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Digital Game Design for Older Adults: A Conceptual Framework

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ABSTRACT

The digital revolution, particularly digital games, can potentially improve older adults' lives. However, the commercialised digital games on the market are not designed specifically to help this demographic cope with the adverse effects of ageing. There are no specific guidelines or frameworks that consider the andragogy principles. We aimed to address our research question: How can older adults' game experience influence design consideration? and discusses a framework that could aid the design and development of digital games focusing on older adults and their gaming experience. Mixed-method approach is used in this study, consisting of four stages in the research design. This article introduces and discusses the purpose, design, play and experience (PDPE) framework which has informed the development of a game prototype that was used to validate the framework by investigating older adults' experiences.

Keywords:

Andragogy; digital games; older adults; mixed-method approach; framework

1. Introduction

Digital technologies contribute towards the quality of life, and they are becoming more pervasive in our day-to-day lives. The world is becoming more digital and interconnecting and its population is ageing. One billion older adults over 60 worldwide will double to two billion in the next three decades from World Health Organization [1] emphasising the need to create accessible, inclusive and age-friendly digital environments and communities [2].

This article argues that digital games as part of digital technologies have the potential to improve the lives of older adults. Digital games are first and foremost widely known for their entertainment values. Apart from enjoyment, there are numerous benefits to playing digital games, which include physical and cognitive improvement, socialisation and the ability to learn through play [3].

The values of digital games should not only be limited to younger audiences. Introducing older adults to interact and experience digital games is a critical process. Most games, however, do not fully consider the needs and interests of older adults in their design [4]. Most of the methodologies or frameworks for designing and developing games have not considered the challenges faced by older

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adults. Older adults are at risk of experiencing adverse ageing effects such as declining cognitive and physical abilities. There is a scarcity of study correlating the attributes of game technology and the consideration such as andragogical perspectives and focusing on how adults might engage with instruments that could be beneficial for their overall well-being. Understanding how adults engage with the learning process helps provide insights into how they could effectively engage with technologies such as digital games for producing serious and beneficial outcomes other than solely for entertainment.

The advancement of technology has provided many benefits to people, including older adults. Zhang and Kaufman [5] have noted that digital games have been employed as a means of psychosocial, cognitive, and neuropsychological rehabilitation in the elderly population since the early 1980s. Digital games have also been reported to boost older adults' fitness by combining enhanced motivation, gameplay, fun and rhythm, and training, encouraging them to improve their health [6].

Older adults often face challenges when engaging with digital game technologies. The psychological strain and worry that they would be unable to properly use technology are believed to be the main reasons why older adults find it difficult to adopt new technology and reject utilising it [7]. Some of them, mostly from marginalised parts of society and geography, are illiterate and lack basic digital literacy, such as knowing how to use digital devices effectively [8].

There is a need to understand the perspective of older adults, which could help inform means for onboarding them into engaging with digital games. Andragogy, which is related to the adults learning process, as the art and science of helping adults learn, could inform how digital games could be empathically designed to respond to the needs of this population [9, 10]. According to Malliarakis *et al.,* [11], adopting the principles of andragogy in education, especially for educational digital games can offer substance to the learning process through active experimentation. Six andragogical perspectives can be adopted to design an effective framework focusing on older adults.

A mobile platform such as smartphones and tablets are popular among older adults compared to other digital devices [12]. The size and interface of the mobile devices are easy to navigate and can be used anywhere without dependent on an electrical supply.

This article presents a research study that seeks to investigate user interaction and experience pertaining to digital games on mobile platforms, with a specific focus on the older adult population aged 55 to 75 years. The overarching question is 'How can older adults' game experience influence design consideration'. The proposed framework in this study will serve as a guideline for designing and developing digital games for older adults.

2. Research Conceptual Framework

2.1 Definition

According to Ravitch and Riggan [13], conceptual frameworks may be characterised as a persuasive rationale for the significance of the chosen research issue and the appropriateness and rigor of the suggested research methods. Researchers who conceptualise and conduct research studies can benefit from conceptual frameworks. Conceptual frameworks assist researchers in developing research questions, research designs, data collection, data analysis and discussion as part of the research process. In general, the framework serves as guidance to create and produce research. As a result, in this study, constructing a framework requires collecting data from all sources relevant to the research framework. The methodology employed in this study is discussed in the following section.

