Serious Games on the Lived Experience of Dementia as Learning Tools in Pharmacy Education

by

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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Abstract

Dementia is a stigmatized and often 'invisible' condition which requires clinicians to have a nuanced understanding of the lived experience to build trust and provide better quality of care. Pharmacists are at the frontline of care for patients who may have dementia and there is a need for effective and engaging learning opportunities to prepare them for caring for patients living with dementia. Serious games have gained popularity for their potential in facilitating safe and engaging learning opportunities. However, there are limited applications of serious games in clinical education on the topic of dementia and little transparency on the development process. The thesis work outlined in this project intends to explore how serious games can best facilitate a learning experience for senior pharmacy students to better their understanding of the lived experience of dementia.

The primary objective was to develop a serious game with multi-stakeholder input. The secondary objective was to provide game design recommendations for development of serious games on this topic based on end-user play-testing experiences. During both the development and user-testing, qualitative methods were used to gather thorough feedback and understand individual play experiences, namely semi-structured interviews and the think-aloud protocol. To develop a serious game, the game design framework for medical education was adapted in this project, which involved three stages: preparation and design, development, and formative evaluation. In the first stage, a clinician and a systems design expert were consulted to develop the first prototype. In the development stage, the prototype was reviewed by stakeholders including clinicians, people with lived experiences of dementia or care partners, and serious game researchers through semi-structured interviews, resulting in iterative improvements. Stakeholder feedback culminated in the development of a serious game with the goal of helping pharmacy students better understand the lived experience of dementia, in a digital, non-linear story format. During the final formative evaluation stage of game design, 11 senior pharmacy students, a pharmacy educator, and a social worker with expertise in dementia care tested the game. Their learning and play experiences were gauged through the semi-structured interview and think-aloud protocols. The qualitative data was analyzed using the framework method of analysis.

Three factors were necessary for creating an engaging learning experience about dementia for senior pharmacy students. The first was facilitating understanding of dementia through an experiential approach using a realistic environment and authentic storytelling. The second was providing a problem-oriented experience by providing meaningful player interaction opportunities and creative freedom. Finally, novelty in the game format was necessary for an engaging experience. Future directions include recruiting more stakeholders and student participants with experiences relating to dementia, and utilizing these

recommendations to improve on the game and assessing its impact on student empathy and confidence in caring for patients who have dementia.

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Chapter 1

Background

1.1 Dementia

1.1.1 Overview

Dementia is an umbrella term for declining cognitive functions such as memory, language, attention, orientation, or judgement, that are severe enough to interfere with daily life. This brain disorder is not a normal part of aging and may have various causes, the most common being Alzheimer's, for 60-80% of cases [1]. Dementia may be caused by a number of diseases, or result from a combination of diseases, that progressively damage the brain, beyond what can be expected from normal aging. Impairment in cognitive function is commonly accompanied, and sometimes preceded, by changes in mood, emotional control, behaviour, or motivation.

According to the Global Dementia Observatory reports, there were around 55.2 million cases of dementia worldwide in 2021, with the majority living in low and middle income countries [2]. With age being the main risk factor for dementia, the world's rapidly aging population is concerning. Currently, about 9% of the world's population consists of older adults above the age of 65. The percentage of older adults is predicted to reach 16% by 2050 [3]. Currently, there are about 10 million new cases of dementia per year worldwide, which is expected to rise due to population aging [2].

In 2019, the cost of dementia amounted to 1.3 trillion US dollars globally. Of the sum, 16% were direct medical costs, 34% were direct social sector costs (including long-term care), and 50% costs of informal care, provided by family and friends. Although more than

half of people with dementia live in low- and middle-income countries, 74% of the costs occur in high-income countries [4], illustrating that countries that may be more heavily impacted by population aging and a rise in dementia cases, are the least prepared to face these challenges.

1.1.2   Prevalence of Dementia in Canada

As of 2022, 19% of Canada's population were over the age of 65, which is expected to reach 25% by 2050 [5]. The cost of health care for adults over 65 years of age is about four times higher than those who are younger, which is testament to the increasing amount and complexity of health problems with age [6]. Aging is the inevitable and biggest risk factor for dementia. In Canada, for people between 65 and 69 years of age, around 2 in every 100 have dementia. A person's risk then increases as they age, roughly doubling every five years, meaning that, of those aged over 90, around 33 in every 100 have dementia [7].

Given that the main risk factor for developing dementia is aging, higher prevalence and increasing health care costs are to be expected. According to Canada's Landmark Study Report, in 2020, an estimated 597,300 Canadians were living with dementia, with 124,000 new cases diagnosed that year. About 60% of those living with dementia in 2020 were over the age of 80. By 2030, the total number of cases is expected to reach close to 1 million. The annual incidence is also expected to rise, with 187,000 new cases per year by 2030. By 2031, it is projected that the total annual health care costs for Canadians with dementia will have doubled since 2010, from 8.3 to 16.6 billion Canadian dollars [8]. Health care expenditures aside, dementia profoundly impacts the lives of those diagnosed, their family, and community.

1.1.3   Impact of Dementia

Dementia is not only complex in its prognosis, but also in its impact on the physical, emotional, and social well-being of those affected. The experience of dementia can differ between people. Generally, forgetfulness, confusion, changes in mood, difficulty with making decisions or solving problems, and with communication are some of the most common symptoms. There are numerous challenges that those affected cope with including declining quality of life, loss of independence, and stigma surrounding the condition [9].

Quality of Life

Almost half (48.4%) of Canadians aged 35 years and older living with dementia reported having fair or poor general health. It was estimated that men with dementia would lose on average 16.0 years, and women 15.2 years of life in full health due to disability and premature death [10]. In 2013–2014, the age-standardized all-cause mortality rate was about four times higher among seniors with dementia compared to those without [8].

Dementia is associated with mood disorders, disability, functional impairments, pain, and incontinence. Almost one-third of Canadians living with dementia reported having mood disorders. 58.4% reported impaired mobility, and 37.0% reported moderate or severe pain and discomfort. More than half (56.8%) of Canadians with dementia also reported urinary incontinence, and about one-third (31.7%) reported bowel incontinence [8].

Being an illness mainly brought on by aging, dementia tends to be accompanied by other chronic conditions. This is demonstrated by the common occurrence of multimorbidity - the presence of more than one chronic condition — in older Canadians. Using data from the Canadian Chronic Disease Surveillance System, analysts have demonstrated that over half of Canadians over the age of 70 have two or more chronic conditions. Living with dementia alongside other chronic illnesses compounds challenges of managing other chronic conditions. For instance, dementia hinders individual's ability to self-manage their diabetes care plan [11].

Independence

Living with dementia can eventually lead to greater reliance on others to provide care and a gradual loss of independence. In a Canadian survey, 1 in 4 people living with dementia at home reported needing a lot of help for activities of daily living, such as eating and dressing. Compared to seniors who live with their primary care partner, those who do not have a primary care partner living with them are around twice as likely to enter long-term care [12]. People with dementia who live at home will over time need increasing levels of medical and social support.

In 2020, 350,000 Canadians identified as care partners for people with dementia. Care partners can include spouses, family, or friends, and most commonly adult children. Care partners often become secondary patients due to physical and emotional labour that can come with providing care for a family member or friend with dementia [13]. Almost half of care partners of people who have dementia exhibit symptoms of distress, which is twice as high as the rate for care partners of other health conditions [14].

Stigma

Social stigma is defined as disapproval and discrimination based on perceived characteristics. There are two types of stigma: one that is external, or toward a person, and one that is internal, where an individual feels shame about themselves [15]. People living with dementia may not seek help in time due to stigma, depression, and compensatory help from carers, and even once they have sought help, are vulnerable due to communication difficulties. In a study at a Quebec memory clinic, at initial assessment about 30% of patients reported having already experienced cognitive symptoms for three years or more [16]. Additionally, stigma can deter people from participating in research and advocacy, resulting in work that is produced without their much needed input [17]. Even after diagnosis, stigma can prevent people from seeking the support that they need.

The road to diagnosis is often filled with uncertainty with the changes to come, exacerbated by the perception of dementia being associated with ill mental health and institutionalization. Accepting a diagnosis is often met with depression, resistance, anger, embarrassment, frustration, and shame that follows with diminished ability and autonomy [18]. Living with dementia involves concurrently balancing continuity and change in one's identity [19]. However as one person living with dementia explains: "There is life after diagnosis and I have learned to live life to the fullest" [9]. Receiving adequate and timely support from formal and informal care teams can help make this a reality.

1.1.4 Pharmacist Roles in Dementia Care

Pharmacists are among the most qualified and accessible health care professionals that can provide care for people living with dementia and their care partners. This section explores how pharmacists can be involved, how they can develop the skills they need to support patients, and gaps in training.

1.1.5 Evolution of Pharmacy Practice

The origins of pharmacy are deeply rooted in patient care. In the mid-twentieth century it became clear that more emphasis on clinical pharmacy is needed. The transformation from only dispensing medicines, without having permission to share and discuss the contents of prescriptions with patients in the 1920s, to pharmacists now having a more active role in patient care has been an uphill climb. Since the 1980s, referred to as the pharmaceutical care era, the scope of practice for pharmacists has gradually expanded [20]. Today most

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pharmacists work in patient care settings in community pharmacies, long-term care centres, inter-professional care settings, and more [21, 22]. Pharmacists are in a unique position to be involved in patient care for older, vulnerable populations due to their accessibility and expertise.

Access

Over 55% of Canadians see a pharmacist up to 10 times more often than their physician and visit their community pharmacy once per week. In Canada, pharmacists are highly trusted as health professionals, and over 80% of Canadians believe that expanding the scope of pharmacy practice would improve patient health outcomes [22].

Most seniors in Canada have access to a family physician, but they are also more likely to use the emergency department and experience coordination of care problems than seniors in most other countries surveyed [23]. Given the high accessibility of pharmacies across Canada, particularly to the older adult patient population, pharmacists are in a position to play a greater role in dementia screening and care.

Current Scope of Practice and Potential

With the ever expanding pharmacist scope of practice, pharmacists can be involved in a wide range of ways in dementia care. For instance, due to their accessibility and frequent encounters with an older adult patient population, pharmacists are in a unique position to screen and detect dementia. The Mini-Cog, which is a rapid screening tool for cognitive impairment is an easy to use and effective tool for dementia screening, which has been used by various health care practitioners, including pharmacists [24].

Managing medications for patients with dementia, especially for those who must follow a complex regimen, results in practical problems and an emotional burden. Pharmacists can play an instrumental role in medication management for patients who have dementia [25]. A systematic review of pharmacist-led medication reviews in residential aged care facilities found improvements such as reductions in medications and improved appropriateness of psychotropic use [26]. Pharmacist interventions show promise in improving medication usage for patients with dementia. There are few studies on this topic, making it difficult to draw robust conclusions. However, the potential for pharmacist involvement, particularly in medication reviews, is desired by patients and shows promise for alleviating some of the challenges of managing medications. Pharmacies can also serve as support centres, providing patients and care partners with information and resources [27, 28].

Despite this potential, many Canadian pharmacists do not feel adequately prepared and equipped to support patients with dementia. A survey of pharmacist level of comfort and interest in providing care for patients with or at risk of major neurocognitive disorders, including dementia, showed that Canadian pharmacists and senior pharmacy students feel comfortable with their knowledge of pharmacotherapy and are interested in being actively involved in care for these patients. However, they have lower comfort levels in early detection, intervening, providing appropriate resources to patients, and adequate communication skills [29]. Another study examining the impact of a simulation training exercise about dementia found that at baseline, pharmacy students had low level of comfort in providing care for patients with dementia and low confidence in their communication abilities [30]. In both studies, limited experience and training opportunities related to dementia are noted as reasons for low comfort levels, which reveals a gap in pharmacy education on dementia. The next section will explore how pharmacy students learn about and gain experience relating to dementia care throughout their education.

1.1.6   Pharmacy Education on Dementia

For a condition that is as prevalent, upending, and stigmatized as dementia, clinician understanding of patient experiences is paramount to providing high quality patient care. In dementia care, clinician empathy encourages patients to share more about concerns and symptoms, helps build better rapport and trust, allows for patient participation in decision-making about their health, and leads to better health outcomes [31, 32, 33]. Due to the vulnerability of people living with dementia, understanding their experience beyond their symptoms is necessary for building rapport, communicating effectively, and respecting autonomy. As students advance through the pharmacy program, they gain confidence in their ability to care for older adult patients, and maintain positive attitudes toward this patient population [34]. A combination of in-class and experiential learning opportunities help to prepare students for providing care for patients with dementia.

