REDESIGNING THE UBC FIRST YEAR INTRODUCTION TO ENGINEERING: SUCCESSES AND CHALLENGES

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Abstract *A new first year introduction to engineering experience was developed at the University of British Columbia. This paper provides an overview of the two new courses and the lessons learned both in developing and delivering the courses. Several key problematic areas in the previous curriculum were addressed, namely, to improve student connection with the engineering profession, increase design and practical engineering experiences, more effectively integrate sustainability into the curriculum, and better emphasize the human and social connection to engineering.*

The courses operate in a flexible learning framework with a sequence of online, lecture, and studio components arranged in a whole-part-whole format delivered to a class of 850 students. Elements of numerous effective course design, teaching and learning practices, including integrated course design, constructive alignment, components of Team-Based Learning, classroom assessment techniques, peer evaluation, and peer grading were incorporated into these courses. Student feedback through surveys has shown that the new format has been highly successful in addressing most of the key high-level goals, such as establishing a student connection to the engineering profession, helping students understand what engineers do and how they do it, and providing an introduction and appreciation for design, sustainability, decision-making, professionalism, and ethics..

Keywords: first year curriculum, engineering education, teaching design, curriculum development

1. INTRODUCTION

The first year engineering course sequence at UBC Vancouver was re-engineered to better introduce students to the engineering profession. The focus was on *how* an engineer thinks and *why* they act the way they do – not just on *what* an engineer needs to know. We found it helpful to think about how students first encounter engineering, not only how they learn the engineering science, but also how they come to appreciate the complex nature of an engineer's role in society. Specifically, an engineer is a professional that acts ethically and with integrity, has concern for people and the environment, communicates effectively with people around them and has the technical expertise to get the job done.

Biggs and Tang [1] make a distinction between declarative and functioning knowledge; this is often described as the difference between "university" and "professional" knowledge. "Declarative knowledge is knowledge about things" and "Functioning Knowledge is knowledge that informs action, where the performance is underpinned by understanding."[1]

Biggs and Collis's SOLO taxonomy [2] of learning was also useful in imagining and designing students first encounters with engineering. The SOLO taxonomy has five levels:

- **Pre-structural**: acquire new, unconnected pieces of information
- **Unistructural**: begin making simple, obvious connections between pieces of information
- **Mulitstructural**: continue to make connections and begin to be aware of the significance of connections between pieces of information
- **Relational**: switch from information acquisition to the organization of information to facilitate deepening meaning
- **Extended abstract**: begin to recognize and use emergent patterns, and are able to generalize and transfer learning to new situations; students are able to successfully apply abstraction to the understanding of concrete situations.

With this high-level framework in mind, the remaining sections of this paper consist of an overview of the needs and goals in our redevelopment work, a description of the course design process and details, a summary of the assessment tools used in the courses, and a description of key results, before concluding with discussion, conclusions, and acknowledgements.

2. NEEDS AND GOALS

Our goal was to improve student learning and the student experience in first year engineering at UBC Vancouver. Our design ethos was that students need to know more of *how* and *why* an engineer acts the way they do, rather than knowing *what* an engineer knows. We sought to lay a motivational foundation that empowers students in the future courses to really put everything they are learning in the context of professional practice and their personal journey to becoming a professional engineer.

Engineering students at UBC previously reported feeling disconnected from the engineering profession in first year, and leaving first year without an understanding what an engineer does or what their role is in society. Students and faculty also expressed a need for an increase in practical engineering experiences in first year, including experiences in design, teamwork, and engineering graphics. In addition, emphasis of the human and social connection of engineering is known to be an important factor in the recruitment and retention of female students, something the faculty and the profession as a whole are striving to do, and something that could be further enhanced in first year.

Some of our broad goals in redeveloping the first year curriculum were to give students a better appreciation of

- what engineering is and what engineers do,
- how engineers balance trade-offs and design solutions to open-ended problems
- the role sustainability plays in decision-making by engineers, and
- the role professionalism and ethics play in the life of engineers.

In addition, we endeavoured to

- increase students' sense of belonging to the engineering profession and community,
- increase excitement about engineering, and
- help students understand what makes each engineering discipline unique, in order to help them select their programs for second year.