2.2 Methodology

We adapted the methodology in this study from Jali [14]. The methodology comprised of four stages, adopting a mixed-method approach (Figure 1). The first stage of this study consisted of an intensive literature review. The technique used in this stage is keyword search.

A preliminary study was conducted with older adults aged 55 years and above in Stage 2, using an online survey and informal interview techniques. The survey's objectives were to gather demographic data, technology usage, gaming experience, game usability, challenges and recommendations. The game experience questionnaire (GEQ) from IJsselsteijn *et al.,* [15] and system usability scale (SUS) from McLellan *et al.,* [16] were adopted to assess the respondents' gaming experience and the usability of the game they played. An informal interview session was conducted with adults who had played digital games. Data from Stages 1 and 2 are analysed and utilised to construct the proposed design framework.

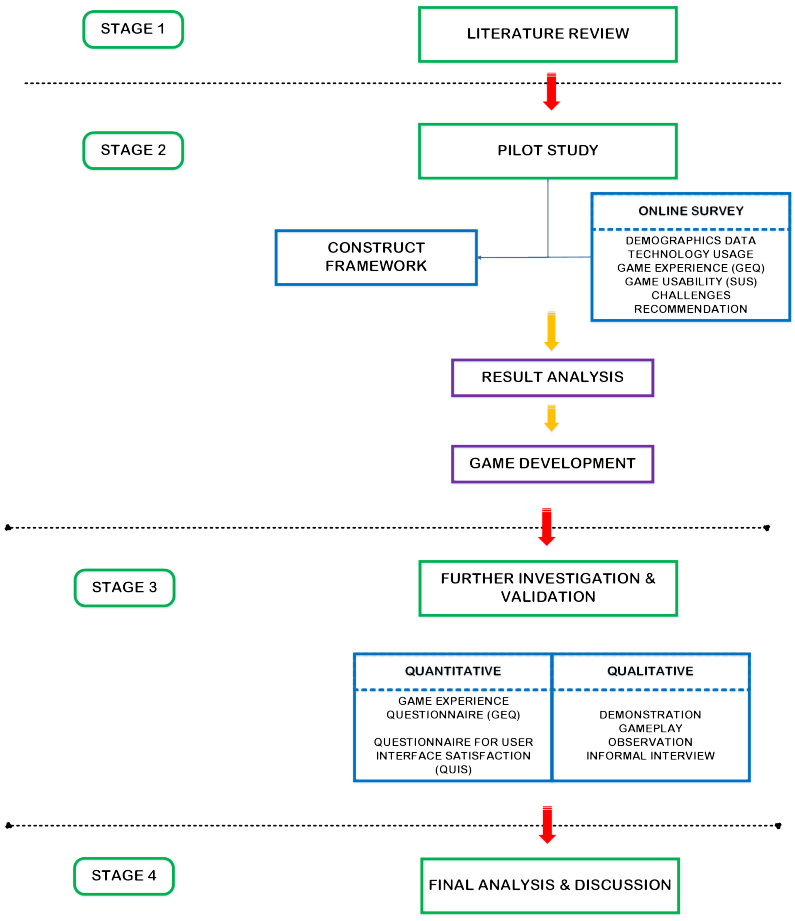

Fig. 1. Research design

A game was developed in Stage 2 using the guidelines in the proposed framework. Further investigation and validation were conducted in Stage 3, where the game was tested with older adults. The method is shown in Figure 2.

Fig. 2. Further investigation and validation techniques

2.3 Designing and Developing Digital Game for Older Adults Framework

The purpose, design, play and experience (PDPE) framework depicts and divides into four elements (see Figure 3), each representing a distinct but significant game element: purpose, design, play, and experience. This framework works iteratively, starting from purpose to experience. All elements are framed together. It includes learning and andragogy principles in combination with gaming requirements. The framework is intended to be a guideline for designing and developing digital games for older adults.

