

Can a Wii Bowling Tournament Improve Older Adults' Attitudes towards Digital Games?

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Abstract: This study examined the effectiveness of a Wii Bowling tournament for improving older adults' attitudes towards digital games. A total of 142 older adults were recruited from 14 senior centers; 81 were placed in the experimental group and 61 in the control group. Participants in the experimental group played in teams of four members formed within each participating site. The 81 participants in the experimental group formed a total of 21 teams, which played against one another in an 8-week tournament. The findings indicate that the Wii Bowling tournament was an effective way to improve older adults' attitudes towards digital games ($t = 2.53, p = .01$). Consistent with the findings in previous studies, this research found that co-located social gaming creates a natural context for fun, immersion, and competition.

1 INTRODUCTION

1.1 Age-related Health Problems

The percentage of older adults in our population has increased in the past decades and continues to do so. By 2050, one in five people in the world will be aged 60 or older (Akitunde, 2012). People are living longer as a result of better health and living conditions. However, with advanced age, older adults experience declines in social contacts, physical abilities, and cognitive function. Impaired balance and falls can lead to injury, increased morbidity, fear of falling, loss of independence, death, and direct medical costs (Lai et al., 2012). Cognitive decline is associated with decreased ability to perform everyday tasks required for functional independence, such as car driving and financial management (Boot et al., 2013). What's more, many older adults face key social and psychological challenges such as loneliness, depression, and lack of social support due to decreased social contact. Since these changes negatively affect older adults' quality of life (Aison et al., 2002), there are growing needs to understand and find ways to prevent or reshape age-related physical and cognitive decline and to increase older adults' social interaction. One of the possible ways that has been gaining researchers' attention is digital

gameplay.

1.2 Older Adults and Digital Games

Digital games (e.g., action, strategy, role-play, sports, and casual games) can be complex, offering flexible activities that use multiple cognitive abilities. Games that require progressively more accurate and more challenging judgments at higher speed, and the suppression of irrelevant information, can drive positive neurological changes in the brain systems that support these behaviors. Today, playing digital games has become a social activity (Ekman et al., 2011). Online games such as Massively Multiplayer Online Role-Playing Games (MMORPGs, e.g., World of Warcraft) allow thousands of players from around the world to interact with each other in the same virtual environment. With advances in virtual-reality interaction technology, somatosensory digital games that combine traditional digital games and physical activities provide older adults with alternative leisure opportunities (Chiang et al., 2012); for example, the Nintendo Wii Fit includes more than 40 activities such as yoga postures, strength training, and balance designed to engage the player in physical exercise.

These games can be played with family and friends in real-world situations. Face-to-face contacts and frequent, meaningful social interactions

can happen through “interacting with other people, spending time with friends, watching others play, chatting and talking about the game, seeing other people’s reactions and expressions, gloating when beating a friend, or feeling pride when they win” (Sweetser and Wyeth, p.11). Engagement in social activities not only meets older adults’ psychological needs for social interaction, but also keeps them physically and mentally active – the “use it or lose it” metaphor.

In addition, games are designed to be fun to play. They appeal to older adults’ desires and needs for entertainment, mental fitness enhancement, competition and success, a satisfying use of time, and, in social games, a sense of belonging (Hoppes et al., 2001, cited in Whitlock et al., 2012). Digital gameplay is inherently enjoyable and motivating, a state which can be described in terms of Csikszentmihalyi’s (2000) flow experience. Flow describes a mental state of complete absorption, accompanied by positive feelings. Gamberini et al. (2008) pointed out that digital games can provide older adults with new opportunities for leisure and entertainment, combined with training that avoids both intimidating task complexity and boredom.

There is now substantial evidence showing that playing digital games can improve older adults’ physical, cognitive, and psychological health. Jorgensen et al. (2012) examined postural balance and muscle strength in healthy community-dwelling older adults using biofeedback-based Nintendo Wii training for a period of 10 weeks. Results showed that the Wii training resulted in significant improvements in maximal leg muscle strength and overall functional performance in participants. Pompeu et al. (2012), investigating the effect of Nintendo Wii-based motor cognitive training on activities of daily living in patients with Parkinson’s disease, found that participants showed improved performance in activities of daily living after 14 sessions of balance training. Basak, Boot, Voss, and Kramer (2008) reported on the use of a real-time strategy video game for the enhancement of executive control processes of older adults. They found that after a period of 23.5 hours gameplay, the experimental group improved significantly more than the control group in executive control functions such as task switching, working memory, and visual short-term memory. Jung, Li, Janissa, Gladys, and Lee (2009) examined the impact of playing Nintendo Wii on the psychological and physical well-being of seniors in a long-term care facility. Results showed that playing Wii yielded a positive impact on loneliness, self-esteem, and well-being

among older adults, compared to a control group that played traditional board games. Previous studies have also suggested that regular and occasional gamers exhibit significantly higher levels of well-being and lower levels of loneliness compared to non-gamers (Allaire et al., 2013; Jung et al., 2009). These findings demonstrate the potential of digital games to improve older adults’ quality of life.

