Exploring the Adaptability of Older Adults to Virtual Reality (VR) Through Experiential Teaching Courses

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The Asian Conference on Arts & Humanities 2024
Official Conference Proceedings

Abstract
As the global population of older adults continues to grow, the use of technology products by older adults has become a trend. Virtual Reality (VR) technology, as an innovative tool for learning and entertainment, may present certain challenges for older adults. The purpose of this study is to explore the adaptability of older adults in operating VR games, including the problems encountered in operation, the level of understanding of game mechanics, and the experience of wearing the device. Through the design of a VR experiential teaching courses for older adults, which breaks down game movements and uses props for practice, this study aims to help older adults become more familiar with and accepting of VR, thereby enhancing their interest and enjoyment in VR. This research employs methods such as literature review, participant background surveys, observation method, post-course group interviews, and community manager interviews to gain an in-depth understanding of older adults' specific experiences with VR in the course. The findings of this study reveal the adaptability issues older adults face when using VR for gaming and propose suitable VR teaching courses designs and teaching methods for older adults, with the goal of promoting their learning and acceptance of new technologies.

Keywords: Older Adults, Virtual Reality, Teaching Courses

Introduction

With advancements in medical care and public health, human life expectancy has significantly increased. According to the United Nations, the global population of older adults is projected to reach 1.6 billion by 2050 (United Nations, Department of Economic and Social Affairs, Population Division, 2022). As the aging population accelerates, society will face numerous challenges such as labor shortages, healthcare, long-term care, and social security. The physical and mental health, social participation, and quality of life of older adults require targeted solutions.

In response, the government of our country has adopted the WHO's framework for a healthy aging society (1. Adapt health systems to the aging population they now serve, 2. Develop long-term care systems, 3. Create age-friendly environments, 4. Improve measurement, monitoring) by formulating five countermeasures for a super-aged society: 1. Enhance health and care, 2. Promote participation and vitality, 3. Foster digital literacy and joyful learning, 4. Ensure accessibility and independence, 5. Stimulate industries and secure financial resources. Among these, the concepts of digital literacy and joyful learning are included in the policy framework, aiming to promote social participation and quality of life for older adults through technology and learning activities. Digital literacy and joyful learning are seen as key elements in promoting social connections (National Development Council, 2022).

The application of digital technology can expand the social circles of older adults, providing new avenues for learning and entertainment, thereby fostering connections and exchanges within and outside the community. Learning new things is considered one of the factors towards successful aging (Sayago, 2012). Through continuous learning, older adults can continually expand their skills and knowledge, enhancing their adaptability and mental resilience, thus adapting to social and technological changes. Learning new things is not only about keeping up with societal changes but also a process of self-actualization. According to Maslow's hierarchy of needs theory (1943), through learning new things, older adults can fulfill needs for self-esteem, achievement, and self-worth, contributing to a richer and more meaningful later life.

With the advancement of technology, products that assist with learning, living, and healthcare have emerged. Among technology-assisted learning products, VR technology offers new channels for learning, socializing, and entertainment for older adults. VR allows older adults to focus more on learning situations and benefit from them. VR-assisted learning activities are expected to become one of the effective means to promote learning, enhance social interactions, and improve the quality of life for older adults (Syed-Abdul et al., 2019). Despite the potential benefits of VR technology in providing new learning, social, and entertainment channels for older adults, they may face many difficulties and challenges when learning something new for the first time, especially with the novel VR technology. Therefore, this study aims to observe and record the problems and difficulties encountered by older adults in the process of learning to use VR through a VR experiential teaching courses, as well as the changes in their emotional and psychological states such as confidence during the process.

Existing VR systems are mostly not designed to meet the needs of older adults' population, and there may be adaptability issues in their use by older adults. Therefore, the purpose of this study is to explore the adaptability of older adults in operating VR games, including the problems encountered in operation, the level of understanding of game mechanics, and the

experience of wearing the device. Through methods such as experimental VR experiential teaching courses, observation, group interviews, and expert interviews, this study aims to understand the situations and reasons for problems encountered by older adults when using VR in the experiential courses. By summarizing, integrating, and analyzing the data, the study proposes suggestions for the content and methods of future VR introductory courses for older adults.

