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Perceptions of Older Adults on the Use of an Interactive Video Game in Promoting Health and Well-Being

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Perceptions of Older Adults on the Use of an Interactive Video Game in Promoting Health and Well-Being

Abstract

Background: This study explored the perceptions of older adults on the use of a custom built interactive video game (IVG) in promoting health and well-being among the older adult population.

Method: This qualitative study used a phenomenological approach and enrolled 10 older adults over the age of 65 years in a client-centered, custom-built interactive video game program. This program was designed to promote activity tolerance, balance, range of motion, cognitive skills, and enjoyment through physical activity. The participants completed up to 12 Coin Catcher IVG sessions over a 4-week period. A postprogram, semi-structured, and audio-recorded interview explored their perceptions and experiences of the IVG.

Results: The participant interview transcripts were individually coded, categorized, and then collapsed into broader themes. The three themes emerged as: I was thinking all the time, it is a good workout, and I thought it was fun.

Conclusion: The custom built IVG is perceived by the older adult population to be engaging and meaningful while promoting physical performance.

Comments

The authors report for this study, an interactive video game program, The Coin Catcher, was designed by a team of health professionals, including the first and third author, with the objective to engage older people in a fun, user friendly game to promote functional mobility, range of motion, and cognitive skills. No compensation was paid to the authors for their role.

Keywords

exergames, interactive video games, older adults, healthy aging

Cover Page Footnote

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Credentials Display

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Between the years 2015 and 2050, the percentage of adults aged 60 years and older worldwide will nearly double from 12% to 22% (World Health Organization [WHO], 2015a). The U.S. population aged 65 years and older is projected to grow to 83.7 million by the year 2050 (Ortman, Velkoff, & Hogan, 2014). This increase will present challenges to policymakers and health care insurance agencies, such as Medicare, as well as to families, businesses, and health care providers (Ortman et al., 2014). Good health is vital for older adults to enjoy their later years and to contribute to their families and communities. Physical activity enables well-being and healthy aging in older adults. A decline in physical and mental health is detrimental not only to the individual but to society as well (WHO, 2015b).

The U.S. is experiencing an increase in life expectancy. Improved health and well-being for the older adult population should be a priority for health care professionals (Crimmins, 2015). Functional mobility refers to the ability to move in your environment safely and effectively; to perform basic ambulation; to walk for leisure; to complete everyday tasks; and to participate in activities, such as work, play, and exercise (Centers for Disease Control and Prevention [CDC], 2013; Satariano et al., 2012). Every day over 10,000 Americans will turn 65 years of age. Falls are the leading cause of injury among this age group, with 2.8 million emergency room visits each year (CDC, 2015; CDC, 2017). Factors associated with the risk of falls are closely linked to muscle weakness, decreased postural balance, gait deficits, and vision problems (CDC, 2017). Falls among older adults can lead to an increased fear of falling, isolation, weakness, limited mobility, poor balance, and decreased activities of daily living, all of which contribute to an even greater risk of falls, injury, and loss of independence (CDC, 2017). It is imperative to understand the importance of mobility among older adults and the implications of health and well-being to prevent adverse health outcomes (CDC, 2013).

Health recommendations for older adults include leisure-time physical activity (i.e., walking, dancing, gardening, and swimming), transportation (i.e., walking or cycling), occupation (if still employed), household chores, games, planned exercise, family and community activities to prevent depression, cognitive decline, and disease (WHO, 2016). As the population of older adults continues to grow, their ability to engage in meaningful occupations will influence their well-being (Hasselkus, 2011). The promotion of health and well-being through engagement in occupation continues to be a focus for the occupational therapy profession (American Occupational Therapy Association [AOTA], 2013).

