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Julia Naumes

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# Use of Technology in Occupational Therapy Rehabilitation from an Elderly Perspective



by Julia Naumes

2013 Excellence in Internet Research Award Winner

Through advances in medical research, nutrition, hygiene, and technology, people are living longer today than in the past. Today, as the Baby Boomers begin to reach retirement age, it is expected that the elderly population in the United States will increase significantly in the near future. The use of rehabilitation therapy is an important intervention for elderly patients to maintain their quality of life and sense of self. Specifically, “Rehabilitation therapy comprises various treatments aimed to restore, improve, or increase functional independence, prevent further loss of function, and maintain or improve quality of life for individuals living with physical illnesses or conditions”. [1] Occupational, physical, and speech therapies are examples of rehabilitative therapies (RT) that are utilized by many elderly patients.

Occupational Therapy (OT) in particular is a commonly used RT aimed at improving the quality of life of patients by enabling them to do things they highly value (e.g. occupations). Since patients have varying occupations, therapists need to use creative techniques to address a variety of needs. In recent years, technology has been used to help meet the needs of patients in a variety of ways, enabling them to stay socially active, maximizing independence, and assisting in mobility, driving, hearing, typing, and communication needs. [2] Many clinics and long-term elderly care centers are beginning to incorporate virtual rehabilitation (VR) into their therapeutic practices using programs and modules such as the Nintendo Wii and the OMNI Virtual Rehabilitation (VR). VR is defined as “the use of interactive simulations created with computer hardware and software to present users with opportunities to engage in environments that appear to be and feel similar to real world objects and events”. [3] As the world of medicine becomes more technologically based, it is important to understand how the growing elderly population perceives technological

## Literature Review

The Nintendo Wii is the most researched gaming console in therapeutic settings. Research by Deutsch, examined the feasibility of using the Wii gaming console for physical therapy rehabilitation. They chose the Wii for of a variety of reasons—including affordability, ability to let the client sit while participating, knowledge of performance and of results, allowance for multiple users, and ability to be analyzed biomechanically and for motor control requirements. [4] For example, the option of sitting is important for many elderly clients because some cannot stand for long, or at all. In many situations it is not safe for them to stand for long periods of time. Also, allowing clients to sit lessens the negative impact fatigue can have on therapy.

Compared to other Virtual Rehabilitation (VR) consoles, the Wii allows more patient access to quality care. Research shows that the Wii is preferable to other forms of VR because it is cost-effective, has good graphics, and is fun for clients, which encourages them to work harder and socialize with other people.[5] Accomplishing therapeutic goals while having fun offers strong motivation for patients to work hard. Further, being able to have fun while in a group therapy setting is a way for patients to feel socially connected.

Preliminary research shows that the use of the Wii gaming console in therapy settings has positive affects on patients' quality of life, primarily because it increases their group interactions and provides social support. [6] Although many elderly patients rarely engage in group interactions, research shows that social support and social interactions are critical for sustaining a sense of self and improving quality of life. [7] Connecting with one's former self also is a highly motivating factor for many people. As people age, they lose their ability to engage with life in the way they once did. This is due largely to physical changes in their bodies, disease, and injury. Sports that clients were once involved in, such as golf and/or bowling, can connect clients with their former selves and passions while doing similar but modified actions on the Wii. [8] Research demonstrates that staff members at rehabilitation clinics perceived many benefits for patients who used the Wii as a therapy modality. [9]

Higgins, Horton, Hodkinson, and Muggleton (2010) found that while using the Wii, clients were distracted from their physical pain, which enabled them to continue therapy sessions longer and thus reap better treatment outcomes. The positives noted included increases in general mobility and physical activity, greater persistence with therapeutic activity, social interactions and social skill building, heightened self esteem and confidence, connections with former self, and pacification of challenging behaviors. [10] Bell and colleagues also found that patients typically spent more time doing their therapeutic activities when playing the Wii when compared to conventional therapy tech-

niques, (e.g., learning how to use aids for dressing and improving balance). [11] Such findings were also supported by Halton who discovered that clients often forgot about their physical limitations while using the Wii for rehabilitation purposes. [12] Conventional therapy can be repetitive and boring for patients; however, the variety in tasks that VR allows can be rewarding for patients. [13] This, along with the feedback given by the VR consoles and connection with former self, helps keep patients motivated and engaged.

