Adapted video game controller use following upper extremity Injury and amputation: from fun to functional

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INTRODUCTION

Engagement in video game play has become increasingly popular within the past few decades and can be considered a meaningful occupation to a large population of individuals.[1] For many players, video games provide an opportunity to escape reality through engagement in tasks that facilitate success and can serve as a platform for social participation in both a physical and virtual context.[2] For many individuals who sustain upper extremity injuries that limit function such as amputation of fingers or whole hands, brachial plexus injuries, and spinal cord injuries, video game play has the potential to provide an escape from the devastating implications of these injuries. Video games provide users with tasks that can be completed and often have clear goals that give the player a sense of control over their actions. [2] These tasks provide immediate feedback and an altered sense of duration of time. A deep but effortless involvement in play produces experiences of “losing awareness of worry and frustration of everyday.”[2]

Unfortunately, many individuals with upper extremity injuries that limit functional use of that extremity find it difficult to engage in video game play due to the set up and button placement of standard controllers and are therefore unable to experience all of the potential benefits that engagement in video game play can provide.[3] Custom adapted video game controllers that meet the exact needs of an individual with physical disabilities can provide these individuals with the opportunity to engage in video game play once again. These custom adaptations include re-wiring button placements so they are more accessible, utilization of bite switches, levers that can be activated with the legs or feet, built-up or larger buttons, sip and puff switches, and many other adaptive hardware techniques. [3] Through adaptations in controller hardware, individuals with limited upper extremity function secondary to injury are now provided with the opportunity to engage in this meaningful occupation once again. This study explored the impact of re-engagement in video game play on quality of life for individuals with upper extremity injury through the use of adapted controllers.

METHODS

Design

This was a mixed-methods survey-based study that employed the use of the Psychosocial Impact of Assistive Devices (PIADS) standardized assessment. The survey also included intake questions that gathered information on the nature of the participant’s injuries, age, gender, the capacity in which they use video game play, time spent engaging in game play per week, components of hardware on the controller they use, and an opportunity to provide open ended responses or general comments about their experiences with adapted controllers. The study was approved by the University of Scranton Institutional Review Board.

Participants

This study included a sample size of 20 participants. The age range of participants was between 25 and 52 with a mean age of 29.38. Five of the participants were civilians and the other 15 participants were veterans of the United States military. Half of the participants utilized adapted controllers secondary to non-amputation related injuries such as traumatic brain injury (2), spinal cord injury (2), nerve injury (1), limb salvage (1), brachial plexus injury (1), muscular dystrophy (1), or paralysis (2). The other half of the participants utilized adapted controllers secondary to amputation-related injuries. This included bilateral upper extremity amputations (2), amputation of one extremity and injury without amputation to the other extremity (1), above elbow unilateral amputations (3), below elbow unilateral amputations (2), amputation of just the hand (1), and amputation at the wrist joint (1).

Figure 1. Sample of Adapted Controller used by Participants [4]

Equipment

Every controller utilized by participants in this study differed from one another due to the variety of functional ability and nature of injury of that participant. Each controller was custom-made to fit the needs of the individual in order to provide optimal performance in game play. Some standard adaptation components identified by participants used for their controller included combinations of the following: bite switches (2), leg operated paddles (6), enlarged buttons (10), oversized joysticks (10), foot operated buttons or switches (10), levers that extend the length of bumper buttons (10), and buttons that are rearranged to another location on the controller (6). Many controllers that were more complex were laid out on a platform with careful placement of controller components to allow easy access for the user.

Procedure

Recruitment for participants in this study was conducted via the social media outlet Facebook. The non-profit organization that created and provided the adapted controllers to the participant population consented to post an online survey link to an anonymous survey platform which contained the Psychosocial Impact of Assistive Devices (PIADS) assessment, intake questions, and open-ended comment boxes on their Facebook page. Those who were apart of this organization's social media network and wished to voluntarily participate in the study upon viewing the Facebook post were able to direct themselves to the survey via a posted link and respond to the survey questions containing the preliminary intake questions and the PIADS assessment. Anonymity of participants was maintained through the online survey platform.

Analysis

The impact of adapted controller use on quality of life was assessed through scoring of the participant's PIADS assessment responses. The scores for this assessment are broken down to three subscales (Competence, Adaptability, and Self Esteem) comprised of a total of 26 questions. Mean subscale scores were calculated using the algorithm provided by creators of the PIADS assessment. [5]

Mean scores for all participants for each subscale were compared to a study with the same sample size (n=20) but used the PIADS assessment on a different piece of assistive technology (manual wheelchair) in order to serve as comparative data.