Virtual context refers to interactions in the environment that occur in simulated or real-time situations through the use of technology and video games (AOTA, 2014). Originating between the years 2000 and 2005, exergaming is defined as playing interactive video games using physical exertion as a form of exercise: exer (cise) plus gaming (Dictionary.com, 2016; Nawaz et al., 2015). Health professionals have explored the role of gaming technology to improve physical function in older adults; however, the evidence to support the effectiveness of using video games to encourage physical performance, also called exergames, would benefit from further studies to provide stronger scientific evidence (Molina, Ricci, de Morales, & Perracini 2014; Skjæret, et al., 2015). For the purposes of this study, the term interactive video games (IVGs), also known as exergaming, will be used for consistency and clarity (Nawaz et al., 2015).

Studies have found that further research is necessary to determine if the games are safe and which technology are most effective in improving physical functioning in older adults (Molina et al., 2014; Skjæret et al., 2015). Most longitudinal studies with older adults have used Nintendo Wii

platforms and off-the-shelf IVGs, which are popular among younger groups of gamers (Nawaz et al., 2015). Products like Nintendo or PlayStation were originally designed for a younger audience; therefore, the hand controls, speed, and graphics may create a more challenging experience for older adults. Older adults may experience poor balance, decreased vision, muscle weakness, decreased confidence, and decreased postural balance; therefore, video technology for this population must be practical and acceptable (Nawaz et al., 2015). Researchers need to assess and develop the usability of IVGs and other technologies with the older adult in mind to allow for a positive outcome (Nawaz et al., 2015).

IVGs are potential tools for occupational therapy practitioners to improve balance and functional mobility and to increase engagement in meaningful activities in older adults (Karahan et al., 2015; Skjæret et al., 2015). IVGs are an attractive and interactive way to motivate individuals to engage in physical activity by combining both cognitive and motor skills focusing on the outcome of movements in the game and not the movement itself (Lamoth, Caljouw, & Postema, 2011). Through engagement with a virtual environment, IVGs can simulate complex physical dynamic movements and facilitate the cognitive skills needed to navigate daily living in a fun and challenging way (Ribas, da Silva, Corrêa, Teive, & Valderramas 2017; Skjæret-Maroni et al., 2016).

Limited research has explored the role of an IVG in promoting health, well-being, and engagement in meaningful activities among the older population. Nawaz et al. (2015) conducted a scoping review of studies that revealed that older adults consider the usability and acceptability of exercise video games good. Further research is necessary to support the use of IVGs as an occupational therapy intervention (Doucet, 2012; Williams, Doherty, Bender, Mattox, & Tibbs 2011). For this study, a team of health professionals, including the first and third author, designed an IVG program, the Coin Catcher, with the objective to engage older people in a fun, user-friendly game to promote functional mobility, range of motion, and cognitive skills. The purpose of this research project was to explore the perceptions of older adults following involvement in an IVG program. We specifically sought to understand if the IVG program influenced health and well-being.

Method

Research Design

A phenomenological qualitative research design was used to explore the perceptions and experiences of older adults following involvement in the Coin Catcher game (Creswell & Poth, 2017). Through this phenomenological study, the participants described in detail their experiences before and after involvement in the game (Creswell & Poth, 2017). Understanding the meaning of lived experiences through a naturalistic lens allowed the qualitative data to emerge from the participants (DePoy & Gitlin, 2015). This study was approved by the University Institutional Review Board. Informed consent was obtained prior to recruitment and data collection.

Participants

Participants were recruited from an independent and assisted living facility in Southern California through a brief presentation and posted flyers. This study used purposive and snowball sampling to recruit 10 older adults (DePoy & Gitlin, 2015). The participants were required to be between 65 and 99 years of age, not gender specific, and to score at least 25/30 on the Mini Mental State Exam. Other inclusion criteria included the ability to walk independently with or without an assistive device, such as a cane or a walker, the ability to stand for a minimum of 15 min, and not currently receiving occupational or physical therapy. The participants were assigned pseudonyms to maintain

confidentiality. Ten participants participated in the study, with nine participants completing all 12 of the Coin Catcher IVG sessions.

Instruments

A demographic questionnaire was developed for this study to collect information about age, gender, education, place of dwelling, physical activity, mobility, self-care skills, health, function, and experience using an IVG (see Table 1). After completing the initial demographic questionnaire, the participants were scheduled 3 times a week for 15 min sessions of IVG playing, up to 12 session, over a 4-week period.

