

The Food Security Quest: Research and Development Report



The Food Security Quest



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Executive Summary

The objective of the current project was to develop and evaluate an online learning game, **The Food Security Quest** as part of eCampusOntario's Research and Innovation Priority Theme #5: Connecting Programming and Labour Market Needs, especially in relation to "innovations in providing experiential learning opportunities (including simulation) in the digital space."

The game was developed and evaluated during three phases of the project:

Phase 1. During Phase 1 of the project (February 2017 to April 2017), the two principle investigators, 1 graduate research assistant, and 1 undergraduate research assistant met with 7 faculty members, 2 affiliates of Ryerson University's Centre for Studies in Food Security, and 1 graduate student with expertise in the area of food security. Using feedback from these subject matter experts as a guide, we identified 11 knowledge-based and 4 empathy-based learning objectives that guided the eventual development of six explicit learning outcomes for the Food Security Quest.

Phase 2. Phase 2 of the project focused on developing the game structure (April 2017 to September 2017) and assets for the game (September 2017 to March 2018). Throughout the process, we conducted 20 interviews with subject matter experts to gather feedback on the game as it was developed. We also documented the lessons that we learned about game development.

Phase 3. Phase 3 of the project (March 2018 to May 2018) involved collecting data to test the effectiveness of the game in meeting the identified learning outcomes and in piquing students' interest in the topic of food security. The research data from 59 students revealed that the game was effective in expanding students' definition of food security, increasing empathetic attitudes towards those experiencing food insecurity, and increasing knowledge for most of the identified learning outcomes.

Dissemination plans: The Food Security Quest and this research report are being made available on Ryerson University's Open Learning Website, <https://www.ryerson.ca/openlearning/>

The research results and lessons learned were also disseminated at the following conferences:

- October 2017, Presentation at the Annual Meeting for the International Society for the Scholarship of Teaching and Learning (ISSOTL) in Calgary, AB.
- December 2017 & May 2018, Ryerson University Library Collaboratory Showcase.
- May 2018, Presentation at the Ryerson Faculty Conference organized by the Learning and Teaching Office at Ryerson University, Toronto.
- May 2018, Presentation at the annual meeting of the Canadian Association for Food Studies in Regina, Saskatchewan.

Project Overview

Project Goals

The objective of the current proposal was to develop and evaluate an online experiential simulation tool, **The Food Security Quest**, to provide education on the social justice and human rights issues that accompany food insecurity. The Food Security Quest was developed as an educational tool for use in college or university courses that focus on, or include units on, food insecurity or poverty.

The project was designed to address the eCampusOntario Research and Innovation Priority Theme #5: Connecting Programming and Labour Market Needs, especially in relation to “innovations in providing experiential learning opportunities (including simulation) in the digital space.”

Specifically, the project was designed to contribute to the advancement of knowledge on educational technologies in the following ways:

1. **Document the learning game development process.** Ke (2016) notes that, to date, there is very little research documenting the process by which online learning games are created. Like, Lee and Fisher (2015) who previously documented the processes and challenges of creating a food insecurity game for youth, we documented the process by which we designed and implemented our online experiential simulation, The Food Security Quest. The lessons that we learned in this process have been (and will continue to be) disseminated via conference presentations, this white paper, and possible publication in a refereed journal.
2. **Formally assess the effectiveness of the learning game in meeting learning outcomes.** Lee and Fisher (2015) documented the challenges of creating an online food security games. However, to our knowledge the current project is one of the first studies to formally evaluate and establish the effectiveness of an online food insecurity simulation in producing better knowledge and understanding about food insecurity.

Background

Food insecurity is the “inadequate or insecure access to food due to financial constraints” (Tarasuk, Mitchell, & Dachner, 2016). It is estimated that 1.3 million households in Canada experience food insecurity. In Ontario, 594,900 households experience food insecurity (Tarasuk et al., 2016). The Dietitians of Canada note that “food insecurity is an urgent human rights and social justice issue for local, provincial and federal public policy agendas” (2016, p. 4); efforts to address food insecurity must address its root causes of poverty and income inequality.

Teaching about food insecurity as a social justice issue can be challenging. To understand poverty one must unpack systems of privilege and oppression that lead to income inequality; and one must examine the groups that are most likely to be impacted by these inequalities (including, but not limited to, women, children, aging populations, Indigenous populations, immigrants, individuals with disabilities, ethnic and racial minorities, and those who identify as LGBTQ+). It can be challenging to effectively teach about these topics, as students often react defensively to discussions about social inequality (Bramesfeld & Good, 2015; Watt 2007).

Simulation activities and learning games provide an ideal tool for teaching about these sensitive issues. A simulation activity allows learners to experience aspects of a phenomenon for themselves prior to examining underlying explanations for that phenomenon (Dorn, 1989; Kolb, 1984). Simulation activities can be especially effective for teaching about sensitive topics, as they allow students to externalize their initial emotional reactions onto the simulation, rather than onto themselves or classmates. Opportunities to externalize reactions can reduce feelings of defensiveness (Simpson & Elias, 2011) and lead to deeper self-reflection (Patrick & Connolly, 2013). Simulations activities can also be beneficial for teaching about complex issues, as they allow students to examine larger scale patterns that may not be possible when examining an issue in “real time” (Bramesfeld & Good, 2015; Bramesfeld & Good, 2016).

For the current project, we created, developed, and evaluated an online experiential simulation activity called the Food Security Quest. The Food Security Quest was designed to highlight higher-level learning outcomes related to food insecurity, income inequality, and social justice. The activity built off of the learning game design experiences of one of the partners on this project, Dr. Kosha Bramesfeld, who has previously developed and evaluated several learning games (see Bramesfeld, 2015a; 2015b; Bramesfeld & Good, 2015; Bramesfeld & Good, 2016). This was, however, Dr. Bramesfelds first adventure in building an **online** learning game. Likewise, Dr. Andrea Morae has been a long advocate for the use of learning games in her classroom, regularly using games like the Family Farmer to teach issues around food security and sustainable production. However, this was her first adventure in actually creating a learning game of her own.

To facilitate the game development process, it occurred over three phases. Phase 1 of the project focused on identifying clear learning goals, objectives, and outcomes for the Food Security Quest. Phase 2 of the project focused on designing, developing, and building the assets for the game. Phase 2 relied on a design-based paradigm to ensure continuous feedback and data collection on the game elements as the assets were designed and built. In Phase 3 of the project, we conducted a larger scale learning outcomes study based on the core content of the game. The feedback collected throughout the process informed the eventually published Food Security Quest, which is available through Ryerson University’s Open Learning website, <https://www.ryerson.ca/openlearning/>.