Further analysis included looking for trends in the capacity in which users indicated their reason for controller use and game play (as a means of leisure, engaging with others, passing time, increasing functional independence, escaping from current problems, etc.). Qualitative data was also gathered through open-ended comment responses provided by participants.

RESULTS

The survey provided participants with the opportunity to select as many options as applicable in terms of the capacity in which they use video games; 100% of participants indicated that they use video games as a leisure activity that they enjoy, 23.81% indicated that they use video games as a means of engaging with their children, 57.14% indicated that they use video games as a means of passing time, 42.86% indicated that they use video games as a means of increasing their functional independence, and 57.14% indicated that they use video games as a means of escaping from current problems.

When comparing mean scores of the PIADS assessment for participants in this study to participants in a different study who completed the PIADS assessment based on their experience with manual wheelchair [6], participants in this study scored higher in all three subcategories (Competence, Adaptability, and Self Esteem).

Table 1. PIADS Assessment Scores

Adapted Game Controller PIADS Assessment (*n*=20) Mean Subscale Scores (SD)	**Manual Wheelchair PIADS Assessment (*n*=20) Mean Subscale Scores (SD)**
Competency: 1.47 (.76)	Competency: 0.95 (1.10)
Adaptability: 1.74 (.93)	Adaptability: 0.90 (1.32)
Self Esteem: 1.57 (.68)	Self Esteem: 045 (1.06)

Some particularly compelling qualitative data that was gathered included open ended statements provided by participants such as “knowing that I can adapt to video games helps me with my daily struggles in a way most people could never imagine,” and “having a one-handed gaming controller has completely increased my happiness tremendously as well as my coordination.” Other responses from participants that suggest the positive impact of adapted controllers include “getting my game controller helped me heal my depression and gave me something to do and for that I am grateful.” Qualitative data that emerged with common themes of adapted game controllers use to increase function included “most physical sports are difficult to engage in with my friends, but the adaptive controllers make it possible to engage in online gaming with my friends” and “gaming (driving games) gave me the confidence to get back behind the wheel and start driving again.”

DISCUSSION

Although preliminary quantitative and qualitative analysis of data from this study suggests that the use of adapted video game controllers that allow individuals with upper extremity injury to engage in play once again has overall positive effects on various aspects of one’s quality of life, there is very limited normative data to compare the results of this study to in order to best determine the impact of these devices on this population.

General themes and trends from the data gathered suggest that video game play through the use of adapted controllers extends further for users than just a leisure activity and may also serve as a means of increasing functional independence through improvements in coordination as a result of play, and provides an escape from the user’s current problems or frustrations of everyday life.

Study limitations included the fact that this was a pilot study with a small sample size of individuals who had diverse backgrounds and mechanisms of injury which warranted adapted controller use. This study should provide grounds for further research on the positive impacts of adapted video game controllers on quality of life.

CONCLUSIONS

The use of adapted video game controllers after upper extremity injury have an overall positive effect on users in the subcategories of competence, adaptability and self esteem as compared to another assistive device. Usage of these devices and their impact on quality life extend beyond fun and leisure. Adapted

video game controller use may also impact one's functional independence, mental health and social participation which can all be considered constituents of one's quality of life.

REFERENCES

[1] Gillen, A., & Watkins, J. (2011). Where is the Evidence Base to Help Occupational Therapists Select Technological Occupations for Current and Future Service Users? *British Journal of Occupational Therapy, 74*(2), 92-94. doi:10.4276/030802211x12971689814124

[2] Cowley, B., Charles, D. Black, M., Hickey, R. (2008). Toward an understanding of flow in video games. *ACM Computers in Entertainment,* 6(20), 1-27.

[3] Jones, K. (2016, December 19). Warfighter Engaged - About. Retrieved November 20, 2017, from http://www.warfighterengaged.org/about

[4] Warfighter Engaged. (2016). *Project 4.* [Photograph]. Retrieved from http://www.warfighterengaged.org/project-4/

[5] Day, H., Jutai, J. (1996).*PIADS Manual.* University of Ottawa

[6] Martins, A., Pinheiro, J., Farias, B., & Jutai, J. (2016). Psychosocial Impact of Assistive Technologies for Mobility and Their Implications for Active Ageing. *Technologies, 4*(3), 28. doi:10.3390/technologies4030028