1.3 Older Adults and New Technology

Older adults are stereotypically viewed as having negative views towards technology. However, although physical and cognitive declines may hamper their ability to use technology as effectively or proficiently as younger people, older adults have been found to be willing to use technology when they are aware of the benefits such technology can offer them (Eisma et al., 2004; Heinz et al., 2013). Reviewing studies that compare older and younger adults’ attitudes towards and abilities with computers, Broady, Chan and Caputi (2010) found that lack of knowledge of the capabilities of modern technologies and how to use them is a major influence on older adults’ avoidance of technology. Other barriers include confusion regarding usage procedures, fear of the unknown, lack of confidence, and lack of understanding of the value of products and services. Understanding technology as being personally relevant and useful, as well as overcoming the initial fears and external factors (e.g. how one is viewed and treated by others) are crucial to overcoming those barriers. Overall, Broady et al. (2010) concluded that older people appear eager to accept technological advancements and exhibit attitudes that are as positive as young peoples’ towards the use of computers. In addition, first-hand experience can trigger older adults’ interest and provide opportunities for improving attitudes towards a new technology (Bandura, 2001; Melenhorst, 2002; cited in Gajadhar, Nap, de Kort, and IJsselsteijn, 2010).

1.4 Research Purpose

Despite potential physical, cognitive, and social benefits, older adults are far less likely than younger people to play digital games (McKay and Maki, 2010). Older gamers are playing more and more games, but only 29% of gamers are over the age of 50 (Galarneau, 2014). In the U.S., some 61% of gamers are younger than 36-years old (Entertainment Software Association, 2014). It is understandable that older adults play fewer digital

games, as many did not grow up with computer and information technologies. However, encouraging their engagement with these new technologies could help to realize the potential of digital games to address a variety of health, social-psychological, and functional needs for older adults.

Social interaction has an important effect on older adults' successful aging (Lewi, 2014) and is a strong motivator among older people for playing digital games (Rice et al., 2012). Competition is another important factor that affects their in-game enjoyment (De Schutter, 2011). Previous research has shown that playing together in the same place, as opposed to remotely, significantly contributes to fun, challenge, and perceived competence in the game as older adults prefer co-located co-play to playing with other people online (Gajadhar, de Kort, & IJsselsteijn, 2008; Gajadhar et al., 2010). Therefore, the purpose of this study was to examine whether a co-located Wii Bowling digital game tournament could improve older adults' attitudes towards digital games.

2 METHODOLOGY

2.1 Intervention Tool

In a qualitative focus group study, Diaz-Orueta, Facal, Nap, and Ranga (2012) identified digital game features of most interest to older adults: the social aspect of the experience, the challenge it presents, the combination of cognitive and physical activity, and the ability to gain specific skills. Wii Bowling is a game that offers these features.

Wii Bowling offers a convenient platform for multiple players. The Wii console allows users to interact with the game via remote, using natural body movements that are recognized by motion sensors. The game action is displayed on a large screen. Wii Bowling was selected for this study because: 1) most older adults are familiar with bowling; 2) bowling and the WII are fun to play; 3) the game is relatively simple to learn and to play; and 4) bowling is a social activity that allows a group to play together.

2.2 Outcome Measure

Participants' attitudes toward the game were assessed by 8-items selected from the Computer Game Attitude Scale (Chappell and Taylor, 1997), which measures the level of positive attitude toward

digital games. Items were rated on a 5-point Likert-scale ranging from 1 (Strongly disagree) to 5 (Strongly agree). Higher scores indicated higher level of positive attitude towards the social aspects of digital game. Its reliability is .79.

2.3 Participants and Procedure

Participants were older adults aged 60 and over. A total of 142 older adults were recruited from 14 centers, 81 were placed in the experimental group and 61 were in the control group. The participants in the experimental group played in teams of four members formed within each participating site. Since older adults might have appointments, commitments, or illnesses that prevented them from attending a session, only the top three scores of each game were recorded each week, even if four players attended that session. This approach allowed some flexibility when one team member was absent.

A total of 21 teams played against one another in the tournament. To avoid potential issues (e.g., social anxiety, time conflicts) that might have affected outcomes, team members, team names, availability and avatar names in the Wii Bowling game were all decided by participants. Follow-up interviews found that the teams were formed based on availability. Before the tournament, participants had one practice session, where observations and interviews showed that most participants felt tired after playing two games in succession. To sustain participants' interest to the game but not make them feel overwhelmed, the experimental group played two games in one week.

