

AN EXPLORATION IN FACILITATING LEARNING EXPERIENCES TOWARDS INSPIRING RESPONSIBLE SOFTWARE ENGINEERS

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Abstract –Johnson poses the question, “what does it mean to be a responsible engineer?” Characteristics could be wide-ranging. Engineers Canada helps by defining graduate attributes (GAs). All GAs are important. However, GA-9 “impact(s) of engineering on society and the environment” is one characteristic that this author proposes is fundamental. The idea of sustainable design and development has seen increasing conversation and engagement in our field in recent years. With initiatives such as the UN’s “decade of action,” engineers have the innate responsibility to help deliver the promise of positively transforming our world by 2030 and beyond. Reflecting on Quan-Haase’s idea of technology as society, relating to the idea that society advancements are in large part intertwined with advancements in technology, software engineers may have a significant role to play. This work explores the following questions. Can inspiration towards becoming a responsible software engineer be instilled in engineering learners in academia? Can this be accomplished by facilitating a learning experience that immerses engineering learners in researching and exploring the design and development of computer technologies in support of the United Nations Sustainable Development Goals? This paper will describe a software engineering course at the University of Regina that facilitated a learning experience around these questions. A discussion regarding the structure of the course, its educational content, and results and feedback obtained on the learner experience will be provided. As well, ideas for continued exploration of this work will be discussed.

Keywords: Sustainable Development Goals, Humanity-Centred Engineering, Collaboration & Learning Tools

1. INTRODUCTION

Most engineering educators acknowledge, in part due to accreditation guidelines and in part due to how engineering professionals have been trained in an academic setting throughout the years, that traditional analytical and technical engineering skills, those represented in the sciences, technology, engineering, and math (STEM) areas, are well represented in the curriculum [7]. Where

there might exist opportunities to add to the learner experience is in introduction of ideas outside of the traditional norm. As the author reflects on this idea, what comes to mind is Johnson’s [2] question, “what does it mean to be a responsible engineer?” Characteristics could be wide-ranging, from the analytical and technical norms, but also in experiential and reflective knowledge growing opportunities through exposure to fields outside of engineering like the arts and humanities (i.e. STEAM, the extra “A” in STEM representative of the arts and humanities).

Often referred to in engineering education literature as humanitarian engineering (HE), HE has seen increasing interest among engineering educators [4, 6]. HE can be described as “an engineering specialization focusing on the design of products, systems, or services to support the sustainable development of resource-constrained communities”, supports that are well represented in fields outside of engineering like within the arts and humanities [4]. With interest in HE growing, the Canadian Engineering Education Association (CEEA) recently created a special interest group (SIG) on the topic. The SIG, titled “humanities and engineering,” aims to bring together educators across Canada from wide-ranging areas in engineering to discuss ideas and integrations of HE/STEAM within engineering curriculum. This author is highly encouraged. However, one of the perceived hurdles educators may experience in attempts at exposing HE to engineering learners, as Khalid et al. state, is that “a number of engineering students take [arts and] humanities courses thinking that they are wasting their time.” This author has also experienced such attitudes among engineering faculty in institutions worldwide and out in science and engineering attitudes of professionals out in industry. These counterproductive thoughts need addressing as at the heart of the profession, a fundamental aim of engineering work is to create experiences in the service, betterment, and aid of humanity. Further, with initiatives such as the UN’s “decade of action” (DoA. Online (March 2022) at: <https://www.un.org/sustainabledevelopment/decade-of-action/>), although potentially ill-advised as per the author’s opinion to put dates around such initiatives as they could

have negative consequences if the goal(s) are not met (e.g. the fuelling of partisan political opinions), engineers have the innate *responsibility* to help deliver the promise of positively transforming our world by 2030 and beyond. It may be that by incrementally and iteratively exposing engineering learners to HE within the confines of current engineering educational offerings in respective areas, that we may begin to change attitudes accordingly and truly begin to “grow” responsible engineers.

In the area of software engineering (and computer science), the opportunity of exposing HE/STEAM to learners is grand! Reflecting on Quan-Haase’s [5] idea of *technology as society*, relating to the idea that advancements in society are in large part intertwined with advancements in technology, exposing learners to HE may lead to more humane software technologies being built. From the author’s opinion we have seen the direct results of a lack of exposure otherwise. From software engineers and computer scientists creating software tools that ignore inequities related to occupation, openness, and access (e.g. the COVID-19 pandemic has highlighted such inequalities as, for example, it has been estimated that less than 50% of the world has access to a computer at home limiting options for technology-augmented interactions with software tools such as Zoom, and others [13]), to software and algorithm facilitated misinformation campaigns on the social web, and the social web itself, contributing to harmful partisan divides, cyber bullying, and to the overall decline of empathy (e.g. Pariser’s online “filter bubbles” creating information and knowledge divides [8]), to artificial intelligence bots contributing to hate, racism, and culturally insensitivities [9], the current state may not be ideal. Although it’s not all bad, there exists much that can be explored, and the solution may reside with us in the education realm. As learners are in our care, we can choose to take on the responsibility of exposing engineering learners to all the above so that they can experience and reflect on design ideas and decisions (the good, bad, and the ugly) in a “safe-fall”, “fall-forward-fast” environment. It is the hope of this author that as software engineering learners are exploring the analytical and technical norms, as well as aspects of HE in their work in academia, that they are also inspired to continue said explorations post-graduation.

Schneider et al. describe a recent trend in engineering education “to include a broader notion of helping” [3]. The notion of helping could provide the basis for experiential design opportunities where engineering learners explore how to help society/citizens better understand ideas of sustainability in a personal, local, and broader/global sense of *helping*. This, by facilitating leaning opportunities where engineering learners design collaborative and knowledge expanding software tools on the subject in project-based learning activities. It could be as engineers become more knowledgeable in this realm, so too might everyday citizens in their interactions with the technology

artifacts that are created. Herein lies the inspiration of the exploratory work-in-progress described in this paper.

Prompted by the questions: can inspiration towards becoming a *responsible engineer* be instilled in software engineering learners in academia? Can this be accomplished by facilitating a learning experience that immerses software engineering learners in researching and exploring the design and development of computer technologies in support of the UN Sustainable Development Goals (SDGs. Goals that shed light towards opportunities to positively advance society based on societal needs. Online (March 2022) at: [Online: https://sdgs.un.org/goals](https://sdgs.un.org/goals))? Through resulting explorations, might both engineering learners and everyday citizens who interact with the engineered creations be better equipped to participate in the UNs DoA, and beyond?

This paper will describe an undergraduate software systems engineering (SSE) course, and its graduate-level counterpart, at the University of Regina that facilitated an experiential and reflective learning experience around these inspirations and questions. A discussion regarding the structure of the course, its educational content, student output, and results of qualitative feedback obtained on the learner experience will be provided. As well, as this exploration is an iterative work-in-progress, ideas for continued exploration of this work will be discussed.

2. COURSE DESIGN & EVOLUTION

Inspired itself by the United Nation’s (UN) Sustainable Development Goal (SDG) #4 “quality education” (SDG-4: Online (March 2022) at: <https://sdgs.un.org/goals/goal4>) the author explored a course re-thinking effort to introduce and incorporate aspects of HE into an upper-level undergraduate SSE course titled “designing apps for collaboration & learning” and its graduate-level counterpart titled “researching and engineering community-centred software.” The undergraduate and graduate offerings of the courses were similar. The one exception being in the graduate class learners were also required to complete a literature review and conference-style presentation on work in the engineering of community-centred software throughout the years.

In both courses, curriculum was a 50/50 mix of 50% exposure to theory in community-centred design and HE and 50% towards an engineering design project. Lectures were a mix of learning about the topics of communities of practice, digital habitats, the social web, tools in support of collaboration, knowledge management, education, (digital) literacy, change management, and wide-ranging discussions on HE as it relates to the applied practice of software engineering, technology, ethics, and society. Experiential and reflective engineering design activities made up the other aspects of the learners’ experience. Here, SSE learners were asked to immerse themselves into researching and engineering a humanity-centred software

system of their choosing. The guiding basis for learner explorations involved tackling a problem area related to education for sustainable development (ESD) around one, or several of the UN SDGs.

