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How might active video gaming affect physical activity and physical fitness of students with intellectual disabilities?

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How Might Active Video Gaming Affect Physical Activity and Physical Fitness of Students with Intellectual Disabilities?

by

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Abstract

In the United States, there has been increasing concern about the obesity crisis. A large factor in this crisis is physical inactivity, which may have detrimental effects on an individual's health. Participation in physical activity is essential to preventing and reducing obesity and may positively affect physical fitness. Researchers have begun to look at a newer form of video gaming called active video gaming (AVG), which is a physically interactive video game that helps individuals stand up and move. The purpose of this research study was to examine what effects active video gaming has on physical activity and physical fitness of students with intellectual disabilities. Selected from an adapted physical education class, six participants between the ages of 19 and 22 years old with a moderate intellectual disability participated in the research study. For the study, on the first and last day, each participant completed a Pacer 20m fitness test, and in between the two tests, the participants participated in two 10-minute active video gaming dance sessions each day for 10 school days. It was hypothesized that students with intellectual disabilities would show significant improvement in physical fitness after dancing for 20 minutes per day for 10 school days using the Nintendo Wii AVG system. The results of a paired sample t-test indicated there was a non-significant statistical difference in the number of Pacer 20m laps completed from the pretest to the posttest, which suggest that the Nintendo Wii AVG intervention had little to no effect on the physical fitness of these six participants with intellectual disabilities. Further research on AVG should be done to see if it could be used as an effective instrument to increase physical activity and physical fitness for individuals with intellectual disabilities, thus improving their overall health.

Keywords: active video games, physical fitness, physical activity, obesity, intellectual disability, special education

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Chapter 1: Introduction

There has been increasing concern about the number of individuals living physically inactive lives, which could lead to obesity (Graf, Pratt, Hester, & Short, 2009; Graham, Perron, Feldman, & Hall, 2011; Lanningham-Foster et al., 2006; Maloney et al., 2008; Sell, Lillie, & Taylor, 2008; Trout & Zamora, 2008). Physical inactivity is a large factor in the obesity crisis spreading across America (Sell et al., 2008). The percentage of overweight youth (ages 6–19) in this country has tripled from about 5% in 1980 to about 16% in 2002 (U.S. Department of Health and Human Services, 2005). The U.S. Department of Health and Human Services (2005) has recommended people get at least 60 minutes of moderate to vigorous physical activity every day. Yet in 2008, the Centers for Disease Control and Prevention found 75% of young people do not meet the national recommendations for physical activity levels. Physical inactivity has harmful effects on our health, such as type 2 diabetes, hypertension, and cancer (Sell et al., 2008). In addition, inactivity at a young age may have negative effects on a person's health throughout their life (Duda, Ntoumanis, & Standage, 2003).

The health of individuals with intellectual disabilities is of tremendous concern because this population tends to have higher levels of obesity and physical inactivity compared to individuals without disabilities (Foley, Lieberman, & Wood, 2008; Smith, 2015). People with intellectual disabilities are at risk of developing physically inactive ways of life (Smith, 2015; U.S. Department of Health and Human Services, 2005). The organization, Healthy People 2010, had a goal to increase the physical activity of individuals with disabilities. However, five years into the 10-year plan, the physical activity levels of individuals with disabilities did not change (Centers for Disease Control and Prevention, 2008).

Individuals with intellectual disabilities have the same daily fitness needs as those without disabilities. However, children and adults with intellectual disabilities fall below their peers on almost all health and fitness measures (Winnick & Short, 1999). People with intellectual disabilities have less opportunity to participate in sports programs as compared to those without disabilities, because coaches may feel they do not have the necessary skills to effectively coach these individuals in an integrated team setting (Kozub & Porretta, 1998). Further, individuals with intellectual disabilities have low skill levels and fitness scores, which might be explained by the research findings showing they have a propensity to be less inclined to participate in physical activities than individuals without disabilities (Kozub, 2002). These low fitness and skill levels could lead to inactivity in individuals with intellectual disabilities (Kozub, 2003).

