Design of a Completely New First Year Engineering Program at the University of Saskatchewan

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Abstract – *The rapidly evolving role of the engineering profession in society requires an engineering graduate with a more diverse and robust skill set than ever before. To answer this challenge, the University of Saskatchewan's College of Engineering has embarked upon a complete redesign of its first year program. This project essentially started from a "blank slate" and posed the question, "If we could design any first year program that we wanted, what would we create?" The outcome of this endeavor is intended to be an extremely effective first year program that excites, engages and inspires students, and that holistically prepares them for the challenges to come in later years. In this paper, we review the broad learning objectives of our new first year, and the values that we applied to our decision making during its design.*

The overall project consists of three distinct phases: determination of required first year graduate attributes, development of program structure and delivery methods, and detailed course design. Phase I has been completed. It has left us with a detailed inventory of knowledge, skills, experiences, and attitudes, distributed across 23 content categories, that the College wants students to internalize by the end of their first year of study.

We will outline the methods that we used to compile and refine this attribute inventory, including multiple approaches aimed at meaningful stakeholder engagement, surveys of existing first year programs across Canada, and an analysis of gaps and redundancies between the Saskatchewan high school curriculum and our existing first year program. We will also describe the 23 content categories used to organize the graduate attributes of the proposed first year program and how these categories are weighted in relative terms.

We share some of our key learnings from Phase I of the project, including which consultation strategies worked most effectively, why we focused on first year graduate attributes and not content, and key elements that will be emphasized in our new program. We will also briefly describe the process by which we are starting to develop the program structure and delivery methods i.e. Phase II.

Keywords: first year, engineering, program, design, curriculum, planning, graduate attributes, Saskatchewan

1. INTRODUCTION

Curriculum change in higher education is known to be challenging [1]. Incremental improvement is a common strategy for most academic program development and, as an optimization process, it can work very well. However, given the passage of enough time combined with enough change in the service environment, the best "solution" to the current incarnation of the first year pedagogical "problem" might not be found using this approach. This is akin to seeking an energy minima in a distributed energy field [2]. We do not want to get trapped in a local minima from which we will never escape. However, this can happen using incremental optimization. This strategy can prevent us from finding a better way (a global minima). To avoid this fate, periodic leaps are sometimes necessary to thoroughly explore the "pedagogical energy landscape".

This was the rationale that led the University of Saskatchewan's College of Engineering to undertake a redesign of its first year, starting from a blank sheet of paper. This approach allowed for a wide-angle view of the landscape to see where a first year engineering program could best meet the needs of the present and near future, given the current environment as characterized by student attitudes, preparation, motivations, needs, and skills.

The work began with a committee looking at different structural models for a new first year program. It soon became clear that the volume of work required for the redesign demanded more than volunteer effort. Last year, a full-time curriculum developer was hired, and a small management and advisory team engaged more intensively with the project. We identified the main phases to the project, as well as a clear vision of what we were trying to accomplish and a mission by which the vision could be achieved. Taking a technical-rational approach [3], a focus on the quality of the innovation informed by diverse expertise, iteratively examined by stakeholders, adjusted and refined in combination with reasoned planning for implementation, can create the envisioned change.

The vision for the redesign was simply to attract excellent students to our College from Saskatchewan, Canada and beyond, and to excite, engage and inspire our students, while preparing them holistically for the challenges to come in later years. While retention is a common concern and a driver for change in higher education, this curriculum design process intentionally

focuses on the qualities of the learning experience that engage and empower students. There is a well-founded expectation that retention impact will be positive when the quality of the learning experience is enhanced [4].

Informed by research on effective instruction in undergraduate science and engineering [5], research-based principles for teaching and learning in higher education [6,7], and research on policies and practices known to support student success [8], the mission for this curriculum would involve:

- attracting a diverse set of students well-suited for the work and challenges of engineering,
- effectively bridging the transition into engineering student life,
- allowing students to make a well informed decision as to whether engineering is for them,
- encouraging students to engage in self-directed life-long learning, including extracurricular activities,
- showing students career possibilities and available paths through the College,
- facilitating student development in terms of knowledge, skills and attitudes/beliefs in ways that effectively prepare every student for the challenges to come in their engineering degree, and beyond,
- sequencing learning material progressively and thoughtfully,
- integrating knowledge and skills in different areas in realistic scenarios,
- applying formative and summative methods of student assessment that accurately evaluate student performance as well as encourage growth,
- helping and encouraging students to be healthy and strong, physically and psychologically, and
- providing them with sound academic guidance as they consider their career path.