A research assistant (RA) was assigned to each team. During the eight-week tournament, the RA visited the site every week, set up the game for the team, and recorded each member's score and the team's weekly score. A weekly observation protocol was designed that informed how RAs were to take field notes, collect feedback, and identify any problems. The RA also posted each team's weekly score on a tournament website and provided the scores in hard copy to the team.

The control group didn't play digital games during the tournament, but they were welcome to watch the gameplay of the experimental group. After the tournament, both the experimental and control groups completed the post-test.

Table 1: Baseline Characteristics of Participants and Outcome Measure in Each Group.

Variables	Contro Group	Experiment Group	Chi-square	p
Gender(frequency, percent)			1.35	.25
Male	13(21.3%)	24(30.0%)		
Female	48(78.7%)	56(70.0%)		
Age (frequency, percent)			8.33	.14
60-69	5(8.2%)	16(20.0%)		
70-74	4(6.6%)	8(10.0%)		
75-79	8(13.1%)	16(20.0%)		
80-84	19(31.1%)	14(17.5%)		
85-89	15(24.6%)	14(17.5%)		
>=90	10(16.4%)	12(15.0%)		
Current relationship status			3.61	.06
Married/Common law	6(10.9%)	18(24.0%)		
Single/Widowed	49(89.1%)	57(76.0%)		
Living arrangement			2.58	.11
Alone	44(83.0%)	53(70.7%)		
With someone	9(17.0%)	22(29.3%)		
Education level(frequency, percent)			.86	.93
Less than high school	4(6.6%)	4(5.1%)		
High school or equivalent	24(39.3%)	34(43.0%)		
Some college/CEGEP	14(23.0%)	18(22.8%)		
Two-year degree	7(11.5%)	6(7.6%)		
University degree	12(19.7%)	17(21.5%)		

2.4 Data Analysis

Data analysis was carried out using IBM SPSS Statistics V22. Demographic characteristics of the participants in each group were compared using chi-squared analysis to examine whether the two groups were equivalent at baseline. Then, independent t-test analyses were conducted to compare the difference between the two groups both before and after the intervention. For qualitative analysis the field notes were imported into MaxQDA for coding. Codes were collected under major themes

3 RESULTS

Demographic information for both groups is provided in Table 1. Participants in the two groups did not differ in terms of gender, age, current relationship status, living arrangements, or education level. However, the majority of participants in each group were single or widowed and lived alone. Because of this, it is possible that they had smaller social networks than those in other circumstances.

3.1 Quantitative Results

For game attitudes, there was no statistically significant difference between the two groups in the pre-test ($t = 1.51, p = .13$). As shown in Table 2, the

levels of game attitudes increased from 3.72 ($SD = .58$) to 3.89 ($SD = .70$) in the experimental group, but only from 3.54 ($SD = .66$) to 3.55 ($SD = .73$) in the control group. The experimental group generally had higher levels of positive attitudes towards digital games than control group. More importantly, the post-test showed a significant difference between the two groups ($t = 2.53, p = .01$).

Table 2: Results of Independent T-Test on Game Attitudes.

	Control		Experiment		t	p
	M	SD	M	SD		
Pre-test	3.54	.66	3.72	.58	1.51	.13
Post-test	3.55	.73	3.89	.70	2.53	.01

3.2 Qualitative Results

Data from weekly interviews indicated that the majority of participants enjoyed playing Wii Bowling. By analyzing the weekly field notes, five elements were identified that contributed to maintaining participants' interest in Wii Bowling and to changing their attitudes towards digital games:

(1) In-Situation Teaching

Team members worked together to accomplish each team's objectives. Direct teaching from team

members was quite frequent, happening whenever a player wanted to get a strike or had a high possibility of losing. For example, on one occasion, D wanted to get a strike (all pins hit down in one throw) because all of the other three team members had already gotten one, leading to the following conversation:

- A: Move the line over.
 B: Make sure your hand is straight.
 A: Get your hand straight.
 C: You can do it, D.

(2) Encouragement from Team Members

Encouragement was a key aspect of team members' social interactions. One player was left-handed, and her ball always ran slowly. When she didn't do very well in one throw, her teammates said, "At least, that's a fast bowl" and "It's good. At least, it's straight." On another occasion, she got many curves and couldn't make the ball run straight. When her bowl ran slowly and gradually changed direction, her teammates murmured, "Come on, come on"; "Yes, yes..." Finally, the ball hit the last pin. Everyone in the room applauded and cheered for her with "Good for you"; "You have some suspenders."