Although there has been a great deal of research done on the use of gaming consoles, like the Nintendo Wii, as therapeutic devices, little research has been done on how the elderly population perceives the use of technology in therapy. The Wii is similar to the OMNI VR, a device also used in many rehabilitation settings. Little research has targeted other forms of VR, like the OMNI VR. This leaves a significant hole in the elderly experience of this particular program. Further technological advances indicate a need for research on how elderly people feel about using technology within rehabilitation settings. Typically the elderly population in the United States is less comfortable with technology than the rest of the society and few consider themselves digitally literate. [14] However, as digital literacy becomes essential to performing many daily tasks, it is important to understand the elderly experience. [15] By researching the technological needs of the elderly population, VR can be improved and hopefully cost-effective, enabling more patients to access the care. It is also important to see how VR can extend the rehabilitation process and improve the quality of life of senior citizens.

The current study focused on the experiences of patients at an elderly care facility in a small rural town in the Northwest United States. Patients use the OMNI Virtual Rehabilitation system during Occupational and Physical Therapy sessions to improve balance, endurance, and coordination. Hopefully, the information collected will be used to enhance the experiences of both current and future patients utilizing technology driven rehabilitation. Findings will be shared with staff and directors so that they can better meet their population's needs. This information could prove invaluable since gaming consoles are typically designed for young people, and so do not always work well with the physical and mental impairments that come with aging.

## **Methodology**

Six semi-structured interviews were conducted with elderly rehabilitation patients, male and female. Initial contact was made via referrals from the rehabilitation team at the care facility. Once co-participants agreed to participate they were contacted in person to discuss the parameters of the study and to schedule interview times. After obtaining written informed consent, the

principal investigator (PI) began the interview. Participants were interviewed using a semi-structured interview protocol about their experiences using technology, of the rehabilitation process, and of using technology within the rehabilitation process. The themes of the questions included, (1) experiences with technology prior to OT, (2) experiences of OT, (3) experiences with the OMNI Virtual Rehabilitation, and (4) adherence rates and motivation. Additional questions were asked to gain further clarification and/or provide additional details to previous comments. Interviews lasted from 10 minutes to 2 hours and were an average of 60 minutes, depending on the depth of co-participants' responses. All of the interviews were audiotaped and later transcribed verbatim. In addition to conducting the interview, the PI also took field notes to describe the physical location of the interview and any other behaviors of the co-participants not caught on tape. The final sample size was dictated by data saturation; the concept of saturation refers to the point at which no new information or themes are being obtained in the interviews. [16]

## **Data Analysis**

The data was analyzed in a number of ways. After the interviews were transcribed from audio to text, co-participants were sent a copy of the written interview to verify their responses and ensure that the representations were correct. The PI began the initial stage of analysis by identifying codes, or important concepts, that emerged during the data collection process. The PI then invited members of her research group to question, challenge, and reinforce the interpretations in order to assure they were fully supported in the interview transcripts. [17] The use of a research group enhanced the rigor of the interpretative process as well as provided inter-rater reliability. [18] All members of the research group were required to sign a confidentiality agreement form. The PI also worked with the group in developing a thematic structure for the data. This process involved the identification of "meaning units," grouping the meaning units into sub-themes, and clustering sub-themes into major themes or categories.

## **Results & Discussion**

Two main themes emerged from the data analysis—Psychosocial & Functionality (Figure 1). The psychosocial theme illustrated the value elderly rehabilitation patients placed on the psychological and sociological benefits of using technology within rehabilitation. The psychosocial subthemes included, Keeps Mind Engaged, Distraction from Pain, Limitations, & Disability, Connection with Former Self, Social Interaction, Fun, and Confidence & Digital Liter-

acy. The majority of the Psychosocial subthemes were consistent with previous research cited in the Literature Review. However, Keeps Mind Engaged and Confidence & Digital Literacy were new concepts. The functionality theme indicates that to increase adherence rates and motivation, the patients must find the technology interesting, easily accessible, and rational. The subthemes here included Setup & Ease-of-use, Increased Strength & Endurance, Game-like, and Adaptability. The main barriers to using technology in rehabilitation settings were Confidence & Digital Literacy and Setup, the rest of the subthemes that emerged were positive.