To the last point, in forming projects and case studies for the two courses, we wanted to showcase as many of the engineering disciplines as possible. We also endeavoured to devise projects and cases with a clear societal or personal connection (known to appeal more to female students, [3]), or otherwise at least be neutral in tone (i.e. avoid combative projects, such as the ubiquitous "battling robots").

There was a direct effort to rework the learning outcomes from the previous course to focus on higher level Bloom's outcomes, and a conscience shift in focus from declarative knowledge to functional knowledge.[1]

3. COURSE DESIGN

Key elements of our course design context and process are outlined below, including the institutional context, the stakeholder engagement process, the course context, and our resulting course design.

3.1. Institutional Context

The first year engineering cohort at UBC Vancouver consists of approximately 800-850 students. Students take a common first year consisting of math and science foundation, computer science, communication/English, and introduction to engineering courses. The proportion of credits by topic area for comparison schools in Canada (Alberta, Dalhousie, Guelph, Manitoba, McGill, McMaster, Queens, UofC, UofT, UVic, Waterloo, and Western) and the US (CalTech, Carnegie Mellon Harvey Mudd, MIT, Olin College, Purdue, Rose Hulman, Stanford, UC Berkley, U of Colorado, U of Illinois, and U of Michigan) is shown in Figure 1.

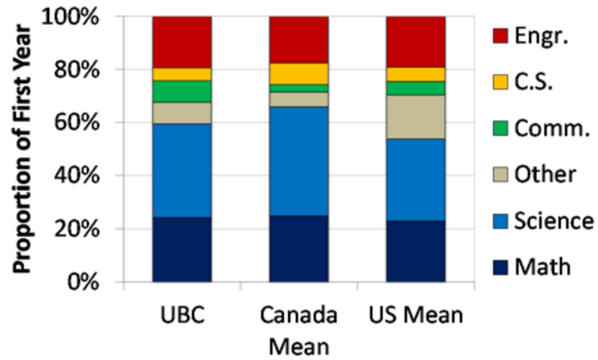

Figure 1 – First Year Curriculum Comparison. C.S. = computer science, Comm. = communication/English

Previously, most students took a 5-credit engineering case studies course (APSC 150) that included a three-week hands on project and otherwise considered topics in materials engineering, mining engineering, chemical and biological engineering, and/or sustainability from a theoretical perspective. This course was routinely criticized by students and faculty. In first year survey reports prepared by the Engineering Undergraduate Society (EUS) at UBC, the EUS commented that the APSC 150 course was the "least liked course" (2014), "too heavily based on theory" (2014), "not structured" (2014) and that student responses indicate student "dissatisfaction and disinterest with the course, either due to lack of challenge or meaning" (2013). All students also took a mandatory 0-credit pass/fail course (APSC 122) introducing the engineering disciplines.

After several false starts, a commitment to redeveloping the first year was made. A First Year Chair position was created, new teaching spaces were created, and a team was assembled. Funding for this redevelopment effort came primarily from a UBC Teaching and Learning Enhancement Fund (TLEF) grant in the amount of almost $250,000 split over two years. This funding helped to hire a team of graduate student curriculum developers, undergraduate co-op students, and other people to assist with development.

3.2. Stakeholder Engagement Process

Our first year curriculum redesign began with extensive stakeholder consultation. The extensive nature of the consultation was in-part motivated by the fact that previous attempts to change the curriculum were unsuccessful. The primary means of consultation consisted of the following:

- Through meetings with program heads, curriculum committee members, and other faculty, input on what the new first year should be and do was sought independently from each of the 10 engineering disciplines at UBC.
- Meetings with other faculty and staff groups in engineering at UBC were held to explore
  - embedding communications outcomes in first year engineering courses,
  - enhancing student professional development,
  - promoting equity and inclusion, and
  - enhancing student experience and support.
- Focus groups with students were held for input on
  - the overall first year experience,
  - what design in first year should look like,
  - how learning spaces (two new classrooms) should be designed, furnished, and utilized,
  - how communication should be integrated into the curriculum, and
  - the overall curriculum redesign process.
- Roundtables with faculty experts from across the disciplines were put on to inform
  - what design looks like in the different disciplines, and what would be appropriate to teach in a common first year,
  - what sustainability learning outcomes would be appropriate for engineers, what should be taught in first year, and how that might bridge to senior years, and
  - how should the different engineering disciplines be introduced in order to help inform their program selection in second year.
- A number of surveys were administered to validate key outcomes of focus groups and roundtables. Specifically, these included surveys on
  - student perceptions on topics that should be emphasized,
  - student preferences on instructional methods,
  - student perceptions of and previous experiences in sustainability, and
  - student perceptions of and previous experiences in engineering graphics.