Experiential Learning

Experiential learning opportunities allow students to gain practical experience, apply their knowledge, and practice their soft skills. This situated form of learning is considered to be an irreplaceable gold standard in clinical training in many health care professions. For instance, a training program for physiotherapy and nursing students involving a class-based session followed by a volunteer experience where students interacted with people living with dementia in care homes, had a positive impact on student communication skills,

attitudes toward patients, confidence, and perceived competence. However, the quality of the experience was not consistent for all students. Some students were able to better connect with staff or were given more opportunities to interact with patients compared to others. Also, the experience was brief and students would have preferred a longer duration [35].

At the University of Waterloo School of Pharmacy, students can benefit from patient care rotations, paid co-op placements, and service learning opportunities. These opportunities help with preparing students for practice through gaining exposure to different care settings and patient populations. In Canada and the US this experiential learning component is commonly referred to as an Advanced Pharmacy Practice Experience (APPE). These within-context learning experiences occur in communities of practice with the support of preceptors, other students, coordinators, and health care professionals.

For pharmacy students, direct patient interactions and community involvement are essential in building soft skills, as well as self-efficacy. A narrative review of service learning opportunities for various health care professions, including pharmacy, demonstrates this through opportunities serving a wide range of patient populations such as older adults, patients living with dementia or Parkinson's, and unhoused patients [36]. While students in most studies initially expressed anxiety about working with older adult patient populations, a semester of weekly visits resulted in improvements in attitudes and empathy. Although not all studies found a significant improvement through attitude change scales, students self reported positive perceptions and decreased prejudice toward people living with dementia. Regarding self-efficacy, pharmacy students working in a hospital setting within an inter-professional team showed improvements in performing medication reconciliation [36]. Generally, among most articles, students with limited baseline clinical experience benefited the most from direct patient interactions. For studies that did not find a significant improvement in empathy or self-efficacy outcomes, a longer duration for the program was suggested as a next step. Part of the situated nature of clinical experiences stems from inter-professional interactions which help to prepare students for practice. Studies have shown that these opportunities improved geriatric knowledge scores and medication knowledge [37]. A qualitative study found that an inter-professional experience involving in-home visits with community dwelling older adults allowed students to reflect on their scope of practice, geriatric care and health outcomes, team communication, and advocating for one's own profession [38, 39]. However, the evidence on dementia-related opportunities is limited. Supervised and direct patient care training opportunities for dementia, although ideal, can be difficult to organize. Innovative, in-class learning opportunities can serve as more accessible, safe, and standardized learning experiences.

Simulation Learning

In preparation for practical experiences, simulation training can be provided for pharmacy students and has been shown to be effective in improving knowledge, confidence, and attitudes. Various simulation methods have been used such as actor patients, computer-based simulations, and immersive Virtual Reality (VR) experiences. A systematic review of simulated or actor patients for a variety of conditions in pharmacy education aimed at developing communication skills found that 10 of the 15 included studies used this method for assessment purposes only. Of these studies, only two provided students with immediate feedback and only one provided students with corrective feedback [40]. This speaks to the difficulty of organizing and implementing actor patient simulations for educational purposes.

Given that dementia involves cognitive and physical symptoms, more creative simulation methods are needed. For learning about the experience of dementia, VR simulations have been effective in increasing awareness and empathy toward dementia for health professional students and may be easier to implement as educational opportunities [41, 42]. For pharmacy students, a multi-sensory VR experience helped to improve self-reported attitudes and knowledge of dementia [43]. For an improved experience, students in this study suggested an experience that better incorporates pharmacy-specific learning objectives and opportunities for role play. Another study of a multi-sensory virtual simulation demonstrating the cognitive and perceptual difficulties of living with dementia resulted in improvements in attitudes and knowledge on dementia for medical and pharmacy students [44]. Similarly, aging suits have been used to simulate frailty and impairments in vision, hearing, and mobility and have demonstrated an improvement in student empathy toward aging [45]. Simulations can be effective in improving student empathy, however, they may sometimes result in negative effects on attitudes and anxiety. A systematic review of aging simulations found that in some studies students had more negative views and anxiety about aging following the simulation due to a drastic change in expectations about aging and reinforcement of negative stereotypes [46]. Therefore, when designing simulations, it is important to create experiences that are closely representative of patient experiences and that a balance is struck between positive and negative experiences.

Although they make for memorable and effective learning experiences, simulations are costly to develop or organize and are not easily accessible. Moreover, the dementia-related simulations available are not tailored to pharmacy education. As an alternative, serious games can be another potential avenue to explore for learning opportunities that are innovative, engaging, and accessible. The next section explores definitions and the unique affordances of games for learning and their potential in pharmacy dementia education.

1.2 Serious Games

Games have gained popularity in many different domains including education, health, art and culture, and more. Although many different definitions have emerged over time, a game can be simply defined as a structured form of play composed of goals, rules, challenges, which one would participate in voluntarily [47, 48]. A goal creates motivation to engage in play, rules determine how a player can go about achieving the goal, and feedback informs players of how well they performed. Gamification involves bringing game mechanics into non-game contexts. When games are used for a purpose other than pure entertainment, they are referred to as serious games. Serious games as a field of study emerged in the late 1980s. The term 'serious games' was first coined and defined by Clark Abt and is defined as follows:

> "Games may be played seriously or casually. We are concerned with serious games in the sense that these games have an explicit and carefully thought-out educational purpose and are not intended to be played primarily for amusement. This does not mean that serious games are not, or should not be, entertaining."

The definition for a serious game is broad, hence the countless applications such as games that teach content, strategy, simulate real life, or facilitate physical exercise. One could go as far as to argue that any game can teach something, therefore all games may be more serious than they appear. In fact, learning and playing are thought to be related in that they both involve the challenge of learning new rules, whether it is to advance in a game or to acquire knowledge, and both processes can be rewarding [49]. Gamification in learning is well-suited for the needs of contemporary learners since it provides players with a self-directed [50, 51], and engaging [51, 52] experience. Some of the ways that serious games afford a unique play experience and their significance in learning are outlined below.

1.2.1 Attributes of Serious Games

Examining the theoretical foundations of serious games, three categories of theories are used to justify gamifying an activity or learning experience: theories relating to motivation, behaviour, and learning are most common in serious game literature [53]. Each category as well as relevant theories are described below.

Motivation and Flow

Gamifying learning can create an engaging experience. Aside from being extrinsically motivating, promoting learning for practical reasons or validation, gamification can also inspire intrinsic motivation. Intrinsic motivation while playing games is closely related to the idea of 'flow'. Csikszentmihalyi introduced flow state as:

> "A state in which people are so involved in an activity that nothing else seems to matter; the experience is so enjoyable that people will continue to do it even at great cost, for the sheer sake of doing it."

Studies have found that flow generally enhances learning [54]. For instance, in a study assessing flow, motivation, and learning for medical students who played a serious game, positive correlations were found between the experience of flow and both intrinsic and extrinsic motivation [55]. Games can induce flow when the player's skills are at a balance with the challenges they must overcome.

Behaviour and The Magic Circle

Motivating effects of game-based learning are consistently accompanied by positive behavioral outcomes. These include engagement and participation, social collaboration and teamwork, persuasion and attitude change, and measurable performance improvements in academic and work tasks [53].

One way that games can change behaviour is described by the idea of the magic circle. The idea was introduced by John Huizinga as "temporary worlds within the ordinary world, dedicated to the performance of an act apart". This refers to a physical or imaginary space where rules of the real world do not apply and artificial game rules are followed. Players are of course still aware of real world rules and bounds, meaning they may freely 'step' in and out of the circle, and bring outside knowledge into the game [56]. The magic circle allows players to explore the boundaries of freedom and control.

To create a convincing and immersive magic circle, fantasy elements can be used, although even in games set in everyday scenarios (e.g. *The Sims*) game rules that give players extraordinary abilities can be effective [57]. Playful approaches in teaching allow students to temporarily participate in an environment where they can transform, be creative, and collaborate without fear of real world consequences [58]. This mindset provides players with a safe environment to make mistakes, take on different perspectives, and create meaning.

Situated Learning

Learning is situated when the subject matter or skills to be learned are linked to the needs and concerns of learners. This allows learning to be easily transferable from the classroom to real world challenges [59]. Serious games provide players with opportunities to problem-solve and apply their skills. Doing so within context that is relevant to the learner's life amounts to a more meaningful and useful learning experience [60, 61].

One way to facilitate situated learning through games is by incorporating authentic storytelling, which adds relevance and meaning to the experience. A review of narratives in serious games found that they provide a more meaningful learning experience for students [62]. Meaningfulness refers to the intent behind learning and the personal relevance, which contributes to long lasting knowledge and skills acquired. Storytelling in games can be engaging and meaningful because it fosters curiosity and allows for empathetic exchanges between the player and characters.

1.3   Rationale

Canada's aging population presents many challenges for the health care system. One of the most relevant challenges is the rising prevalence of dementia. Canadian pharmacists are at the forefront of providing care for people living with dementia due to higher accessibility compared to other health care providers. With their expertise and high level of interest in providing care for patients who have dementia, they can be involved in screening, medication monitoring, providing resources and information, and more. However, many pharmacists do not feel prepared in taking part in these roles to the fullest extent due to low comfort levels in communication, inadequate training, and minimal exposure to patients with dementia. To be better prepared in providing care for patients who have dementia, pharmacists can gain experience and knowledge through clinical rotations and in-class simulation opportunities. Although effective, these opportunities can be difficult and expensive to arrange and are often used as assessments rather than for learning purposes. As an alternative solution, serious games can be adapted to meet the needs of pharmacy students. Serious games have shown promise in many different fields, however, more research is needed on their effectiveness and impact in health care education. The following sections discuss the value of serious games as learning tools, current literature of serious games in pharmacy education and games related to dementia, as well as literature on the game development process.

1.3.1 Serious Games as Vehicles for Learning

Malcolm Knowles' theory of adult learning forms the basis of many learning theories today. Adults learn differently compared to children according to Malcolm Knowles' five assumptions of adult learning: 1) adults prefer to pursue self-directed learning, 2) adults have accumulated a variety of experiences that aids their learning, 3) an adult's readiness to learn depends on the impact of their learning on their social roles, 4) an adult's orientation to learning is shifted from delayed application to immediate application, and 5) adults are internally motivated to learn [63]. Current literature has confirmed and built on these assumptions. For instance, in a study comparing traditional students who have followed a linear educational path compared to non-traditional students, value in learning stemmed from how applicable it was in real life for non-traditional learners. Moreover, non-traditional students often do not expect an immediate reward and are able to support their interests with intrinsic motivation [64]. Mezirow's theory of transformative learning, a more recent theory of adult learning, states that adult learning is not simply adding more information, but rather is dependent on adult life experiences and as adults make sense of their world, a perspective transformation is necessary [65]. Pharmacy students can be considered to be adult learners, not only on the basis of age, but also due to the fact that pharmacy programs are geared toward preparing students for real world practice, as evident by the importance and integration of patient care rotations in the pharmacy curriculum. Students in professional health care programs are therefore encouraged to approach their learning with this future-oriented mindset.

Based on Knowles' adult learning theory, a learning experience tailored to adult earners should have the following characteristics [63]:

- allow learners to be involved in the planning and evaluation of their learning

- provide the opportunity to experience, and make mistakes, at the core of any activity

- contents being presented must be directly relevant to the learner's professional or personal life

- learning should be problem-centred, rather than content-oriented

Given the attributes of serious games, gamification of learning experiences can help to facilitate these four key principles. With clear and relevant learning objectives, serious games have the potential to provide an self-directed, engaging, experiential, and problem-centred learning experiences [66]. For this reason, health care educators are turning to serious games as safe and innovative learning opportunities for students. However, much more research is needed in this field.

1.3.2 Application of Serious Games in Pharmacy Education

Serious games are being increasingly applied to health care education, for public users, patients, and especially for health care providers [67]. The value of serious games in professional health care education is in their ability to create a safe learning environment (for patients and learners), or one that allows students to experience uncommon outcomes, transferrability to real-world problems, and all for a lower cost [68, 69]. Studies on games related to dementia tailored to health care education are limited. There is one example of a dementia awareness game, initially developed for public use, used in nursing education with the aim of improving knowledge about dementia. This game consists of a series of multiple-choice questions designed to dispel myths and misconceptions about dementia. Significant improvements in knowledge were observed by comparing pre- and post-testing of dementia knowledge. Moreover, students found the game to be motivating and engaging, especially in an asynchronous, self-directed learning environment [70]. No serious games about dementia have so far been developed or tested with pharmacy student audiences. Moreover, no games have been developed that focus on the lived experience of dementia and practice of soft skills needed to support patients.