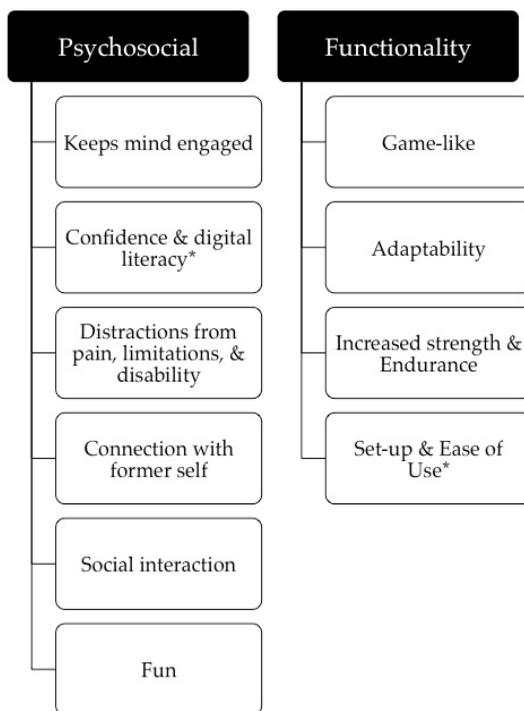


Figure 1. A visual depiction of the themes and subthemes found in the research. Note. \* Indicates a barrier to technology use.

## Keeps Mind Engaged

Participants stated that both the OMNI VR and the Nintendo Wii helped to keep their mind engaged and that cognitive awareness was one of the most beneficial aspects of using VR in the therapeutic setting. This is exemplified when Sam said:

*There's lots of benefits. [The Wii] keeps you thinking. It keeps your mind working. If it weren't for that, what would I do? Sit in a chair*

*all day long because I'm not physically able to work. But at least that keeps my mind thinking.*

*This demonstrates the importance Sam placed on being able to use the Wii in his day-to-day life and that it added to his quality of life. Similarly, a sufferer of Multiple Sclerosis (MS), Betty, felt the use of VR enabled her to focus mentally and physically on her surroundings for greater mobility.*

*I don't think I played all the games. They would do them at different speeds, but they really made you pay attention. Depending on the game you really had to be paying attention up here, you were using your brain, your eyes, and whatever physical parts you had to use. Whether it was standing or you just really had to focus on the objective of the game and then do your best at whatever you were supposed to be doing. Whether it was moving your feet to a certain spot on the screen or whatever, you really had to focus and that helped you physically and mentally (Betty).*

For Betty, the use of the OMNI VR allowed her to exercise her mind and body, be more aware of her surroundings, and lessen the risk of falling. This is especially important for patients with balance problems since they are at a higher risk of falling. [19] The literature review did not reveal cognitive engagement as an important theme in VR research, which suggests that this is a new concept in this field. It would be beneficial for further research to specifically focus more on how VR affects cognitive awareness.

## **Confidence & Digital Literacy**

Many co-participants felt their digital literacy was a barrier to their use of technology. For example, Whitfield said, “my wife runs the computer and she has troubles with it, so I don’t even try.” His lack of self-confidence affected his ability and motivation to operate a computer. Similarly, Sam said, “Well, it [technology] hasn’t affected me much because I haven’t used it. I don’t know how to use it. I went through the tenth grade and then to farming. I never graduated.” Sam’s lack of education, knowledge, and experience prevented him from attempting to use technology.

These findings are supported by research conducted by Morris. Morris found that older people are missing out on the benefits of technology because of perceived barriers to e-literacy. Barriers include “lack of interest, feeling too old, fear of new technology, lack of access to IT, lack of IT skills and experi-

ence, cost, concerns about security, and problems with associated disability". [20] Similarly, Pietrass found that the elderly population utilizes technology for rational purposes, whereas youth use it playfully. The co-participants in this study stated that they would not use technology unless they saw the point in it, also known as functionality. Many participants used technology to pay bills, increase strength and endurance, and to communicate with loved ones, all of which they saw these as functional uses for it. [21]

## **Distraction from Pain, Limitations & Disability**

Interestingly, The OMNI VR offered a distraction from pain, limitations, and disability. This was supported by previous research that found the Nintendo Wii, a form of VR, enabled patients to continue with therapy sessions for longer amounts of time. [22, 23, 24] For example, Doonie describes one of the first times she used the OMNI VR:

*The OMNI VR, yes ... it tested my endurance. The first one was the bingo game and the first two times I played I wasn't too lucky with getting a bingo very quick. There was the one where you chase the bugs off the stepping-stones and another where you do a puzzle. I like puzzles. These things were entertaining. They weren't something that I would get tired of too easily. Other than the bingo. But, be that as it may, I got through that and it made the time go faster, by far. I didn't realize I'd been in there as long as I had when they finally says, "Okay you're gonna go back." I says, "thank you," cause I was exhausted. I mean more than I thought I could be. I couldn't sleep that night I was so exhausted.*

This quote also demonstrates the importance of therapists' awareness of each individual's limitations and to be mindful of not pushing the patient past their endurance level. This is especially important for elderly populations because they are more susceptible to injuries.

## **Connection with Former Self**

As discussed in the literature review, VR allows patients to connect with their former selves by allowing them to participate in similar motions and sporting activities they once did. [19, 20] For example, Sam said that he and his wife regularly used the Wii because it enabled them to golf, which was an important activity in their lives when they had greater physical mobility. As Sam said:

*Well I've always been a sportsman. I golf on it [the Wii] all the time. And once in a while we will change over and play something else, but mostly golf. It is a very good, very nice machine ... It's a good machine to golf with. Because I'm more or less held to a chair anymore. I don't get up and run around like I used to. I've had a good life though.*

Although Sam can no longer physically golf, he is able to participate in a similar activity using the Nintendo Wii. This also tied into the theme of social interaction because he was able to connect with his wife and grandchildren by competing with them virtually.

## **Social Interaction**

Social interaction is a subtheme that emerged both in the previous research and in this current study. In the following quote Doonie discusses the importance of social interaction in her life, along with the ease-of-use and adaptability of the OMNI VR.

*The first time I saw [the OMNI VR], I was very impressed. I like the colors. I like the ease-of-use, that's a biggie! I like that there's different levels of everything. In fact I was thinking of asking them where I could pick one up! Haha. I wouldn't be against using one at home, for a couple of reasons. If the grandkids come in while I'm doing it, they could join me! They could manage it as well. And, they'd get bored with it, I'm sure, cause they're young. But you know, for me, it's the kind of thing that would probably help me get through the winter (Doonie).*

Doonie valued the ability to connect with her grandchildren and husband and demonstrated that the OMNI VR could be used as a vessel to facilitate social interactions. She also stated that it would help her to continue exercising throughout the winter months, which were a struggle for her because she typically exercised outside when the weather was nice.

## **Fun**

Similarly, patients value rehabilitation that is fun because it helps keep them interested and engaged in the process. Fun and game-like are two related subthemes that emerged. Whitfield explains how he values that VR can be more fun than traditional rehabilitation.

*Well it was rehab, but it was things that are fun to do. And it makes a*

*big difference if it isn't just straight rehab... The picnic one where you stomp out the ants and things like that. That was kind of fun! And then bouncing the Ping-Pong balls was kind of fun. And they do, try and make things so you have some interest in really doing what it is and it's a lot easier than just plain rehab.*

Halton also found that when patients enjoy their rehabilitation experience they are able to work harder and longer. [24] Doonie covered such subthemes in the following quote.

*Keeping it interesting. And I think even someone who doesn't like computers, who doesn't like dealing with them, I really think it's a way to keep them engaged, to keep them interested. And the graphics are beautiful on that program. To me, that's the biggie. Yeah, I think that, if nothing else, that's the main thing. And maybe the fact that it can be changed easily. Changed out. The program can be tweaked sometimes. And even the different levels. And you've got that all built in. I think that's fantastic. I think it's a really worthwhile program.*

Doonie explains that the OMNI VR has many attributes that are valued by the elderly population, such as being appealing to the eye, easy to operate, fun, and useful. One of the most important topics in rehabilitation is adherence rates once the patients return home. Having a fun program that physically and cognitively benefits the individual is a great asset for improving quality of life and increasing adherence rates.