The first exploration of these ideas occurred in the undergraduate offering of the course in the Winter 2021 term (January-April), and then in the graduate-level offering in the 2021 Spring term (May-June). Given the author's perceived success in integrating HE into the course curricula based on informal feedback received from learners in both the undergraduate and graduate-level course offerings, the author formalized the HE-integrated curriculum in the Fall 2021 offering of the course (September-December). It is the experience within this course that frames the discussion in this paper.

The course syllabus for the Fall 2021 course offering is provided in Appendix A. To help document engineering learner attitudes towards being exposed to HE in their learning, the author added the requirement of a lessons learned document from all SSE learner participants to enable qualitative analysis of the learner experience. Given this requirement, the author formally went through a research ethics review where it was determined that the exploratory analysis fit more in line with a program evaluation. As such, a formal research ethics board waiver was received that allowed the author to engage in a qualitative learner analysis of the course experience.

2.1. Exposure to the UN SDGs & the UN RCE Network

Early in the Fall 2021 undergraduate course offering, the author invited Dr. Roger Petry, a philosophy professor at Luther College at the University of Regina and co-coordinator of the Regional Centre of Expertise (RCE) on ESD for Saskatchewan to introduce the UN SDGs and UN's Regional Centre of Expertise (RCE) network. The global RCE network is an expansive network of locally operated RCEs around the world that engage communities on ESD initiatives in their areas (more information on the RCE Network can be found online (March 2022) at: <https://www.rcenetwork.org>). This author recommends other engineering educators interested in integrating HE within curricula to engage with their local RCE network if one is available. They are a great resource). Each RCE provides opportunities for educators, learners, industry practitioners, and beyond to build knowledge and form connections with local and territorial organizations and citizens on specific needs relating to the advancement of the UN SDGs within geographic localities. Dr. Petry's lecture provided learners in the course with a background knowledge of the UN SDGs, the global and local RCE network (emphasizing RCE Saskatchewan (online (March 2022) at <https://saskrce.ca/>) as that is the RCE within the geographic region of the University of Regina), and the inspiration and promise of (software and other)

engineering activities to help contribute to solving local and global needs as they relate to the UN SDGs.

2.2. Researching & Engineering Digital Habitats in Support of the UN SDGs

As a basis for guiding the software engineering process of experiential and reflective learner research and engineering design activities, in addition to the lecture topics previously described at the start of Section 2, aspects of the Agile/Scrum Framework [10] and the Wenger et al. [11] methodology for researching, creating, and sustaining digital habitats (i.e. online-facilitated communities of practice) were used. The schedule of the course was a 75-minute course, twice per week over the Fall 2021 semester. One of the weekly lectures was devoted to lecture/theory-based learning. As discussed, theory lectures immersed learners on the knowledge content within the areas of community-centred design and HE specific and as related to the world of SSE. The second of the weekly lectures was devoted to engineering design activities in support of learner projects – either in learners conducting research and software engineering work or giving updates to the author on their project progress.

Following the inspirational lecture provided by Dr. Petry, course learners were asked to explore the UN SDGs and come up a project idea of their choosing that aimed to advance collaborative and knowledge growing efforts of a community as it related to ESD and their selected UN SDG(s). The community, UN SDG, and ESD area of focus that the learner selected did not have to be a local need. Simply a community, UN SDG(s), and/or ESD area where the learner was passionate about helping and diving deep into creating solutions for.

A traditional project experience may include four key phases: initialization, planning, execution, and closing [12]. In the project initialization and planning phases for learners in the course, the initial activity was to undertake an effort in community research with an attempt to have the learners formalize a deeper understanding of their chosen SDG(s) and community they aimed to help. Learners were asked to explore the community's characteristics in any way possible, gathering knowledge such as its current life cycle (is the community just starting, or has it been around for a while), the community's constitution (its diversity, openness, connectedness), technology aspirations of the community (is it eager to use technology to assist efforts of ESD?), and orientations (meetings-based, project-based, content-based, etc.). Some learners researched the community by actively engaging with community members. Others researched their chosen communities as best they could otherwise (e.g. through articles, publications, official statistics). Learners were also asked to explore current technologies presently supporting the community, if any, and to highlight any gaps/opportunities for innovation. After summarizing gaps and ideas for innovation, learners were asked to create a

business case document and community stakeholder analysis, with a supplemental video introducing the area of ESD selected, the UN SDG(s) of focus, a high-level project vision, current state of technology support for the community, the innovation, need, and/or gap, the audience (“customer” group), and any envisioned constraints (beyond class time/duration). Adapted templates provided by Wenger et al. [11] and Barrett [12] were supplied to the learners to help guide their exploration and documentation. These are provided in Appendix B (“Community characteristics & orientation”, “Technology configuration inventory”, “Business case”, and “Stakeholder analysis” documents).

Building on their exploratory work in the initial project activity, learners shifted focus from evaluating the current state of their selected community to discussing the future state of their proposed innovation/software creation in support of advancing ESD for the community. Learners were asked to “draft an emerging picture” of innovation by detailing community orientation coverage (do opportunities exist to expand the community’s present technology, if any, in support of its efforts in ESD?), discussing polarities with respect to current offerings (e.g. if a community only uses synchronous technology to support their current efforts on ESD, is there an opportunity to create something that aids the community asynchronously?), and envisioning an iterative approach to engineering design by proposing several minimum viable products (MVP. An MVP, in a software engineering sense, is a partial but functional/usable slice/iteration of a working software). Learners were also asked to create low-to-high-fidelity prototypes (from paper and pencil to technology software rendered drawings) of envisioned software solutions. Further, the learners were asked to take into consideration an MVP perspective of what could be delivered within the constraints of the 4-month course timeline (however, learners were also asked to envision a minimum of three MVPs plus a future vision of iterations beyond). See Appendix B for adapted templates provided to learners to use for project reflection and documentation (“Drafting an emerging picture”, “Project scope”, “Project requirements”, “Activity-based schedule” documents).

In the execution phase of the project course learners dove into creating their proposed and envisioned solutions. As mentioned, learners were asked to envision three MVPs. Each MVP was given a two-week software engineering design/development cycle (called a “sprint”). After each sprint learners were asked to demo their software engineered solution, provide a project status update for the next MVP/future work, and participate in a question-and-answer session with the author and other course learners. These sessions were called “scrums” (as per the Scrum Framework). See Appendix B for adapted templates provided to learners to help frame scrum discussions (“Project status report” document).

In the closing phase of the project course learners submitted their completed software engineered solutions. Learners were also asked to complete a project report-out and lessons-learned document. Specific to the project report-out and lessons-learned document, learners reflected on their projects, results, and overall experience. This included being asked to provide reflections on their exposure to learning about ESD, the UN SDGs, their idea of responsible engineering, and their opinion of what they learned in the course and how it may impact their work in academia and beyond in industry. See Appendix B for the “Project report-out & lessons learned” template that was provided to aid learners in their documented reflection.

3. RESULTS & DISCUSSION

There was a total of 13 engineering learners in the Fall 2021 undergraduate course offering, 12 of which were SSE learners, one of which was an electronics systems engineering (ESE) student. Appendix C details the learner software engineered solutions, with links to video commercials summarizing their solutions and links to respective GitHubs (open-sourced project documentation and code). Engineered software solutions were wide ranging, from the engineering of software solutions to tackle food waste and community hunger, software solutions to support mental, emotional, and physical health, software solutions to promote open access to quality education, software tools to advance knowledge of equity and society, and software tools to advance ESD on environmental sustainability.

As mentioned in the previous section, in the closing phase of the project, in addition to course learners submitting their completed software engineered solutions, all learners completed a project report-out and lessons-learned document. It was made known to the learners that these documents were not to be reviewed by the author before the course ending to help address any potential bias. With the help of a teaching assistant (TA), the author asked the TA to review document submissions and report back on whether students did successfully submit a document and formally write responses to all questions for grading purposes. The TA did not do a deep dive into the responses, however. This had a minor risk that the content provided by the course learners was of poor quality. However, on the author’s review of submission post-course, the author found that all students acted professionally and submitted quality reflections.

