instill a culture that all new students are part of the "Engineering Class of 20xx" cohort.

TABLE 1
VISITS TO ENGINEERING ONE WEB SITE

Resources	Visits
Practice Problem Set	240
Resources	58
Solutions	33
Groups	51

III. Curriculum Development and Enhancement

Through positive interaction with course instructors, ESEP's have developed a variety of course materials including video content, practice problems, demonstration materials, and active engagement activities. These are identified in Table II. Figure 3 shows a slider-crank mechanism demonstration tool, which can be reconfigured with offset, for a case study on

engine shaking forces. Figure 4 depicts an acrylic box generated by an ESEP student, in collaboration with the instructor, to aid with orthographic projection visualization.

TABLE II
MATERIALS DEVELOPED BY COURSE

course	Materials
ENGI 1010 Statics	Practice Problem Sets
ENGI 1020 Intro to Programming	Practice Problem Sets
ENGI 1030 Graphics & Design	Demonstration Materials, Active Learning Activities, and Experiential Activities
ENGI 1040 Thinking Like an Engineer	Demonstration Materials, Draft Case Study, and Visual Content

FIGURE 3
SLIDER-CRANK MECHANISM

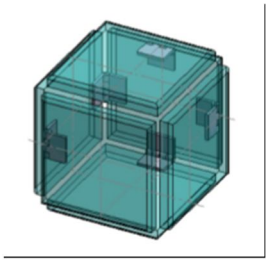

FIGURE 4
ACRYLIC BOX (SOLIDWORKS DESIGN)

An ESEP student generated a comprehensive literature survey of the use of case studies for strengthening student learning. That report is a meaningful contribution to the administration as it builds consensus among faculty who may be resistant to departure from traditional course syllabi.

IV. Student-Instructor Partnership

Instructors' acceptance of a student voice as a positive resource in program development is essential. Three first-year instructors that commented on the ESEP program indicated the program provided value to their respective courses and suggested that this initiative continue. One instructor, upon receiving feedback from the ESEP stating that students were struggling with a programming concept, modified subsequent lectures, and provided additional practice problem sets for posting on the web site. The Graphics and Design instructor embraced the changes to practice exercises in isometric drawing that were suggested by the ESEP. That new feedback loop appears to be a promising means of increasing student learning.

DISCUSSION, SUMMARY AND FUTURE WORK

Compared to professors and even graduate Teaching Assistants, ESEP peer mentors have less of an "expert blind spot", as they have struggled with the material more recently. They bring a unique perspective of student experiences and expectations to any academic program. Their willingness to be a "voice" of today's engineering student, by sharing ideas of how students best learn and ways to motivate students to pursue engineering, is valuable to the faculty's growth.

A productive student-instructor relationship has resulted in a collaborative effort to address student challenges as evidenced through student feedback and reflections. One instructor suggested hiring initiatives take place prior to the beginning of a semester to facilitate course preparations with the potential contributions of the ESEPs in mind.

ESEPs are seen by Eng One students as model students who have had a successful transition from high school to university. Their close proximity in age and academic experience to the students they mentor benefits their collaborative relationship. Through interactions with Eng One students, ESEPs share their knowledge and experience to help others who are beginning their academic journey.

Overall, the ESEP initiative is showing potential benefits in the four areas described in the Results section. Future work will attempt to quantify the correlation between student uptake of ESEP services and academic success.

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