Looking more broadly at serious games in health care education, although there is optimism and potential, they are not mainstream practice. This is due to the lack of quality evidence regarding their effectiveness and impact. For instance, Maheu-Cadotte et al.'s systematic review and meta-analysis of serious games for health professions education using randomized controlled trials, found no significant improvement in knowledge acquisition, cognitive and procedural skills development, or behaviour change [71]. Other reviews found that there is potential of serious games improving these outcomes, however more rigorous studies are needed [72]. Furthermore, higher level impact of learning through serious games, such as clinical behaviour needs to be studied. There are similar findings in serious games used in pharmacy education. In a systematic review of digital serious games related to patient care, the effects on patient care related competencies was not significant in most of the studies [73]. Despite the lack of clarity in their effectiveness, students tend to prefer gamified experiences over traditional learning methods due to higher engagement. Games may not yet be more effective than traditional learning methods, however, research has showed that they can often be as effective, which is a promising starting point. This illustrates that more research is needed to ensure that games developed for health care education meet the expectations and needs of learners and teachers alike. Given that there is unmet potential in the use of serious games in pharmacy education, it is necessary to examine game development approaches.

1.3.3   Serious Game Development

In serious game literature, there are many variations of game design frameworks. Among literature reviews on design approaches, the work of Connolly et al. [74] focuses on software engineering strategies for designing computer-based games, and the work of Abdul & Felicia [75] investigates the motivational, interactive, fun and multimedia elements needed in game design. These approaches are informative, however, given that this project involves a game related to health care education, an approach that includes evaluation methods would be more suitable to ensure the safety and validity of the game. The work of Ávila-Pesántez et al., which provides an all encompassing review of serious game design approaches, found 11 different approaches and summarized the common characteristics [76]. The four common phases are summarized below:

- Analysis: identification of the problem to be solved with the game and the pedagogical objectives

- Design: the digital resources necessary for the creation of the game are created

- Development: determination of the requirement for tools and software resources to create the game

- Evaluation: consolidation of developments in previous phases by users and experts

This approach is similar to approaches taken in serious game development related to health care education, a field where best practices are still being defined. One of the challenges of designing effective serious games for health care education is that there is no consensus or consistency in the game development process. This is not surprising considering that developing serious games for health or health education is a highly multi-disciplinary field. In addition, the lack of transparency is an issue since many serious games in medical education have been created and released, likely internally, without publication. A review of serious games used for medical education by Olszewski et al. found a total of 65 original papers, however only 11 provided a brief description and only two provided a detailed description of game development methods [77].

Some of the commonly used methods in serious game development outlined in Olszewski et al.'s review include an iterative development process, gathering verbal feedback or using focus groups, and generating feedback through questionnaires [77]. Similarly, in a review of serious game development for health, an ideal development process was found to have the following features: engagement of stakeholders from different disciplines, iterative improvements, and involvement of some form of evaluation of the effectiveness and/or safety

of the game [78]. The main difference between these approaches and findings in the work of Ávila-Pesántez et al. is that stakeholder and end-user involvement is more emphasized and is introduced earlier in the development process. Given that this thesis project is concerned with understanding the experience of people living with dementia, more prominent stakeholder involvement is necessary to ensure that the game is representative of real patient experiences. Therefore, Olszewski et al.'s approach is more suitable for this project.

Given that there is promise unfulfilled with the effectiveness of serious games used for pharmacy education, it is important to take a step back and examine how games can be designed to meet learner and educator expectations. As outlined earlier, serious games have the potential to facilitate learning that is imaginative, intrinsically motivating, and situated. These features can be used to facilitate for learning about skills such as understanding a patient's perspective, using holistic approaches, and being proactive in providing care. With the rising prevalence of dementia, gamifying a learning experience about dementia is a relevant and exciting endeavour in pharmacy education.

1.3.4 Game Format

Given that experience in interacting with patients who have dementia is ideal, as explained in earlier sections, the game that will be developed in this project will attempt to simulate this interaction. The game will be written from the perspective of a pharmacist interacting with a patient who may have dementia. However, for a more engaging and realistic experience, players would not simply be walking through an experience, as is the case in most simulations. They would also choose how the story progresses. In a choose-your-own-adventure, or non-linear story format, players can explore their decision-making capabilities as they interact with a virtual patient.

Although this project may not provide conclusive answers about the design of all serious game formats relating to understanding dementia, it is a suitable starting point given that it will be feasible to develop with a small team and limited time, and it is similar to current approaches of case-based learning that are used in simulations. The learning objectives of the game are outlined below.

1.3.5 Learning Objectives

A review of dementia knowledge and attitudes of undergraduate students (including medical, nursing, and pharmacy students) found that in-class learning would benefit from additional modules on theoretical and practical knowledge of dementia. Moreover, the

modules would be most effective if integrated with clinical, hands-on experiences. Students with more experience and exposure to people with dementia have greater knowledge, more positive attitudes, greater confidence and comfort, and a better understanding of how to communicate with patients [79]. Given that not all pharmacy students have had prior personal or professional experiences with dementia, opportunities to better understand the lived experience of dementia can help to prepare students for their future practice [79]. The learning opportunities in this study will span two categories of learning objectives, which will be reviewed and further refined with stakeholder feedback:

1) The Lived Experience of Dementia

- Experience of cognitive symptoms such as confusion, forgetfulness, and disorientation

- Emotional experience of cognitive symptoms (e.g. frustration, embarrassment, social withdrawal)

- Burden of daily challenges (e.g. managing medications)

- Impact of dementia on care partners

2) Pharmacy Practice

- Communication skills needed to build rapport with patients, and to facilitate a holistic approach to care

- Exploring and being proactive within the scope of practice as a pharmacist

- Considering challenges and barriers to ideal practices

This project begins with developing a serious game with multidisciplinary stakeholder feedback. Serious game development framework proposed by Olszewski et al. [77] will be used in this project, since it was created based on serious games in clinical education. To ensure that the learning opportunity is situated, the game will present a choose-your-own-adventure story based on a typical pharmacist-patient interaction where the student will play from the perspective of a pharmacist. The initial prototype of the game will be developed through consultation with experts. Later, stakeholders with various expertise and experiences will review the game for iterative improvements. Finally, the game will be play-tested with senior pharmacy students and educators in pharmacy or dementia care to determine recommendations for future, related game design projects based on their play and learning experiences. To gain in-depth insight into end-user experiences, qualitative methods will be used to gather feedback from stakeholders end-users.

Chapter 2

Objectives

2.1 Research Question

What game features are needed to create a learning experience about dementia through serious games for senior pharmacy students?

2.2 Primary Objective

To develop a serious game with stakeholder feedback about the lived experience of dementia for senior pharmacy students.

2.3 Secondary Objective

To provide game design recommendations based on end-user testing for creating a learning experience about dementia for senior pharmacy students.

Chapter 3

Methods

3.1 Qualitative methodology

Qualitative research approaches are concerned with how people make sense of or interpret phenomena in a particular context. It involves collecting and analyzing non-numerical, or descriptive data. Qualitative approaches are suitable when detailed understanding of complex issues are needed and the topic of concern cannot be separated from the people involved [80]. Some common characteristics of qualitative approaches include:

- Focusing on the participant perspective: there is greater focus on the meaning that participants ascribe to experiences, rather than the meaning that researchers understand about the issue

- Researcher as a key instrument: the researcher is an instrument in collecting data by examining documents, observing participants, or interviewing

- Natural setting: given the importance of context, data is collected in the field rather than the lab. The researcher and participants interact face-to-face.

- Emergent design: the initial plan for the research may change based on data that is collected

For this study, qualitative approaches are in line with user-centred design. User-centred design requires involving the end-users of a product at various stages in its development and results in products that are well-suited to a particular user group. The principles of user-centred design are as follows [81]:

- design is based on the understanding of users and their entire experience (e.g. functionality of design, interactions with the system, attitudes, capabilities and preferences of users)

- users are involved throughout the development process

- the design is tested by users and refined accordingly

- refinements are iterative

- the design team includes multi-disciplinary perspectives and expertise

In user-centred design approaches, both quantitative and qualitative methods can be used. Given the exploratory nature of this project and the fact that literature on the subject is limited, a more in-depth look at user experiences would be suitable as a starting point. Qualitative methods will be used to gather feedback from stakeholders in the development process and for the evaluation of the game by end-users.

3.1.1 Summary of Common Approaches in Qualitative Studies

Some common types of qualitative approaches include grounded theory, ethnography, and phenomenology. When using grounded theory, the goal is to develop a theory rooted in the data. As data is collected, it is constantly compared to previously collected data. Codes or tags are assigned to important, recurring ideas, and themes, which are used to develop a theory. This approach is, however, very time consuming and complex. Another type of qualitative research is ethnographic studies where a cultural group is examined. People knowledgeable about the culture, also known as key informants, are interviewed or observed. This approach relies heavily on the researcher to produce and interpret data and is subject to observer bias. Another common type of qualitative research is case studies. In case studies, a person or a group is studied in depth and typically over a longer period of time, therefore they are not generalizable. Case studies can be used to generate hypotheses for future studies [80].

3.1.2 Qualitative Description

The qualitative approach of choice for this study will be qualitative description, which entails describing the range of responses relating to a phenomenon, life event, or problem. This approach is not concerned with defining the essence of an experience, as is required

by the closely related phenomenological approach, but rather to describe the experience of individuals at a surface or manifest level, in their own words [82]. Sally Thorne, a leading qualitative researcher, elaborates on the practical nature of qualitative description [83]:

> "We desperately need new knowledge pertaining to the subjective, experiential, tacit, and patterned aspects of human health experience — not so we can advance theorizing, but so we can have sufficient contextual understanding to guide future decisions that will apply evidence to lives of real people."

In education research, qualitative description can be used to explore teaching and learning processes, student experiences, and educational practices [84, 85]. Understanding play and learning experiences of end-users through qualitative description facilitates a user-centred approach to serious game design. The findings would provide a means to transform ideas, themes, or concepts from participants to be used for future development of educational interventions.

3.2 Overview of Serious Game Design Framework

Olszewski and Wolbrink's review of serious games proposes and tests a framework for developing serious games in medical education [77]. Their framework will be adapted to this project for the development of a serious game to help pharmacy students better understand the experience of dementia.

The boxes outlined in blue show the steps where modifications will be necessary for the framework to be adapted to this project. As an additional step, experts in the committee will be consulted first to determine the direction of the project, game idea, and initial design considerations. Stakeholders will then review the prototype for iterative improvements in the development stage rather than the preparation and design stage. The game created in Olszewski and Wolbrink's review involved stakeholder team assembly as the initial step in preparation and design since the game format and design was already decided. However, due to the lack of precedents in serious games for understanding dementia, it will be necessary to explore different ideas and consider feasibility with experts early on. Finally, in the product delivery step, data analysis will be conducted to provide recommendations for future serious game design projects based on end-user play experiences, as stated in the secondary objective.
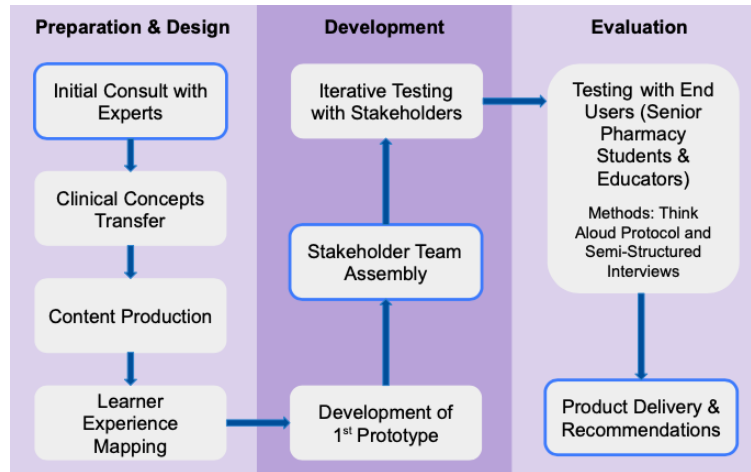
Figure 3.1: Overview of the modified structured framework for serious game development in health education

3.3 Preparation and Design

3.3.1 Initial Consultation with Experts

Clinician and systems design experts will be consulted in informal, open-conversation, online meetings to discuss the direction of the project and tentative game design ideas. Within the format of a story-based game, the goal will be to develop a game that fills in missing gaps in training, that is relevant for a pharmacy student audience, and is feasible given the timeline and resources.