Older Adults and Technology

With the rapid development of technology, older adults face the challenge of learning and adapting to new technologies. Many older adults feel psychological burdens such as anxiety and fear when using smartphones, tablets, computers, and other technological products due to a lack of confidence or knowledge and fear of causing damage. Compared to complex technological products, older adults find simplified technology products easier to use (Vaportzis, Clausen, & Gow, 2017). Additionally, age-related cognitive declines, such as slower information processing speeds, reduced working memory capacity, and decreased attention capabilities, are often considered factors that affect older adults' ability to learn new technologies (Isabelle, 2022). However, older adults generally hold an open attitude towards learning new technologies, believing it is necessary to stay connected with societal developments and to fully utilize the benefits brought by technology (Pihlainen et al., 2022).

VR and Older Adults

The development of VR technology provides older adults with a novel way of learning and entertainment. Research indicates that VR technology can serve as a tool for older adults to engage in physical exercise, encouraging them to participate in daily activities and offering a positive new experience (Syed-Abdul et al., 2019). However, a common issue with VR use is the occurrence of motion sickness, which can cause dizziness and nausea during prolonged use. Although the incidence is low among older adults, it can severely impact their experience and may lead to a greater reluctance to use this technology. Therefore, it is crucial to develop highly immersive VR environments with integrated sensory synchronization to reduce this risk (Liu, Cai, & Wei, 2021). Past studies have used relatively outdated equipment, which may have contributed to a higher incidence of motion sickness due to issues with user experience, comfort, and wearability. By adopting newer VR equipment, the occurrence of motion sickness during use may be reduced (Appel et al., 2019).

Educators should rethink the design of experiential teaching courses to meet the learning needs and preferences of older adults. Knowles' (1990) theory of adult learning suggests that adult learners (including older adults) want to take responsibility for their learning, have a rich experience base, and prefer problem-centered learning approaches (Boulton-Lewis, 2010). When learning new skills, older adults may require more time and practice, and their practical life needs drive their motivation to learn (Syed-Abdul et al., 2019). Therefore, teaching activities should connect with learners' real-life situations and provide opportunities for social interaction (Sayago, 2012). Additionally, engaging in enjoyable and relaxing activities has been identified as a factor that promotes health among older adults. Therefore, instructional design should consider incorporating fun, stress-free, and step-by-step activities to enhance older adults' interest, learning motivation, and efficiency (Jeng, Pai, & Yeh, 2016).

Methodology

This study explores the impact of VR on older adults by understanding through literature review how VR can provide immersive experiences, increase enjoyment and interest, and thereby enhance learning willingness and motivation, leading to improved learning efficiency. The purpose of this study is to investigate the adaptability of older adults in operating VR games through experiential teaching courses, employing experimental methods, group interviews, and expert interviews.

Participants

This study recruited 20 community-dwelling older adults aged 65 and above with normal physical functions, no severe myopia or hyperopia, and no severe motion sickness.

Equipment Platform and Courses Tools

This study used the Meta Quest Pro as the experimental equipment platform. Based on literature review, a music rhythm game, Beat Saber, was selected for the courses content due to its intuitive game and lack of complex operational processes. The game parameters were adjusted to not restrict swing direction, to prevent failure from missed swings, and to reduce block speed, thereby lowering the learning threshold. The courses used instructional aids to help older adults understand game concepts. The aids included: 1. Controller Handle Prop: Simulates the grip, click, and swing operations of the controller. Produced using 3D printing (FDM). 2.Game Interface Prop: Simulates the game interface by demonstrating the blue buttons (interface) to be clicked, helping older adults understand the interface operation. The game interface was captured and printed on cardboard. 3. Red and Blue Lightsaber Props: Simulates the way to swing the lightsaber in the game, helping older adults understand how to hit the incoming blocks. Made by printing and rolling paper into stick shapes. 4. Red and Blue Block Props: Simulates the way to swing the lightsaber in the game, used with the red and blue lightsaber props. Game images were captured and printed on cardboard. 5. 21.5-inch Portable Monitor: Displays the Games screen inside the VR headset during teaching, helping other older adults intuitively understand the game progress and the Games of other participants. The monitor also allows researchers to grasp the actual operation status of the older adults through the screen.