We would do this by:

- consulting all stakeholders,
- studying best practices for first year programs across Canada and around the world,
- ensuring curriculum content is relevant, appropriate, and up-to-date,
- embracing proven best practices in pedagogy to facilitate deep, intrinsically motivated, and self-directed learning,
- exploring novel content delivery methods and structures, where appropriate,
- removing unnecessary barriers to success for under-represented groups of students,
- presenting, and developing an appreciation for, Indigenous perspectives in engineering and design,
- adopting a holistic approach to education that considers the experience of the student as a complete person, and

- developing methods of receiving timely feedback on important program metrics to facilitate continuous improvement.

The project was broken into three phases:

- Phase I - determination of required first year graduate attributes,
- Phase II - development of program structure and delivery methods, and
- Phase III - development of course material.

Phase I has been largely completed and is the focus of this paper, while Phase II is currently underway.

2. PHASE I METHODOLOGY

2.1. First Year Graduate Attributes

The focus of Phase I was the determination of required first year graduate attributes. It began as the identification of content in first year. However, it was quickly realized that attributes and content are not equivalent concepts and the differences between them became pivotal to our overall program design approach.

In this work, *content* defines what is in the program. *Graduate attributes* define, most simply, what the students leave the program with. Examining the notion of attributes at completion of first year has helped us to come to explicit terms with the fundamental purposes of the first year program for student learning [9]. Not all students enter the program in the same state of preparedness and not all progress through the material at the same speed and with the same degree of success. Nevertheless, students are expected to leave first year well-equipped with knowledge (facts and concepts), skills (demonstrable abilities), experiences (meaningful applications of skills), and attitudes/beliefs (adoptable philosophies), or KSEA [10]. This is the primary basis for being considered “prepared” for second year and beyond. Sometimes these expectations are explicit, but we learned that, oftentimes, they are not.

In Phase I, it became readily apparent that we needed to be explicit about all of these expectations, where relatively few had ever been so. Moreover, if the “output” of first year (students having these “graduate attributes”) was to meet some minimum standards, then by definition, the first year would have to effectively adapt to differences among student preparedness, success rates, and speeds of learning. This insight became a major design parameter for the structure and delivery models in Phase II.

In Phase I though, the idea of “graduate attributes” clarified what information we were seeking and how we would manage it. Ultimately, we gathered information in 23 distinct topical categories spanning the breadth of all that we could imagine might be included in first year. Collectively, preparing students with these attributes would meet the specifications of our vision and mission.

The following four sub-sections describe how we gathered these first year graduate attributes.

2.2. Analysis of Existing Programs (Internal)

The first step of Phase I was the determination of the content and learning objectives currently included in first year engineering at the University of Saskatchewan. Less than half of the courses taken by engineering students enrolled in the full first year program are taught within the College. Therefore, this first step required consultation across campus.

We began by gathering the most recent syllabus for each course and extracted and categorized what we believed to be the most important knowledge, skills and attitudes aspired to in each course (the idea of experiences being a separate and distinct type of attribute had not yet emerged). These lists were then shared with course coordinators and instructors for feedback on the accuracy of our interpretations. This feedback, as well as meetings with instructors, and hours spent reading over course notes and lab manuals, resulted in the most detailed itemization of the first year curriculum that the College has had in recent memory.

Anecdotal evidence gathered from discussions with first year instructors led us to believe that certain existing courses contained a large amount of material which was potentially redundant with prerequisite Saskatchewan high school courses. As a result, we also conducted a brief analysis of the learning outcomes of these high school courses to identify where, on paper at least, there was significant overlap. The courses evaluated included Pre-Calculus 30, Calculus 30, Chemistry 30, and Physics 30.

2.3. Analysis of Existing Programs (External)

An analysis of 17 other first year engineering programs across Canada was conducted, including UofA, UofC, UBC, UofM, McGill, McMaster, Dalhousie, Queens, Western, UofT (TrackOne), UofR, Victoria, Carleton, Guelph, York, Ryerson and Waterloo. Utilizing online course catalogs for each school, a comparison of relative weightings of each subject (by contact hours) at each institution was performed. For programs with direct entry into each discipline (a non-common first year), the first year program experienced by mechanical engineering students was chosen for comparison, due to the relatively broad applicability of a mechanical engineering program. This survey of the Canadian engineering education landscape also presented an opportunity to seek out innovative ideas in content delivery being implemented across the country.