At another site, a participant's vision was so poor that she needed help to locate the button in the controller and the pins in the screen, but she did very well every week. Her teammates said: "You are remarkable. You always inspire us." On one occasion, she had technical problems and needed several tries to let the bowl go. She was disappointed, saying "I'm sorry. At least, I let it go," but her team members were kind and supportive, saying "It's fine"; "That's OK. You can't hit them all the time"; "You participated. It's fine."

(3) Audience Support

Audiences played important roles in supporting players and sustaining their interest and passion during the tournament. Support from the audiences made the players believe what they were doing was interesting. They felt proud of themselves because they were doing something that they never thought they could do. As shown in Table 1, approximately half of the players were aged 80 and over. People at this age are likely to suffer from some age-related functional limitations (Bouma, 2000). For example, at one session an audience member who sat next to a player and coached that player every week was late arriving for the game. The players were quite reserved, and didn't interact with each other as much as they had in previous weeks. However, once the audience member walked in, the four players became alive and said: "We need you, coach."

(4) Humor

Humor was another key aspect of social interactions among team members, contributing significantly to players' enjoyment of the game. Team members liked to joke and laugh together during gameplay, as in the following conversation about a pin that didn't fall down:

- A: Stupid pins.
 B: Silly pins.
 C: Not smart pins.
 D: The nice pin is going to fall down.

(5) The Game

Wii Bowling enables *enactive interactions*, or motor acts used in real life such as swinging arms to play bowling (Vanden Abeele & De Schutter, 2010). One advantage of enactive interaction was that players could focus on hitting the pins rather than having to learn complex mappings between in-game actions and specific button presses (Vanden Abeele & De Schutter, 2010). So, the game was easy to learn and understand, although difficult to master. For example, skill was needed to achieve a split (knocking all pins down in two throws of the ball). Some participants mentioned minor medical effects from playing the game; one said that she was surprised that she didn't feel arm pain when swinging her arm.

4 DISCUSSION

The findings of this study support the conclusion that the Wii Bowling tournament was effective for improving older adults' attitudes towards digital games. In addition, the qualitative data demonstrate that participants enjoyed the experience of engaging in the Wii Bowling tournament. Although many participants had no prior experience with digital games before the intervention, the majority of them indicated that they would be interested in playing digital games in the future.

The possibility of using Wii Bowling to improve older adults' attitudes towards digital games is appealing for many reasons. First, participants were fully immersed in the game. They were excited and even danced whenever they got a strike or several strikes in a row, especially when there was an audience cheering for them. Second, many participants mentioned that they enjoyed the competition and cared about their team's position among all the teams. One participant said: "It's great to beat another team because we have two teams here (in an assisted living center)." Third, emotional

support from team members was a key factor that contributed a significant part to participants' enjoyment. Encouragement from team members, jokes, and applause created a natural social context in which participants felt free to express themselves. Fourth, the positive experience of gameplay improved participants' confidence with the new technology. Many participants indicated that they were proud of themselves; they hadn't played the game before the intervention, but they were able to master the game by the end of the eight-week tournament. During each session, participants were provided with directions for each game and individual assistance from a research assistant. This on-demand support helped them to acclimate to the game controls, alleviating potential confusion and frustration. Last but not least, Wii Bowling was easy for older adults to interact with since it allowed participants to interact naturally with the game. The game also provided clear and positive feedback to promote players' self-confidence. Marston (2013) pointed out that older adults will only invest their time in such entertainment if they can understand and see the purpose of their actions.

Nap, de Kort and IJsselsteijn (2009) found that the majority of older adults have negative perceptions about multiplayer gaming. Gajadhar et al. (2010) pointed that older adults' negative perceptions about playing against other human players could be caused by the fear of failure. In this study, many participants highlighted their positive experiences of competing with other teams. Therefore, we suggest that in the context of co-located gameplay, older adults enjoy team competition or social competition. The findings of this study support Gajadhar et al.'s (2010) conclusion that co-located social gaming is a "mix of social fun and involvement and social competition" (p.80).

There are two limitations to this study. One limitation is that the participants were recruited based on their availability and interest in this study. Therefore, the results cannot be generalized to other populations, such as older adults who are not interested in Wii Bowling. Another limitation is that health condition was not one of the sample inclusion criteria. Some participants had to sit to play due to Parkinson's disease or physical impairments. We are unsure whether participants' physical health affected attitudes towards playing Wii Bowling.

5 CONCLUSIONS

We are confident that the Wii Bowling

tournament provided positive gaming experiences to the older adults in this study and was an effective way to improve their attitudes towards digital games. Older adults are willing to use digital games if they are motivated and understand the purpose of their actions. These findings could encourage other researchers to investigate in more depth how to help older adults benefit from digital games. In addition, the social use of Wii Bowling may enable older adults to take-up this activity within many senior centers, thus enriching their daily activities and enhancing their physical and cognitive function and social interactions.

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