Following the 4-week program, semi-structured interviews were conducted to gather information regarding the individual's experiences with the IVG exercise. The research team developed interview questions through a review of the literature. The participants were asked questions such as, How important is it to you to stay physically active to maintain health and well-being? What are some of the benefits you found from using the interactive video game? What are your thoughts about using an interactive video game to maintain physical and mental health? What was your experience using the interactive video game? Is there anything you would change about the interactive video game? The post-program interviews took approximately 60 to 90 min and were audio recorded. All interviews were transcribed verbatim by Rev.com, a technology-based company.

IVG Program: The Coin Catcher Game

The Coin Catcher is a user-friendly interactive software video game developed for seniors to facilitate functional movement, range of motion, activity tolerance, balance, and cognitive skills. The Coin Catcher game was designed by a Health Interactives team in Southern California that included the first and third author along with video game developers and computer scientists using the Microsoft Kinect technology. The IVG is played on a 46' screen television (TV) with the Kinect sensor mounted on a SmartMount flat panel TV cart to track an individual's image as a form of "avatar" in real-time. The individual stands approximately 10 feet from the Kinect sensor, which allows ample space for movement. The participants are encouraged to use a walker if deemed necessary and to sit in a chair and rest as needed during the sessions.

The Coin Catcher IVG consists of coins falling from above with the intent of the individual to reach forward, sideways, and backward (shoulder elevation/flexion, abduction, extension) as tolerated, touching the coin and guiding it down to the bank. The coins have a value amount and are color-coded to be dropped to the designated bank. The sensor mimics the individual movements throughout the game. The IVG involves the individual with visual, auditory, and sensory movements with the timer set for the individual's appropriate standing tolerance. Soft music is set to resemble a game show.

Data Analysis

The research team coded and categorized each transcript, thus creating a foundation for a paper-based word document method codebook (Creswell & Poth, 2017). Regular research team meetings among the authors focused on intercoder agreement for main codes and subcodes as well as the creation of a codebook. Intercoder agreement meant that the entire research team agreed on the same code for the exact passage of the transcript for every interview (Creswell & Poth, 2017). Differences on coding and thematic analysis were resolved by in-depth weekly discussions of coding, grouping, subcoding, and teasing out code words to come to a unified agreement. The codebook was revised following each research team meeting, which helped to inform future coding. The initial 125 code and approximate 150 subcode categories were narrowed and finalized into broader themes (DePoy & Gitlin, 2015). The

emerging themes reflected the perception of the benefits and challenges of older adults engaging in an IVG. A detailed audit trail and rigorous weekly coding meetings allowed the team to address any researcher bias that could shape the interpretation of the data (Creswell & Poth, 2017).

Results

The participants' ages ranged from 76 to 99 years, with an average education of grade 12 and above. Fifty percent of the participants lived in an independent facility and perceived their health to be fair and above, with 90% engaging in physical activity. Eighty percent of the participants ranged in age from 76 to 99 years and considered themselves physically active. Two out of the 10 participants had prior experience with IVGs, with the majority of the participants having no previous experience. Stacy voluntarily dropped out of the program after completing four sessions. The other nine participants completed all 4 weeks of the program. Four of the participants expressed challenges while engaging with the custom-built IVG. These challenges included initiating the game if range of motion was a factor and the color contrast and glare for some participants with diminished vision.

Table 1

Demographic Information (N = 10)

Participant pseudonyms	Age	Gender	Residence: Independent Facility (IF) or Assisted Living Facility (ALF)	Education	Perceived health	Physically active	Loss of balance or falls in the last year	Fear of falling	Prior experience with IVGs
Stacy	86-99	Female	IF	Doctorate	Fair	No	No	Yes	None
Rebecca	86-99	Female	IF	College	Good	Yes	No	No	None
Heather	86-99	Female	IF	College	Good	Yes	Not known	Not known	Bowling
Paul	86-99	Male	ALF	Master's	Poor	Yes	Yes	No	None
Victoria	86-99	Female	IF	High school	Good	Yes	Yes	Not known	Not known
Mary	76-85	Female	ALF	College	Good	No	Yes	Yes	None
Edward	86-99	Male	IF	College	Good	Yes	No	No	None
Carmen	86-99	Female	ALF	College	Fair	Yes	Yes	Yes	None
Gloria	76-85	Female	ALF	High school	Good	Yes	Yes	No	N/A
Larry	86-99	Male	ALF	Doctorate	Good	Yes	Yes	Yes	Minimal