2.4. College Staff and Faculty Engagement

While informal discussions with staff and faculty in the College helped to socialize, normalize and inform the development of the project, we sought to formalize the

input process. This was done through the use of surveys. It was decided that these initial surveys should remain internal to the College as, in alignment with the concept of engineering being a self-regulating profession, the members of the College should be in the best position to determine the ideal attributes of our students. Moreover, the staff and faculty of the various programs within the College are key stakeholders in this project, as the effects of success or failure to effectively prepare the students for upper year study have enormous implications on them.

The first faculty and staff survey (FSS1) asked the respondents to determine what KSEA attributes all students *should have* by the end of their first year, across all 23 graduate attribute categories listed in Table 1 (see Section 3). It did not ask respondents what KSEA attributes they believed the students do develop as a result of our existing program. Program undergraduate chairs were asked to consider what attributes the ideal student entering their particular program would have. FSS1 also included a 24th category of “Other”, but responses received under this category were easily included in one of the 23 prescribed categories after subsequent analysis.

The results of FSS1 were compared against the list of learning objectives arising from our existing program (the compilation described in Section 2.2). This comparison generated a list of content that is currently covered in first year, but was not noted as being needed by any respondents in FSS1. This list was then disseminated to the College faculty and staff in the form of a second survey (FSS2) asking which, if any, of these identified content items should be retained. Since these items were not foremost in any respondent’s mind during the first survey, we also asked for a justification for retention.

The results of FSS2 were used to finalize a draft first year graduate attributes proposal. This exhaustive list of KSEA attributes for each of the 23 categories was shared with department heads and undergraduate chairs in each engineering program in the College. As well, relevant external programs (Mathematics and Statistics, Chemistry, Physics, Biology, Geology, and Business) were also consulted for input. The project team held meetings with representatives from each internal and external department to discuss the generated attribute lists most pertinent to each department.

Useful feedback was received from subject matter experts (SMEs) in every meeting, with the needs and/or interests of their respective programs kept as the focus of the conversation. Post-meeting, departments were asked to provide further written feedback as well as a list of core concepts and threshold concepts appropriate for first year study for their respective field. Threshold concepts are transformative and troublesome concepts, an understanding of which forever changes a student’s perspective on the respective field of study [11]. We requested these lists from SMEs to allow for the

prioritization of attributes once we begin allocating contact hours for each category in Phase II of the project.

2.5. Student Engagement

It is not the norm to involve students early on and with frequency in first year curriculum design, yet there is great potential and value for their strategic and appropriate involvement [12]. Informed by the notion of students-as-partners [13], substantive student engagement was incorporated into Phase 1. In November of 2017, we drafted a student engagement strategy and reached out with a student survey (SS1) focused on Fall term curriculum content. Current first year students were surveyed on their general experience in first year, including their feeling of academic preparedness, their sense of belonging, and supports offered by the College. They were also asked to rate their experience in each of their first term courses and to identify any content in each course which was not new to them. This could reveal materials that were possibly redundant.

A separate version of SS1 was sent out to all upper year students in the College. This survey asked students to identify core concepts they took away from each existing first year course and to rate how prepared they were for the demands placed on them by their program in second year in each of the 23 content categories.

In March – April of 2018, a second student survey (SS2) was sent out to all current first year students asking similar questions to SS1, but focusing on the Winter term first year courses.

To facilitate more meaningful student engagement, we also created a Committee of Student Advisors on Curriculum Development (CSACD). The first members of this committee consisted of 21 students with representation from every year of study and each of the 8 upper year programs offered by the College. Program diversity was the main selection factor for this first group (there were over 70 interested applicants), but students were also chosen for having different backgrounds and life situations to be sure that as diverse a set of voices as possible was represented by the committee.

The committee became active in January, 2018 with anticipation of continued engagement over the summer and renewed membership in the Fall of 2018. The committee has met monthly to provide feedback to the project team on curriculum proposals. We have evolved the engagement philosophy beyond simple consultation into a more co-creative environment, by providing opportunities for the student advisors to provide ideas for the new program and to assist in conducting research into best practices.

This broad and varied strategy for student engagement has yielded some very meaningful insights for the project team and will most certainly result in the development of a more robust and accessible program [12].

3. FIRST YEAR GRADUATE ATTRIBUTES

The stakeholder engagement described above yielded a first year graduate attributes proposal with almost 1800 individual line items describing the desired KSEA attributes in the 23 categories listed in alphabetical order in Table 1. Table 1 also shows the percentage of line items attributed to a given category. It should be noted that not all line items in the proposal represent the same number of contact hours or credit units, but it is interesting to compare the relative detail included for each.