Of specific interest to the discussion here was the learner reflections provided in the third section of the project report-out and lessons-learned document, i.e. the “General reflections on the class and project experience.” Table 1 summarizes author-codified qualitative findings. The first question asked whether learners had knowledge of or encountered the UN SDGs before taking the course. 77% (10/13) had not. The second question asked whether

learners were concerned with the ideas of UN SDGs in their software explorations before taking the course. Although the qualitative data indicated no, many learners attempted to make connections to the UN SDGs with examples of previous work, e.g. comments along the lines as “before this class there was never an emphasis on communities or on designing software for people in need. [However,] A previous project I worked on ... could be adapted into something for the Quality Education SDG...” These types of responses were encouraging to the author as it, as perceived by the author, demonstrated active reflection which the author hopes spans beyond course experiences.

Table 1. Author summaries of the learner general reflections on the class and project experience

Question/prompt	Analysis
Before taking ENSE 405, were you aware of the UN SDGs?	Yes=3 No=10
Typically, before taking this class, when you engineered software solutions, were you concerned with areas encompassing the UN SDGs?	Yes=2 No=11
Did learning about the UN SDG(s) help you understand better your role and responsibility as an engineer to society?	Yes=11 Neutral=2 No=0
What was your experience(s) in engineering your specific software solution to address the UN SDG(s) selected?	Positive=11 Neutral=0 Negative=0 Unsure=2
As a future engineer, what are your thoughts on the UN SDGs as a whole? Do you think they can help or hinder our work as software engineers?	Help=11 Hinder=0 Unsure=2
Should we use the UN SDGs to guide our work or is our work dependent on customer requests, regardless of the UN SDGs?	Yes=6 No=0 Both=5 Unsure=2
Will you use your understanding of the UN SDGs in engineering solutions in the future?	Yes=11 No=0 Maybe=2
Will your experience learning about the UN SDGs inform your career path decisions in the future?	Yes=11 No=1 Maybe=1

The third through sixth questions dealt with the learners’ reflections on utilizing the UN SDGs as a basis to understand and act on the *responsibility* engineers have on society as it relates to the *things* engineers build and put out into the world. Although most learner reflections indicated positive reflections on the utilization of the UN SDGs on engineering work, question six illustrated the potential conflict learners may have between fulfilling customer requests and societal impacts of engineering works/

ensuring engineers always act *responsibly*. One learner reflection summarized the conflict and possible solution by stating, “for many of us at the end of the day we’re hired by either a company or a customer to do a job – if you can push to make a difference in the world while also being professional then that’s great but you can’t force SDGs in contexts that are irrelevant.” It was encouraging that the learner also continued by stating, “it’s also important to remember that if you feel very passionately about these things – you can develop an open-source project outside of your actual job to make a difference as well.”

Regarding the final two questions, the author was encouraged to find that the exposure to ESD and the UN SDGs had mostly a positive impact on learner reflections for future work in the software engineering field. Although, as noted, the comments did indicate a conflict between fulfilling customer requests and addressing societal impacts of engineering works, and the future is unknown for where these learners may find themselves post-academia. However, this author is encouraged that the learning activity described will, at the very least, allow these learners and future engineers to at the very least reflect on their experiences in this course when working in the field and engineering future software projects.

4. CONCLUSION & FUTURE WORK

This paper described an iterative, work-in-progress towards facilitating a software engineering learning environment around ideas of responsible engineering. As mentioned, this work was prompted by three questions. Upon the analysis and reflection of learners’ experiences, a positive narrative emerged. First, the question: can inspiration towards becoming a *responsible engineer* be instilled in engineering learners in academia? Given the learners’ experiences and reflective responses summarized in Table 1 it appears that it is possible. Second, the question: can this be accomplished by facilitating a learning experience that immerses engineering learners in researching and exploring the design and development of computer technologies in support of the UN SDGs? Again, given the learners’ experiences and reflective comments the analysis indicates a positive result. Third, the question: through resulting explorations, might both learners and everyday citizens who interact with the engineered creations be better equipped to participate in the UNs DoA, and beyond? Again, given the learners’ experiences and reflective comments the analysis indicates a positive direction. Here, by learners immersing themselves in research and engineering work on topics of ESD around the UN SDGs, they gained useful knowledge to take with them in other courses and out in industry. Further, with respect to the learner software creations, most can currently be used out in the world in support of advance local and global knowledge of all citizens. As well, as all software creations are provided under a culturally open license model

(Creative Commons attribution ShareAlike license, BY-SA 4.0. Online (March 2022) at: <https://creativecommons.org/licenses/by-sa/4.0/>). In utilizing an open cultural licensing model it ensures that all software solutions can continue to be explored, iterated, and evolved by any citizen willing to continue the exploration.

The author wishes to continue exploring the ideas and questions described in this paper. This, in the mentioned courses, but also in others (the author is currently developing a multimedia SSE course where it is envisioned the UN SDGs will play a role in the learner experience as well). The author was quite encouraged to find that the exposure to the UN SDGs had mostly a positive impact on learner reflections in the class and in their view of future work in the software engineering field. Although it cannot be stated soundly that the learners' experiences will come into play when they carry on exploring other projects in academia and out in industry, nor when they are on the job hunt. However, the author is encouraged that there is a strong likelihood that in gaining knowledge on ESD, the UN SDGs, and the RCE network, that all learners would at least look back and reflect on their learning experiences when future decision-making and software engineering.

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The author would like to make note that all procedures performed in studies involving human participants (engineering learners) were in accordance with the ethical standards of the of the University of Regina Research Ethics Board (REB), even though this exploratory work received an REB program evaluation waiver: 2021-134.

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Appendix A: COURSE SYLLABUS

See attached documents

Appendix B: LEARNER PROJECT TEMPLATES

See attached documents

Appendix C: LEARNER PROJECT DESCRIPTIONS

See attached documents

Appendix A: Course syllabus for ENSE 405

ENSE 405: Designing Apps for Collaboration & Learning. Fall 2021

Instructors:

- **Lecture:** Dr. Tim Maciag | tim.maciag@uregina.ca | <https://www.maciag.ca/>
- **Tim's (virtual) office hours:** By email request/appointment only

Lectures:

- Tuesdays & Thursdays | 11:30 am – 12:45 pm | Remote via URCourses/Zoom

Course description & learning outcomes

Engineering user experiences for community-centred software applications (e.g., technology tools in support of collaboration, learning, & knowledge). To take this course the student must have completed ENSE 374 or have permission from the instructor

Text/Resources

- Course content will be loosely based on the following texts.
 - E. Wenger, N. White, and J.D. Smith. *Digital Habitats: Stewarding Technology for Communities*. CPSquare. 2009.
 - C. Shirky. *Here Comes Everybody: The Power of Organizing Without Organizing*. Penguin Books. 2009.
 - J. McGonigal. *Reality Is Broken: Why Games Make Us Better and How They Can Change the World*. Penguin Books; Reprint edition. 2011.
 - A. Quan-Hasse. *Social Networks, Power, and Inequality*. OUP Canada. 2020.
 - S. Garfield. *Handbook of Community Management*. De Gruyter Saur. 2020.
- All other resources will be posted in URCourses.