Project Activities and Outcomes

Phase 1: Identify Learning Objectives

Approach

Timeline: February 2017 to April 2017

Team members: During Phase 1 our team included:

- Principal Investigators (Dr. Andrea Moraes, Dr. Kosha Moraes)
- Project administrator (Dr. Cecilia Rocha)
- Graduate Research Assistant (Jacqueline Vykoukal),
- Aboriginal Experiences Research Assistant (Joleine Kasper).

Activities: During the Winter and Spring of 2017, our team met with 7 faculty members, 2 affiliates of Ryerson University's Centre for Studies in Food Security, and 1 graduate student. Each of these subject matter experts had expertise related to the topic of food security and provided their feedback on our initial simulation and learning game ideas as an in-kind contribution to the project. During our meetings with these subject matter experts we asked the following six general questions:

1. What do you perceive to be the biggest challenge(s) when teaching about food security?
2. In what ways might a learning game about food security be advantageous for meeting these challenges? In what ways might a learning game be limited in meeting these challenges?
3. For what level of learner (e.g., beginner, intermediate, or advanced learner) do you think that a learning game focused on food security might be most advantageous?
4. What do you think should be the key learning objectives for a learning game focused on food security?
5. What topics and features about food security do you think would be most important to highlight in the learning game?
6. What resources or other learning games should we know about or consider as we develop a game on food security? Who else might we meet with during our planning phase?

Outcomes

Game focus

Feedback data from the subject matter experts suggested that a learning game focused on food security might be best targeted at an introductory level designed to provide university and college students with a basic introduction to the topic of food security. In

particular, the subject matter experts felt that a learning game might provide added value above and beyond a traditional lecture in the following two ways:

1. Helping students conceptualize the complexities of food security beyond a singular definition of “being able to access food”.
2. Helping students empathize with the choices and trade-offs and resiliency required to live with food security.

Learning Outcomes

Using the topics and features suggested by the subject matter experts as a guide, we identified 11 knowledge-based and 4 empathy-based learning objectives to guide the development of the learning game (see Appendix A). As the game development progressed these learning objectives were eventually shaped into six explicit learning outcomes for the game:

1. **Recognize the wide-spread prevalence of food insecurity in Ontario**
 - Introduce prevalence statistics of food insecurity in Ontario.
 - Illustrate the levels of food security as defined by the Household Food Security Survey Module (HFSSM).
2. **Contextualize food security within the context of the Five A’s of food security as defined by Ryerson University.** (Definitions quoted directly from the Centre for Studies in Food Security, <http://www.ryerson.ca/foodsecurity/our-approach/>):
 - **Availability:** Sufficient food for all people at all times.
 - **Accessibility:** Physical and economic access to food for all at all times.
 - **Adequacy:** Access to food that is nutritious and safe, and produced in environmentally sustainable ways.
 - **Acceptability:** Access to culturally acceptable food, which is produced and obtained in ways that do not compromise people’s dignity, self-respect or human rights.
 - **Agency:** The policies and processes that enable the achievement of food security.
3. **Identify key income-related risk factors for food insecurity.**
 - Low income (PROOF, 2017; Dieticians of Canada, 2016).
 - Reliance on social assistance (PROOF, 2017; Tarasuk, Mitchell, & Dachner, 2014; Silverthorn, 2016).
 - High cost of food, especially in northern and remote on-reserve communities (Veeraraghavan & Sheedy, 2016; Nutritious Food Basket Scenarios).
 - High cost of housing and other expenses (Nutritious Food Basket Scenarios).
4. **Appreciate how structural inequality puts certain populations of individuals at higher risk for food insecurity.**

- First Nations (Baskin et al., 2009; Dieticians of Canada, 2016; Reading & Wien, 2009; Veeraraghavan & Sheedy, 2016).
 - Families with children (Dieticians of Canada, 2016).
 - Lone-parent households, especially lone-mother households (Dieticians of Canada, 2016; PROOF, 2017).
 - Government-assisted refugees (Huang, 2014).
 - Racialized groups, ethnic minorities, and other minority groups (Dieticians of Canada Executive Summary, 2016).
 - Individuals with chronic illness and disability (Dieticians of Canada Executive Summary, 2016; PROOF, 2017).
 - Single aging adults, aged 60-64 (Dieticians of Canada, 2016)
 - LGBTQ+ youth (Brown, Romero, & Gates, 2016)
5. **Accept the limits of existing ameliorative efforts to reduce food insecurity.**
- Lack of government programs in Canada that focus specifically on food security (PROOF, 2017)
 - The severe limitations of food banks to protect people from food insecurity (Kirkpatrick & Tarasuk, 2009).
 - Limited ability of skills-based education to reduce food insecurity, as experiences of food insecurity are not linked to lower knowledge and skills around food preparation, but rather to lower income (PROOF, 2017).
6. **Internalize empathy for individuals living with food insecurity.**
- Build empathy and understanding for the long term and short term choices and trade-offs that are required in making financial, social, and personal decisions related to food security.
 - Develop appreciation for the resiliency, strength, and resolve required to persevere in the face of significant structural barriers and severe adversity.
 - Recognize the limited role of individual “choice” and the importance of structural factors and policies in determining food security.
 - Highlight and educate users about the detrimental impact of discriminatory policies on First Nations communities.

Phase 2: Food Security Quest Development

Phase 2 of the project, which focused on the development of the learning simulation, unfolded over three stages. The timeline of each of these stages is outline below. In the following sections we discuss our “Simulation Development Approach” for each stage in the process and our “Lessons Learned”.

- **Stage 1:** Initial game development planning (April 2017 to September 2017)
- **Stage 2:** Asset development (September 2017 to March 2018)
- **Stage 3:** Feedback on authentic representation (November to March 2018)

Approach

Stage 1: Initial design

Timeline: April 2017 to December 2017

Team members: Our team members included:

- Principal Investigators (Dr. Andrea Moraes, Dr. Kosha Moraes)
- Project administrator (Dr. Cecilia Rocha)
- Aboriginal Experiences Research Assistant (Joleine Kasper)
- Game Development Research Assistant (Kieran Ramnarine)

Development activities: Our team met regularly throughout the summer to discuss initial ideas and game structure. As part of this process we:

1. Met with Ryerson University faculty and staff with expertise related to online game development (7 people), eLearning pedagogy (4 people), accessibility standards (1 person), and copyright adherence (1 person). Each of these staff members provided their time as an in-kind contribution to the project.
2. Performed a “game audit” in which we actively sought out examples of games that we thought might be used to inspire ideas for our own game structure. In the end, we identified five games that we used as inspiration for developing our own learning game (see Appendix B for a description of these five “inspiration games”).
3. Conducted eight formal research interviews with two instructors, five individuals working/ volunteering in social service industries related to food security, and one educational developer. As part of the interview we shared our developing game ideas and asked questions designed to receive feedback on these ideas. (REB # 2016-386)

Outcomes: The resulting outcome of stage 1 was an idea for a learning game that utilized a branching decision tree format to tell fictional stories of food security. As each story unfolded, players would be presented with scenarios and asked to make choices and trade-offs based on the resources that the character had at their disposal. The simulation game would track three metrics: (a) money resources, (b) risk of food insecurity, and (c) overall wellbeing. Initially we sketched out an idea for game characters. However, as development of the Food Security Quest progressed we set a more realistic goal of developing four characters:

- **Dolores.** First Nations single mother (age 27) with two sons, Alex (age 9) and Nick (age 6). Has just finished her nursing degree and has \$25,000 in student loan debt. Is moving with her children to an urban area in Ontario to start a new nursing job.