3.3. Overview of New Courses

An integrated sequence of two new introduction to engineering courses (APSC 100 and 101) has been developed and implemented. It is during this common first year course experience that students learn about engineering and select their program of study (civil, electrical, materials, etc.) for second year. Topics in APSC 100 and 101 include the roles and responsibilities of the engineer, the engineering disciplines, sustainability, an introduction to the engineering design process, application of scientific principles, prototyping, engineering graphics, technical communication, and engineering ethics. APSC 101 builds on the themes of APSC 100, but explores the topics but in greater depth. The two courses are divided into seven modules, as shown in Table 1. Each module has an associated project or case study, and one or more deliverables, as summarized in the table.

Table 1 - Summary of APSC 100 and 101 Modules

Mod.	Duration (weeks)	Key topics	Project / Case	Key Deliverables
APSC 100 – Introduction to Engineering I				
1	3	Introduction to design; introduction to prototyping	Design-build of a cardboard chair for semi-nomadic schoolchildren	Cardboard chair for evaluation and testing; poster summarizing design process
2	4	Decision making; weighing trade-offs; introduction to sustainability; introduction to stakeholders	Site C Clean Energy project assessment	Oral presentation summarizing recommendation
3	3	Stakeholders; design; prototyping; CAD	CAD design of an adaptive device for client with hand paralysis	CAD solution with option to 3D print; technical memorandum
4	2	Professionalism; ethics	Engineering Codes of Ethics	Letter to future students
APSC 101 – Introduction to Engineering II				
5	4	Design; prototyping; engineering tools; scientific principles	Design-build a microcontroller-articulated semi-autonomous claw	Claw competition; poster summarizing design process; business letter invitation to media
6	4	Sustainability; stakeholder engagement	Examine water scarcity through lens of sustainability	Personal reflection video defining sustainability; lead-in to Module 7
7	5	Design; stakeholders; specifications; analytical prototyping; decision making; scientific principles	Design a rainwater harvester collection and treatment system for a remote dwelling	Design specifications for a class-wide competition simulating system performance; oral presentation summarizing design

3.4. A Typical Week

Both courses are 13 weeks in length and have 4 contact hours per week. The cohort is divided into 4 large class sections (roughly 220 students each) and 14 design studio sections (60 students each). Each student has 2 50-minute classes that bookend a single 110-minute design studio class. The design studios are the focal point of each week. The following outlines a typical week for June, a fictitious first year engineering student in APSC 100 and 101.

On Sunday, June prepares for the week by viewing an 8-12 minute video that introduces two big topics for the week. As she views the video, it stops periodically and displays self-test questions she must answer before the video proceeds. It takes her about 25 minutes to view the video and complete the questions. Now she is ready for her class tomorrow.

On Monday morning June goes to the first class of the week, in a large lecture hall with 220 students. Class begins with a timed 6-question team test modeled on Team-Based Learning Readiness Assurance Process. The test is based on the themes introduce in the online video. The test is completed in the assigned, permanent teams of 6 using the Immediate Feedback Assessment Technique (IF-AT) cards. These cards are like lottery scratch cards – the team discusses their way to a consensus decision, then one student scrapes off the opaque coating to check their chosen answer. These are noisy, somewhat chaotic learning events where students consolidate what they have learned from the online video. The team test ends after 10 minutes and the teacher responds to any questions and clarifies any lingering misconceptions. The remainder of the class is primarily focused on activities to get student ready for the design studio (i.e. lab/tutorial). The class activities include mini-lectures, Classroom Assessment Techniques (CATs), sketching interludes, discussions, and peer instruction.