Course evaluation

Project (individual)	Exam 1	Exam 2	Lecture quizzes	Participation, professionalism, & attendance	Instructor discretion
50%	15%	15%	15%	5%	+/- 5%

Important notes

Exams:

- Deferred exam requests are not accepted. Exam dates are set as per the schedule and are non-negotiable (minus extreme circumstances as per the instructor's discretion)
- Combining both Exam 1 and Exam 2 student scores, students must obtain an accumulated grade of greater than 50% (i.e., an accumulated grade of greater than or equal to 15/30 combining grades obtained from both exams). If students fail to obtain a grade of higher than 50% as indicated, students will receive a 0/30% for their exam #1 and exam #2 grade allocation

Course project:

- Participation in the course project is mandatory. If students fail to participate in the course project, the student(s) will receive an NP in the course. This will be evaluated based on project insights (via GitHub),

information obtained in individual (& class)/instructor conversations (scrums) (and all as per the instructor(s) discretion)

- Throughout the semester, individual (& class)/instructor “scrums” (meetings) will occur. Attendance at scrums is mandatory, with non-attendance resulting in a zero grade for the specific project deliverable scrum. As well, tardiness will be observed and individual deductions will apply, upward to the full specific project deliverable allocation (as per the instructor’s discretion)
- Students who miss the project scrum s(instructor/peer) presentations & demo sand/or the final project scrums (instructor/peer) presentations & demos (both session 1 & 2) will get 0% on their project allocation as per Zoom logs. Students who arrive late will be deducted 5% of their project allocation grade for every minute they are late after the first presentation, again, as per Zoom logs (individual deduction). Also, please note that presentations on both days will be recorded by the instructor in Zoom and will be used for grading and accreditation purposes (but please know the videos will not be posted on the World Wide Web)

Instructor class research disclaimer:

- This class is an experimental class where the instructor is actively researching the student experience, specifically as it relates to the engineering graduate attributes (<https://bit.ly/2WBqSxx>). Specific emphasis will be on the deeper understanding of student experiences from the lens of graduate attributes 3.1.9: impact of engineering on society and the environment, and 3.1.12: life-long learning
- Student written and verbal reflections may take up part of course deliverables. For example, survey submissions may be collected to understand impact of the student learning and experience (Note: some of this data may be collected by the course teaching assistant and provided to the instructor post-class after final grades have been submitted and released to ensure all perceived bias is removed from grading decisions. This, with the caveat that the instructor will make note of the student’s individual student response/submission rate. If students fail to submit deliverables as outlined, this may have an impact on the individual student’s project and participation, professionalism, and attendance grade allocation

Lectures:

- Lecture quizzes may be (or may not be, depending on how my technology experiments go) only available in URCourses for one week after posting their corresponding video lecture
- Students who have not watched lectures within 1 week of their go-live date will see grade deductions within their “Participation, professionalism, & attendance” & “Lecture quizzes” grade allocations accordingly (upwards to the full grade allocation/individual lecture)
- Students must obtain a grade of 50% (7.5/15) or higher in the course lecture quizzes. If students fail to obtain a grade of higher than 50% as indicated, students will receive a 0/15% for their lecture quizzes grade allocation

Student professionalism:

- The instructor reserves the right to interview students on understanding of submitted works, altering individual grades accordingly (as per the instructor’s discretion). In the perceived event that a student’s submitted works appear to have been copied from a solution manual, classmates, or online sites such as Stack Overflow, CHEGG, Course Hero, etc., the student will receive a zero on the submitted work and be flagged to the Associate Dean Academic for a warning letter. If the behavior is repeated, the student will be flagged to the Associate Dean Academic for a formal academic misconduct investigation which will be documented in the student’s official university student file

Student safety, behavior, ethics, & special needs:

- University of Regina, student behavior: <https://bit.ly/2Kppljm>
- University of Regina, about plagiarism: <https://bit.ly/3ymC8uB>
- University of Regina, health, safety, & emergency preparedness: <https://bit.ly/2HFIOKA>
- If there is any student in this course who, because of a disability, may have a need for accommodations, please contact the Centre for Student Accessibility at: <https://www.uregina.ca/student/accessibility>

Course schedule *All topics/dates are tentative/subject to change minus the exam dates*

- [1] Wenger et al. Digital Habitats: Stewarding Technology for Communities. CPSquare. 2009.
 [2] Shirky. Here Comes Everybody: The Power of Organizing Without Organizing. Penguin Books. 2009.
 [3] J. McGonigal. Reality Is Broken: Why Games Make Us Better and How They Can Change the World. Penguin Books; Reprint edition. 2011.
 [4] A. Quan-Hassé. Social Networks, Power, and Inequality. OUP Canada. 2020.
 [5] S. Garfield. Handbook of Community Management. De Gruyter Saur. 2020.

Date	Lecture topics & project activities	Reference material/notes
Aug 31	Zoom full session (11:30 – 12:45) Course introduction; Syllabus overview; Teaching philosophy; Instructor research discussion	
Sept 2	It takes a village to find a phone; Communities of practice (CoP);	[1] Chapter 1 [2] Chapter 1 [5] Chapter 2
Sept 7	Zoom check-in (11:30 – 12:00) Technology and community; Technology stewardship; Experience and education (Dewey)	[1] Chapter 2, 3, 10 [4] Chapter 1, 2, 6 Kevin Kelly: https://youtu.be/GS1xL1qcBa4 John Dewey: Education and experience
Sept 9	Constructing digital habitats	[1] Chapter 4 Tim Berners-Lee: https://youtu.be/OM6XIIcm_qo
Sept 14	Zoom check-in (11:30 – 12:00) Community orientations;	[1] Chapter 6
Sept 16	Making sense of the technology landscape;	[1] Chapter 4, 5, 7 Eli Pariser: https://youtu.be/B8ofWfX525s NN/g (A. Kaley and M. Rosala): Tool Abundance in the Digital Workplace, Trendy or Troublesome?
Sept 21	Zoom full session (11:30 – 12:45) Project discussion (with Roger Petry) & project reflection	https://www.un.org/sustainabledevelopment/ https://www.rcnetwork.org/portal/
Sept 23	Zoom full session (11:30 – 12:45) Project discussions & instructor signoff (idea & scope)	Schedule TBA



Sept 28	Dedicated project research time	
<i>Sept 30</i>	<i>No class, National Day for Truth & Reconciliation</i>	
Oct 5	Zoom full session (11:30 – 12:45) Community research & understanding scrum & documentation due	Schedule TBA
Oct 7	Zoom full session (11:30 – 12:45) Exam 1	
Oct 12	Zoom check-in (11:30 – 12:00) Data, Information, & Knowledge Management	Tim Maciag: Knowledge Management using SpiCE
Oct 14	Sharing anchors community; Personal motivation meets collaborative production; Rhizomatic learning	[2] Chapter 2, 4, 5 Dave Cormier: Community As Curriculum
Oct 19	Zoom full session (11:30 – 12:45) Drafting an emerging picture, software design, & architecture scrum & documentation due	Schedule TBA
Oct 21	Content strategy; Dis/information strategy	J. Barshay: Why Content Knowledge is Crucial to Effective Critical Thinking D. Stiles: Meme Warfare: Design in the Age of Disinformation Mozilla: Web Literacy CBC: The real 'fake news' CBC: fake news tips M. Caulfield: The CBC Infolit Bot May Make People Worse at the Web CNN: Finland is winning the war on fake news Wired: There's a lot Wikipedia can teach us about fighting disinformation
Oct 26	Zoom check-in (11:30 – 12:00) Creativity is Queen when everyone is a media outlet	[2] Chapter 3 Adobe: State of Create (2016) Larry Lessig: https://youtu.be/7Q25-S7jzgs Eric Raymond: The Cathedral and the Bazaar Richard Stallman: https://youtu.be/7twCCWjSnMg
Oct 28	Supporting learning & collaboration with Gamification	[3] Chapter 1-15
Nov 2	Zoom full session (11:30 – 12:45) *** Project scrum (instructor/peer) presentation & demo (Following a 2-week sprint cycle with MVP 1 expected)	Schedule TBA



Nov 4	Product quality; Change Management; Plan for change and stewarding technology in use activity;	[1] Chapter 7, 8, 9, 10 Prosci: ADKAR model for Change Management
Nov 9	<i>No class, Fall break</i>	
Nov 11	<i>No class, Fall break/Remembrance Day</i>	
Nov 16	Zoom full session (11:30 – 12:45) *** Project scrum (instructor/peer) presentation & demo (Following a 2-week sprint cycle with MVP 2 expected)	Schedule TBA
Nov 18	A more distributed future; Promise, tool, bargain; A learning agenda	[1] Chapter 11, 12 [2] Chapter 11 [4] Chapter 12
Nov 23	Zoom full session (11:30 – 12:45) Exam 2	
Nov 25	Dedicated project development time	
Nov 30	Zoom full session (11:30 – 12:45) *** Final project scrum (instructor/peer) presentation & demo – Session 1 (Following a 2-week sprint cycle with MVP 3 expected)	Schedule TBA (Random draw)
Dec 2	Zoom full session (11:30 – 12:45) *** Final project scrum (instructor/peer) presentation & demo – Session 2 (Following a 2-week sprint cycle with MVP 3 expected)	Schedule TBA (Random draw) Mason requested
Dec 21	<i>There is no “final” exam on Dec 21</i>	

*******As mentioned in the “Important notes” section, Students who miss the project scrums (instructor/peer) presentations & demo sand/or the final project scrums (instructor/peer) presentations & demos (both session 1 & 2) will get 0% on their project allocation as per Zoom logs. Students who arrive late will be deducted 5% of their project allocation grade for every minute they are late after the first presentation, again, as per Zoom logs (individual deduction). Also, please note that presentations on both days will be recorded by the instructor in Zoom and will be used for grading and accreditation purposes (but please know the videos will not be posted on the World Wide Web)



Appendix B: Learner templates

Community characteristics & orientation

Name: _____

Community (UN SD goal): _____

Date: _____

Instructions

Research the community you are most interested in exploring using links from the UN Sustainable Goals website (<https://www.un.org/sustainabledevelopment/>) and others. In your exhaustive research, answer the following.