- **Dawn.** Single female, age 59, of European background, no children, works as a contract truck driver. Lives in a rural area in Ontario. Has just been diagnosed with Type 2 diabetes. Until her diabetes stabilizes she is unable to drive.
- **Saad.** Age 36, Syrian, former math teacher. Married with three young children. Wife, Aya, is pregnant with their fourth child. Government Assistant Refugees (GARs) from Syria. Aya is on medical bed rest until the end of her pregnancy. The family follows a Halal diet.
- **Maxine,** aka “Max”, of European background, 18 years old, grew up in a working class home. Max’s relationship with her parents has been rocky since she came out to them as a lesbian. Max is leaving home to attend university in a large city.

Feedback data from the eight research participants revealed the following themes that helped guide the development of the four identified characters:

- **Effect of the environment.** The environment in which an individual lives plays a crucial role in their access to food. For example, food swamp, food desert, and seasonal dependency are the types of environmental factors that need to be considered for each character’s unique living environment.
- **Strengths/vulnerability/resiliency of each character.** Each character comes with a set of social and cultural characteristics that can act as strengths and/or challenges as they make choices through life. For example, being part of a minority group can equip an individual with access to social services unique to that community; however, it may also lead to discrimination. In particular, *resiliency* was a prevalent theme across the interviews. Resiliency must be highlighted as a protective factor against food insecurity in all characters.
- **Goals of each character.** As game developers, we must clearly outline the goals of each character. What exactly are they trying to accomplish during the game play journey? What makes a player win or lose? This will contribute to the playability of the game and perhaps the motivation for the player to try again.
- **Solutions.** Several interviewees suggested that the game should embed potential solutions for food insecurity as a way of promoting awareness to the player. For example, joining a food coop/community garden, or engaging in social advocacy, are ways that the game can inspire potential courses of action.

Stage 2: Game development

Timeline: September 2017 to May 2018

Team members and activities: In stage 2, we utilized a “students-as-partners” leadership model to build the assets for the Food Security Quest. The game developer, each of the storytellers, and each of the creative assets developers were undergraduate students who took on a paid leadership role in advancing one or more aspects of the Food Security Quest. In addition, three undergraduate student volunteers met semi-

regularly with our research supervisor to provide additional feedback and guidance on the Food Security Quest. Members of our team also met with members of our Technology Advisory Group to receive feedback and guidance on game development. The key team roles during the game development phase are outline below:

- **Leadership Team** – Dr. Kosha Bramesfeld provided creative direction and general leadership and supervision on the project. Dr. Arla Good (a postdoctoral student) took on the role of Research Supervisor and provided mentoring and guidance to the storytellers/research assistants. She also coordinated interviews with the research participants. Dr. Andrea Moraes remained involved in the project as a subject matter expert and Dr. Cecilia Rocha continued handling the administrative aspects of the grant.
- **Storytellers (student leaders)** – The four storytellers on our team (Joleine Kasper, Lina Rahouma, Jennie Biewald, and Tim MtPleasant) worked on the project as research assistants and script writers. They conducted background research related to food security and used this information to sketch out key characteristics related to the four fictional characters of the simulation game. They also identified subject matter experts who could serve as research participants for providing feedback on the authenticity of each of the characters.
- **Creative assets developers (student leaders)** – The team included three creative assets developers. Sam Kranyak created the character sketches for the Food Security Quest, while Meredith Burling created the background images. Marissa Frosst provided guidance on the website design. All three of the creative assets developers worked closely with the storytellers to capture the essence of the scripts. They also provided input and guidance concerning the overall visual layout of the Food Security Quest.
- **Game Developer (student leader)** – Kieran Ramnarine took the lead on providing feedback and consultation on the actual design and development of the Food Security Quest. Given our desired layout, he programmed the game in Unity. Because neither of the principal investigators had experience developing an online learning game before, Kieran was instrumental in providing education and information related to user experience, game layout options, and the development of each of the characters.
- **Technology Advisory Group via the Ryerson University Collaboratory.** To ensure that our team had adequate mentoring and support for undertaking the task of developing an online learning game, we applied to be a pilot project with the Ryerson University Collaboratory (<https://library.ryerson.ca/collab/>). The Collaboratory provided us with physical meeting space to meet and work on the Food security Quest, along with a technology advisory group that provided feedback and guidance on game design and art direction (Namir Ahmed, Tanya Pobuda, Nada Savicevic, Fangmin Wang), educational technology (Wendy Freeman, Restiani Andriati), and accessibility standards (Adam Chaboryk). Each

of these members of the technology advisory group provided their services as in-kind contributions.

- **Learner experience feedback (undergraduate student volunteers)** – Three student volunteers (Nicole Forget, Leen Al-Feyez, and Jenessa Clark) met semi-regularly with our Research Supervisor, Dr. Arla Good, to provide feedback on the Food Security Quest and its characters.

Outcomes: The outcome of our game development activities was the creation of the visual and text-based assets for the learning game “**The Food Security Quest**”.

Stage 3: Feedback interviews

Timeline: November 2017 to March 2018

Activities: A key priority of ours in developing the characters and visual imagery for the Food Security Quest was to ensure authentic representation of the lived experience of food insecurity. To this end, we recruited 12 additional interview participants who had expertise teaching, working, or volunteering in one of the following areas: educational development, equity education, food security, income inequality, poverty, social assistance, Aboriginal knowledge and experiences, refugee experiences, lone-parenting, living with a chronic condition, and first generation university student experiences.

Interview participants played initial versions of the game and then answered key questions, such as:

- What were your impressions of the content of the game in terms of the character scripts? The visual representations? The flow? The metrics? The debriefing? The character introduction?
- In what ways did you feel like the game did or did not authentically represent experiences with food security?
- How would you improve the content of the game?

Outcomes: The interviews with the subject matter experts revealed the following themes.