On Wednesday afternoon, June goes to her design studio. There are 60 students in each design studio, assigned to permanent, randomly-formed teams of 6. The Studio instruction starts by providing context for today's work, guides the teams through a series of activities, and finally gets them ready to complete their team's worksheet. Studios are designed to help student teams build towards the major module deliverable. Worksheets are submitted online in the campus learning management system (LMS).

On Friday morning, June goes to the last class of week that focuses on consolidating all that has been learned during the week and getting students prepared and motivated for the following week. These classes are designed to use many active learning techniques and reflection activities. In APSC 100 in first semester, the last class of the week closed with a 15 minute presentation by a different engineering program. These presentations were designed to help students to identify their program choices for second year, to be declared in a ranked list after Term 2 ends, in May.

4. DESIGN FOR LEARNING

Elements of numerous effective teaching and assessment approaches, including Team-Based Learning, [4],[5], classroom assessment techniques (CATs), [6], peer evaluation, peer grading, integrated learning experiences, and more are integrated in these courses, as outlined below.

- **Online Self-tests**: students complete online activities in order to make the lecture and studio activities meaningful. Weekly online self-tests integrated within the videos are used to encourage students to prepare adequately for the week's activities.
- **Readiness Assurance Tests**: Drawn from Team-Based Learning (TBL), Readiness Assurance Tests (RATs) are in-class quizzes to ensure students complete the required pre-class videos, readings, or other preparation. The RATs build from the material in the online quizzes and are done in teams. The RATs are administered using questions on auto-advancing PowerPoint slides, projected to the class and with teams answering using IF-AT scratch cards.[7] The use of projected PowerPoint questions was selected to minimize the distribution of paper in a large class, to minimize "leakage" of questions to other class sections, and to preserve questions for refinement and reuse in future years. The IF-AT cards provide teams with immediate feedback on their responses, and allow them to continue to discuss questions that they initially get wrong. Lastly, the RATs also provide feedback to the instructors on the students' level of preparation and the need for any just-in-time instruction.
- **Studio Activities**: The studio activities are connected to the module project or case study and, in most cases, to the lecture topic for the week. Emphasis in the studio is on teamwork, the ability to follow instructions, the correct use of equipment, adequate reporting of results, and general understanding of the material. For this course, lengthy essays or lab reports are not required. Instead, students usually complete worksheets that guide them through exercises involving discussions, calculations, or experiments. Students work in their teams and worksheets are submitted in paper or electronically to the LMS. This allows the majority of the studio time to be devoted to team discussion and hands on work with the lab equipment, rather than with lengthy writing assignments. Given the blended learning aspects of the course, modules are designed such that, other than module project and case study deliverables, out

of class time is generally spent before the weekly activities rather than after it. A consistent structure is maintained throughout the courses, as this is key to creating a predictable and therefore sustainable workflow for the students.

- **Peer Reviews and Reflections**: Several exercises in the course help students reflect on what they have learned and how that integrates with what they know of the engineering profession. A peer review process, where students view and evaluate the work of others, is integrated into this process. The reflections are administered using the peerScholar system.[9]. The stages of the peer review and reflection require, first, each student create their own work and upload it to peerScholar. Second, each student anonymously reviews a predetermined number (we used 3 and 5, respectively) of randomly-determined assignments from peers. Third, and finally, each student reviews the feedback they have received and writes a reflection about how they would approach the exercise in future based on what they have seen in their peers' work and the comments they have received. All three parts of the exercises carry a mark in the course.
- **Project Deliverables**: There are design embodiments and communications deliverables associated with the projects and case studies, as summarized previously in Table 1. These deliverables are assessed using grading rubrics aligned with the graduate attributes from the Canadian Engineering Accreditation Board.
- **Formal examinations**: Each course includes a midterm and final exam. Exams are written individually, and students must pass the weighted exam average to pass each course. Exams include a mix of multiple choice, short answer, and scenario-based questions.
- **Peer evaluations**: Teammates evaluate each other in terms of contribution to the team's success. As Gueldenzoph and May quote from Johnson, "who better to evaluate students' performance in group activities than the group members with whom the student works."[10] We used iPeer, an online peer evaluation system (http://ipeer.ctlt.ubc.ca/). Peer evaluation scores are normalized to a team average of 100, and individual grade components are the team grade multiplied by the average peer evaluation score.