## **Adaptability**

Rehabilitation programs need to be adaptable in their intensity level so that as the patient develops neural control and physical fitness levels they can continually be challenged. [25] The OMNI VR is adaptable in that you can perform from standing or sitting positions, can change the number of puzzle pieces, and a variety of difficulty levels in virtual rehabilitation. Doonie describes her experience of the adaptability of the OMNI VR:

*It could be done from a standing position, that's the way I've done it. And then the puzzle game, there's a good selection of easy to hard pictures to choose. And, it's nice that they've got a choice of how many squares, for me I think they chose 25 squares per puzzle.*

The adaptability allows the VR to be made developmentally appropriate as increases in skill-level and physical ability occur.

## **Increased Strength & Endurance**

The primary goal of elderly rehabilitation is to increase strength and endurance so patients are able to safely return home. Therefore, this is a strongly valued attribute of the OMNI VR. It has been demonstrated that OMNI VR helps patients increase their strength and endurance levels. For instance, Fern said, “Well I don't know exactly when it happened, but it was great when I started getting stronger.” Betty expands this when describing how she perceived the OMNI VR has helped her deal with her MS symptoms.

*You had to really concentrate and test how you needed to react and where you needed to react. Whether it was your hands, or your feet, whether you were standing somewhere. Some of them involved sitting and then standing, then sitting, then standing repeatedly. Some of them were standing, then moving, or sitting then, using your feet to direct whatever was going on on the screen. So it was quite a wide variety and it helped to build strength. The therapy was some of the best things that happened here and really helped to build my strength. I got a lot of exercises to do that I did in therapy and then I could do them everyday. I am still doing them everyday so that I can retain what I gained during therapy before I go onto assisted living and don't lose any of that.*

To Betty it was very important to be able to retain the gains from rehabilitation in order to continue living a quality life.

## **Set-up & Ease-of-use**

A deterrent to many elderly patients attempting to use technology is having a long or complicated set-up. Doonie discussed how she was not motivated to use the Nintendo Wii. “It's too much for me to set it up. You know after the grandkids have used it, I have to re-set it up for me. I guess I'm just not into it enough to care.” She has utilized both the Nintendo Wii and the OMNI VR and compared both consoles on their ease-of-use.

*Wii is hard for me because first you're supposed to fill in all this personal data. And then they do all the measuring. I suppose if I ever got into it, I might enjoy it, but I never got into it. By the time I got into it*

*I'd wasted so much time, I felt like that I didn't want to bother with it. And so, truly I doubt if I've used the Wii more than 5 or 6 hours in the 7 years I've had it. Now with the OMNI VR, you know, I've only been here about 10 days and I haven't had that much use with it. But the first time they showed it to me, I liked the colors, I like the graphics, I like the way it was point and click and you were doing your exercise. You didn't have to fool with a lot of setup. You know, I've got scales, I can weigh myself. I don't need the machine to do that for me. I've got my own physical ability that tells me that I'm getting better. I did like the page that shows the goals that I've accomplished, or how many mistakes I've made, cause I go against myself now and then. But I think the ease of use is probably the biggest benefit to that. And I would think that would be true to also the therapists. You know, they don't want to spend all their time getting setup and everything. If they can go turn on a button and put you in position, and you can do it, that's a good program to me. Something that doesn't get overly complicated.*

## **Conclusion**

Virtual Rehabilitation is a great tool for the elderly population to utilize in maintaining physical and mental engagement, connection with former self, and maintaining or increasing physical fitness levels. The elderly population interviewed was receptive to the use of VR and perceived many positive attributes associated with it. Since this study has a small sample size, more research is required to extend the findings to a larger elderly population.

The co-participants who had the highest amount of social support also had better health and a more positive outlook on life. Future research should look into the relationship between outlook, social support, and health. Although this was not within the bounds of this study, it would be interesting to see how these three variables relate within the elderly population and to research how to increase social support in elderly rehabilitation centers so health and perspective on life may be improved.

Elderly rehabilitation centers could further support their patients by setting up a transition program to help interested patients continue to use VR; for example, staff members could create a document for patients to refer to when setting up the OMNI VR, Nintendo Wii, or Xbox Kinect. They could also assist patients with technical difficulties so they adhere to the rehabilitation program while at home.

The facility where the research was conducted did not have a Nintendo Wii for the patients to utilize. Investing in one could be beneficial for patients to enable them to connect with their former selves, distract them from their

ailments, and increase the social connections and support between patients and staff members. The addition of a fun, competitive, and therapeutic device could greatly increase perceptions of the clinic and rehabilitation experience by giving patients something to look forward to while they are not doing therapy or visiting with loved ones.

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