The full list of attributes is too long to be included here. However, interesting elements will be discussed and related to the points in the project mission statement to which they contribute.

Table 1: Proposed first year KSEA graduate attributes categories and the relative proportion of each category.

Attribute Category	% of Proposal
1. Biology and Environmental Engineering	2%
2. Business, Economics and Entrepreneurship	2%
3. Chemistry and Chemical Engineering	12%
4. Communication (Oral, Written and Graphical)	7%
5. Computing, Software, Programming and Computer Engineering	7%
6. Design	5%
7. Electricity, Magnetism and Electrical Engineering	6%
8. Geology, Civil Engineering and Geological Engineering	4%
9. Health, Safety and Risk Management	2%
10. Humanities and Social Sciences	2%
11. Integration Between Subject Areas	1%
12. Intro. to the Profession, Ethics and Inclusivity	4%
13. Leadership and Group Dynamics	3%
14. Math: Algebra	5%
15. Math: Calculus	7%
16. Mechanical Engineering and Mechanics: Dynamics	6%
17. Mechanics: Statics	5%
18. Physics and Engineering Physics (excluding mechanics, electricity, and magnetism)	8%
19. Project Management	2%
20. Research (Students conducting research)	2%
21. Study Skills, Life Skills and Self-Assessment	5%
22. Teaching (Teaching students to teach, mentor and tutor)	2%
23. The University/Institution (U of S history, policies, infrastructure and services)	1%

3.1. Better Preparing Students

When it comes to the “hard” technical content in the proposed curriculum, there are few, if any, major surprises. The core technical expertise required by a burgeoning engineering student is well defined by Canadian engineering accreditation requirements [14] and is well covered by the proposed attributes. The review of first year programs across Canada showed little variation in the basic philosophy of the content covered. An average distribution of contact hours for the Canadian institutions studied can be seen in Figure 1 in the middle column. This distribution is similar to that seen in previous surveys and is similar to the distribution for major US schools, although many often delay linear algebra and some physics content until second year [15,16].

Relatively unique elements identified in the existing University of Saskatchewan first year engineering program included a 3 credit unit (CU) business class, a lack of any computer programming, and a choice of natural science elective between physics, biology, geology or an additional chemistry class. A full comparison of the distribution of contact hours for the existing U of S program, the Canadian average distribution, and the proposed U of S program can be seen in Figure 1. The proportions represented for the proposed program are based on the number of line items in the proposal, which do not fully correlate with the contact hours that will eventually be associated with them. It can be seen that computer programming will make up a sizable proportion of the new first year program. It should also be noted that the apparent decrease in math and mechanics content is not precisely indicative of what the final program will include. These are areas of study well defined at the U of S and stakeholders did not feel the need to itemize these topics in as much detail as some other topics.

The proposed program will do away with the existing natural science elective and will replace it with a strong introduction to each of the four core sciences (chemistry, physics, geology, biology). The learning objectives in each of the four areas will be the same: appreciate each in relation to the others, compare and contrast with each other and with respective engineering disciplines (e.g. chemistry versus chemical engineering), and develop a skill that can be applied to virtually any branch of engineering. These science experiences will involve hands-on lab activities.

Similarly, each of the 8 engineering programs will be introduced to all of the first year students in an intensive multi-hour format with similar learning objectives i.e. appreciate each in relation to the others, compare and contrast with each other, and develop a skill that can be applied to all of the other branches of engineering. This will give them all a better sense of the breadth of the engineering profession.

As well, instead of a standard social science or humanities course, students will take part in a new type of arts course that will orient them to the various fields in the

social sciences and humanities, while linking them to engineering. In this way, when they do select subsequent arts electives, those choices will be informed and relevant and will provide a more meaningful experience [17].

The overarching learning objective is to better prepare students to make a good vocational choice, whether that be engineering generally, or their discipline, specifically.

The proposed program will also ensure appropriate preparation in areas such as mathematics and mechanics, while better preparing all first year students in electrical circuits, physics, CAD, computer programming, technical communication, and engineering design. Design will be more deeply integrated with other course material, and will include elements of interest to every discipline.

The curriculum will also focus on better preparing students to acquire an engineering-related summer job after their first year of study. They will be proficient in at least one programming language, will have basic first aid, CPR and WHMIS training, and will have an understanding of an engineer’s professional obligation for health and safety. They will also have solid design and CAD skills, and will be able to apply the basics of project management.