3.3.2 Medical and clinical concepts transfer

Developers involved in making serious games who do not have prior medical or clinical experience would need a crash course in the important clinical concepts in order to create games. The developer and researcher in this project will consult with clinicians and a pharmacy student, shadow a geriatrician, and take relevant courses to gain a better understanding of a pharmacist's role in dementia care and expectations in pharmacy education.

3.3.3 Content production

Based on a sample case, provided by a geriatrician, about a patient who has dementia, containing information about relevant medical conditions, medications, and social history, a map of the story with possible decision-making points and outcomes will be drawn. This map will reflect the possible interactions between the sample patient and pharmacist.

3.3.4 Learner experience mapping

This step involves determining the game functionality, feedback, and scoring. A format or software that does not require extensive technical skills will be selected. The format determines how players will interact with the game and the game objectives.

3.4 Development

3.4.1 Development of the first prototype

After determining the content and format of the game, the first prototype will be developed. The prototype will then be ready for review by each stakeholder group to create improved versions.

3.4.2 Assembling groups of stakeholders

This step involves identifying stakeholders needed for reviewing the content and technical components of the game. Since the game will not require extensive technical skills to develop, the focus of stakeholder involvement is on the content and user experience. Therefore, it will be necessary to consult with clinicians, people with connections to dementia, and game designers. Stakeholders will, respectively, comment on the content, authenticity, and player experience. The following groups of stakeholders will be involved:

- Clinicians: given that the game needs to be relevant to pharmacy education, specifically for senior pharmacy students, clinicians with experience in providing care for people living with dementia, or expertise in pharmacy education can best advise on the content of the game. Their expertise will help to determine the learning objectives, write realistic patient-pharmacist interactions, and identify inaccuracies. They

can also determine if the game is in a state that would be appropriate to move on to being reviewed by other stakeholder groups. Potential stakeholders may include physicians, pharmacists, and pharmacy students.

- People with lived experience of dementia or care partners: since the goal of the game is to help students better understand the perspective of patients living with dementia, the expertise of people with lived experiences will be necessary to ensure that the content is authentic and realistic. Potential stakeholders may include people living with dementia or their care partners and family members.

- Game designers: to ensure that the content is presented in an engaging way and to improve the learning experience, people with experience in game design will review the game to provide feedback. Potential stakeholders may include game designers and researchers with expertise in serious games.

The number of stakeholders involved in any project depends on the project's unique needs and there is no consensus on a specific sample size for serious game development in health education. In similar game development projects involving development of games for health, 5 to 10 total stakeholders from various disciplines may be involved [78, 77]. For interdisciplinary serious game design projects, the involvement of stakeholders with experiences spanning a variety of relevant disciplines, is more important than the number of experts. In this project, the three above areas of expertise are needed. The number of stakeholders that will be involved will be limited by availability since it will likely not be feasible within the timeline of the project to recruit stakeholders until saturation is reached. Within each area of expertise, described above, 2 or more stakeholders will be recruited, for a minimum of 6 stakeholders in total, which falls within the range of 5 to 10 stakeholders from similar projects.

Stakeholders can be contacted through connections in the research team network by email or word of mouth. Information about the project as well as the game will be shared with the stakeholder to review in their own time. Once a meeting time is arranged, interviews will be held online with each individual stakeholder. Due to the informal nature of interviews, the meetings will not be recorded or transcribed, however, with stakeholder permission, feedback will be documented. Changes made to the game will then be shared with the stakeholder, by email or through a second meeting, to determine whether their feedback was implemented as they requested. Details on collecting and analyzing feedback are provided in the following sections.

3.4.3 Stakeholder involvement

The Olszewski and Wolbrink framework suggests regular group meetings with stakeholders throughout the development process. Due to time and feasibility constraints, feedback will be collected individually from each stakeholder at critical points in the development, as illustrated in Figure 3.2.
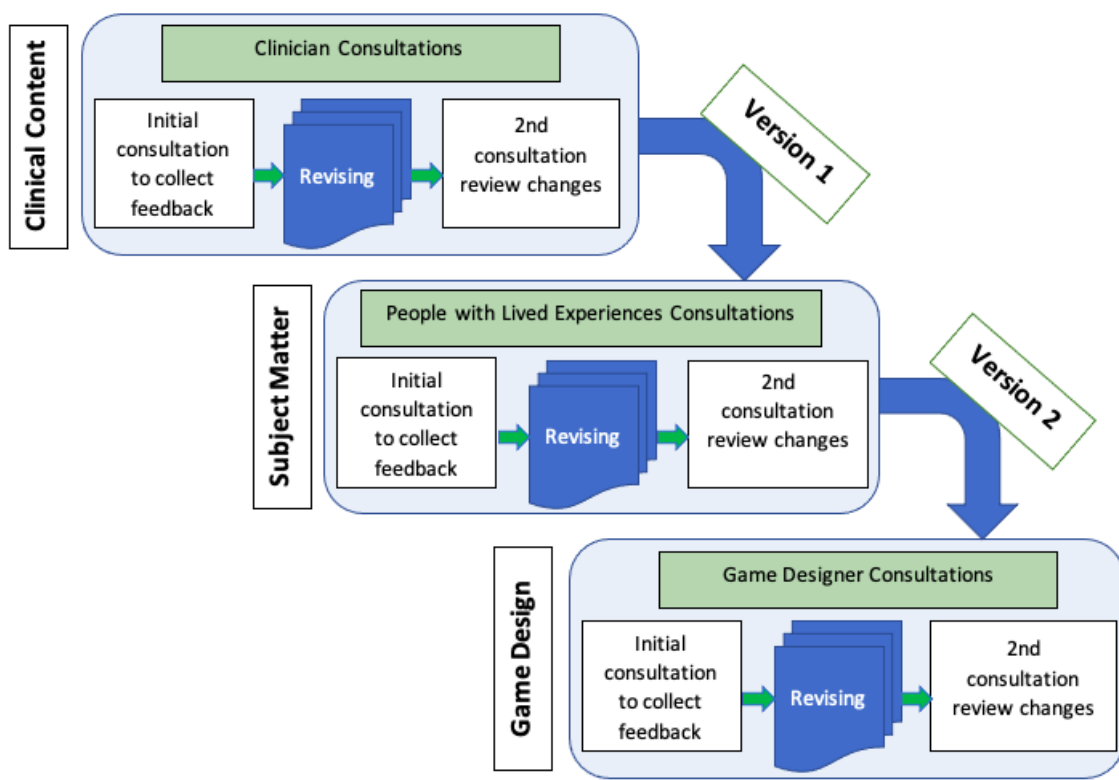
Figure 3.2: Step-wise approach to serious game development with multi-stakeholder input and multiple iterations

Initially, meetings will be held with each stakeholder individually to review the game. Their feedback is collected during this meeting. Their feedback will be implemented to revise the game. Meetings with the same stakeholders will be held again to review the revised version of the game and determine what aspects of their feedback were or were not captured in the changes. This results in one iteration from each stakeholder group. This improved version will then be reviewed by stakeholders with a different area of expertise. The clinician stakeholders will be the first to review the game for clinical content, followed

by people with lived experiences of dementia to refine the story, and lastly game designers who will provide feedback to improve the learning and play experience. The final version of the game will be tested with end users, including senior pharmacy students, and educators in pharmacy or health related disciplines with expertise in dementia.

3.4.4 Knowledge management framework for collecting stakeholder feedback

Knowledge management is defined as "the process of capturing, distributing, and effectively using knowledge" [86]. The knowledge management protocol [87] shown in the figure below will be used to gather feedback from all stakeholders.

Figure 3.3: Knowledge management protocol for gathering and implementing stakeholder feedback

This framework was originally developed for interviewing software industry experts, with questions tailored to their expertise. Therefore, although this project uses the same steps in the protocol, the interviews will be semi-structured, with questions tailored to the stakeholders with expertise in the field of health, dementia, and serious games. To ensure that feedback gathered and implemented in a way that meet's the stakeholder's expectations, improvements in the game will be reviewed again by the same stakeholder.

3.4.5 Stakeholder interview protocol

Based on the earlier initial consultations with experts, core questions and topics of discussion will be chosen for an interview with each stakeholder. Stakeholders review the game prototype or versions through video calls where they will discuss their first impressions and feedback in semi-structured interviews. The semi-structured format allows for stakeholders to express ideas that may not have been covered by the interview questions. Possible topics of discussion with each stakeholder group are outlined below.

Clinician, pharmacist, and pharmacy student

- Different ways to approach the case (ideal decisions, possible mistakes, possible outcomes)

- Relevant learning outcomes

- Patient experiences and possible reactions to decisions

People with lived experience of dementia or care partners

- Impressions on authenticity and clarity of the story

- Challenges that they face as care partners

- How pharmacists or other clinicians can best support them

Game designers

- Impressions on game-play

- Ways to improve the learning experience

- Ways to improve interest and engagement

3.5 Formative Evaluation

3.5.1 Recruitment and data collection

Qualitative description studies use various sampling methods, the most common being purposeful sampling. This is due to the need for understanding the perspectives and

experiences of a particular group that will be most useful to understanding a phenomenon or problem. In this case, the end-users including senior pharmacy students and educators in pharmacy or dementia related courses and training opportunities will be able to provide the most relevant feedback. Although there is no specific recommended number for the sample size, most studies recruit between 6 and 20 participants [88]. Participants will be recruited until data saturation is reached by constant comparison. This means that during data collection, the researcher will determine when the data has become redundant and no more interviews are needed [89]. In a systematic review of qualitative studies that used statistical modeling or empirical data to assess saturation, sample sizes of included studies ranged from 9 to 17 interviews [90]. Interviews will be analyzed continuously during data collection to determine when saturation is reached, signaling the end of recruitment.

Senior pharmacy students, in 3rd or 4th year of their studies, are more likely to have acquired knowledge and experience relating to providing care for patients with dementia and their insight would be valuable in determining the value of educational tools on this topic. Teaching staff in pharmacy or educators who train students, families, and patients on the topic of dementia will be recruited as potential expert end-users. Their experiences and insight will shed light on the value of the game as an educational tool, and its practical value in a classroom or training program setting.

With ethics approval, posters and emails containing information about the nature of the study and details on participation will be shared on pharmacy student Facebook pages and email lists. To recruit educator participants, they will be contacted individually by email through connections within the research network. Following participation in the study, snowball sampling can be used to continue recruitment for students and educators.

If individuals are interested in participating, they will contact the researcher by email to receive the information letter and consent form. Student participants will also receive a basic demographics form to complete where they can report on their gender, age, year of study, and previous experiences relating to dementia. The researcher and student will arrange a suitable time to meet privately in-person for the session which consists of play-testing the game and an interview. For educator participants, the meeting will be held online. This is in anticipation of time and availability constraints of expert participants.

Before starting the session, the researcher will review the risks and benefits and remind the participant that they may withdraw from the study at any point during or after the session by informing the researcher. The participants will also be notified that the entire session will be audio recorded for accurate transcription and analysis.

To understand user experiences, both the think-aloud protocol and semi-structured interview will be used. The think-aloud protocol allows users to comment on their experience

during play, and the interview that follows allows them to further elaborate and reflect on their ideas. The data collected through both methods will be captured continuously within one audio file and will be analyzed as one transcript.

The audio files will be transcribed using otter.ai. Any identifying information will be removed from the transcript, after which the audio and/or video will be deleted. The anonymous transcripts would then be ready for analysis. After the session, regardless of completing the session or withdrawing, participants will receive a thank you letter with contact information of the researcher and supervisor. Student participants will also receive a remuneration as stated in the information letter.

Think-aloud protocol

During the play-testing session, student participants will be asked to think aloud as they play the game to describe their experience, feelings, strategy, and any feedback that may come to mind. The think-aloud protocol is applicable in usability testing of products and commonly used in psychology, education, and games user research [91, 77, 92].

Participants will be encouraged to verbalize their thoughts as they play the game. The researcher plays a role in this structured data acquisition by actively observing the participant and encouraging the verbalization of the process. An interview typically follows the think-aloud process to capture any other thoughts and feedback. Three main steps are taken in administering the think-aloud protocol:

- Clarifying the role of the researcher in the project, purpose of the study, and encouraging the participant to express their honest opinion without fear of offending the researcher

- Explicitly asking participants to think-out-loud prior to beginning the session and giving a few examples of what this may look like

- Reminding and encouraging participants to think-out-loud during the session, since they may forget or believe that there is no thought worth expressing. Open-ended phrases such as 'please keep talking' or 'can you elaborate more?' can be used.