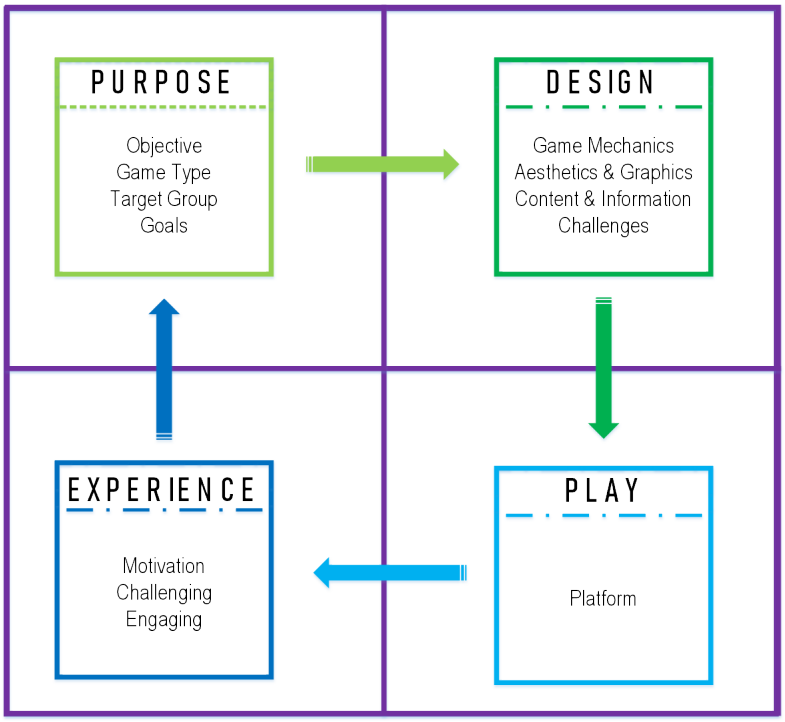

Fig. 3. The purpose, design, play and experience (PDPE) framework

2.3.1 Purpose

The first element in this framework is purpose. Designing a purposeful game starts with investigating the purpose of the game and how it can impact the player [17]. There are four elements that the game designer should define before starting to design a game. These elements are the objectives, type of game, target groups and game goals.

Game designers need to define their objectives before designing a game for their target group. The objectives should relate to the learning outcome that they want the player to experience during the gameplay session. Concerning games targeted at older adults, game designers should design games capable of dealing with the negative effects of ageing (i.e.: the decline in cognitive or physical ability). Therefore, developers need to address the needs of their target group [18]. Knowing the target group before designing a game helps ensure the players have a good gaming experience without being distracted from the challenges during the gameplay session.

The enjoyment factor is one of the crucial factors that need to be considered while designing and developing games for older adults. One of the motivations for older adults to play digital games is to relieve stress [19]. As a result, one of the goals of designing games is to develop a game with emotional benefits.

2.3.2 Design

The design element is the crucial element in this framework. Many game designs and attributes need to be considered in designing games for older adults to ensure the players have a positive gaming experience. Four game designs and attributes are highlighted in this framework: game mechanics, aesthetics and graphics, content and information, and challenges. The following section will go into greater detail about each of these aspects.

2.3.2.1 Game mechanics

Game mechanics or game value is essential in ensuring the game's success. Therefore, it needs to be designed with crucial consideration as it affects game balance [20]. Thus, game designers must carefully consider three aspects of game mechanics, including the game goals, procedure and rules.

Game goals refer to the meaningful experience for players to experience throughout the gameplay session. Game designers need to define their purpose in the first element of this framework. The experience varies according to the type of games played by the players. Regarding games for older adults, they are more familiar with puzzle games as they could correspond to their offline activity [4]. A puzzle game's procedure and rules are easy to grasp, requiring less effort for older adults to understand and learn the game mechanics. According to Wang *et al.,* [4], manageable goals and operations with simple instruction can entice older adults to play the game. Apart from that, game instructions and technical jargon should be clarified [21].