Community characteristics		
Community life-cycle (current state)		
Where is your community in its life-cycle?	What you need to focus on:	Special needs
<input type="checkbox"/> Just forming Need basic tools to connect, but not sure from there	Research and/or discuss the potential of some basic tools with members, explore what ideas it might give them, and see what they might bring in with them.	
<input type="checkbox"/> Self-designing Information stage, but with a strong sense of what it wants to accomplish	Contribute ideas to the design. Analyze systematically the implications of their community design for technology, infrastructure, and technology skills.	
<input type="checkbox"/> Growing & restless Ready to add new functionality to its tool configuration	Try to make this a community reflection and self-design event. Does their restlessness suggest a major change, such as a transition to a new platform?	
<input type="checkbox"/> Stable and adapting Just needing some new tools	How much disruption will the community tolerate? How will the new tools be integrated into or affect existing practices?	
Constitution		
Diversity: How diverse is the community?		
Topic	Your notes	



What are the different types of members and what are their levels of participation?	
How spread apart is it in terms of location and time zones?	
What language(s) do members speak?	
What other cultural or other diversity aspects may affect your technology choices?	
Openness: How connected to the outside world is your community?	
Topic	Your notes
How much do you want to control the boundaries of your community? Does your community need	<input type="checkbox"/> To be private/secure <input type="checkbox"/> Open boundaries <input type="checkbox"/> Both private & public spaces
How does your community need to interact with other communities? Do you need common tools for sharing and learning with them?	
Technology aspirations	
Technology savvy, tolerance, & constraints: What are your community's technology interests and skills and patience thereof? What are the constraints imposed by technology factors?	
Topic	Your notes
How interested is your community in technology?	
What is their capacity for learning new tools?	
What is the range of skills? If their interests and/or skills are diverse, could it cause conflict or distraction?	
How tolerant are members of the adoption of a wide variety of tools?	
How many technological boundaries are they willing to cross, e.g. sign in to more than one web-based tool, learn to	



use new tools, or give up old favorites? This helps you understand what level of integration you need.	
What are your members' technology constraints (e.g., bandwidth, operating systems, etc.)?	
How much time are members able to be online and from where (office, home, field)? Some people have limited online time, or are able to be online only in specific locations. Others are always on. Very diverse situations can affect participation	

Community orientation

Relevance to community: Use the range from 0 (no relevance) to 5 (high relevance) to determine what matters most to the community. Look at these from the perspectives of the different types of members (under "constitution"). Also discuss the "value-added" to each member group

0	1	2	3	4	5	Orientations	Variants	Key activities/your notes
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Meetings Many communities place a great emphasis on regular meetings where members engage in shared activities for a specific time. Meetings, and the visible participation of members, assert the community's existence	<input type="checkbox"/> Face-to-face/blended <input type="checkbox"/> Online synchronous <input type="checkbox"/> Online asynchronous	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Open-ended conversation Some communities maintain ongoing conversations as their primary vehicles for learning. Open-ended conversations are common when a community is co-located and people keep the conversation going as they "bump" into each other.	<input type="checkbox"/> Single-stream discussions <input type="checkbox"/> Multi-topic conversations <input type="checkbox"/> Distributed conversations	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Projects In some communities' members want to focus on particular topics, go deep, and collaborate on projects to solve problems or produce useful artifacts. Learning is not just a matter of sharing	<input type="checkbox"/> Practice groups <input type="checkbox"/> Project teams <input type="checkbox"/> Instruction	



						<p>knowledge or discussing issues. Members need to do things together in order to develop their practice. Projects usually involve a subgroup within the community</p>		
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<p>Content Some communities are primarily interested in creating, sharing, and providing access to documents, tools, and other content. Valuable and well-organized content is a useful resource for members</p>	<input type="checkbox"/> Library <input type="checkbox"/> Structured self-publish <input type="checkbox"/> Open self-publish <input type="checkbox"/> Content integration	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<p>Access to expertise Some communities create value by providing focused and timely access to expertise in the community's domain, whether internally or externally. Communities with this orientation focus on answering questions, fulfilling requests for advice, or engaging in collaborative, just-in-time problem solving</p>	<input type="checkbox"/> Questions & requests <input type="checkbox"/> Access to experts <input type="checkbox"/> Shared problem solving <input type="checkbox"/> Knowledge validation <input type="checkbox"/> Apprenticeship & mentoring	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<p>Relationships Some communities focus on relationship building among members as the basis for both ongoing learning and being available to each other. This orientation emphasizes the interpersonal aspect of learning together. Communities with this orientation place a high value on knowing each other personally, emphasizing networking, trust building, and mutual discovery</p>	<input type="checkbox"/> Connecting <input type="checkbox"/> Knowing about people <input type="checkbox"/> Interacting informally	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<p>Individual participation Learning together happens in the context of a group, but it is realized in the experience of individuals. People bring different backgrounds, communication styles, and aspirations to their participation in a community. People have different levels of commitment, they take on</p>	<input type="checkbox"/> Levels of participation <input type="checkbox"/> Personalization <input type="checkbox"/> Individual development <input type="checkbox"/> Multi-membership	



						different roles, and they use tools differently		
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<p>Community cultivation</p> <p>Some communities are happy with loose self-organization and unplanned evolution, while others thrive on attention to community cultivation. They have a need to reflect on the effectiveness and health of the community to make things better, joined with a willingness to work on it</p>	<input type="checkbox"/> Democratic governance <input type="checkbox"/> Strong core group <input type="checkbox"/> Internal coordination <input type="checkbox"/> External facilitation	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<p>Service context</p> <p>In some cases, serving a specific context becomes central to the community's identity and the ways it operates. They may live inside an organization, whose charter their practice needs to serve. They may have a mission to provide learning resources to the world or to recruit members widely. Or they may seek interactions with other communities whose domain complements their own</p>	<input type="checkbox"/> Organization as context <input type="checkbox"/> Cross-organizational <input type="checkbox"/> Other related communities <input type="checkbox"/> Public mission	
Scratchpad (other interesting insights, questions/answers, etc.)								



Technology configuration inventory

Name: _____

Community (UN SD goal): _____

Date: _____

Instructions

It is useful to inventory the current technology configuration of the community, i.e., the current technology that the people working, learning, advancing knowledge (etc.) in the specific area you are engineering software for are using, as a way to understand the community better and what matters to them better. If yours is a new community, it may not have any specific technology yet, but even for brand new communities, the current configuration may not be empty, for instance if general tools like email or phone are going to be used. You can use a version of the table on the next page to inventory and analyze the current configuration of your community:

1. Get the big picture. Research the area and make a list of all the platforms and stand-alone tools in your community's configuration as best you can
2. For each platform, list the tools and check the ones that are being used. Why are some not being used? Are there duplicates? Are there issues around integration between tools?
3. To the left, make a note of which community activities/orientations the tools currently support in your community
4. To the right, identify the key features of tools. Are some of these features commonly or rarely used? What are the reasons for that?
5. Assess actual tool use if you can. Identify which are dominant and which are only used by smaller groups and individuals.