The advantage of this method is that it helps to reveal the thought processes of the learner, as well as to identify technical issues in usability or accessibility. It not only provides a detailed picture of participants' thought processes, but also helps to highlight individual differences in responses [91].

Semi-structured interview protocol

Student and educator participants will be interviewed to understand the play experience and gather further feedback on the game. A list of topics to be discussed in the interview are provided here for each group of participants. The semi-structured nature of the interview will allow for further exploration of ideas and perspectives that may not have been captured by the pre-written interview questions.

Pharmacy student interview question topics

- Previous experiences and current attitudes relating to dementia and games

- Feedback on the play experience

- Changes in understanding of dementia through playing the game

- Implications of using the game in pharmacy education

Educator interview question topics

- Experiences and expertise in pharmacy education or education on dementia

- Feedback on the game (play experience, content, application in different settings)

- Feasibility of providing the game in an educational setting, particularly in pharmacy education

The interview protocol for both student end-users, and pharmacy and dementia educators is provided in Appendix B.

3.5.2   The framework method of analysis

Thematic analytic strategies are recommended for qualitative description [82, 93]. For a more systematic approach, the closely related framework method of analysis will be used. This method allows for similarities and differences to be identified in the data as well as relationships between different parts. Due to its unique method of organization, data can be compared *across* different participants, and *within* individual participants [94, 95, 96, 97]. The following steps will be taken for analyzing data [94]:

- Transcription: audio will be transcribed word for word. Since the content is the primary concern, conventions of dialogue (such as pauses) are not necessary to include. For this project, otter.ai will be used to transcribe interviews, edit transcripts, and to later label the data with codes.

- Familiarization: researchers will take time to listen and read through a few interviews. In this study, two researchers will collaborate in the analysis. They may make reflective notes about first thoughts and impressions. This stage is particularly important when researchers new to the project become involved in the data analysis. During this stage, researchers begin to create the codebook, which is the collection of codes and themes. Prior to reviewing the transcripts, potential codes are at first created deductively, based on the interview guide. Later, when researchers become familiar with the interviews and begin coding, an inductive approach is taken where codes can be revised and new codes can be added for a better representation of the data.

- Coding: researchers will go through the first three transcripts together, line by line, and apply a label or code, pre-existing or newly created, to any ideas that may be relevant. The codebook can be revised and amended collaboratively during this stage. The remainder of transcripts will be coded by the lead researcher and their work will be reviewed by the second researcher. If any changes or additions to the codebook are necessary, the second researcher will be consulted. The codebook may be finalized as late as the coding of the last transcript.

- Developing and applying the working analytical framework: the codebook is reviewed by both researchers so that codes may be categorized into larger themes.

- Charting data into framework matrix: coded quotes are charted in a table with the columns being each code, and the rows being each participant. This way the data can be compared across and within transcripts.

- Interpreting the data: as a clearer picture emerges by looking at the data as a whole, potential themes and connections between ideas are explored and finalized to help answer the research question. The goal here would be to provide recommendations for designing serious games for education on dementia based on the end-user experiences.

Overall, this flexible method allows for a practical way to summarize descriptive, qualitative data, while staying close to the participant's subjective points of view [98]. The matrix organization simplifies pattern recognition and comparison of ideas between participants and within each transcript.

Chapter 4

Findings

This chapter presents results of the serious game development and end-user testing experiences. In the first stage of preparation and design, involvement of stakeholders is described. Next, the development stages outline the process of creating the final version of the game. Finally, qualitative data of end-user testing is presented.

4.1 Preparation and Design

4.1.1 Initial Consultation and Game Design

A choose-your-own adventure (CYOA) game was created to be played from the perspective of a pharmacist interacting with a patient who has dementia. The initial prototype was made using *Twine*, a software for making non-linear stories, through initial consultations with a geriatrician and a systems design engineer. The sample case forming the basis of the story is provided in Appendix A. The design consisted of pages of the story that were linked. Players can click on decision options which would direct them to the next page in the story. Players are provided with feedback on their decisions with a brief text that describes how the patient feels about the situation or the decision made. To keep the game simple and the design feasible, there is no scoring system. Students would aim for the most ideal outcome for the patient as they make decisions. Below, the map of the entire story and a sample page are shown:

As a community pharmacist in Stratford, Ontario, you get to know some of your patients during their visits, many of whom are older adults. Today, Carol is coming by to pick-up a refill of her lorazepam prescription.

Carol is a 73 year old retired CEO of an advertising company. Her husband passed away a few years ago and her children live in B.C. with families of their own. In the past you've spoken with Carol about her Parkinson's medications, fatigue, and pain.

You notice Carol slowly walking up to the counter, using her walker. She pauses along the way a few times. The pharmacy technician mentions that Carol has missed her co-payment for the last two times. However, she paid right away when contacted.

Option 1: Give your full attention to Carol and continue the conversation at the prescription pick-up counter.
Option 2: Greet Carol and invite her to have a seat in your office to discuss medications.

Figure 4.1: Story map and sample page of the CYOA game

4.1.2 Stakeholders

Since this was a multi-disciplinary project, involving pharmacy practice, experience of dementia, and serious game design, multiple stakeholder perspectives were necessary in development. The following stakeholders were recruited through connections in the research team.

- Three clinicians: a geriatrician, a pharmacist, and a pharmacy student helped with creating the content and determining the pertinent learning objectives

- Two people with lived experience of dementia: two older adults who provide care for a family member with dementia helped to refine the content

- Two game designers: two serious game researchers were consulted to provide feedback on the play experience

4.2 Development

4.2.1 Stakeholder feedback

The initial prototype was reviewed by each clinician stakeholder individually through online meetings with a semi-structured interview guide. With their permission, notes were taken to document their feedback, which was then summarized as shown in Table 1. Their feedback was then used to make improvements in the game. The improved version was then reviewed by each clinician again to confirm whether their feedback was implemented as discussed in the meeting. This iteration culminated in the first version of the game.

Next, the first version of the game, now having been reviewed by clinicians, was reviewed individually by people with connections to dementia. Their feedback was documented and used to make improvements in the game. The improvements were then confirmed by each stakeholder. This iteration resulted in the second version of the game.

Finally, with the game having been reviewed by clinicians and individuals with connections to dementia, the second version of the game was then reviewed by two serious games researchers individually. Their feedback was implemented and the improved version was reviewed again by each researcher, which resulted in the final version of the game, ready for end-user testing.

Table 1: Summary of stakeholder feedback, implementation of feedback, and unmet needs

Stakeholder Group	Feedback	Functional Improvement	Unmet Needs
Clinicians	• Chance to explore the scope of pharmacy practice • Need better information seeking • The right choices are too obvious	➔ Added mini-cog dementia assessment ➔ Added to dialogue included open-ended & closed-ended dialogue options ➔ Included challenging choices (realistic vs ideal)	✔ ✔ ✘ Options are multiple choice style (the answer has to be written). Only feasible to include 2 options at every step.
People with connections to dementia	• Elaborate more on patient perspectives • Use sensitive language • Include care partner or family perspectives	➔ Added more patient perspective pages ➔ Provided options with sensitive & insensitive language ➔ Included more about the backstory of patient	✘ More text was included, but did not accurately capture first-person perspective ✔ ✘ More text was included, but did not accurately capture first-person perspective
Game Designers	• Include more meaningful player decisions • Lacking creativity and fun • Include opportunities for recovery after a "wrong" decision	➔ Added more challenging decisions ➔ No room for creativity ➔ Created loops	✘ Due to multiple-choice nature of options, game is not challenging enough ✘ No way to allow students to create their own options ✔

Not all feedback could be implemented due to the limitations of the game format. Check marks show the feedback points that were implemented and the crosses show the feedback points that could not be implemented with a brief explanation of why. For example, options at each decision-making point had to be predetermined rather than allowing students to create options of their own which would have made for a more challenging and realistic

experience. Since people with personal experience of dementia were not involved in the writing of the content, there was risk of the story or character being inauthentic to players. Feedback that could be implemented included adding a mini-cog assessment to enhance relevance to pharmacy, more open-ended and closed-ended dialogue options, which could prompt students to consider their language when interacting with patients, and loops in the story for players to recover from mistakes. The final version was then tested with end-users (senior pharmacy students and educators) for further feedback. The final version of the game is provided in Appendix C.

4.3   Formative Evaluation

Saturation, determined using constant comparison, was reached after 9 interviews with student participants. Two more pharmacy student participants were recruited to confirm that saturation was reached, and recruitment ended after 11 interviews. Of the 11 senior pharmacy students recruited for end-user testing, 6 being in 3rd year and 5 being in their 4th year of studies, 9 identified as women, and 2 as men. Only 3 participants had previous personal or professional experience with dementia. In addition, a pharmacy teaching staff, and a dementia educator were recruited for testing. Upon reading and signing the information and consent form, and filling out a basic demographics survey, the 1 hour session including play-testing and interview were held in person with each individual participant. The teaching staff participant and dementia educator participants participated through an online video call to accommodate their schedules. The sessions were audio recorded and transcribed with identifying information removed for analysis.

4.3.1   Analytical Framework

Upon familiarization with the transcript alongside a second researcher new to the study, possible codes were collaboratively compiled based on the interview guide and from examining responses from three of the transcripts. With the start of coding, revisions to the codebook were made to ensure the codes reflected the data. Coding was completed by the lead researcher and reviewed for accuracy by the second researcher. Through regular meetings throughout the coding process, the codebook was finalized and the codes were grouped together into three major themes: understanding the lived experience of dementia, relevance to pharmacy practice, and game design features. The organization of the codebook is shown in figure 4.2.
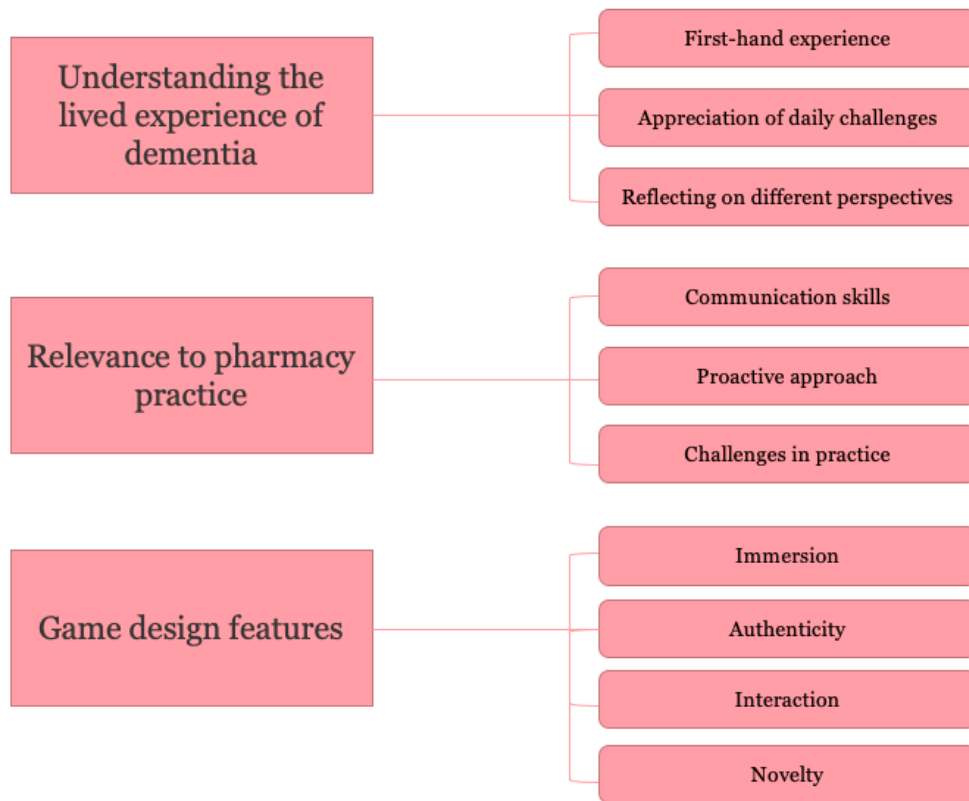
Figure 4.2: Analytical framework including the three major themes and corresponding codes

Once coding was completed, quotes that were tagged by a code were compiled into a spreadsheet matrix for each participant. This allowed for the data to be more accessible and organized for interpretation. The data is described in the next section.