- **Game effectiveness (Empathy).** Interviewees felt the game successfully induced a sense of empathy for their character. For example, individuals noted that game was “viscerally affecting,” and they “felt strangely satisfied when the well-being increased.” One interview participant remarked, “I’m so engaged in [Saad’s] story. I want to know what’s going to happen. It makes me want to learn more.” Several interviewees felt that the addition of introductory videos or additional information about the characters’ backstory could help to increase the effectiveness of the game in building empathy for the characters.

- **Game effectiveness (Knowledge and Education).** Interviewees felt the game would be successful in increased a player’s knowledge and understanding of food security, particularly the 5 As of food security. However, a few suggestions for increasing the educational capacity of the game included: adding pop-ups or icons that the player can hover over to get more information as they go (e.g., on diabetes) and organizing the debriefing information into a more accessible form.
- **Metrics.** Interview participants felt it was important for the players to know how they are doing and to understand the impact of their choices on the various metrics (money, wellness, and food security). The game could improve the way it communicates the metrics to the player in two ways. First, the scales felt arbitrary to interview participants (e.g., what does 5 wellness mean?). They suggested that the metrics be placed into relative terms. Second, the box containing the metrics, and any changes in the amount, should be made more obvious to the player. Bigger text or different colours and/or sounds can be used to draw the player’s attention to their score.
- **Visual aspects of the game.** Many interviewees commented on the visual appearance of the game. The character drawings and backgrounds were highly praised. However, individuals also thought the game could be more dynamic (adding social interactions and facial expressions) and more colourful (e.g., text boxes).

To the extent possible, we incorporated feedback from these interviews into the Food Security Quest. For example, based on the feedback received we re-organized the debriefing information to better allow for easier navigation. We also incorporated more meaningful reference to the metrics in the game in the game structure and character scripts. However, some of the feedback went beyond what we were able to accomplish within the context of this initial concept test (e.g., the addition of videos to introduce the characters, opportunities to “learn more” by hovering on options, and the inclusion of dynamic character interactions). These points of feedback were recorded for future game development and are discussed further in the section [“Future Game Development Directions”](#).

Lessons Learned

During each stage of the game development process, we recorded the lessons that we learned as we developed the Food Security Quest. It is our hope that by recording our own challenges, errors, and successes that other educators and game developers can learn from our process (see Lee and Fisher, 2015 for a similar approach).

Lesson 1: It is okay (and in fact preferable) to start small

One of our biggest challenges during the initial stages of the project was agreeing on a single cohesive idea for the simulation game. Our initial Phase 1 meetings with subject matter experts identified several areas of food security that would benefit from a game

approach. We genuinely wanted the game to capture all of these key elements. In addition, our identified inspiration games provided many ideas for ways that our game could incorporate fun, interactive, and high impact ideas for engaging our learners.

Trying to incorporate all of these learning topics and game element ideas into a single game quickly became a frustrating endeavor. In the end, one of the biggest lessons that we learned is that it is okay (and in fact preferable) to start small. This was a lesson we had to return to frequently throughout the entire game development process to keep ourselves focused on a doable and realistic project. Indeed, one of the biggest challenges in responding to feedback on the Food Security Quest is that much of the feedback focused on making radical changes to the game (change in focus, change in layout, change in interactivity). We strongly agreed with the feedback that the game had huge potential for “more”, but we had to be realistic about which points of feedback we could address immediately and points that had to be recorded for future developments.

Lesson 2: Game design takes time

Originally, we had planned to have an initial prototype of the learning game ready to be pilot tested by September 2017, and six full months to trouble shoot, adapt, and evaluate the learning game prior to the end of the project. In reality, it took us until September 2017 to even develop a rough sketch of the learning game ideas. An initial version of the Food Security Quest was not ready for pilot testing until the end of February 2018. Ultimately, we ended up trouble shooting, adapting, and evaluating the learning game as we built it. Lee and Fisher (2015) estimate that it takes 8 months to up to two years to develop a learning game. We concur with this estimate, as we found that even with a full 12 months to develop a concept-test for the game, we struggled to design, develop, and evaluate the Food Security Quest within our scheduled timeline.

Appendix D outlines each step in our game development process, how long each step took, and some of the unanticipated challenges that we encountered along the way.

Lesson 3: Build your team early

At the start of this process, we did not have a clear idea of what roles would be needed for our game development team. As such, we built our team as the roles became apparent. Now that we have a clearer sense of what roles are required we would recommend that each game development team include at least one person in each of the following roles (the same person can hold multiple roles on the team if they can provide expertise in multiple areas):

- **Subject matter expert(s)** – In a learning game the learning objectives must be at the forefront of the game. Having strong subject matter expertise is critically important for making sure that the learning content of the game is accurate and targeted.
- **Project management** – There are a lot of roles and activities to coordinate in a game development team. Having a project manager with experience developing a learning game is critical for keeping people on task and for coordinating communication.

- **Instructional Developer** – Having an instructional developer, or someone deeply familiar with eLearning pedagogy, is key for helping to align learning objectives with game content and reflection/assessment.
- **Game developer** – A game developer and/or program developer needs to be involved in the process from the initial conceptualization of the learning game. Communication between the subject matter expert and game developer is key.
- **Art direction and creative assets developers** – We learned (after the fact) how valuable it would have been to have somebody on the team that could have provided art direction early on in the process. Bringing somebody on to team who can provide art direction from the beginning can go a long way in providing shape and structure to a learning game and ensuring that game elements match the mood and tone of the learning content you are trying to portray.
- **Accessibility consultant** – As we discuss in greater detail below (“Lesson 4”) we learned that there are very few “cookie cutter” options currently available for creating accessible games. We did accessibility consultations at the beginning of the project and again at the end, but in retrospective we feel like it would have been valuable to have had this consultation and guidance all along. We highly recommend that game development teams invest in accessibility consultation throughout the process.
- **Research consultant.** One of the principal investigators on the project is very experienced in conducting outcome evaluations, thus the evaluation components of the game were at the forefront of this project from the beginning. We highly recommend that game development teams consider the evaluation and assessment of their game and their game development process from the beginning stages of development.

Lesson 4: It’s hard to align game goals and educational goals

Games for entertainment often move at rapid speeds, require “on the fly” decisions, and thrive on novelty. In contrast, learning often requires digging deeply into a topic, spending time reflecting on it, and returning to the material frequently for retention. Creating alignment between these contradictory goals proved to be very challenging. For example, the original characters that we sketched out for the game had rich backstories, complex story lines, and deep debriefing. However, when these in depth character scripts were put into game form the text-heavy nature of the scripts resulted in an awkward and tedious game experience as the player was forced to read through lines of text in between each decision. The solution for improving game play was to drastically simplify the game scripts. The trade-off in doing so is that our characters lost some of their richness and depth. Indeed, a common theme in our feedback interviews with subject matter experts was the desire for more information, more depth, and more exploration of the characters. In contrast, the feedback data from game development experts was to use even less text and less complexity in the character build up.