NOTE: Add new rows as needed below. Please know your search should be as exhaustive as possible given the area you are researching

Platform	Platform type or name		
Supported activities	Tools	Key features	Usage notes

Stand-alone tool	Tool type or name		
Supported activities	Tool	Key features	Usage notes



Business case

Name: _____

Community (UN SD goal): _____

Date: _____

Proposed Project

[At this point, the project is not yet approved, so it may not have its final name or the name may change. The current name or identifier should be included here.]

Date Produced

[The date the Business Case is produced.]

Background

[This section should include information that will help the reader understand the context and background history regarding the potential project. This section should not be written assuming that the background is common knowledge, but instead should be specific in order to create a common understanding of the context.]

Business Need/ Opportunity

[This section should demonstrate the business need or opportunity that the proposed project will address.]

Benefit Analysis

[This section contains the detailed benefits of each option listed in the previous section. The benefits may include the potential of increased sales, market share, and brand recognition and the reduction of errors and ongoing costs. Each option should be clearly identified and listed separately.]

Recommendation

[This section contains the recommended option from the previous section.]



Stakeholder analysis

Name: _____

Community (UN SD goal): _____

Date: _____

Project Name

[This section contains the project name that should appear consistently on all project documents. Organizations often have project naming conventions.]

Name

Project Role

Power

Interest

Level of Support

[Name of the person or group.]

[Project role/title or the reason that they are a stakeholder.]

[High/
Low]

[High/
Low]

[Supportive/
Neutral/
Unsupportive]



Drafting an emerging picture

Name: _____

Community (UN SD goal): _____

Date: _____

Instructions:

Using your researched information fill out the flowing comparing the current state of the art with what you think new (software) innovations could bring to the community

Covering the orientations	
Compare the left-hand column of the document "Technology configuration inventory" table with the right-hand column of the document "Community characteristics & orientation" table. What do you notice about the match (or mismatch) between your dominant community orientations and the current configuration of tools?	
How well does the technology inventory cover the orientations? What themes emerged from both the community orientations and the technology configuration from your colleagues' notes	
<input type="checkbox"/> Are you almost there? <input type="checkbox"/> Are there big gaps?	
What is the range of skills? If their interests and/or skills are diverse, could it cause conflict or distraction?	
Achieving integration	
Look at all the pieces of your configuration	
What level of integration and interoperability has been achieved?	
Where are there big gaps	
Balancing the polarities (Current state)	
How is the configuration balanced with respect to each polarity?	



Project scope

Name: _____

Community (UN SD goal): _____

Date: _____

Project Name	[This section contains the project name that should appear consistently on all project documents. Organizations often have project naming conventions.]
Project Deliverables	
[Epic story/High-level deliverable from the WBS is listed here.]	<p>[Work package/user story listed here.]</p> <p>[Describe this work package in as much detail as possible.]</p> <p>[Work package/user story listed here.]</p> <p>[Describe this work package in as much detail as possible.]</p> <p>...</p>
[Epic story/High-level deliverable from the WBS is listed here.]	<p>[Work package/user story listed here.]</p> <p>[Describe this work package in as much detail as possible.]</p> <p>[Work package/user story listed here.]</p> <p>[Describe this work package in as much detail as possible.]</p> <p>...</p>
Project Exclusions	
[Indicate anything that will not be included in the scope of the project.]	



Project requirements

Name: _____

Community (UN SD goal): _____

Date: _____

Project Name

[This section contains the project name that should appear consistently on all project documents. Organizations often have project naming conventions.]

Functional Requirements

[This section should list the functional requirements for the project including any features or properties of the project's outcomes.]

Technical/Performance Requirements

[This section should list the technical requirements for the project (e.g., the required technology infrastructure) and any performance requirements (e.g., the minimum response time).]



Activity-based schedule (Kanban/User Story Mapping)

Name: _____
 Community (UN SD goal): _____
 Date: _____

Project Name [This section contains the project name that should appear consistently on all project documents. Organizations often have project naming conventions.]

Activity	Duration	Start Date	End Date
----------	----------	------------	----------

MVP 1

[Name of work package.]

[Name of activity.]	[Duration in days.]	[Start date of activity.]	[End date of activity.]
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...
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[Name of work package.]

[Name of activity.]	[Duration in days.]	[Start date of activity.]	[End date of activity.]
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...
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MVP 2

[Name of work package.]

[Name of activity.]	[Duration in days.]	[Start date of activity.]	[End date of activity.]
---------------------	---------------------	---------------------------	-------------------------

...
-----	-----	-----	-----

MVP 3

[Name of work package.]

[Name of activity.]	[Duration in days.]	[Start date of activity.]	[End date of activity.]
---------------------	---------------------	---------------------------	-------------------------

...
-----	-----	-----	-----



Project Status report

Name: _____

Community (UN SD goal): _____

MVP # _____

Sprint cycle dates: _____

Project Name	This section contains the project name that should appear consistently on all project documents. Organizations often have project naming conventions.
Blurb	Briefly restate what you are doing; The UN Sustainable Development Goal focus(es); Any changes to your project vision/why; The specifics of the community-centred digital habitat you are designing and developing - introducing to the world
For Week Ending	Date of the report-out/presentation/demo
Project Status	Green, Yellow, or Red.
Status Description	Provide an overview of the project’s current status. If the status is yellow or red, indicate: * The reason(s) that the status is yellow or red. * The planned action(s) that will bring the project back to a green status.

Activities—During the past sprint cycle

List all activities that the team members worked on during the past week of the project. Show code and/or demo what you got

Project Issues

List any issues from the Issue Log that are significant and should be shared with the audience of this report. If any related work has been done or decisions have been made, a summary should be provided.

Project Changes

List any project changes that were approved since the last report/discussion.

Activities—Planned for Next Week

List all activities that the team members will work on during the next week of the project.

Reflection

Do you feel "on track"?; What progress do you particularly feel good (great) about?; What barriers (if any) do you feel is/are a current impediment to success?; What help (if any) do you require to move positively forward?; What questions or concerns do you have (if any)?



ENSE 405 Project report-out & lessons learned

Disclaimer: This template can be used to guide your discussion. Feel free to use this template design or your own but if using your own, ensure you follow the requirements below. The course instructor asks that you be as open, honest, and professional in your responses as possible. Please know it is OK to agree/disagree with any concept, process, or idea discussed in this class. The knowledge gained from your open, honest, educated, and professional responses will help guide and evolve understanding of the value of the class experience and may be discussed at a future “Canadian Engineering Education Association (CEEA)” event.

Project name

Provide your team’s “name” and team member(s)

Project sponsor & class facilitator

Dr. Tim Maciag (ENSE 405 Lecturer)

Business need/opportunity

- Keep this to a maximum of ½-page

Reflections on project planning

- Keep this to a maximum of 3-pages (with images if needed)
- State the United Nation’s (UN) Sustainable Development Goals (SDGs) selected and your “why” for selecting the one(s) you did
- Summarize key findings from community research and understanding (Community characteristics and technology configuration inventory)
- Summarize your professional opinion of the processes and documentation used in this course for project planning
- State selected north star & carryover customers. Why are these customers important?
- Summarize assumptions made and constraints uncovered, re: drafting an emerging picture
- Discuss initial & the evolution of your technology stack selection, drafted prototypes, and initial Minimum Viable Products (MVPs)

Reflections on project results

- Keep this to a maximum of 3-pages (with images if needed)
- Summarize how you felt about this project (likes/dislikes), from your experiences with the technology stack selected, translating prototypes into real solutions, and the evolution of your Minimum Viable Products (MVPs)
- Summarize what went well during the project
- Summarize what not went well during the project
- Summarize software design activities and findings. Ensure you discuss how you/your team either linked or envision links to design ideas back to topics discussed in class
- What would you do the same on future projects?
- What would you do differently on future projects?
- Summarize opportunities and design ideas for future work