4.3.2 End-User Learning and Play Experience

The CYOA format allowed students to gain some insight into the experience of dementia, was directly related to pharmacy practice, and provided an interactive learning opportunity. Students began to understand some of the challenges of living with dementia, relating to their medications, however, they were not able to relate to the patient character. The relevance to pharmacy practice was a strength of this game, facilitated by the non-linear

narrative format with decision-making opportunities. Exploring the advantages and disadvantages of the game format provided participants with opportunities to express how their learning experience could be enhanced with game features.

Understanding the Lived Experience of Dementia

This section explores how students gained an understanding of life with dementia through the game, as well as what could be improved to further enhance this understanding. Specifically, preferences for first-hand experience, seeing the impact of dementia on activities of daily life, and exploring different perspectives and people affected were expressed as necessary ways to improve this understanding. Although the game did not meet all of these expectations, students were able to use the play experience as a way to express their learning preferences and needs.

First-Hand Experience

To better understand the patient's perspective, students were provided with passages that explained how the patient was feeling about the conversation and the decisions that were made. Although the patient perspective and some of the feelings of living with dementia were presented in the story, students sensed a lack of authenticity which prevented them from relating to the patient character. Students reflected on the patient's feelings and the social context as described here:

> "I think she's probably overwhelmed right now. But I do think she feels glad that it seems like somebody is looking out for her because it doesn't seem like, anybody has assessed these concerns. So I think she would maybe be a little bit hesitant, but she'd be happy to have some support." – P1

Students read about the patient from an omniscient perspective, and had to make some assumptions about what the patient was feeling or experiencing. This did provide students with the opportunity to reflect on the patient perspective, however, the experience was not memorable or new. Moreover, the game did not allow students to themselves experience feelings of confusion, disorientation, frustration, or social withdrawal. Based on the play experience of an educator, more detail is needed to provide students with an opportunity to truly understand how someone living with dementia may feel.

> "I think they're more there. If you're not able to understand how a person is experiencing [dementia], you may not have that kind of sympathy for them. I

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strongly believe that you need to have that empathy, where you can connect with a person in a more relatable way." – Pharmacist clinician and educator

Being able to experience some of feelings of frustration, disorientation, and confusion first hand was noted as the ideal way to gain empathy for the lived experience of dementia. As future pharmacists, students are likely to observe these feelings in patients, or become frustrated and confused themselves at times, however, to gain better insight into the thought processes and daily challenges of people living with dementia, students felt that working through the thought processes first hand would be more valuable. The CYOA format lacked the opportunity to experience these feelings first hand.

Appreciation of Daily Challenges

The game allowed students to reflect on the daily challenges of living with dementia. For instance the impact of living alone and being away from family was explored. However, students were most interested in learning about the challenges related to managing a complex medication regimen; a challenge that they felt more competent in addressing as a pharmacist. All students commented on the number of medications that the patient was managing:

"I think it's a lot of medications for anyone to remember to take - let alone someone with Alzheimer's." – P2

Students then discussed blister packs as a solution and how they would go about making this suggestion to the patient. Overall, students found that reading about the challenges gave them the context needed to take a more holistic approach when addressing the open-ended discussion questions, however, more detail or clearer emphasis on the impact of the challenges was needed for a more impactful play experience.

Reflecting on Different Perspectives

The CYOA format allowed students to consider different possibilities of how the patient may react to their decisions or suggestions. For instance, the student here described potential resistance to the use of blister packs:

"Sometimes when you suggest patients to be put into a blister pack, for example, they think... well, you know, 'you're judging me' or 'you don't think I can remember to take my medications'. But in this case, it's really for her well-being to make sure that she is getting the medications for her conditions." – P7

When approaching each decision point in the game, students considered the different possibilities of how their decision would impact the patient. However, the game did not prompt students to reflect on perspectives other than that of the patient and the pharmacist. For this reason, discussion of the impact of dementia on care partners, family, and friends was missing from student reflections.

Relevance to Pharmacy

Students appreciated the clear relevance of the game to pharmacy practice. The game allowed them to practice communication skills, see the importance of being proactive in their role, and reflect on challenges that they may face in practice. Walking through these skills and thought processes was a valuable part of the experience.

Communication Skills

Through the decision-making process, students were able to see the value of communication that facilitated a holistic approach. After completing the simulation, students who chose options that were more holistic reflected on the value of this approach:

> "I think it's important to take every factor into consideration rather than just like focusing on that one question - or that one drug therapy problem. I think you have to look at the big picture." – P2

By choosing options that included open-ended questions, or an opportunity to further explore a concern that the patient was presenting, students were able to gain more information, better address the patient's concerns, and build trust. Students reflected on the importance of these communication skills, which they hoped to use in their future practice. Students who chose options that were not holistic, decided to go back in the story and try a different route, which they found to be more satisfying in the end.

Proactive Approach to Practice

The game presented some decisions and opportunities that students were not yet familiar or confident in pursuing. For instance, the decision to conduct a mini-cog test with the patient was a dilemma that students faced. Most students were unfamiliar with the assessment or the fact that it is within their scope of practice to conduct it, however, within the context of the game, they were willing to try:

> "I am unaware if there is an assessment to be performed in the pharmacy but if there was, I would choose [to try the assessment in the game]. And then from my assessment, maybe we could refer to physician afterwards." – P7

Being made aware of the assessment and walking through the steps of performing the assessment, resulted in students feeling more confident about performing the assessment in the future:

> "In the context of the game, I would be more willing to explore other options. Just because you have nothing to lose, to have to worry about, like, taking up her time, or tiring her out, or potentially irritating her. I would investigate more for my own learning purposes, in the context of the game." – P10

The game allowed students to explore their scope of practice in a safe setting. Students valued becoming familiar with the mini-cog assessment and its benefits, given that they had no previous experience with it. Students who chose not to complete the assessment decided to go back and try it. They appreciated becoming familiar with the assessment and stated that they felt more comfortable with the possibility of using it in the future.

Challenges in Practice

Since most students had not had an encounter with patients who have dementia, they found that walking through the case in the format of the game was a worthwhile experience, and representative of what they may encounter in practice.

> "I really liked it as a future pharmacist and the patient case has really helped me. Looking through this, it's been nice to think through what I would do in this situation, because I have not been put in this situation before." – P7

Considering different courses of action, dialogue options, and patient reactions helped students to feel more prepared in approaching similar scenarios in the future. Students explained that debating between the ideal versus realistic choice as they played is what made the scenario representative of real world practice. For instance, when choosing between asking an open-ended question versus a quick response question, students discussed how challenging it may be to choose the ideal open-ended route in a busy pharmacy:

> "When you're looking at the options, you know what's the better option, but sometimes, in reality, a lot of people probably don't pick the more comprehensive option, especially in community pharmacy, because they don't have the time or they don't think it's really part of their role." – P11

Students who chose the 'comprehensive options' felt satisfied with their choices, and students who chose the quick response options decided to go back in the story and explore other options. After seeing the consequences of their choices as they progressed in the story, they were able to appreciate the value of taking a more proactive and holistic approach.

Game Design Features

Throughout the play experience, participants commented on how the format of the game influenced their understanding of dementia, relevance to pharmacy practice, and overall engagement. Generally, students favoured an immersive, authentic, and interactive experience to enhance the experiential aspect of learning. The novelty of the game format created some excitement initially that wore off upon familiarization. More interactive opportunities to allow players to make meaningful decisions were also preferred.

Immersion

Students did not feel that the CYOA format was immersive since there were no visuals, and many of the pressures of real life practice were not present (i.e. time pressure, distractions, etc.). The student here described the unrealistic nature of the game:

> "I guess it is a little unrealistic, just because we do have unlimited time. And I have time to think about what's best practice as opposed to what's the most practical or realistic." – P4

Although the game was not completely realistic in that it allowed players to explore different decision paths with unlimited time, students did value the exploration and opportunity for reflection in a safe setting without real life consequences for themselves or the patient. Students suggested adding in challenges or barriers to ideal practices would make the game more realistic. Moreover, being able to immerse oneself in the story (i.e. with visuals or audio) would make the story more representative of real life, as described here:

> "I think in this case - it's a little hard just because I am reading instead of seeing an actual patient, but being able to kind of understand their body language, even as they came in can say a lot about this person." – P6

A visual experience would provide students with a sense of presence that was missing in the story and additional information about the patient character. Reading alone was not telling enough and did not fulfill the expectations of an experiential opportunity.

Novelty

This game format consisted of reading and clicking to select between options. Therefore, it mainly relied on the intrigue of the story and decision paths to be considered an engaging learning experience.

"This feels like a very typical pharmacist perspective encounter, which is something that you kind of do in school as well, when you're walking through scenarios. – P11

While it was practical to present a typical scenario that students may encounter, the story and format lacked intrigue since it was similar to previous case scenarios that students encounter in class. Moreover, the reading format was not engaging to interact with.

Authenticity

Students noted that this was a typical encounter that they would expect in practice and found it helpful to read about the patient's thoughts as they made decisions in the story, however, the descriptions did not feel authentic for students, as shown here:

"I like how you can see [the patient's] inner thoughts..., but it was very - it didn't seem like the most realistic." – P9

Although the descriptions were reasonable and reinforced their decisions within the game, they "felt generic" (P6). The patient perspective passages lacked the detail and nuance needed to make them feel realistic.

Interaction

In the CYOA format, students were able to make meaningful decisions to progress in the story. This interactive feature was appreciated by all students as described here:

"Because I got to pick between two [options], it was very straightforward. I think if every page was free-form, where you can think out loud, there would be so many different options. I would probably sit there thinking, 'well, I don't know what you want me to say, there's a million different answers'. So I liked that the first few [pages] were picking between the two [options]. And then the last [page] when it comes to thinking about options for her ... and coming up with strategies - that being free-form was good." – P3

Having a mix of clearly laid out options at the start and an opportunity to be creative at the last page was appreciated by students. Although students appreciated having options to choose from, they felt that at times their preferred approach or decision was not an option that was available. Having more options available or being able to create one's own course of action would be ideal, however it was not feasible within the format of the game. The last page of the game contained open-ended questions for students to consider, which allowed students to be more creative in their responses.

Chapter 5

Discussion

The goal of this project was to determine what game design factors are necessary to create serious game that can serve as a learning experience about living with dementia for senior pharmacy students. A choose-your-own-adventure (CYOA) serious game was developed with multi-stakeholder feedback. The game involved interacting with a patient who has dementia from a pharmacist's perspective and directing the story with player decisions. The game was then tested with end-users, including 11 senior pharmacy students and 2 pharmacy and dementia educators. With the descriptive qualitative approach, semi-structured interviews and the think aloud protocol were used to understand the end-user play and learning experience, and to develop recommendations for future serious game design projects.

5.1 Participatory Development

Input from stakeholders was necessary due to the multi-disciplinary and specialised nature of the project. Specifically, input on the clinical, subject matter, and game design foundations were needed. Similar studies involving the development of multi-disciplinary game-based interventions gathered feedback and information from stakeholder group meetings early on in the development process, which helped to determined the intervention. Stakeholder feedback helped to form a clearer picture of what the game should achieve and encompass [99]. In another study for the development of a serious game, early stakeholder involvement was facilitated through stakeholder workshops, which was instrumental to the validity and impact of the game [100]. Therefore, as confirmed and recommended by literature, a participatory approach to serious game development involving stakeholders is

necessary to ensure that the intervention is representative of end-user needs, engaging, and efficient in achieving its goal. The importance of the involvement of stakeholders in this thesis project is in agreement with findings in serious game development literature.

Surprisingly, involving end-users is not standard practice in the development of serious games for healthcare education. A systematic review of involvement of end-users in the development of serious games for healthcare professions education found that end-user involvement (i.e. input on goals and aesthetics of the game or prototype testing) was mentioned in 21 out of the 45 included studies. Furthermore, their involvement was poorly described in most studies, making it difficult to draw conclusions about the impact of end-users on the development process [101]. Providing details about characteristics of end-users, methods of collecting their input, and modifications to be made are suggested as ways to improve transparency in serious game development.