This study explored the perceptions of older adults following engagement in the Coin Catcher IVG. Themes emerged based on the data collected and the analysis from the participants using the Coin Catcher game. The three themes—I was thinking all the time, it is a good workout, and I thought it was

fun—provide insight into how the participants perceived the impact of the Coin Catcher game on their overall health.

I Was Thinking All The Time

The first theme, I was thinking all the time, emerged to reflect the participants' views on how the Coin Catcher game impacted their mind and processing speed. The participants described their interaction with the Coin Catcher game as "something new" that encouraged them to "learn to do things more quickly." Rebecca shared that she found the Coin Catcher program mentally engaging: "Well, you're using your brain more often, it helps you think more quickly. Well, it helps you move, your body. And that helps to stimulate your brain." Gloria shared, "It was challenging and that's where I had to think more. I was thinking all the time, so it's very good. Very good." Mary described how she was "absorbed" with the Coin Catcher game:

> You forget about it. It's like your mind is absorbed on it, and, and you don't even think about what you're doing, you know. You just do it, and then afterwards you're just, "Oh I did this and I did that and I move here and move there," you didn't even think about doing it.

Gloria further illustrated being immersed in the Coin Catcher game: "Not consciously aware of it, I'm just doing it. My mind is saying to me, 'Well you've got to reach up here, you've got to step over here' do you know what I mean, it's an automatic." Carmen felt that the Coin Catcher game helped her as she felt that she knew what she wanted her extremities to do but she had limitations:

> I think my brain worked faster, too, but I know I have to catch something coming down really fast, you know but, actually, it's my movements that are not fast. My brain is thinking, but my coordination with my brain and my hands [is] not working. They're not cooperating, but my mind is going over there and my hand is not going over there. I mean, they were not working together.

Mary reflected on her experience using the Coin Catcher game as, "it gives you some good motion and ideas of moving around and getting and doing things that we never think about doing" and proceeded to explain, "I can move around easier, you know, get myself going a bit better, bit more." Larry summarized how active he felt his mind was during the game, "You couldn't relax. You had to be thinking in three dimensions from three and four areas. You couldn't just concentrate on the coin, you had to also concentrate [on] where you are." Overall, a majority of the participants found that the Coin Catcher game was mentally challenging, stimulated their brain, and really made them think.

It Is a Good Workout

In addition to the impact on their minds, most of the participants felt that the Coin Catcher program impacted them physically and was an effective workout. Mary shared her experience using the Coin Catcher game as, "Oh, oh it is a good workout, it was definitely a good exercise." Rebecca claimed, "Oh! I got lots of exercise… once those coins started popping up (laughing) over the top, it gave me some…good exercise." Gloria affirmed, "I've enjoyed this, this exercise has been a real enjoyment for me." Victoria commented:

> I had no idea what good it would do for me to play with coins, you know, to move my arms. But as I went along, I thought, Yeah, I can see some benefit in moving and maybe even moving my legs. And seeing quick enough.

Some of the participants reflected on how they perceived their balance during and after the Coin Catcher game sessions. Heather shared, "some of those where you had to take a sidestep, why that would give me better, better balance from the side. I'd like it." Mary reflected on the impact the Coin

Catcher game had on her balance: "Yeah I think, maybe that's a testament of God, because I've been walking around quite a bit now, quite a bit actually. I think it's improved my balance some." Carmen explained, "It helped because I feel I'm able to do a lot more independently. Like I can walk faster with my walker." Whereas some of the participants like Larry shared, "Well today I felt I lost my balance temporarily there, but I think that today I had loosened up and I was moving considerably faster." One of the participants, Stacy, struggled with the program and was not able to finish all of her sessions, and she shared her experience in the program:

> Well, I didn't get along very well with those sessions. I felt as if I was just barely able to stand up without wobbling back and forth, needing to sit down all the time. So, I was frustrated. Really frustrated. I have been sorry that I had to drop it. But I just couldn't keep up.