Game rules and procedures depend on the type of game selected by the game designers. Game designers should avoid designing excessive game procedures that require physical activity from the players.

2.3.2.2 Aesthetics and graphics

Aesthetics and graphics refer to sensation, which the user experiences depending on when playing games. The central problem of this research is that some commercialised games are not designed specifically for older adults. In addition, some older adults lack computer literacy and may experience a cognitive and physical decline. Therefore, to reduce the challenges and enable older adults to interact with and experience digital games, it is essential for game designers to consider the challenges.

The game interface is the first thing the player sees. Therefore, a game interface designed for older adults must be simple and easy to understand. In addition, to entice older adults with hearing or vision impairments to play the game, the games should allow the players to control the colour, font, and audio-visual elements.

The sound and music selection in the game are important factors in game design. The excessive sound effects can distract older adults during gameplay sessions [22]. Razak *et al.,* [19] discovered that older adults preferred to play games in silence and with the game sound muted.

Apart from that, game designers should also avoid using small fonts in the games. The implication of utilising small fonts in games will make players unable to view the game's contents and information. Additionally, game designers should reduce the number of graphics elements to avoid distracting older adults during gameplay sessions [23]. Finally, game designers should avoid putting too many superfluous graphics onto a single interface.

2.3.2.3 Content and information

Game designers have wanted players to learn and experience the narrative, that it, the content and information, throughout their gameplay. Therefore, the game's content is crucial in attracting older adults to play games. According to andragogical perspectives, older adults will only use and learn something new if it provides them with benefits and relevance to their daily lives [10].

The game content should be straightforward, not too complex for older adults to let players feel the game experience and be satisfied. According to Wang *et al.,* [4], a game with relevant themes can attract older adults to play it. Moreover, Santos *et al.,* [24] stated that choosing the game's theme and visual style is important to ensure that older adults understand the rules and goals during gameplay sessions.

Apart from that, the content and information in the game should contain less text [25]. Additionally, it is vital to embed fantasy and curiosity elements which can be one learning element in the game [26]. Finally, game designers must avoid including advertisements so that older adults are not irritated during gameplay sessions due to an accidental click.

2.3.2.4 Challenges

The importance of challenges in encouraging players to play the game regularly cannot be overstated. Neto *et al.,* [27] revealed that healthy older adults would become demotivated during gameplay if the game was not challenging. Therefore, game designers should design games with different challenges. Merilampi *et al.,* [28] asserted that the game must be a simple design to ensure it is suitable for different players (i.e., age, cognitive ability, physical ability). They advised that the game's first level, Level 1, should be easy enough for players with cognitive disabilities to participate. The rationale of providing game challenges is to encourage older adults to play again [23]. Aside from that, the game's increasing difficulty might help keep players' attention throughout the gameplay session and reduce boredom [29]. A player immersed during a gameplay session is more focused on solving the problems and achieving the game's goal. The game designer needs to avoid designing a game with too fast pace and timer in terms of game pace. The rationale for avoiding these two elements is to prevent older adults from feeling pressure during gameplay sessions and resulting in a loss of enjoying the gaming experiences [12].

2.3.3 Play

The third element in the framework is play, which refers to the platform used to allow older adults to interact and experience digital games. Motor decline is one of the negative ageing impacts. Older adults who are affected by it may have difficulties using a mouse and keyboard [30]. Therefore, it is essential to choose the right platform to ensure older adults are comfortable and enjoy the gaming experience. Jali and Arnab [10] stated that consoles and tablets have advantages and disadvantages as game platforms. However, according to Duplàa *et al.,* [31], tablets are better suited for older adults due to their simpler interface. Oppl and Stary [32] supported Duplàa *et al.*,'s [31] claim, stating that older adults had a positive experience playing digital games on a tablet platform when tablet devices are more convenient and less expensive than console platforms. Older adults with physical disabilities such as poor body balance should play digital games on console platforms, particularly those that use Kinect technology, as it requires physical activity.