5. RESULTS

The effectiveness and impacts of the changes to the first year introduction to engineering courses were examined through a number of methods. These are presented below in terms of the changes in learning outcomes, key results from student surveys, and feedback arising from focus groups and meetings with student representatives.

5.1. A Shift in Learning Outcomes

Table 2 summarizes the learning outcomes from the previous course (APSC 150) and the new courses (APSC 100 and 101). Not only do the new courses have a greater number of learning outcomes, but they are at a higher level in terms of Bloom's Taxonomy and SOLO (see Section 1). The expected student development is also evident through progression from lower to higher level outcomes from APSC 100 to 101.

Table 2 - Summary of Learning Outcomes between the Previous APSC 150 Course and the New APSC 100 and 101 Courses

Metric		Previous	New	
		APSC 150	APSC 100	APSC 101
Learning objectives		4	12	12
Bloom's low/high level		3/1	8/4	4/8
Declarative/Functional		3/1	6/6	3/9
SOLO	Unistructural	2	1	0
	Multistructural	1	7	4
	Relational	1	4	7
	Extended Abstract	0	0	1

5.2. Survey Data

As part of an optional and anonymous course exit survey, students were asked to what extent they agreed with a number of statements relating to key goals the APSC 100 and 101 courses were intended to address. In particular, on a 5-point Likert scale (strongly agree, mildly agree, neither agree nor disagree, mildly disagree, strongly disagree), students replied to the following:

- I have a much better overall sense of what engineering is and what engineers do.
- I have a much better sense of how an engineer designs solutions to open-ended problems.
- I feel I am a part of the engineering profession and community.
- I am excited about engineering.
- I have a much better sense of how engineers balance trade-offs and make decisions.
- I have a much better sense of the role sustainability plays in decision-making by an engineer.
- I appreciate the role professionalism and ethics plays in the life of an engineer.
- I understand what makes each engineering discipline unique.

The results (n = 182, 25%) are shown in Figure 2. The numbers in parentheses are the percentage of students who either mildly or strongly agreed that the course goal had been achieved. There was over 90% agreement in all categories except feeling like a part of the engineering profession, which still had a respectable 83% agreement. Considering one of the main complaints from students in the previous curriculum was that they did not know what engineering was and did not feel a connection to it, these results are very encouraging. Also very encouraging was the fact that over 57% of students very strongly agreed that they were excited about engineering. Anecdotally, opposite appeared to be true in the previous curriculum.

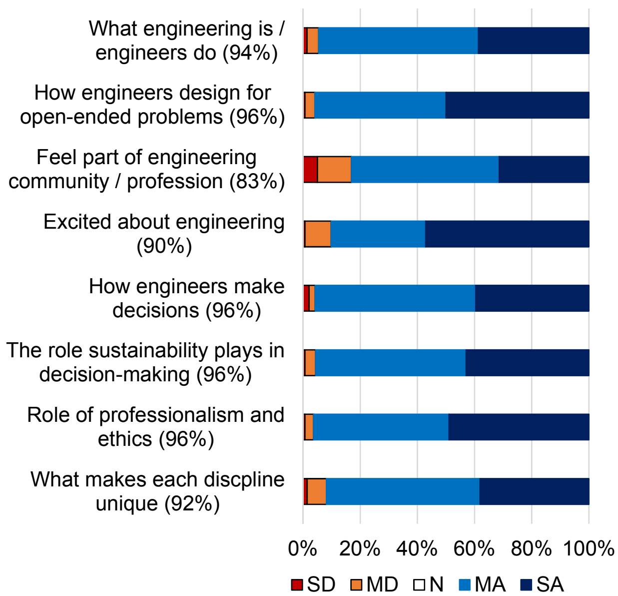

Figure 2 – Student Rating of Achieving Program Goals (5-point Likert Scale, strongly disagree to strongly agree)

We also asked students to rank the modules in the order from least to most enjoyable (Figure 3) and from smallest to largest contribution on their development as an engineer (Figure 4). The two design-build projects (Module 1, cardboard chair, and Module 5, Arduino claw) were ranked as the most enjoyable for both male and female students. The biggest differences between male and female students were on the two virtual design projects, namely, Module 3 (CAD design of an adaptive device for a specific client with hand paralysis, females ranked higher) and Module 7 (virtual design of a rainwater harvester system through numerical modelling and simulation for a general client, male ranked higher). Both projects used interviews of actual people expressing their real needs, but in Module 7, the interviewees represented a community rather than a single stakeholder.