Stacy felt that she was unable to maintain her balance in standing even though she used her walker while attempting to participate with the Coin Catcher game.

Gloria felt that engaging with the Coin Catcher game allowed her to reach, as she stated, "I think it was all great I mean, from reaching for those coins to having to decide where they had to go, and I mean it's just mind boggling, I think it was wonderful." Each participant expressed what movements felt like during his or her engagement with the Coin Catcher game. Heather mentioned, "I think it loosened up my muscles." Reaching was not always easy, as Stacy shared with us: "And I couldn't get my arms up high enough above my head to catch the silly cents" (laughter). Most of the participants experienced some physical limitations while using the Coin Catcher game. Mary shared what it was like with an extremity that had limited range of motion, "I'm doing it and I don't even think about what I'm doing. I know this arm's not going up really far, but I'm going like this with it and pulling it down, and I don't even think about it." The participants shared their overall enjoyment while engaging in physical activity through the IVG.

I Thought It Was Fun

Some of the participants expressed feelings of excitement during the 12 Coin Catcher game sessions, while others felt frustrated. Victoria shared, "It annoyed me that I didn't know it better" and recommended that the researcher explain to the participant what to look for "because I had to do it by trial and error." Larry explained his frustration as, "Well, my problem is my depth of vision. Those things are presented on a flat surface and I don't know if they're there or here . . . and I get disgusted when I'm not able to retrieve one when I've been too far forward with it." Larry concluded with, "I like it, it's a challenge to me." Most of the participants felt that interacting with the Coin Catcher game was fun and enjoyable, yet other participants initially felt it was a silly game. Rebecca shared, "it was fun, too. We had some good laughs." Edward stated, "It's silly first, but then when you see what it does to you, then it's okay" (laughter). Stacy shared that her initial reaction to the Coin Catcher game was that it was a silly game: "Okay, I thought it was silly. But then I began to realize, when I began to feel what was happening, then I realized that yes, there really was a good purpose to it." Mary seemed to agree that the Coin Catcher game had a purpose and shared:

> I enjoyed it, it was kinda fun, and I think it helped me realize, you know what I need to do. Each level you got me on I was a little, oh this is faster, this is harder to get into, but I'll just have to work a little harder at it. So, I kind of enjoy it.

Carmen found the experience to be enjoyable, as she shared, "it was a fun thing. I mean, it wasn't just boring. It was fun and it was exciting . . . really challenging and I thoroughly enjoyed it." Gloria claimed, "I thought it was fun. Yeah! I mean I just liked it from the beginning to the end. I loved every

minute of it." Heather's remarks regarding her experience were, "I enjoyed it very much . . . I just enjoyed the experience." Some of the participants, such as Gloria, expressed anticipation and excitement: "I look forward to it, you see. I enjoyed all of it. I did. Right in the start [until] the ending, yeah." Some of the participants expressed that the program should be available for further use. Edward said, "It should because you, you are moving. Instead of sitting there."

Discussion

The phenomenological strategy used in the qualitative research allowed us an opportunity to understand the participants' experiences with the IVG and their engagement in meaningful physical activity. Engagement in meaningful occupations promotes health and enhances the quality of life (Reitz, Scaffa, & Pizzi, 2010). The interventions of occupational therapy practitioners can facilitate changes in the person, the environment, and occupations to enrich occupational performance, health, and well-being (Reitz et al., 2010). An older adult's journey does not end at a set timeline but continues only through engaging in meaningful occupations essential for well-being and health (Hasselkus, 2011). Through engagement with the Coin Catcher game, the participants expressed their overall enjoyment, affirming the benefits of staying active by facilitating engagement and participation through the use of meaningful activities (Lamb, 2016).