Physical activity (PA) is defined as any movement produced by the muscles that result in energy expenditure (Fogel, Miltenberger, Graves, & Koehler, 2010). A relationship exists between physical inactivity and the risk for developing several chronic diseases, such as obesity, heart disease, diabetes, and cancer (Sell et al., 2008). Regular PA decreases the risk for health problems, such as heart disease, hypertension, and obesity (Sell et al., 2008). Currently, there is an increase in the interest of measuring PA among many parts of the population (Trout et al., 2008).

With the growing use of video gaming by young people and the rise in obesity rates, video gaming is often considered a major factor in the increase of obesity and the decreasing levels of physical activity among youths (Maddison et al., 2007). Despite this, research indicates only weak relationships between video games, and obesity and physical inactivity (Daley, 2009). With time spent playing video games continuing to increase, researchers have begun to examine a new form of video gaming called active video gaming (AVG). The use of physically interactive

video games to get individuals physically active has received a lot of attention, mainly due to games and systems such as Dance Dance Revolution (DDR) and the Nintendo Wii (Griesr, Goa, Ransdell, & Simonson, 2012). AVG allows individuals to begin at their own fitness level in safe and relaxed surroundings. In addition, playing AVG systems is an intervention individuals like to do (Worley, Rogers, & Kraemer, 2011). Even with the growing popularity of AVG, some people continue to be unconvinced of the proclaimed health benefits of AVG. However, recent research has shown that some AVG systems may provide health benefits by increasing PA, thus improving physical fitness (PF) (Graf et al., 2009).

The purpose of this research study was to examine what effects AVG has on the PA and PF of students with intellectual disabilities. It was hypothesized that students with intellectual disabilities would show significant improvements in PF after dancing for 20 minutes per day for 10 school days using the Nintendo Wii active video game system.

Chapter 2: Literature Review

Since active video gaming (AVG) has unlocked this alternative way to play video games by getting people up and physically active, and with the increasing popularity of AVG, there have been many studies examining the effects AVG has on physical activity (PA) and physical fitness (PF). In addition, with the continued development of AVG comes many more new opportunities for educational research. Therefore, PA and PF continue to be critical areas that require quality research in AVG. The purpose of this literature review was to examine what effects AVG has on PA and PF of students with intellectual disabilities. I hoped the findings would result in significant increases in PA and PF, thus providing another option to help improve student's health. In my literature review, I could not find any research exploring the impact of video gaming, AVG, and PA for people labeled as having intellectual disabilities. Thus, the review drew upon the information found in the current research in regards to the general population. To reveal what effects AVG has on PA and PF, the following topics are discussed: sedentary screen time (SST), traditional physical activity, in-game difficulty levels, and enjoyment.

Sedentary Screen Time (SST)

The rapid rise of obesity together with low levels of PA have been partially blamed on the increase of SST, such as watching television, using computers, and playing video games (Lanningham-Foster et al., 2006; Lanningham-Foster et al., 2009; Maddison et al., 2007). Researchers have begun to examine the use of AVG as an intervention to decrease SST and encourage active screen time to increase PA levels (Lanningham-Foster et al., 2006; Lanningham-Foster et al., 2009; Maddison et al., 2007).

In this section of the review, I examined three research studies that compared energy expenditure (EE) and PA levels between the AVG systems of PlayStation 2: Dance Dance Revolution (DDR), PlayStation 2: Eye Toy, Nintendo Wii Boxing, and the SST activities of sitting watching television and sitting playing a sedentary video game (Lanningham-Foster et al., 2006; Lanningham-Foster et al., 2009; Maddison et al. 2007). The data showed significant increases in EE and PA when playing DDR, the Eye Toy games, and Wii Boxing when compared to sitting watching television and sitting playing traditional video games (Lanningham-Foster et al., 2006; Lanningham-Foster et al., 2009; Maddison et al., 2007).

In addition, there were two in-home research studies reviewed that examined the use of the AVG systems of DDR and Eye Toy games and the effects they have on the PA levels and SST (Maloney et al., 2008; Mhurchu et al., 2008). The PA data showed a significant increase in vigorous PA and an increase in PA counts when compared to the control groups. The SST data revealed the AVG group reported significant decreases in SST and had a significant increase in AVG playing time when compared to the control groups. Lastly, the control groups showed no increases in PA levels and reported an increase in SST activities (Maloney et al., 2008; Mhurchu, et al., 2008).