In this study, involvement of senior pharmacy students as end-users allowed them to take on quasi-researcher roles in user testing. Given that they have had a few years of experience in their pharmacy education journey and some relevant clinical and personal experiences, they were able to provide feedback with a critical mindset. The feedback of participants with little prior experience was also valuable because they are likely to be the majority of end-users. Participants approached the play-testing session as a chance to make improvements to the educational tools that may be available to them one day. In a way, end-users were treated as stakeholders. The semi-structured interview and think-aloud protocol were suitable for eliciting feedback from this critical point of view since it allowed participants to express their thoughts and feedback, particularly about the limitations of the game, minimizing bias from the researcher's perspective. The senior pharmacy student, pharmacy educator, and dementia educator feedback was compiled. Their input was used to develop recommendations for future serious game design development on the topic of dementia, which is described in the following section.

5.2   Design Recommendations

The research question in this project was: What game features are needed to create a learning experience about dementia through serious games for senior pharmacy students? This question is answered through the recommendations that are provided below, however it is important to note that these recommendations are drawn from and therefore limited to the CYOA game format. While they may potentially be useful for other game formats, more research would be needed to confirm this.

5.2.1 Experiential Learning

Students were highly motivated to participate in the study and learn more about the experience of dementia due to its relevance to their future practice as pharmacists. Their interest partly stemmed from the fact they had little or no previous interactions with patients who have dementia. They viewed games as a prerequisite to real world experience, in preparation for future encounters with patients. This is in accordance with Kolb's description of experiential learning which views it as the essential link between formal education and adult life [102]. Experiential opportunities allow learners to participate and apply their learning and gain exposure to the variability and uncertainty of the real world. Participants in this study were most interested in serious games for the promise of immersive, experiential learning. Two factors were lacking in the game, which could facilitate immersion: 1) Realistic environment, and 2) Authentic storytelling.

Recommendation 1: Realistic Environment

Students found that the game lacked certain aspects of a realistic environment needed to make the experience immersive. For instance, as they read about the patient, they would have also preferred to have a realistic visual. They believed that seeing the patient, in a pharmacy environment, would provide them with valuable information and context. Game or simulation formats that facilitate a realistic environments have been shown to have an advantage. A systematic literature review of virtual reality as pedagogical tools found that virtual reality enhances experiential learning, especially for procedural skills [103]. A realistic environment, whether through virtual reality or through realistic equipment, actors, and visuals, creates believable cues that allow learners to react to planned challenges in a realistic way [104]. The success of virtual reality simulations is due to the realistic and immersive environment created which fosters a sense of presence for players [103]. Although serious game literature in pharmacy education is lacking, in the literature of simulations used for health care education, realism is a necessary factor, a finding that can be applied to serious games as well as demonstrated by student experiences in this project.

For case-based serious games to be developed in the future for pharmacy education, having realistic visuals and audio would be necessary to enhance experiential learning. For this particular CYOA game, illustrations of the scenario in each passage, background audio of a pharmacy setting, and even audio for the dialogue could be provided, which is feasible within the Twine software.

Recommendation 2: Authentic Storytelling

Although the game represented a typical scenario, reading from a simulated patient's perspective felt inauthentic to students due to a lack in detail and nuance. Relying on personal stories and experiences from real patients and families would preserve authenticity in games. In healthcare training, the emotional labour of real, personal stories is often used to promote awareness and understanding in listeners. If portrayed authentically, testimonial listening is an alternative to passive empathy [105]. Authenticity is particularly important since patients are often subject to testimonial injustice, in other words, misrepresentation due to presumptions of cognitive unreliability or emotional instability [106]. A study comparing the design of virtual simulations and serious games in nursing education, elaborates on the place of authenticity and realism in the design of educational interventions [107]. In health care education, authenticity is often associated with the realism of a simulation, in other words, the realism of the environment for learners. Moreover, serious games are not bound by the same constraints of realism and authenticity. The findings of this project showed that students value an authentic story and characters in addition to the realism of the environment. Therefore, although it is not a requirement or commonplace in serious games literature, using personal stories can enhance the authenticity of the content presented in games, which would help to facilitate experiential learning and prevent harmful misrepresentation of patient experiences. To improve the current game, stakeholders with lived experience of dementia should be involved in the development of the game content for more authentic characters and stories.

5.2.2 Problem-Oriented Approach

Providing problem-solving opportunities within games are essential for problem-oriented learners [63]. By solving problems relevant to their future practice students see the relevance and value of the activity. Two factors proved useful in facilitating practice of situated problem-solving: 1) Meaningful decision-making, and 2) Creative freedom.

Recommendation 3: Meaningful Decision-Making

Students appreciated not only gaining a better understanding of living with dementia, but also learning how they could apply their knowledge in practice. The choose-your-own-adventure (CYOA) game provided students with the opportunity to use their knowledge from a pharmacist perspective, which allowed them to practice their soft skills and appreciate the value of being proactive. Connecting the game content to the student's profession

and providing opportunities to reflect on what they can do differently in their future practice cultivates testimonial listening. A study by Matthews and Sunderland where 21 dementia educators and health care professionals with expertise in dementia care were interviewed for insight on teaching health care students about dementia revealed that the powerful emotions that are aroused through digital storytelling are more useful when directed at improving care [105]. In the literature, computer-based simulation training has been shown to be effective in improving clinical reasoning skills in nursing education [108]. This project confirms that students can benefit from the same decision-making opportunities in case-based games in pharmacy education and that learning opportunities would be most useful if they clearly connect learning to application in practice.

To ensure that meaningful decision-making opportunities are provided in this game, more care providers of people living with dementia and pharmacists with experience of caring for patients with dementia should be involved. Their perspectives would be valuable in determining the different ways that pharmacists can apply their knowledge to meaningfully help patients.

Recommendation 4: Creative Freedom

When it came to the number of decisions that students could make or the different ways that they could interact with the game, more creative freedom was appreciated. In the CYOA game, students preferred to have more choices or different dialogue options. In the literature, one of the downsides of simulations is that students feel frustrated by the restrictions in the decisions that they can make and in the inability to create their own decisions [109]. In a study of learning in healthcare simulations, it was determined that simulations cannot be completely predetermined, but rather emerge through interactions of the participant with the context. This creates a more authentic representation of clinical practice [110]. Players therefore need to be given creative freedom within the rules of the game.

Within a non-linear story created in Twine, allowing students to create their own options was not possible. More player autonomy can be granted by providing players with more options to choose from at each decision-making point. Another possibility is using AI which facilitates an adaptive system. Using AI, a co-creative storytelling game where players can develop a story transcript in an emergent way, showed promise in enhancing player creativity [111].

5.2.3 Medium Considerations

One of the main motivators for participating in the study was the anticipation around the use of serious games in education. Students were hopeful about the prospects of a new learning medium suited to their learning style and learning needs. While the CYOA format was intriguing at first, the straightforward nature of the rules and content delivery did not sustain the initial engagement. For an engaging experience, novelty is a necessary factor.

Recommendation 5: Novelty

Novelty, defined as the degree of familiarity, can be an important determinant in student engagement in learning. The "Novelty Space" consists of geographical, psychological, and cognitive dimensions [112]. The effect of novelty was demonstrated in a study involving augmented reality to learn about heart anatomy and music, where participants found AR to be more enjoyable and curiosity-inducing compared to conventional learning tools [113]. Participants in this thesis project had limited or no experience with games used in education, however they were familiar with the concept. The novelty of the CYOA format of the game was intriguing in itself. Another benefit of the CYOA game was that it allowed students to explore and make mistakes, even when they felt that they lacked certain skills or were unfamiliar with the correct course of action, such as administering the mini-cog assessment. Players could also go back and explore a different decision path. Trying new skills, within a new format, made the experience novel and intriguing.

The effect of novelty on learning is not linear since too little novelty results in boredom, and too much novelty can cause anxiety. The "right amount" of novelty, however, can be used to induce curiosity in learners [112]. The novelty effect is a phenomenon where there is an improvement in learning due to interest and motivation toward a new technological medium, which is observed in computer assisted instruction [114]. However, this effect wears off as users become familiar with a product or tool. This project confirmed the finding in literature that the novelty of serious games is expected and contributes to motivation and engagement during the learning experience [114]. Using new technology or an intriguing game premise can enhance the curiosity of learners. However, the game did not provide lasting intrigue since it was similar to previous learning experiences of case-based learning and mainly involved reading passages.

Since the CYOA game consists of a pre-written story, it is difficult to maintain novelty if the game is replayed, unless if different decision paths are explored. One way to encourage this exploration is to assign different conditions before students begin playing (e.g. by noting that the pharmacy is unusually busy today, or that a family member of the patient

has expressed concerns for the patient the day before). Another way to sustain novelty, would be to explore new game formats that allow for a different play experience each time. Games can also be personalized to the student's preferences and knowledge to create an optimally challenging experience.

5.3   Conclusion

Serious games can be suitable vehicles for delivering a learning experience about dementia in pharmacy education. Developing a multi-disciplinary serious game for pharmacy students requires input from multiple stakeholder perspectives. Allowing end-users to take on a quasi-researcher role in play-testing culminates valuable feedback to guide future, related game design projects. Based on the end-user play-testing experiences, the recommendations for creating a serious game about dementia for a pharmacy student audience include: providing a realistic environment, authentic storytelling, incorporating meaningful decision-making, providing players with creative freedom, and using novelty. These appropriateness of recommendations provided in this project are limited to the development of similar games that are case-based, created for a Canadian pharmacy student audience, and on the topic of dementia. Exploring different topics, audiences, and game formats would require following similar processes of rigorous and participatory development and testing.

5.4   Limitations

A limitation of this study is the relatively small sample size of 13 participants, which is common for similar qualitative studies. In the review of end-user involvement in serious game development for healthcare professions education, sample sizes between 12-36 were reported, with qualitative studies being on the smaller end [101]. While the sample size is smaller, qualitative methods allow for deeper insight into user experiences. Saturation was reached with the pharmacy student end-user participants after 9 interviews, and 2 more interviews were conducted to confirm this. However, only 2 educator end-users were recruited, which was not enough to reach saturation. Therefore, more educator participants would be needed in the future to ensure that the conclusions drawn are in accordance with their perspectives.

Another limitation of this study is that there were few participants with prior experience with dementia. More stakeholders, and student participants with prior experience or exposure to dementia would be needed to ensure that the results are externally valid

and can be applied to the development of other games on the topic of dementia. In addition, recruiting pharmacy students from different schools of pharmacy across Canada could reveal differences in training needs regarding dementia. It is possible that with different participant groups with varying levels of experience with dementia, different recommendations for game design may come into light. Next steps would be involving people living with dementia in the development of the game as stakeholders, and testing the game with participant groups of varying levels of experience with dementia.

Overall, given the small sample size of stakeholders and student participants, and that only one game was developed, the conclusions and recommendations are limited to the audience, topic, and game format that was tested. These conclusions are applicable to a serious game about understanding dementia for Canadian pharmacy students, in the CYOA format. Further research would be needed with different game formats, topics, or audiences. Furthermore, in this project, conclusions cannot be drawn on the impact of the game on student learning, attitudes, empathy, and clinical reasoning. More testing, over a longer duration, and larger sample sizes would be needed to assess impact.

5.5   Future Directions

Future avenues would be revising and re-evaluating the CYOA game with the above recommendations, or considering different serious game mediums and formats. For instance, trying immersive VR simulations or strategy games. The current recommendations can be considered, however, more testing would be needed to ensure that these recommendations are useful for different game formats. The same rigorous process of serious game development and testing would be needed for a game that has a different topic, audience, or format. The effectiveness and impact of games can be measured with quantitative, in addition to qualitative methods, and with a larger sample size. Particularly, measuring pre and post play-testing knowledge of dementia, empathy and attitudes towards people living with dementia, and user satisfaction can provide more conclusive results on the effectiveness and usefulness of serious games for pharmacy education on the topic of dementia.

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APPENDICES

Appendix A

Game Design Materials

A.1 Sample Case

The following sample case was provided by a geriatrician to aid in the story writing for the game:

Carol is a 72-year-old women. She was widowed 2 years ago when her husband died from prostate cancer. They used to come into the shop together. She has 2 adult children who reside in British Columbia and 7 grandchildren. She talks about them, but you have not met them. She is a retired CEO of an advertising company. She has been an active volunteer playing piano at the local nursing home on Wednesdays and used to enjoy playing pickle ball and has a large vegetable garden. She is looking forward to travelling to BC to visit her children in the fall.

She was diagnosed with Parkinson's disease when she developed a resting tremor in her right hand 7 years ago. Her balance seems impaired. She is a bit slow and wobbly. She holds on tightly to her shopping cart and needs help getting Tylenol from the lower shelf. Occasionally she seems to freeze when walking. Lately she reports feeling weak when coming into the store to get her prescriptions. She purchased a rollator walker from your store 2 years ago.