The participants engaged in decision-making as they executed movements to capture the coins and place them in the designated bank during the game. As the complexity of the level increased, the speed, size, and quantity of the coins differed, allowing the individual to make the necessary quick decision to reach for the coins. Through the use of functional task exercises, older adults with mild cognitive impairment demonstrated improvement in cognitive function (Law, Barnett, Yau, & Gray, 2014). Current literature supports the possibility of the cognitive benefits associated with physical activities to enhance neuroplasticity and prevent diseases that are associated with the decline in cognition (Hötting & Röder, 2013). Learning new things and keeping the mind engaged in cognitively demanding activities are essential for enhancing memory function in older adults (Park et al., 2014).

Many of the participants perceived that they received a "good workout" and that the Coin Catcher game provided a form of exercise. The movements allowed the participants to elaborate on their ability to perform reaching, balance, and endurance according to their own physical limitations. Most of the participants felt that the Coin Catcher game allowed them to improve their balance. The participants echoed how the game gave them ideas to help them stay active in their daily lives. Some of the participants shared how they had incorporated new activities, such as using the stairs. Kinect has the potential to facilitate dynamic balance, as it allows the user to move more freely in space (Bieryla, 2016). Videogame-based exercise has been shown to improve balance, and individuals are more motivated to exercise if they find the games to be challenging and enjoyable (Lamoth et al., 2011). Karahan et al. (2015) concluded that IVGs can be considered a safe and entertaining alternative for older adults and may have positive effects on balance, functional walking, and quality of life. This study demonstrated the value of occupational therapy intervention in a virtual environment in the client factors and performance skills to contribute to the participant's health and well-being (AOTA, 2014).

As the participants focused on the outcome of the game, most of them felt it was challenging but "fun." The participants expressed excitement, enjoyment, and laughter. The Coin Catcher game initially appeared silly to some of the participants, and there was a learning curve; however, as the participants progressed through the game they saw the benefits. The usefulness of the video game must be perceived as not too difficult and should allow for the participant to feel satisfied, happy, and engaged

while also avoiding frustration (Morán et al., 2015). The future of IVG technology has the potential to engage older adults in social activities in a fun and motivating way (Skjæret et al., 2015). This research aligns with the AOTA Vision 2025 to maximize health, well-being, and quality of life for older adults through effective solutions in order to facilitate active participation in everyday living (AOTA, 2016). The Coin Catcher game incorporated both cognitive and motor skills, allowing the participant to engage with and focus on the game according to his or her individual limitations.

Limitations and Future Research

This study's limitations include a small sample size and recruitment from two dwelling facilities targeting the older population, thus limiting generalization of study findings to other populations in other geographic areas. Although some rehabilitation facilities use IVGs, further research is needed to target a specific function, such as balance or range of motion, with the geriatric population. Researcher bias could be seen as a limitation, as the first and third author were involved with the development of the game. More research is needed with the aging adult population in mind to target the effectiveness and usability of the game during the development of the game. Further research is needed in adhering to the progression of the IVG and adapting to the complexity of the levels as the participants are ready for the challenge.

Conclusion

This study illustrated the benefits of an IVG in the context of occupational therapy practice to contribute to and promote health and well-being in the older population (AOTA, 2014). Healthy aging is the process of maintaining one's functional ability and enabling well-being in older adults (WHO, 2015b). Through engagement with the Coin Catcher game, occupational therapy practitioners support healthy aging by promoting health and well-being in the older population as an evidence-based intervention (Williams et al., 2011). The act of doing promotes health and well-being, and as the population of older adults continues to increase, the ability to engage in life's daily activities will influence their well-being (Hasselkus, 2011). This study's results demonstrated that a majority of the participants perceived the Coin Catcher game to be meaningful and engaging while promoting their physical activity. As a society and a profession, we need continued evidence-based research to promote the well-being, happiness, satisfaction, and fulfillment of older adults (WHO, 2015b).

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