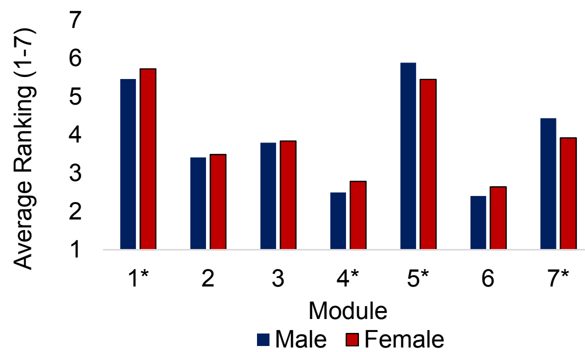

Figure 3 - Student Average Ranking of Enjoyment by Module (1 = least enjoyable, 7 = most enjoyable), * indicates statistically significant difference with $p < 0.05$

The relative rankings students gave the modules for how they contributed to their development as engineers closely mirrored their enjoyment rankings. Male students ranked Module 7 (virtual design of a rainwater harvester) highest followed by the two design-build projects (Modules 1 and 5), while female students again ranked the two design-build projects (Modules 1 and 5) highest followed by Module 7. Both male and female students ranked the sustainability case studies (Module 6) lowest.

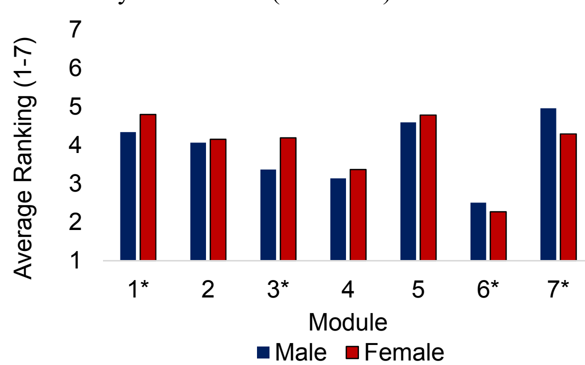

Figure 4 - Student Average Ranking of Contribution to Development as an Engineer by Module (1 = smallest contribution, 7 = largest contribution), * indicates statistically significant difference with $p < 0.05$

5.3. Feedback from Focus Groups and First Year Representatives

We held focus groups with students enrolled in APSC 100 five times and in 101 twice. This was done to get their feedback on the courses and seek their input on potential course improvements. In parallel, we held two meetings per course with representatives from the first year executive from the Engineering Undergraduate Society (EUS). Prior to these meetings, the EUS students spoke to a representative group of first year students and then relayed their findings to us at the meetings.

6. DISCUSSION

6.1. Successes

In addition to the positive student feedback on our primary program goals (described in Section 5.2), there were a number of other successes in this first year of offering this new curriculum. Beyond a rephrasing of the learning outcomes to higher level objectives (Section 5.1), students are now directly engaged in developing a large number of CEAB graduate attributes, and we have assessments in place to collect data on their competency. Table 3 summarizes key graduate attribute development and assessment that has been added beyond what was in the previous curriculum.

Table 3 - Summary of Key Graduate Attribute Development and Assessment

Attribute	Development and assessment
4 Design	4 open-ended design projects
5 Use of engineering tools	CAD and rapid prototyping project; microcontroller project; spreadsheet simulation project
6 Individual and teamwork	Peer evaluations; peer assessments; personal reflections
7 Communication skills	2 poster presentations; 2 oral presentations; 1 technical memo; 2 letters; 1 video
8 Professionalism	1 course module on professionalism
9 Impact of Engineering	2 course modules on sustainability
10 Ethics and Equity	1 course module on ethics

Another key area of success has been the student reception to the majority of the course material and structure. In feedback, students consistently stated that the studios were very effective towards their development and learning, and that they were their favourite part of the courses. The students also like the projects, and the balance of rankings in Table 3 suggest that we have achieved an appropriate mix of topics that broadly appeal to diverse groups of students. In open-ended response boxes in an optional course exit survey, 31% of respondents cited the team readiness assurance tests as the most effective class activity, and 23% identified in-class sketching exercises (both are highly participatory learning activities). For out-of-class activities, screencasts were highly regarded, and were cited by 22% of students as effective in open response text boxes.