In addition, we intend to equip students with a better sense of intuition in their fields. The proposed program includes experiences in several categories that focus on seeing or feeling the major concepts, not just reading about them. For example, students will develop an intuition for what 10 N feels like, what 30 ml looks like, and how circuits behave.

Figure 1. First year curriculum comparison.

3.2. Bridging the Transition into Engineering

The proposed curriculum places a strong emphasis on bridging students into the program, both academically and socially. Important contributors to a sense of belonging on campus, including an awareness of the supports available, are explicitly identified in the proposal.

The proposal does list many math concepts and skills, such as logarithms, graphing, taking limits and basic differentiation, which have all been identified to be redundant with College pre-requisites. A similar situation exists with chemistry. The proposal includes items such as

basic atomic structure, the periodic table, and types of molecular bonds. These items remain, as they cannot be neglected should a student not have a basic competency. These are KSEAs that a student should have by the end of first year. However, if they enter the program with them, they should not have to spend time relearning them. We will explore options, such as challenges-for-credit, to allow better prepared students to minimize redundancy.

General life skills will also be addressed to better facilitate a smooth transition into the College. This transition support will include ensuring basic competency with word processors and spreadsheets, as well as study skills, time management, exam writing strategies, learning styles, critical thinking, and group dynamics/teamwork training.

Finally, we will explicitly address the reasons they came into engineering. This includes a robust introduction to the scope of the profession and to available career paths. In addition to an awareness of traditional careers in industry, students will acquire a better understanding of the scientific method and how discovery research plays a role in engineering. They will learn the key similarities and differences between discovery research and engineering design. Students will also learn how to apply effective teaching methods to teach, mentor and tutor their peers, to develop an understanding that teaching is often the most effective way to improve one's own understanding of a concept. Business content in first year will become more focused on an awareness of entrepreneurship and how that can relate to design.

3.3. Sequencing and Integration of Material

While sequencing of the content in the program is beyond the scope of Phase I, it is anticipated that various elements of the program can be integrated, meaningfully and purposefully, with mutual benefit. One example is the application of computer programming. If programming is covered early in the year, it can be applied to many other subjects, such as in the solving of systems of linear equations in algebra. Building linkages between course materials in different topic areas will be a key part of the revised first year.

3.4. Encouraging Good Health and Growth

Good physical and mental health are qualities that we don't just hope to facilitate in the program; they will be explicitly supported by several learning objectives. These include an awareness of mental and physical health indicators, practice in implementing effective methods for stress management, an internalization of Carol Dweck's Growth Mindset [18], and how to deal with failure. We want our students to be physically, mentally, and socially healthy. The first year content focused on these goals will be facilitated and enhanced by program structure and delivery methods.

3.5. Attracting and Maintaining Diversity

An understanding and appreciation of the importance of respect, diversity, and inclusivity are specific line items in the proposal. There are also items outlining an Indigenous cultural contextualization and the integration of Indigenous content into the curriculum. This aligns with the University of Saskatchewan Strategic Framework and Narrative for 2025 [19]. Our goal is to provide a welcoming learning environment in which students of any gender, race, ethnicity, religion, identity or background can work hard and succeed in becoming an engineer.

4. LESSONS LEARNED

We have learned much from this (ongoing) program design process, and specifically from the first phase that has focused on first year graduate attributes.

An early lesson was found in the design process that we adopted. Most design processes involve the determination of constraints before coming up with alternative solutions. We are applying constraints at the end of our process. This works in this case because of the composite nature of the curriculum "solution" that we are striving for i.e. it won't all be acceptable or unacceptable. Parts will or will not be. Given the nature of the creation/ideation process that we used, we knew that at least most of the ideas would be deemed acceptable by our College and accreditation bodies. So we adopted open-ended ideation without constraints to prevent the inhibition of new and less conventional ideas. This worked for at least some of our stakeholders, such that we were able to gather a broad swath of suggestions, some of the more novel of which may be acceptable to accreditation bodies within the context of the whole program.

Another design lesson was borrowed from the design axiom "fail early, fail often" [20]. In our context, that meant running our ideas by a wide variety of different people. With intent, we started with more "friendly" audiences whose goals were in close alignment with those of the project. When early "fails" were noted, they were remedied before they could become big and serious fails in front of more challenging audiences. Notably, this strategy has become more important as we have moved into Phase II (Program Structure and Delivery).