2.3.4 Experience

The last element in the proposed framework is the players' experience. To ensure the success of digital games, players must feel motivated, challenged, and engaged during gameplay sessions. Therefore, in this framework, we proposed demonstrating the digital game to the target group, allowing them to play and experience the games during gameplay, and evaluating the digital game to determine the level of experience during gameplay sessions.

The gameplay session is to expose older adults to digital games designed for their demographic. According to the andragogy principles, older adults must experience digital games to learn about digital technology, especially digital games. Furthermore, gameplay sessions can assist in recognising players' satisfaction towards the game based on their playing experience [19].

This element has three sub-elements including motivation, challenging, and engaging. One of the goals of designing games for older adults is to relieve their stress. Therefore, game designers need to address players' gaming experience and the challenges they experience during gameplay sessions.

In this framework, we suggested using game experience questionnaire (GEQ) and questionnaire for user interaction satisfaction (QUIS) to measure player experience and game usability among older adults. The evaluation element in this framework's purpose is to ensure the developed game meets the game goal. As a result, we have demonstrated and proven the effectiveness of the constructed framework. In our study findings, a reliability test was conducted to test the internal consistency of GEQ and QUIS, where both values are accepted with Cronbach's alpha value of 0.878 for GEQ and 0.962 for QUIS.

2.3.5 Framing

Co-design allows game designers to actively engage older adults as users during the design process [33]. During the co-design process, game designers showed the ability to comprehend and address the needs of older adults during gameplay experience. The design process must be iterative and constant to ensure that the game is well-suited for older adults.

All of the elements in the proposed framework are framed by one another. The rationale for framing all elements in the proposed framework is to assure the framework's success and effectiveness. According to Mitgutsch and Alvarado [17], players' literacy can influence their gaming experience.

3. Discussion

The PDPE framework is constructed as a guideline for designing and developing digital games for older adults. Older adults learn differently, so we need to think carefully and use different approaches to ensure they utilise the learning materials. In this study, we focus on using digital games to help older adults get comfortable with technology. However, to understand the needs and perspectives of older adults, it is important to use different approaches and consider the andragogical perspectives. In order to understand what older adults need, the process to construct PDPE framework is by adopting a mixed-method approach, consisted of qualitative and quantitative. It is important to combine these two approaches while designing for older adults. This helps us get a full picture of what they like and what works best for them. There are four major elements in the PDPE framework: purpose, design, play and experience. The most important that needs to be highlighted during the process of designing and developing digital games is the design quadrant. This means we have to think carefully about how the games look and work. However, there is a limitation in our

study. One thing to note is that the result from Stage 3 of the research design is not discussed, where a mobile game application named *Otak Me!* is developed based on the guidelines in the PDPE framework. The application is developed as a tool to evaluate the effectiveness of the PDPE framework.

In a nutshell, the PDPE framework is a guide for creating digital games for older adults, with a focus on good design. We used different methods to understand what older adults need, and we developed a mobile game application to test our framework. A further discussion on the results will be discussed in the next research paper.

4. Conclusions

The purpose, design, play, and experience (PDPE) framework show the guidelines to design and develop digital games specifically for older adults using andragogical perspectives. Every component in the framework has its role in ensuring that the process of designing and developing digital games for older adults is successful. The outcome of this research is a framework for designing and developing digital games for older adults, which consisted of four main attributes in the design element. The crucial process to design and develop digital games targeting for older adults is emphasised in the *design* quadrant, which consisted of game mechanics, aesthetics and graphics, content and information, and challenges. Therefore, we suggest game designers consider each component in the quadrant of this framework when designing an effective digital game specifically for older adults. Furthermore, this concept paper described how the PDPE framework can be used to design and develop digital games for older adults. The next phase will be the development and testing phases of the proposed digital game. These phases will be thoroughly addressed in our future endeavors, aligning the components delineated in this paper with our ongoing research. It is envisaged that this proposed digital game serves not only as entertainment but also offers benefits such as physical and cognitive improvement, socialisation, and learning through play, especially for older adults.

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