Design of Experiential Teaching Courses

The courses activities span two weeks, with lessons held once a week, each lasting two hours. Each lessons includes a courses introduction, VR equipment and game operation instructions, VR experience, group interviews, and courses process (Figure 1). To understand the learning and teaching status of the older adults, "Group Interviews and Expert Interviews" are conducted after the "VR Game Experience". The interviews cover five aspects: teaching methods, equipment experience, game experience, psychological emotions, and courses recommendations. (Table 1). To optimize and adjust the courses for better adaptation by older adults, expert interviews are conducted after the first lessons.

First Lessons: The learning objective of the first lessons is to introduce older adults to VR and help them gradually become familiar with it. Therefore, the game difficulty is adjusted by reducing the game speed to 30%.

Second Lessons: The learning objective of the second lessons is to allow older adults to experience the enjoyment of VR. Thus, the game difficulty is adjusted by reducing the game speed to 70%. Additionally, competitive games and a lottery segment are included to enhance the fun and incentive of the game, thereby increasing the learning motivation and interest of older adults.

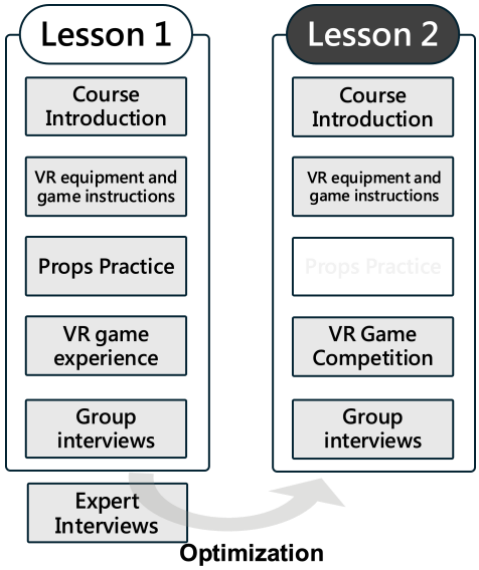

Figure 1: Courses process.

First lessons	Second lessons
1. How do you feel about the teaching method and the experience of using the equipment?	1. How do you feel about using the VR headset and handlebar after the last lessons?
2. How do you feel about the screen and teaching aids?	2. Compared with last week, do you feel more powerful or changed in playing VR games?
3. How do you feel about the VR headset?	3. How do you feel about the operation experience compared to last week?
4. How do you feel about the VR handlebar?	4. How do you feel about the difficulty of the game?
5. How do you feel about the game experience (playing)?	5. How did you feel during the game? How did you feel during the game? How did you feel during the game?
6. What conditions affected your mood during the experience?	6. How did you feel after adding the competition component?
7. What do you think could be improved to help you learn or enhance the experience?	7. How do you feel about the more props and the adjustments to the narration this time?
	8. If you are an older person who has never played VR before, what do you think will be the effect of learning through this course?
	9. What are the shortcomings or deficiencies of this courses and what do you think can be improved?

Table 1: Group interviews.

Results

This study focused on 20 community-dwelling older adults aged between 68 and 90 years, with an average age of 80.6 years. Through two lessons of experiential teaching courses, the study explored the adaptability issues faced by older adults when using VR for game operation (physical movements, device wearing). The following results were obtained through induction and analysis.

First Lessons

Using a presentation to assist with VR equipment and game operation instructions, the courses covered the game flow (Figure 2). The instructor demonstrated the VR game flow and guided older adults in practicing with controller handle props. After practicing, the older adults began their VR experience. During the game process, it was found that: 1. Most participants could identify whether the device was worn correctly and felt comfortable, although some reported initial discomfort and fear, with one experiencing mild dizziness. 2. Participants generally could not immediately find the white guiding line, but with reminders to turn their heads down and lift their hands, they could correctly locate it. 3. Participants found it challenging to use wrist movements to aim the controller at the interface start button accurately. 4. Participants found it difficult to avoid accidental button presses on the controller, leading to unintentional actions outside the interface buttons. 5. Participants had trouble understanding the swinging action but gradually improved with prompts and guidance.