A very important lesson we learned was that of placing our focus on first year "graduate attributes" as opposed to content, following the framework of constructive alignment [21]. As noted earlier, we have a variable input (incoming students), variable processing of those inputs (progress through first year), and a fairly constrained definition of our "minimum viable product" (first year graduates). Non-adaptive first year content simply cannot deliver this product due to the variability in inputs and processing. By shifting the focus to graduate attributes, this makes clear what the desired outcomes are, while leaving the methods to achieve those outcomes as flexible

as possible. For example, it highlights the importance of admissions criteria. It also suggests that not all students should go through all the same courses, in the same way.

Yet another design axiom was highlighted during our experiences with Phase I of this project, that being “don’t get married to your first solution”. Ultimately, the details of any solution do matter. But they don’t matter too much, yet. The key take-away at this stage is the big picture perspective of what topic areas should be addressed by the end of first year, and for what reasons should they be addressed. The ever-present temptation to focus on how material would be delivered is a short-circuiting process that distracts from these key questions. In this design process, “how” comes later, and must be ignored in this first phase of the program design.

Design engineers also know that one should always take input from stakeholders with a grain of salt. While the perception of a need may always be valid, the actual need may not always be so. That is, we must process input from clients and users through a filter that serves to address our design objectives. If we were told by a stakeholder that effective writing skills were not an important first year graduate attribute (because those skills weren’t very relevant to that stakeholder), that might be true for that stakeholder, but it wouldn’t necessarily be true for the program, given the goals of the program. We learned to treat feedback differently depending on the investment of the feedback provider. Indeed, we learned to only seek feedback from stakeholders on topics that were important to them and/or that they were knowledgeable about. The clearest way in which we addressed this point was by specifically asking stakeholders what outcomes they wanted from first year, and not what outcomes they didn’t want from first year.

Related to this last point, we learned that survey feedback often required follow-up interpretive discussions in order to contextualize comments properly. Some respondents, especially those involved in compiling the content of the existing first year, just entered the attributes of the existing class with which they were involved. While a valid response, it remained unclear if this was the path of least resistance or whether this was actually tantamount to saying, “I feel every detail covered in this class is crucial for all engineering students to absorb by the end of first year.” Later conversations with such instructors facilitated a better understanding of why they answered the way they did.

Another key recognition for us, and more especially for our stakeholders, was the idea of pre/co-requisite courses for their program. We have a common first year leading into disciplinary programs in years two, three and four. Oftentimes, we heard the cry “we need that course for our upper year courses”. However, when pushed (vigorously, in some cases) everyone conceded that they needed the learnings of a course, not the course itself. And when pressed further, it became clear that they didn’t require all

of the learnings coming out of a course. They just needed some of them. When everyone adopted this perspective, it provided us with clarity on what specific first year content didn’t directly lead anywhere in subsequent courses. These situations provided some opportunities for dropping non-critical course materials.

A similar concept involved “just-in-time teaching” [22]. In several cases, we were told that first year material was needed for third and fourth year courses. However, pedagogical theory, as well as many students, pointed out that students forgot that material by the time they needed to use it. Early on, we adopted the philosophy that if the only need for some part of the existing first year was in third and fourth year, then first year was not the time to introduce it as one could not expect that it would be retained by third or fourth year.

5. CONTINUING WORK

Phase I was largely completed by January 2018. However, a failure to secure detailed feedback of a consistent and similar nature from all stakeholders (especially the engineering programs) left some work remaining. As Phase II began in early 2018, our concern over this issue diminished. In the spirit of iterative design, we are going through a number of design cycles which refine what will be taught, when it will be taught, and how it will be taught. We are forming an advisory committee consisting of representatives from every academic program with a stake in the first year, and these individuals are helping us in this data collection/refinement/clarification process.

We have also adopted a design process that is analogous to sculpting. It is very compatible with the conventional North American design process that moves from conceptual to configuration to detailed design. In this analogy, imagine that you are a sculptor and that the final design will be the finished sculpture. One begins with the rough outline of the shape. Then there is refinement of the parts. Finally, there is detailing of the minutiae to finish the design. Phase I provided us with the clay and other building materials for our sculpture. Phase II is taking us through the rough outline of the shape of the program, in increasing detail. We are putting our design ideas through various filters such as teaching space availability, staffing, tutorial assistance, accreditation, and transferability. At every stage, we are cycling back to earlier design decisions to refine them. The sculpture is gradually taking shape, in increasing levels of detail. This approach is working well with the tried and tested “fail early, fail often” design philosophy.

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