Lesson 4: Building for accessibility can be a challenge

We also struggled to find an affordable solution that would allow for the development of a fully accessible game. Hiring someone to program the game in HTML 5 (the most

accessible option) turned out to be the most cost prohibitive option for our team. The game development tool Twine publishes to HTML, which allows Twine games to be adapted for accessibility purposes, but Twine was limited in achieving the visual goals of our game. Unity offered a nice environment in which to produce the visual elements of our game, but Unity is limited in achieving a fully accessible game. In the end we produced an image-rich version in Unity and a text-only version for screen readers in Twine. However, this was not an ideal solution. In future game builds we would like to find a solution for building fully accessible learning games.

Lesson 5: Communication is key

Building a learning game is a large enterprise involving people from numerous roles. Each of these individuals will have differing notions about what the game can and cannot achieve. Learning games are unique in that these games must simultaneously be engaging but also meet the learning objectives. These two goals can come into direct contraction with one another. As mentioned earlier, learning often requires digging deeply into a topic, spending time reflecting on it, and returning to the material frequently for retention. In contrast, effective games for entertainment often move at rapid speeds, require “on the fly” decisions, and thrive on novelty. Creating alignment between these contradictory goals can be challenging. Lee and Fisher (2015) note subject matter experts must be willing to develop at least some proficiency in the language of game development and that game developers must be willing to immerse themselves in the topic area, otherwise there is huge potential for miscommunication and conflict.

Coordinating feedback loops can also be challenging. The game development team must organize a plan for incorporating feedback and making revisions. One of the challenges that we experienced is that game assets were often created external to the game and then manually imported into Unity by the game developer. When corrections, even small ones (such as typos) were discovered, the script writers could not correct for these errors directly, rather they had to communicate the changes to the game developer who had to go in and manually make the corrections.

For larger edits, this required weighing the balance between the nature of the edits desired and the time investment requires to make it happen. Because new versions of the game required a new upload of the game, there was often a several day (or even several week) delay between the suggestion of an edit and the appearance of the edit in the public facing game.

In future game builds, we feel that it is important to more explicitly outline a means for pilot test characters in a way that allows for more responsive and rapid revision, especially during the game development and testing phases.

Phase 3: Learning Outcomes Assessment

Phase 3 of the project (March 2018 to May 2018) involved collecting data to test the effectiveness of the game in meeting the identified learning outcomes.

Method

During the Winter 2018 term, our team contacted Ryerson University instructors who taught courses that included a food security unit. These instructors were asked if they would be interested in pilot testing an initial version of the Food Security Quest in their courses. At the beginning of March interested instructors were provided with a link to a pilot version of the game to distribute to their students. The link allowed students to play the game as part of a research study (research option) or to play the game independently, without participating in the research study (game only option).

Research Participants

Ninety-six university students accessed the game via the link provided. Seventy-four of these students provided consent to participate in the study; 6 of these students experienced technical difficulties and were not able to play the game and 9 students failed to complete both the pre-game and the post-game survey. In total, 59 students consented to participate in the study, were able to play the Food Security Quest, and completed both a pre-game survey and the post-game survey.

For the most part, the students who opted to complete the study were already somewhat knowledgeable about food security. Indeed, prior to playing the game 9% had received at least a basic introduction to the topic, 57% had been exposed to at least one chapter/unit on the topic, and 34% had completed at least one course on the topic. Despite this prior exposure, participants reported being somewhat (21%), mostly (27%), or very (52%) interested in learning more about food security. As such, the research participants for the learning outcomes study could be described as intermediate learners who were motivated to gain additional knowledge about food security.

There were no drastic differences as to which character each player chose to play first: Dawn (31%), Dolores (45%), or Saad (25%). Dolores' slight popularity over the other characters is likely an artifact of the courses included in the pilot study, as one of the courses focused on Aboriginal Approaches to Social Work.

Assessment Context

The learning outcomes study focused on a pilot version of the game that was released in early March 2018. The pilot version of the game included the core elements of three characters in the game (Dawn, Dolores, and Saad). However, the pilot version did not include a thorough introduction to the game. In addition, the debriefing for each character was presented in a text-only format without the ability to easily navigate the information. There was also no formal ending to the game. If participants wanted to play

the game again they had to refresh their web page and launch the game again. Despite these limitations, we were able to collect rich feedback data from students that supported the effectiveness of the “core” content of the game and also provided useful suggestions for improving game play and user experience.

Length and amount of game play

One of our goals going in to the game was to produce a high impact game that could be played quickly. Participants in our study reported being able to play the game in 10 minutes or less (40%) or 30 minutes or less (58%).

We also wanted participants to be able to play multiple rounds of the game. Unfortunately at the time of pilot testing, we had not yet built a function in the game for players to be able to easily “play again”. (A function that is now present in the game). Instead players had to exit the game and restart it to play multiple rounds or characters. Several participants even noted this design flaw in the post-game survey:

“I think that it could be more useable - easier to play a different character again- I did not know I could have done that.”

“When getting to the end with a character, there should be a button to return to beginning to choose a character.”

Despite this potential barrier, in our pilot study 18 participants played multiple rounds of the game (with at least 13 of the players playing multiple game characters). Given that 18 players were motivated enough to “play again”, even when they had to explicitly restart the game to do so, we are optimistic that even more players will opt to play again now that there is an easy game option for doing so.

“Multiple characters give good insights to different types of experiences.”

“I can see how playing multiple rounds of the same character would help improve learning.”

Results

The FSQ expanded students' definition of food security

As part of the pre-game and post-game surveys students were presented with seven different aspects of food security and asked to indicate which of the 7 statements might be included in a definition of food security. Overall, students reported an expanded definition of food security after playing the *Food Security Quest* relative to before playing the game, paired-samples sign test, $p = .001$ (see the table below). These findings are particularly notable given that participants already had a fairly expansive conceptualization of food security prior to playing the game.

Table. Percent of participants acknowledging each aspect of food security

| Definitional aspect of food security: | Pre | Post | Change |
|---|------------|-------------|---------------|
| The ability to gain physical and economic access to food. | 82% | 88% | +6% |
| Influence over the policies and processes to achieve sufficient food. | 60% | 76% | +16% |
| Access to culturally acceptable food. | 80% | 88% | +8% |
| Obtain food with dignity, self-respect or human rights. | 73% | 82% | +9% |
| Sufficient food for all people at all time. | 82% | 87% | +5% |
| Access to food that is nutritious and safe. | 88% | 87% | -1% |
| Access to food that is produced in environmentally sustainable ways. | 68% | 72% | +4% |
| Percent acknowledging all 7 aspects | 55% | 75% | 20%+ |

The FSQ encouraged deep reflection about difficult choices

Comments from 17 students revealed that students found the Food Security Quest effective in helping them conceptualize the complexities of food security and appreciate the difficult choices and trade-offs that are required to remain food secure.