Among the teaching team, members described an “infectious” excitement and energy towards developing and delivering the courses, and this permeated to the first year students. The team aspect has allowed dissemination of effective teaching and assessment strategies; at least half of the members of the teaching team have independently remarked that they have acquired new techniques that they are bringing back to their own courses and own programs.

6.2. Challenges and Lessons Learned

One of the most significant challenges we faced in our first year was in maintaining high attendance levels in lectures. Lecture attendance by the end of the academic year ranged from approximately 85% in the most-attended section to approximately 50% in the least-attended. In Term 1 (APSC 100), the least-attended section was at 3 pm and the most-attended was at 11 am, while in Term 2 (APSC 101), the least-attended section was at 8 am and the most-attended was at 3 pm. In other words, time of day alone does not describe the differences in attendance. Through survey and focus group feedback, a consistent theme that emerged was that many students viewed the classes as a duplication of the material from the screencasts completed online at the start of the week. Our view of this same class material was that it *extended* the topics of the screencasts, and that it challenged the students to engage with the material in new ways and at higher levels. Although we endeavoured to incorporate extensive active learning elements in all classes, including discussions, clicker questions, sketching and design exercises, spreadsheet development and utilization activities, mock peer evaluations, and more, students still commented that they felt the screencasts sufficiently prepared them for their studios. It should be noted that students did not have the same teams in class and studio due to various timetabling restrictions. We have successfully adjusted the timetables for next year such that we can use the same teams throughout the course. We believe this will allow greater continuity through the week and team accountability in the classes. It will allow us to shift more of the studio activities – perceived by students as highly valuable – to the classes. Feedback from the first year student representatives suggests this will be perceived by students an effective change and will add value to the classes; this is supported through survey responses where 63% of students expressing an opinion support this change.

Another challenge was in developing a sense of appreciation in students for less technical topics, such as ethics and sustainability (see Figure 4). Students seemed to have discomfort with topics that were abstract or that did not offer a concrete solution procedure. Within sustainability there were differences in student comfort – systems thinking and complexity, for example, seemed less well received than the more procedural life-cycle analysis.

Internally, we struggled to find equity in the teaching team in terms of dividing work between ten different instructors. Most instructors described or demonstrated the infectious excitement and energy mentioned in Section 6.1, and we were able to distribute the teaching load of approximately 200 class contact hours fairly between members of the teaching team; however, we were not able to motive *all* members of the team to contribute equitably to the development of material out of class, such as screencasts, class slides, studio materials, and exams. Students also commented that there were some modules where too many instructors were involved such that each class it felt like someone new.

Lastly, we noticed throughout the courses that no matter how we pushed students towards completing project deliverables ahead of the deadlines, students tended to work to the deadlines and then they complained about being pressed for time. In the case of Module 1 with the cardboard chair, for example, we noticed many teams reluctant to make any cuts in the sheet cardboard they were provided. While working to the deadline is not unique to this class or demographic, we did have concerns that students delayed work due to being afraid of making mistakes. One of the outcomes from several design faculty roundtable sessions was that we should create an environment and culture where making mistakes and failing are not frowned up, and are in fact encouraged. We are examining new approaches for next year to encourage the design adage, “fail fast, fail early, fail often,” as a natural part of the design process.

7. CONCLUSION

The redevelopment of our first year engineering experience was successful in addressing a number of our key design goals. Students reported better understanding what engineering is and what engineers does, and they reported a high degree of excitement towards engineering.

A number of core foundational skills were developed – ethical thinking, communication and presentation skills, professionalism, critical thinking, and respect for the environment, society, and their colleagues. It is hoped that these important skills and attitudes will serve as a solid foundation for success in their future studies and careers.

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