General reflections on the class & project experience

- Keep this to a maximum of 3-pages (with images if needed)
- Before taking ENSE 405, were you aware of the UN SDGs?
 - Yes/No – Please elaborate
- Typically, before taking this class, when you engineered software solutions, were you concerned with areas encompassing the UN SDGs?
 - Yes/No
 - If yes, provide some past examples and explain
 - If no, do you have examples of past engineered works that you (co)created that could address one or more of the UN SDGs
- Did learning about the UN SDG(s) help you understand better your role and responsibility as an engineer to society?
 - Yes/Neutral/No – Please elaborate
- What was your experience(s) in engineering your specific software solution to address the UN SDG(s) selected?
- As a future engineer, what are your thoughts on the UN SDGs as a whole? Do you think they can help or hinder our work as software engineers?
- Should we use the UN SDGs to guide our work or is our work dependent on customer requests, regardless of the UN SDGs?
- Will you use your understanding of the UN SDGs in engineering solutions in the future?
 - Yes/No/Maybe – Please elaborate
- Will your experience learning about the UN SDGs inform your career path decisions in the future?
 - Yes/No/Maybe – Please elaborate
- Provide any other comments on the project accordingly

Appendix 3. Listing of student projects

Learner: Abraham Mugerwa

Project codename: Eatable

UN SDGs: 2 Zero hunger

Description: Regina Community fridge has a great way to provide meals to people who need in Regina. There is a need for such a system in Elementary schools where there are no cafeterias. Restaurants can package leftover foods, to have it be picked up by a volunteer and then distributed to schools in their area. Restaurants can further come together and provide some free pre-packaged lunches that can be delivered to schools in their area and stored for kids to access during breaks. According to the World Food Programme, 135 million suffer from acute hunger largely due to man-made conflicts, climate change and economic downturns. The COVID-19 pandemic could now double that number, putting an additional 130 million people at risk of suffering acute hunger by the end of 2020. With more than a quarter of a billion people potentially at the brink of starvation, swift action needs to be taken to provide food and humanitarian relief to the most at-risk regions. I believe there is an opportunity for communities to step up and help those in need in a way that is simple and easy. Since we see a lot of food everyday go to waste, or people unsure of what they can and cannot donate, this application can help educate, and remove the barriers to entry that will result in helping a lot of underprivileged people within our communities.

GitHub: <https://github.com/AbrahamMugerwa/ENSE-405-Eatable>

YouTube commercial: <https://youtu.be/vECU2mrIVCw>

Learner: Arika Pasha

Project codename: NoMoreWaste

UN SDGs: 2 Zero hunger

Description: The NoMoreWaste app is like any fast-food delivery app (UberEats, SkipTheDishes, DoorDash), however, it is based on donations of food and volunteer drivers. Businesses in the food industry, at the end of the day, can request someone to pick up their leftover food that did not sell and have that driver drop it off to a shelter to ensure that our homeless population in Regina is not starving. During my summers in high school, I used to work in food services at an amusement park in Calgary and, at the end of the day, they would make us throw away all the food that we did not sell. Every single day the park was throwing away hundreds of donuts, thousands of fries, hotdogs, burgers, churros, and anything else it did not sell that day. My coworkers and I felt terrible every time we had to throw the perfectly good food in the trash and even told our supervisors that this food could be donated to shelters for the homeless in our city, but they always refused. This is something that is extremely common in restaurants and fast-food places as well, they will throw the remaining food away at the end of the day when it could have been eaten by someone who may have needed it. Either these managers are not aware that shelters are willing to accept food donations, or they are not willing to drive out of their way to drop it off. With NoMoreWaste, they can easily request a volunteer driver to pick up their food and drop it off at whatever shelters are open or accepting, with the shelter confirming with the restaurant that the food was received. Not only does this allow the business to help our local community here in Regina, but it also allows the volunteer drivers to help make a difference in people's lives. This is extremely important, especially in the wintertime, where around 286 homeless people may not even have a single meal every day. Instead of that food going to waste, it could help someone out significantly.

GitHub: <https://github.com/arikapasha/NoMoreWaste>

YouTube commercial: https://youtu.be/gpl47vO_Znc

Learner: Carter Brezinski

Project codename: In Our City

UN SDGs: 4 Quality education

Description: My project is going to aim to educate the public on the lack of equality in our public & catholic school systems, more specifically focusing on the differences in treatment, budget, and overall care of these schools located in the inner city compared to schools being built in newly developed areas. From my own experience through both work and personal experience, I have witnessed first-hand how schools in the inner city are often neglected and forgotten about by their school systems. These schools are in the center of our community, they are schools pushing 100+ years of being open and are falling apart, have weeds instead of grass fields, and have furniture and desks in it that are breaking daily. Meanwhile there are schools that are being built in newly developed areas of our city, in which every inch of it has the newest technology, desks, furniture, and accommodations for every child. Until I worked for the school system, and witnessed other schools thanks to personal relationships, I never knew how big the difference between these schools was. What I want to make is a learning application or website, that hopefully shows more people what the conditions are like at some of these schools. I should mention that I don't want to develop something that comes across as accusatory towards these school systems, I want to make it informative so that people understand that not every school in our city are as fortunate as others are.

GitHub: <https://github.com/In-Our-City/Main>

YouTube commercial: https://youtu.be/oyKWSrD_J5w

Learner: Jonathan Vargas

Project codename: Shared

UN SDGs: 10 Reduced inequalities

Description: A collection of voice-recorded interactive real-life parables from local LGBTQ people. Finding a significant partner as a member of the LGBTQ community has a lot of hurdles. The majority of them come to terms of who they are near the end of their adolescence or during their adult years. This thrusts the person into a new world of dating that is in its infancy. If not navigated carefully this could lead to common LGBTQ issues such as: hypersexualization, minority stress, lack of confidence. There is no perfect way to pursue a romantic partner. The majority stumble through it. For the LGBTQ community there lacks resources to gather guidance. There is power that can be found on sharing learned lessons in a form of a parable. I aim to create an app that contains multiple interactive lived stories narrated by real people. This is to share the wisdom gained from embarrassing, painful, or happy experiences in an interactive medium.

GitHub: <https://github.com/JonBarVargas/Shared>

YouTube commercial: <https://youtu.be/nND6N78WtWM>

Learner: Joseph Bello

Project codename: SAS

UN SDGs: 3 Good health and well-being

Description: This project is titled Substance Abuse Solution (SAS) - A web application that aims to treat clients suffering from drug addiction and substance abuse, through behavioural therapies and medications. Clients can book appointments with Therapists and Addiction Psychiatrists, who will provide clients with the best treatment, based on their needs. Addiction treatment is not a one-size-fits-all. Treatments vary based on the patient's needs. It depends on factors such as the substance that is being abused, the level of care that is needed, the health care option that the patient can afford, personal mental health needs, etc. There are Therapists and Addiction Psychiatrists out there, but what

SAS strives to achieve is to house a community of therapists and addiction psychiatrists that cater to patients suffering from drug addiction and substance abuse, by providing them with the best treatment based on their needs. On the web application, clients, therapists, and doctors will have a profile. Clients will be able to book appointments (through zoom or in person), have a profile that shows previous meetings and a log of what was discussed during the meeting (this will be provided by the therapists or doctors). The log is needed so that clients can refer back to it to see what treatment plan is given or what medication was prescribed. On this log, therapists and doctors will state how often a client should meet with them per week. Every user (clients, therapist, doctors) will be able to see previous and upcoming meetings on their profiles.

GitHub: <https://github.com/joeyMarshall/SAS>

YouTube commercial: https://youtu.be/NI_iSk-C2Bw

Learner: Kaila Neigum

Project codename: SolarShare

UN SDGs: 7 Affordable and clean energy

Description: Create a mobile app which allows user to easily search a database of solar energy information from real-time consumers. This database could include financial information, such as product and installation costs, average utility bills before transitioning to solar energy, as well as a long term comparison of costs; location information such as data from locations with similar amounts of sunlight to get estimates on power production); consumption information to filter results from users that have similar power consumption habits, and other information such as companies/supplies used, quantity on panels needed, increase in property value, and possible tax breaks or incentives for various area. In addition, there could be a forum for people to ask and answer questions and share their experience relating to solar energy. I am in electronic systems engineering, focusing mostly on the power aspect. After my degree I want to work in the clean energy sector which is why chose affordable and clean energy as my UN SDG that I want to focus on. Although solar is a relatively old technology, it is becoming more and more efficient, and more and more affordable, which a lot of people don't realize. I think some people are hesitant to introduce solar into their homes and/or businesses because the initial start-up costs of solar energy at the individual consumer level is higher than just being hooked up to a meter and company-supplied power even though solar has many additional long-term benefits. Reaching out to firms and companies to be quotes and information can be a lot of work, so I think it could be beneficial to have information from real users/consumers about their experience all in one place. I think this could help a community of clean-energy-seekers make informed decisions and get support and guidance from one another.