"It was almost impossible to make a good decision, each time I was asked to make a decision, I was always picking the lesser of multiple evils."

"I loved how nuanced the choices were. It was hardly ever clear what the best choice in each situation may have been, and I often found myself faced with unforeseen consequences as a result of what I believed to be the best choice."

"The game portrayed how it feels to have to make important decisions in life, especially sacrifice for the sake of getting money for food and rent. Decisions that can have negative consequences, such as weaken the relationship between children and parents, became very apparent."

“How it really puts you in a tough spot in every decision that you have to make in the game. It makes you think, what would I ACTUALLY/REALLY be able to do if this was me?”

“I like the different backgrounds and situations. I like that there were references to the Muslim community association, friendship centres, etc. All these options provide a better understanding of what is available and how sufficient/insufficient they are. The problems of a food bank were portrayed which is important. As well as individual compromises and emotional struggles related to food insecurity.”

The FSQ increased empathetic attitudes

Prior to playing the game and after playing the game, students rated on a 1 (*completely disagree*) to 7 (*strongly agree*) scale their agreement with seven items that assessed people’s attitudes towards individuals experiencing food insecurity. Two items focused on victim blaming and five items focused on empathetic attitudes. The two victim blaming items were reverse coded and combined with the other items to create an index of “empathetic attitudes” (internal reliability at pre-game, Cronbach’s $\alpha = 0.71$, and at post-game, Cronbach’s $\alpha = 0.73$).

After ensuring that parametric assumptions were met, a paired samples t-test was used to examine shifts in reported empathetic attitudes after playing the game relative to before playing the game. Students started the game with relatively high empathetic attitudes prior to playing the game ($M = 5.83$, $S = 0.68$) and reported even more empathetic attitudes after playing the game ($M = 6.10$, $S = 0.69$), $t(53) = 3.82$, $p < .001$, Cohen’s $d = 0.39$ (small effect).

These shifts appear to be attributable to the game, as students reported “very strongly” (52%), “mostly” (41%), or “somewhat” (6%) agreeing with the statement that playing the game character “helped me consider new perspectives.”

Indeed, written comments from 21 students supported the idea that playing the Food Security Quest increased perspective taking:

“It is great that I can understand food insecurity from other people's perspective. Putting myself in other people's shoe definitely helps me understand that what can happen in someone's life that are threats to food security. For example, when the character's kid asked "Are we poor?" before I wanted to decide to access the food bank, I hesitated. It is not just about having enough food, I may also need to take care of my family's feelings. I won't be able to understand this if I haven't played the game because I am not a mother myself.”

"It was easy to follow and allowed you to consider different perspectives for someone who does not share the same situation as you (in my case). Really opens your eyes to what someone could go through."

"I liked being put in their shoes, because I wouldn't be able to completely understand the struggles people face obtaining basic necessities."

"It was highly educational and it showed me a new perspective on food security that I would have never been able to witness before, since I am not a diabetic or from a low income household."

"I was able to experience something that I have not experienced before."

Students found the FSQ to be effective, realistic, and fun

Deeper understanding of food security

After playing the game, students reported "very strongly" (41%), "mostly" (51%), or "somewhat" (8%) agreeing with the statement that, "Overall, playing the game helped me develop a deeper understanding of food insecurity."

"Created a greater understanding of food insecurity with an interactive game."

"The game is a very useful way of understanding the intricacies of food insecurity."

Characters realistically and authentically portrayed

Students "very strongly" (33%), "mostly" (55%), or "somewhat" (13%) agreed with the statement that "characters in the game were realistically and authentically portrayed": Importantly, each of the characters was rated as being realistically and authentically portrayed (on a five-point scale): Dawn ($M = 4.10$, $S = 0.72$), Dolores ($M = 4.21$, $S = 0.69$), and Saad ($M = 4.31$, $S = 0.48$).

"I liked that the situations of each character was realistic and not watered down. I liked that in most choices for the player there was usually a trade-off, making it more difficult to select "the right" option."

"It is very realistic. The things that my character faced were true, I have seen other people facing the same things, and I personally sometimes experienced the same situations."

"I thought it was really realistic in that I was feeling very anxious and stuck in making decisions on what to do."

“Experiencing the no win scenarios that occur in real life.”

Fun and engaging

Students also “very strongly” (22%), “mostly” (55%), or “somewhat” (20%) agreed that “playing the game was fun and engaging.”

“engaging”

“I liked the graphics, and the interactive nature of the game.”

“interesting facts at the ending of the game....”

Recommend the game to others

Finally, students “very strongly” (48%), “mostly” (35%), or “somewhat” (14%) agreed that they would “recommend the game to other people”.

“It was very detailed and clearly based on a lot of research. It provided an empathetic experience. It also had really good illustrations/visuals.”

The game met most of the identified learning outcomes

Prior to playing the game and after playing the game, students responded to 10 true or false statements related to the key learning outcomes of the Food Security Quest. The assessment of these knowledge-based questions revealed that the learning game was mostly effective at meeting the identified learning outcomes.

Indeed, after playing the game students performed better on the true/false questions related to single motherhood as a risk factor for food insecurity (+23%), prevalence statistics of food security in Ontario (+17%), risk factors for food insecurity associated with refugee status (+11%), the connection between low income and food insecurity (+6%), the interaction between diabetes care and food insecurity (+4%), the cost of food on First Nations reserves versus non-reserve communities in Ontario (+2%), and food insecurity in aging adults (+2%).

However, the results also revealed three true/false questions in which students did not perform better after playing the game. All three of these questions utilized complex question wording with “FALSE” as the correct answer. As such, it is possible that the low performance resulted from poorly worded questions, rather than a lack of knowledge gain. Never-the-less, based on the results we strengthened the debriefing of the game to better clarify the learning content. In future evaluations, we will also reword these true/false questions to better assess knowledge related to these content points.