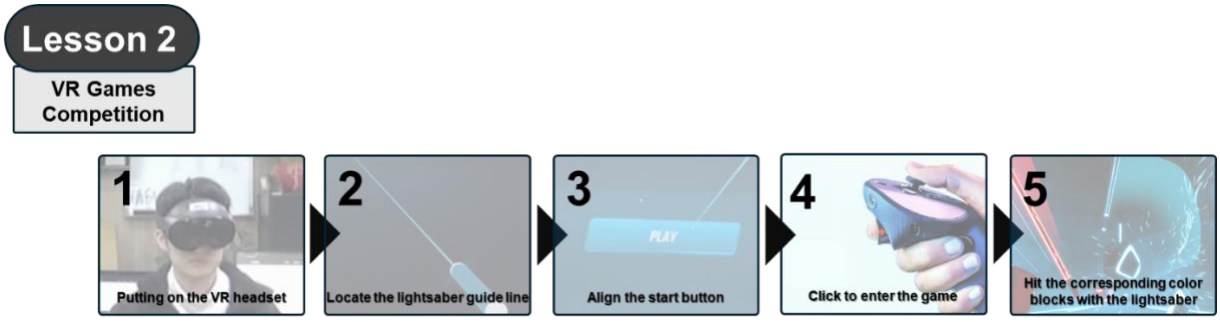

Figure 2: The course covered the games flow.

Second Lessons

Analyzing the issues and conditions from the first lessons, three key points were identified: 1. Lack of understanding of the game process concept. 2. The vocabulary used in teaching did not match the older adults' usual language habits, such as interface button colors and swinging actions. 3. The meaning and interaction concepts between objects were unclear.

In response, the courses process for the second lessons was adjusted (Figure 3) to help older adults better understand VR games. Due to competition (two rounds) and time constraints, there was no practice game operation in the second lessons. After adjusting the courses process, it was found that: 1. Participants felt more accustomed to the device, with no discomfort or dizziness. 2. Participants better understood turning their heads down and lifting their hands to find the white guiding line, quickly locating it in the second round of the competition. 3. Participants better understood the need to aim before clicking, with most achieving more accurate actions. Those requiring assistance were able to operate independently by the second round. 4. Accidental button presses decreased, although some

older adults still experienced this issue, which improved in the second round. 5. Most participants could perform the swinging action, with all mastering it by the second round and continuously improving.

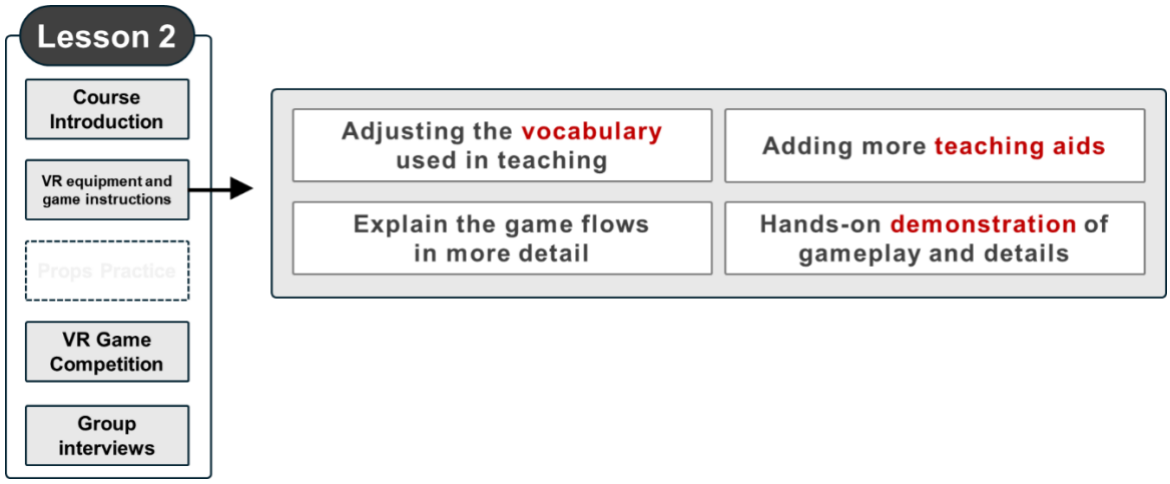

Figure 3: The courses process for the second lessons was adjusted.