GitHub: <https://github.com/kmn999/ENSE-405-Project>

YouTube commercial: <https://youtu.be/h27cV60c0bs>

Learner: Krupalkumar Patel

Project codename: HealthHack

UN SDGs: 3 Good health and well-being

Description: HealthHack is an advanced BMI Calculator which will respond according to the input and will help them realize where do they stand in terms of their health. This result will then be used to give the response of what or how should they proceed with their future plan. What kind of diet/food intake should they be taking. This application will help them form better-eating habits leading to a healthy life.

GitHub: <https://github.com/krupalpatel45/HealthHack>

Video commercial:

<https://github.com/krupalpatel45/HealthHack/blob/main/FinalPhaseDocumentation/Commercial/CommercialVideo.mp4>

Learner: Mason Lane

Project codename: aeS

UN SDGs: 14 Life below water

Description: An interactive game that educates children on the value of our oceans, how we are damaging them and how we as individuals might make a difference. Ultimately the goal will be to foster an appreciation for oceans and a desire to maintain them for future generations. For most of these SDGs, I found myself wondering how I as an individual could contribute - I realized I had very little appreciation for the work a community of unaffiliated people can do. That is, I found it hard to visualize what impact many infinitesimal steps can have. As such, my goal is to make the final part of the game a community experience, which sees our game won through the participation of other visitors. In this way, children can see firsthand the effect of small contribution when combined with others. Ultimately, this should encourage children to be more active in these "baby steps" for sustainable development and drive home the idea that small contributions go a long way.

GitHub: <https://github.com/lane203m/aeS>

YouTube commercial: https://youtu.be/kpQUZAwA_PU

Learner: Mfonisoabasi (MJ) James

Project codename: Curl

UN SDGs: 4 Quality education

Description: The project name is Curl which stands for curated learning. The idea behind this is to create a service in the form of an application to curate free learning on different topics in a step-by-step fashion. Not everyone is as fortunate financially to be able to support their education goals, but it doesn't mean they can't learn in a systematic like school curriculum's for free. Thank God for the internet with a vast wealth of information out there for free. However, this can always pose a challenge on what to look for or where to start. And many may have missed out the opportunity of learning or picking up a new skill cause of the overwhelming nature of the knowledge surrounding the topic. This service will aim to curate free information across the internet on a growing number of different subject matter and will point students to those free materials in an organized and systematic fashion, helping students to accomplish each goal one step at a time. This could be potentially used in schools to help guide free learning or casual hobbies who want to pick up a new skill.

GitHub: <https://github.com/mfjae/CURL>

YouTube commercial: <https://youtu.be/wCoR-XlauP0>

Learner: Qurrat Ulain

Project codename: Find

UN SDGs: 16 Peace, justice, and strong institutions, 4 Quality education

Description: My project idea aims to facilitate the process of finding missing people or those on the run from the police using a database system that users can browse through and leave a tip for the police. It also has an educational aspect to it that will address some of the underlying themes and issues targeting vulnerable people in Regina such as poverty and racism. This app focuses on promoting peace and inclusive societies for sustainable development and providing access to justice for all, following the 16th UN Sustainable Goal. In 2018, 1 in 3 trafficking victims were children, and this has been increased due to the pandemic. The pandemic has also led to the loss of jobs for millions of workers, with a jump in the unemployment rate to 13% from 7%. With so many people losing their sources of income, those already in the low-income bracket were hit the hardest. As popular research shows, people that are

economically and socially disadvantaged are overrepresented among the people reported missing compared to the general population. With COVID-19 putting millions of Canadians at an economic disadvantage, the risk of vulnerable persons being targeted is much higher. This application will not only make it easy for people to get involved in the search for the missing/on the run, but it will also provide them with an easy way to learn about why social exclusion can lead to higher cases of missing persons and what the general population can do to help. For example, if there was a wanted or missing person, a user might see their picture on social media or the news, but those are for fleeting moments and are difficult to compare with on the street. An application such as Find would take data from the Regina Police website or the news and display it in a database format, simplifying the process of comparing and recognizing a specific person during a busy workday.

GitHub: <https://github.com/quu865/ENSE405-Project>

YouTube commercial: <https://youtu.be/hHn5nnnYHKw>

Learner: Rishabh Prasad

Project codename: GreenScreen

UN SDGs: 11 Sustainable cities and communities

Description: A dashboard to visualize the current state of recycling for the City of Regina. The dashboard will provide insight on contamination and success rate of recycling based on waste collection zones within the city. Recycling within the City of Regina is heavily contaminated, inefficient, and expensive. These contaminants lead to a significant number of recyclables being redirected to landfills. This is unsustainable for the city but also unacceptable and irresponsible to actively harm the environment knowing improvements can be made. In its current state, the collected recycling data is difficult to visualize and analyze to educate the public effectively on better recycling habits. I believe there is a large area of improvement in utilizing this data which is being collected regularly and displaying it in a way it is easily digestible to waste management operators. Events for hazardous waste detected in recycling, common contaminants, neighborhoods which tend to contaminate, among other information should all be simple and straightforward to view for waste management workers daily. This will allow them to create actionable items to improve household recycling rapidly. As the recycling collection routes are separated based on zones within city and are collected on different days, recycling from each day can be thoroughly analyzed to understand its levels of contamination as well as its rate of success. A representation of this data which currently does not exist for Regina, will help the city understand issues with household recycling and strengthen the waste management program.

GitHub: <https://github.com/Copy-Waste/cw-greenscreen>

YouTube commercial: <https://youtu.be/YhW4TDqmmDs>

Learner: Roxanne Harrison

Project codename: Cope

UN SDGs: 3 Good health and well-being

Description: The Cope app idea is an Apple Watch mini-app that provides coping techniques for people with anxiety disorders. There may be an iPhone aspect to this, but the main focus is on using technology to overcome panic attacks with breathing exercises and cognitive behavioural therapy (mantras) to reshape the sufferer's thought patterns. Over 18% of adults and 30% of adolescents will experience some form of anxiety disorder in their lifetime with these individuals being twice as likely to suffer from substance abuse (American Addiction Centers). By providing resources and technology solutions to this community, mental health and quality of life can be improved substantially. Current technologies available are mostly targeted towards meditation and not as a coping mechanism for this specific

audience. By providing a quickly accessible application, people suffering from panic attacks or anxiety can be guided through calming breathing exercises as well as mantras. These two methods together will improve health and well-being and can help to strengthen the prevention of substance abuse as a coping mechanism (UN Goal 3.5).

GitHub: https://github.com/roxanneharrison/ense_405_cope_app

YouTube commercial: <https://youtu.be/MK9xSFq4Xs0>

Learner: Shane Toma

Project codename: RageQuit

UN SDGs: 3 Good health and well-being

Description: To improve the wellness of both individual players as well as communities surrounding games by helping players step away from the game when it is no longer a beneficial activity. This can be achieved through well timed messages/alerts and controls such as limiting playtime in a single session, forcing short breaks between games, etc. By improving the game-life balance of players, mental, social, and emotional health are all liable to improve. Overplay of video games can detract from social and emotional health but can also have a profound impact on mental health. It is common for players under the guise of online-anonymity to unload their anger and discontent onto anyone who has the misfortune of being queued into their lobby. The negative emotions experienced by those around them lead to negative thoughts about the game, these thoughts in turn lead to more negative emotions etc. etc.. By helping players control the time they spend in game, a better balance between life and their hobby can be achieved. By keeping players from overplaying they are more likely to remain a positive presence in the game, the wellness of the player in question is liable to improve, the wellness of those around them will improve, and the community as a whole becomes healthier.

GitHub: <https://github.com/RageQuit-NM/Capstone-repo>

YouTube commercial: <https://youtu.be/Hbao8TDZ8ew>