Table. Percent answering each true/false question correctly

| Question: | Pre | Post | Change |
|--|------------|-------------|---------------|
| Lone-mother households with children experience food insecurity at a rate two times greater than lone-father households with children. (TRUE) | 70% | 93% | +23% |
| Ontario has the highest number of households living with food insecurity, with more than 500,000 households experiencing some level of food insecurity. (TRUE) | 72% | 89% | +17% |
| Government Assisted Refugees in Canada receive more support and experience less food insecurity than refugees who come to Canada under private sponsorship. (FALSE) | 45% | 56% | +11% |
| In Canada, food insecurity is most closely linked to low income. (TRUE) | 85% | 91% | +6% |
| People living with food insecurity have greater difficulty managing chronic health conditions (such as diabetes) and, as a consequence, experience higher health care costs than food secure individuals. (TRUE) | 96% | 100% | 4% |
| The cost of nutritiously feeding a family of four for one month in remote First Nations communities in Ontario is approximately 2.5 times higher than in off-reserve areas of Ontario. (TRUE) | 83% | 85% | +2% |
| For adults living alone, the risk of food insecurity doubles after the age of 65. (FALSE) | 30% | 32% | +2% |
| In Ontario, food banks are widely used by those experiencing food insecurity and have been shown to greatly reduce food insecurity. (FALSE) | 76% | 67% | -9% |
| In Canada, people who identify as First Nations are only at higher risk of experiencing food insecurity when they live on-reserve in remote northern communities (FALSE) | 72% | 57% | -15% |
| Households in Ontario that receive social assistance have a much lower risk of food insecurity as a consequence of receiving aid. (FALSE) | 69% | 48% | -21% |

Student feedback was helpful in improving the game

The Learning Outcomes Study was conducted over two different pilot versions of the game and helped to inform the final version of the game posted on the Ryerson University Open Learning website. Because of this, the feedback from the Learning Outcomes study was directly instrumental in improving the quality of the game.

Indeed, feedback from student participants resulted in the following direct changes to the game:

- Inclusion of a better introduction to the game with improved instructions.
- The addition of more visual imagery to the game to set an overall tone/mood.

- Improved accessibility features (higher contrast; the inclusion of a text-only version of the game).
- Improved debriefing scripts that better highlight key learning outcomes.
- Improved debriefing layout to allow students to better navigate the information.
- Identifying and changing scenarios in the script that did not make sense or did not flow with the rest of the character information.
- Balancing the metrics to make for more realistic game play (so that the actions that happened in the game better matched the character outcomes presented in the debriefing for the character at the end of game play).
- The addition of a character focused on the life of a student. (The student character “Maxine” was already in the making, but we were surprised by the number of students requesting it in the learning outcomes study).

Knowledge Mobilization

Research Dissemination Plans

The Food Security Quest and this research report are being made available on Ryerson University’s Open Learning Website, <https://www.ryerson.ca/openlearning/>

The research results and lessons learned were also disseminated at the following conferences:

- October 2017, Presentation at the Annual Meeting for the International Society for the Scholarship of Teaching and Learning (ISSOTL) in Calgary, AB.
- December 2017, Ryerson University Library Collaboratory Showcase.
- May 2018, Presentation at the Ryerson Faculty Conference organized by the Learning and Teaching Office at Ryerson University, Toronto.
- May 2018, Presentation at the annual meeting of the Canadian Association for Food Studies in Regina, Saskatchewan.
- May 2018, Ryerson University Library Collaboratory Showcase.

Our lessons learned and research results may also be presented at additional conferences and/or submitted for potential publication in a research journal. Outlets for consideration include:

- The International Conference on Food Security and Sustainability
- Canadian Food Studies/La Revue canadienne des études sur l'alimentation
- The Journal of the Learning Sciences
- Educational Technology Research and Development
- International Journal for Students as Partners

Future Game Development Recommendations

Focus on remote First Nations communities

One of the strengths of the Food Security Quest is that it provides an opportunity to tell impactful stories of food security to help raise awareness of important issues across Ontario. Given this goal, it is of high priority to our team to expand the game to provide educational information and awareness about food security issues in remote First Nations communities in Northern Ontario.

Due to structural inequality, loss of land for hunting and gathering, unique geographic barriers, and high food costs, First Nations, Inuit, and Métis individuals are at higher risk of experiencing food insecurity than non-Indigenous populations living in Canada (Chan et al., 2014). Indeed, the cost of nutritiously feeding a family of four for one month in remote First Nations communities in Ontario is approximately 2.5 times higher than in off-reserve areas of Ontario (Veeraraghavan, Burnett, & Skinner, 2016). As a future direction for the Food Security Quest, we would like to partner with members of First Nations communities to build one or more characters that highlight the unique food security issues experienced by individuals living in remote First Nations communities.

Addition of more characters

There were numerous other suggestions from both students and subject matter experts as to the characters that could be developed for the Food Security Quest.

"I think having a better variety of people, the characters were individuals that would have an obvious issue with food insecurity. It might be helpful to include people you wouldn't think or attribute to food insecurity, like a student at university, or a young person with family responsibility etc."

"Creating a character that is not of a vulnerable population because they too experience food insecurity."

Improved learning content

Feedback data from subject matter experts and student learners suggested a number of ways that the game could be improved to improve understanding of food security.

- Better highlight food systems and sustainability.
- Better highlight the role of policy in shaping food insecurity.
- Include a focus on disability and disability rights.
- Increase the focus on resiliency and hope.

Improved game interactivity

Feedback data from subject matter experts and student learners suggested a number of ways that the game could be improved to increase learner engagement.

- Improved accessibility features.
- Add video introductions for each of the characters.
- Add sound effects to better draw attention to metric changes.
- Add more character sketch representations (children, spouses, roommates).
- Include opportunity for the characters to move around.
- Include opportunity for the characters to interact with one another.
- Include visual opportunities to see the character's facial/bodily reactions.
- Tell the stories from different perspectives (e.g., parents versus children).
- Have small activities in between making choices to help bring up money or wellness score.
- Being able to select food choices at the grocery store.

"It would be very interesting if you could add a video about an actual person experiencing this situation for every character, at the end of the game."

"Make the character actually participate in the events and walk around the city, instead of staying in one place."

"Maybe incorporating sound, or being able to select actual foods at the grocery store or food bank. Something to add a little more excitement to the game!"

Summary

Overall, the project was a great success. We succeeded in developing and evaluating an online learning game, **The Food Security Quest**. The learning game was found to be effective in expanding learner's definition of food security and increasing empathetic attitudes towards those experience food security. In the process of developing the game we also documented key lessons learned. These lessons learned can be used to inform and shape future learning games that contribute to the larger goal of creating "experiential learning opportunities (including simulation) in the digital space."

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Appendices

Appendix A: Learning Objectives

The goal of the Food Security Quest is to enable students to learn about food security and develop empathy for people experiencing or at risk of food insecurity. Outlined below are 11 knowledge-based objectives and 4 empathy-based objectives aligned with these goals.