To explore the learning effectiveness and adaptability of older adults, a paired-sample t-test was conducted on the scores from the first and second rounds of the competition (Table 2). There was a significant difference in score improvement ($p=0.002<0.05$). The scores represent the number of hits, with a maximum score of 42 for all hits. The first round ($M=29.85$, $SD=10.55$) had a 71% hit rate, and the second round ($M=35.25$, $SD=6.88$) had an 84% hit rate, significantly higher than the first round. Through group interviews, expert interviews, and observation, it was found that using physical props to demonstrate the game process and adjusting the vocabulary for swinging actions effectively helped older adults understand the game flow and actions, reducing the negative impact of unfamiliarity, and shortening the VR adaptation period.

Paired Sample T-Test			
M (SD)		Test Results	
First	Second	t	p
29.85 (10.55)	35.25 (6.88)	-3.44	0.002

Table 2: Paired Samples T-Test of Scores between the First and Second Rounds.

Conclusion

This study found that older adults often experience fear and anxiety due to unfamiliarity and lack of understanding when first encountering VR, leading to negative emotions. These negative emotions result in stiff and tense hand movements, affecting their ability to operate the controller and thus impacting game progress and learning motivation. Through group interviews, expert interviews, and observation, researchers identified three main difficulties faced by older adults: 1. Lack of understanding of the game process concept. 2. The vocabulary used in teaching did not match the older adults' usual language habits. 3. The meaning and interaction concepts between objects were unclear.

To address these issues, researchers adjusted the courses content to include familiar everyday language, explanations linked to life experiences, and the use of physical props to demonstrate game processes and actions. These adjustments effectively reduced cognitive load, helped older adults understand VR games, minimized negative emotions, and increased enjoyment and interest. The adjustments align with previous research findings. Sergio Sayago et al. (2013) emphasized that learning activities should connect with learners' real-life situations; Eleftheria Vaportzis et al. (2017) noted that a lack of knowledge and confidence causes psychological burdens; Jeng et al. (2017) suggested that instructional design should adopt a fun, step-by-step approach to enhance motivation and efficiency. This study's adjustments reflect these principles, helping to stimulate older adults' learning interest and motivation. However, other factors such as skill proficiency, mutual learning, and courses attractiveness may also influence the improvement of learning effectiveness. Future research could consider including more variables to comprehensively evaluate the effectiveness of teaching strategies and further optimize instructional design.

This study explored the use of VR technology as a new method for learning and entertainment among older adults, investigating the adaptability issues faced by older adults during their initial use of VR for game operation through experiential teaching courses. The research found that courses and teaching methods designed specifically for older adults significantly enhanced their adaptability to VR technology.

During the initial experience, older adults commonly faced operational difficulties and psychological burdens. However, through three courses adjustments—using familiar everyday language, explaining game concepts with life experiences, and utilizing physical props for demonstrations—their proficiency and understanding of VR game operation improved, enabling them to grasp VR games more quickly. In the second lessons, older adults demonstrated higher hit rates and fewer operational errors. Additionally, the social elements and competitive design of the courses increased motivation and enjoyment, proving that a teaching model combining physical and virtual interactions effectively reduces the adaptation period for beginners in VR learning among older adults.

Future research could further explore the relationship between different types of VR content and the learning efficiency of older adults, as well as how to expand these teaching methods within broader social and cultural contexts to meet the growing learning needs of older adults. This study confirms the importance of designing teaching methods that address the specific needs of older adults and provides recommendations for experiential teaching courses. These findings have significant implications for promoting technology education for healthy aging societies.

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