She still drives her car, but your tech commented that she is driving slowly. She parks in your accessible parking space. She was late last month with paying her copayment bill. She paid it right away when contacted.

She also has hypertension, urinary incontinence, constipation, glaucoma, sleep apnea and REM sleep behavior disorder. Her medications are fesoterodine 4mg daily, levodopa

2 tabs QID, domperidone 10mg TID, lorazepam 0.5mg nightly, ramipril 10mg daily and metoprolol 50mg PO BID, PEG 17g daily, timolol drops 0.25

When she comes into today your EMR flags that she is 10 days late with her levodopa prescription pick up. You notice this has happened a few times this year and you decide to approach her about this.

Appendix B

Interview Guide for End-User Participants

B.1 Senior Pharmacy Students

Previous Experiences

- What motivated you to participate in the study?

- What are your previous experiences related to dementia?

- What are the best ways to learn about dementia? What would prepare you well?

- What are your previous experiences with games used for education?

Play and Learning Experience

- What are your first impressions of the game?

- What are the strengths of this game? What are the weaknesses?

- How did you approach the game? What was your strategy?

- If you were to play the game again, how may your approach change?

- How has your understanding of dementia changed, if at all?

- What was the most challenging part of the game, and what was the easiest?

- How may your learning affect your approach to practice in the future?

- How engaging was the game play? What would improve your experience?

Final Thoughts

- What criteria would you use to evaluate the game?

- What are your thoughts on games being used in pharmacy education about dementia?

- Please provide any remaining feedback or suggestions for improvement.

B.2 Pharmacy and Dementia Educators

Teaching Experiences

- Tell me about your teaching or training experiences related to dementia.

- What tools have you found to be helpful in this teaching?

- What are your thoughts on games as tools for this teaching?

- What criteria would you use to evaluate these games or tools?

Perspective on the game

- What are your thoughts and first impressions on the game?

- What audience would this game be suitable for?

- What are the strengths of this game? What are the weaknesses?

- If you were to change anything about the game what would it be?

- What is the value of this game as a tool to help students better understand dementia?

- What is the value of this game as a tool for pharmacy education?

- How can the game be made more relevant and useful for pharmacy education?

Final Thoughts

- What are your thoughts on games used for understanding dementia?

- Have your criteria for evaluating the games changed?

- Please provide any remaining feedback or suggestions for improvement.

Appendix C

Game Content

The passages are linked as shown in the figure below and are numbered from 1 to 16.
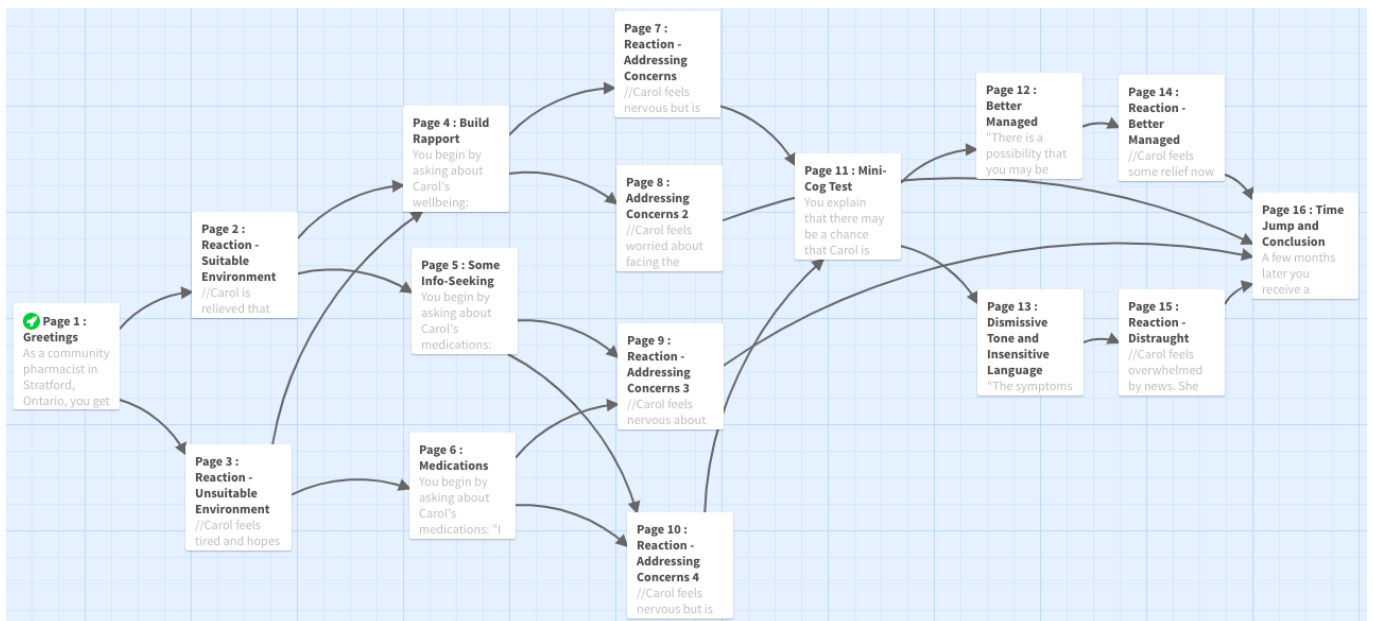

Figure C.1: Story Map and Linkages

The text on each page is provided below.

C.0.1 Page 1

As a community pharmacist in Stratford, Ontario, you get to know some of your patients during their visits, many of whom are older adults. Today, Carol is coming by to pick up a refill of her prescription.

Carol is a 73 year old retired CEO of an advertising company. Her husband passed away a few years ago and her children live in B.C. with families of their own. In the past you've spoken with Carol about her Parkinson's medications, fatigue, and pain.

You notice Carol slowly walking up to the counter, using her walker. She pauses along the way a few times. The pharmacy technician mentions that Carol has missed her co-payment for the last two times. However, she paid right away when contacted.

Option 1: Give your full attention to Carol and continue the conversation at the prescription pick-up counter. Option 2: Greet Carol and invite her to have a seat in your office to discuss medications.

C.0.2 Page 2

Carol is relieved that you asked her to have a seat in a quieter and more private place, and she could use some rest. She feels more comfortable and cared for. Carol wouldn't mind staying a bit longer to discuss medications and other concerns on her mind.

Option 1: Ask if Carol has any concerns or questions about her medications. Option 2: Ask about Carol's well being.

C.0.3 Page 3

Carol feels tired and hopes to get the refill and get home soon. She feels less inclined to talk, but she will stay as long as necessary. She feels irritated by the busy surroundings.

Option 1: Ask about Carol's well being after inviting her to have a seat in your office. Option 2: Inquire about Carol's questions and concerns about her medications.

C.0.4 Page 4

You begin by asking about Carol's well being: "How have you been doing, Carol?"

"I'm getting by. I'm having some trouble walking and gardening has been difficult with the colder weather. Sometimes I'm going about my day when I feel like I can't move. I feel stuck in place, but it goes away quickly, in a few seconds. For the pain, I take some Tylenol... But I still volunteer at the senior home every week, playing the piano. I've always enjoyed that. I suppose I've been a bit worried about the forgetfulness recently. I apologize again for forgetting the co-payment last time.

"No problem, it's all sorted now. Can you tell me more about the forgetfulness?"

"It's been a bit frustrating. I'm preparing for my trip to B.C. to visit my daughters and I keep reminding myself to pack some things but then forget where I've put them. Some days feel foggy so I avoid talking to people... sometimes I just feel frustrated and I'm not sure why. That's all that comes to mind."

Option 1: Discuss the possibility of dementia and ask if Carol would be willing to try a brief assessment. Option 2: Discuss the possibility of dementia and recommend that Carol speaks with her family physician about this.

C.0.5 Page 5

You begin by asking about Carol's medications: "What questions do you have about your medications today?"

"I'm taking them as I should but I'm not sure if they are working for me. I've been feeling tired and forgetful recently."

"Tell me more about the forgetfulness."

"It's been a bit frustrating. I'm preparing for my trip to B.C. to visit my daughters and I keep reminding myself to pack some things but then forget where I've put them."

Option 1: Discuss the possibility of dementia and ask if Carol would be willing to try a brief assessment. Option 2: Discuss the possibility of dementia and recommend that Carol speaks with her family physician about this.

C.0.6 Page 6

You begin by asking about Carol's medications: "I see that you are picking up your sleeping pill medications today. What concerns do you have about this medication?"

"I've been feeling more tired and forgetful recently and I'm not sure if it's because of the pills or something else."

"Tell me more about the forgetfulness."

"It's been a bit frustrating. I'm preparing for my trip to B.C. to visit my daughters and I keep reminding myself to pack some things but then forget where I've put them."

Option 1: Ask Carol to have a seat in your office for a brief assessment to explore the possibility of dementia. Option 2: Discuss the possibility of dementia and recommend that Carol speaks with her family physician about her medications and symptoms.

C.0.7   Page 7

Carol feels nervous but is happy to try something that could help her understand her situation better. She appreciates that you are listening to her concerns. She feels that she is in good hands.

Click here to continue with the assessment.

C.0.8   Page 8

Carol feels worried about facing the possibility of a dementia diagnosis. She will speak with her family physician before leaving for her trip to B.C.

Carol expresses no other concerns for today and leaves. Click here to continue.

C.0.9   Page 9

Carol feels nervous about pursuing the issue and is worried that it may be more serious than she had hoped. She decides to speak with her family physician about it after her trip to B.C.

Carol expresses no other concerns for today and leaves. Click here to continue.

C.0.10   Page 10

Carol feels nervous but is willing to try the assessment.

Click here to continue with the assessment.

C.0.11   Page 11

You explain that there may be a chance that Carol is experiencing forgetfulness, a form of cognitive impairment, or dementia. The assessment is only two questions and completing it can help to bring the family physician into the conversation sooner. Carol agrees to try the assessment.

"I am going to say three words and I'd like you to repeat them back to me. I will later ask you to repeat the words again. The words are: plant, table, glasses." Carol repeats the words. "Now I'd like you to draw a clock that reads 10 past 11."

Carol takes about a minute to draw the clock above.

"Thank you. Could you repeat back to me the three words that I mentioned earlier?"

"Oh, let's see... you said plant, chair, ... I can't remember the third one. I think it was pencil."

Option 1: Encourage Carol to speak with her family physician about her dementia diagnosis when she is ready. Option 2: Encourage Carol to speak with her family physician as soon as possible about the possibility of dementia.

C.0.12   Page 12

"There is a possibility that you may be experiencing dementia. It would be best to speak with your doctor as soon as possible so that he can provide you with more clarity and ways to improve your well being. If you'd like, I can help with this by contacting your family physician about your concerns."

"This is good to know. Thank you with your help so far. I would appreciate it if you helped with contacting my doctor. I want to make sure that I get an appointment before I leave for my trip."

Click here to see how Carol is feeling.

C.0.13   Page 13

"The symptoms you've described and your assessment indicate that you may be suffering from dementia or cognitive impairment and it would be best if you speak with your family physician about this. It may be nothing at all. I forget things all the time. But to be safe,

Figure C.2: Clock Drawing

it would be better to speak about these concerns with a physician. Let's talk about how we can make safer choices when it comes to travelling or other activities."

"Thank for your help. I will talk to my doctor about this once I get a chance."

"No problem."

Click here to see how Carol is feeling.

C.0.14   Page 14

Carol feels some relief now that she has a better understanding of why she is experiencing the fog and frustration. She will call the doctor's office when she gets home.

Click here to continue.

C.0.15   Page 15

Carol feels overwhelmed by news. She will wait a few more weeks, perhaps after her trip to B.C. to speak with a doctor. She has too many things to worry about at the moment.

Click here to continue.

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A few months later you receive a donepezil prescription for Carol.

Carol also has hypertension, urinary incontinence, constipation, glaucoma, sleep apnea and REM sleep behavior disorder. Her medication history includes fesoteridine 4mg daily, levodopa 2 tabs QID, domperidone 10mg TID, lorazepam 0.5mg nightly, ramipril 10mg daily and metoprolol 50mg PO BID, PEG 17g daily, and timolol drops 0.25% 1 drop in the left eye daily.

Looking at her profile, how may her other medications impact her well being knowing that she has been diagnosed with Alzheimer's disease? What suggestions would you make to Carol the next time that you speak to her to improve her well being? How would Carol feel about this?