Knowledge-based objectives:

1. Define food security as *"A condition in which all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life"* (Food and Agriculture Organization (FAO) of the United Nations, <http://www.ryerson.ca/foodsecurity/our-approach/>).
2. Identify geographic disparities, prevalence statistics, and issues across Canada and Ontario.
3. Define and illustrate the Five A's of Food Security. [Definitions come from the Centre for Studies in Food Security, Ryerson University, <http://www.ryerson.ca/foodsecurity/our-approach/>]
 - **Availability** – Sufficient food for all people at all times
 - **Accessibility** – Physical and economic to food for all at all times
 - **Adequacy** – Access to food that is nutritious and safe, and produced in environmentally sustainable ways.
 - **Acceptability** – Access to culturally accepted food, which is produced and obtained in ways that do not compromise people's dignity, self-respect or human rights.
 - **Agency** – The policies and processes that enable the achievement of food security.
4. Identify and illustrate key risk factors for food insecurity, including low income, reliance on social assistance, costs of food/non-food essentials, high housing costs, geographic isolation, transportation costs, special dietary needs, low food literacy, and discrimination.
5. Recognize the limited role of individual "choice" and the importance of structural factors and policies.

6. Illustrate how structural inequality puts certain populations at higher risk for food insecurity, including Aboriginal people, lone-parent families (especially female lone-parents), immigrants, children and youth, elderly, visible minorities, and individuals with disability and chronic disease.
7. Highlight and educate users about Indigenous Canadian history, specifically how the Indian Act, Reservation/Pass System and Residential Schooling has caused detrimental intergenerational impacts in terms of social, political, and economic outcomes as well as with the relationship with food that has contributed to the alarmingly high prevalence of food insecurity in Indigenous populations.
8. Understand how food security fits into the “larger picture” of food systems.
9. Illustrate the resiliency, strength, and resolve required to persevere in the face of significant structural barriers and severe adversity.
10. Identify specific challenges face by people in Ontario that are vulnerable to food insecurity.
11. Illustrate the limits of existing ameliorative efforts to reduce food insecurity (i.e., reliance on food banks and social assistance) and encourage players to critically reflect on transformative structural solutions to food inequality.

Empathy-Based Objectives

1. Build empathy and understanding for the long term and short term choices and trade-offs that are required in making financial, social, and personal decisions related to food security
2. Develop appreciation for the resiliency, strength, and resolve required to persevere in the face of significant structural barriers and severe adversity.
3. Encourage players to engage in self-reflection about one’s own risk and protective factors and (if applicable) to reflect on the structural barriers that they have faced in their own lives and/or the responsibilities that come from having social, economic, and political privilege.

Appendix B: Inspiration Games

Outlined below are five games that served as inspiration for the development of the Food Security Quest.

1. **The Family Farmer:** <http://thefamilyfarmer.com/>
 - The Family Farmer highlights learning outcomes related to sustainable food production and farming. We really liked the interactive and tactile look and feel of this learning game.
2. **The Food Quest: A Food Security Adventure:** <http://unalee.net/work/food-quest-game>
 - The Food Quest (Fisher and Lee, 2015) utilizes five characters and a maze structure to help learners learn more about food security. We really liked the idea of the character profile and the narrative nature of the simulation. We also like the idea of having the character physically navigate a physical space.
3. **Make the Month**, United Way, <http://makethemonth.ca/>
 - Make the Month is a serious game focused on highlighting the lived experience poverty. We really liked the simple interactive graphics and the narrative nature of the simulation. We did find it frustrating, however, that the game stopped once the character ran out of money. In real life, people must continue persevering even when their resources run out.
4. **Syrian Journey: Choose Your Own Escape Route:** <http://www.bbc.com/news/world-middle-east-32057601>
 - The Syrian Journey is an interactive story that follows the lives of people as they face dilemmas in fleeing war and danger. We really liked the strong story telling aspect of the game, as well as the compelling imagery that accompanied the stories.
5. **Depression Quest:** <http://www.depressionquest.com/>
 - Depression Quest is a “make your own adventure” storytelling narrative that highlights the lived experience of depression. We really liked the strong story telling aspect of the game. We especially liked how certain options were or were not available to the character as the player made different decisions through the game.

Appendix C: Game Development Process

The table below outlines each step in our game development process, how long each step in the process took us, and notes on some of the challenges and considerations that we encountered along the way. (Please note that we worked on many of the activities in this timeline concurrently).

| Task | Time (in weeks) | Notes: |
|--|---|--|
| Identify learning objectives | 12 weeks (Mar. to Sept. 2017) | Because we recognized the importance of developing a game that would be widely used, we took our time with this step. This step occurred concurrently with the development of initial game ideas. |
| Initial game ideas | 12 weeks (Mar. to Sept. 2017) | We struggled to agree on a single cohesive idea for the game, in part because we tried to include too many ideas in our initial game planning. When we simplified our approach, game development process went much smoother (and faster). |
| Hire a game developer | 12 weeks (Apr. to Oct. 2017) | Finding a game developer proved to be more challenging than expected. The team that we had initially pegged to develop our game turned out to not be available for our project (at least not within our outlined timeframe and budget). Fortunately, we stumbled upon a new workable solution via the Ryerson University collaborator. |
| Finalize a creative vision for the game | 10 months (Mar. to Dec. 2018; with adjustments through March) | In retrospect, we should have brought on somebody to provide art direction from the start of our planning process. As it was, we did not have a clear vision of the layout of our game until rather late in the planning process. |
| Develop the creative assets for the game | 8 months (Oct. 2017 to May. 2018) | Developing the creative assets for the game (scripts, sketches, background art, music) took a significant amount of time. The time required for this step should not be underestimated. |
| Program the game in Unity | 9 months (Sept. 2017 to May 2018) | Game programming occurred concurrently with the development of the game assets. A challenge that we encountered is developing an effective communication plan that allowed us to be responsive to feedback on the game. |
| Address accessibility | 6 weeks (Mar. 2018 to May) | We struggled to find an affordable solution that would allow for the development of a |

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| requirements | 2018) | fully accessible game. Hiring someone to program the game in HTML 5 (the most accessible option) turned out to be cost prohibitive. Twine publishes to HTML, allowing for it to be adapted for accessibility purposes, but Twine was limited in achieving the visual goals of our game. Unity offered a good programming environment in which to produce the visual elements of the game, but was limited in achieving a fully accessible game. In the end we produced an image rich version in Unity and a text-only version for screen readers in Twine. In the future, we would like to find a solution that allows us to develop a fully accessible game. |
| Getting feedback on the game and game assets | Entire project (Mar. 2017 to Mar. 2018) | A strength of our project is that we gathered and incorporated feedback into the game during the entire game design and game development process. A challenge involved coming up with a workable solution for communicating this feedback between our script writers and the game developer to ensure timely implementation of the changes. |
| Doing the outcomes assessment | 6 weeks (Mar. 2018 to April 2018). | Near the end of the game development process we engaged in a learning outcomes assessment to explicitly test our assumptions concerning the learning goals of the game. |
| Finishing touches and prepping supporting materials | 4 weeks (April 2018 to May 2018) | Developing a plan for sustainability is challenging, especially when working with students and conditional faculty/staff who may be moving on to other projects. |