In summary, these studies have provided some preliminary data that demonstrate how AVG could affect PA and SST.

Traditional Physical Activity

Traditional physical activities, such as playing sports, riding a bike, and running, can be effective in increasing PA and PF (Graf et al., 2009). Since the emergence of AVG and its continued popularity, the following studies compared AVG metabolic and physiological responses to the responses of traditional physical activities.

In this section, I looked closely at five research studies that examined the participant's EE, heart rates, and PA levels when playing the AVG systems of Dance Revolution (DDR); Nintendo Wii Fit: Hula, Steps, and Cycling**;** Nintendo Wii Sports: Baseball, Bowling, Tennis, and Boxing; and a bike ergometer. The data from the AVG systems were compared to the participant's EE, heart rates, and PA levels when participating in the traditional physical activities of walking on a treadmill at various speeds, unstructured activities, and riding a stationary exercise bike while watching television (Graf et al., 2009; Graham et al., 2011; Kraft, Russell, Bowman, Selsor, & Foster, 2011; Naugle, Naugle, & Wikstrom, 2014; Willems & Bond, 2009). The data showed significant and non-significant increases in EE, heart rates, and PA levels when playing DDR; Wii Boxing, Bowling, and Tennis; and Wii Fit Hula and Steps when compared to walking on a treadmill at 3.5 miles per hour and unstructured activity. In addition, the data showed that while playing AVG, the participants, increased EE and PA levels high enough to reach moderate intensity levels, thus achieving the PA recommendations (Graf et al., 2009; Graham et al., 2011; Kraft et al., 2011; Willems et al., 2009).

Contrary to this data, the Kraft et al. (2011) and Naugle et al. (2014) studies found that heart rates for walking on a treadmill and riding a stationary exercise bike were significantly higher than the AVG systems of DDR, cycle ergometer, Wii Bowling and Tennis, and Wii Fit Cycle and Steps. In addition, the Naugle et al. (2014) study revealed the participant's engagement in traditional exercises reached moderate to vigorous PA intensity levels, thus achieving PA recommendations, but the Wii AVG did not reach those levels.

In summary, these studies have provided some preliminary data that demonstrate how AVG could produce similar metabolic and physiological responses to those of traditional physical activities (Graf, et al., 2009; Graham et al., 2011; Kraft et al., 2011; Willems et al.,

2009). Since video gaming is very popular and growing along with the climbing obesity rates, we need further research to find AVG that can consistently achieve intensity levels of traditional physical activities.

In-Game Difficulty Levels

I also reviewed three research studies that investigated whether AVG at different in-game difficulty levels had any effect on PA and PF levels of the participants.

The research studies examined the participant's EE and heart rates at different in-game difficulty levels of the AVG systems Dance Revolution (DDR) and Nintendo Wii Fit Step, Hula, Short Run, and Long Run (Grieser et al., 2012; Noah, Spierer, Tachibana, & Bronner, 2011; Worley et al., 2011). The data showed that when participants engaged in DDR on the high difficulty level, Wii Fit Hula and Steps on the intermediate level, and the Wii Fit Long Run on the intermediate level, significant increases and non-significant increases occurred in EE as compared to the less intense in-game difficulty levels. In addition, the data showed the participants increased PA levels high enough to reach moderate to vigorous intensity levels, allowing them to achieve the PA recommendations (Grieser et al., 2012; Noah et al., 2011; Worley et al., 2011).

These three studies provided preliminary data demonstrating that AVG at higher in-game difficulty levels can produce higher levels of EE and increases in PA and PF (Grieser et al., 2012; Noah et al., 2011; Worley et al., 2011). Thus, examining the effects of AVG at different in-game difficulty levels seems to be a worthwhile venture to continue to research. Any possibility of increasing PA and PF would be beneficial to an individual's health.

Enjoyment

I examined four research studies that investigated the enjoyment levels of AVG. If people consider AVG enjoyable, that might motivate inactive individuals to engage in AVG on a more consistent basis, thus increasing PA levels (Graf et al., 2009).

The four research studies examined the enjoyment levels of the participants in regard to playing the AVG system DDR. After each DDR session, participants filled out a modified Physical Activity Enjoyment Scale questionnaire, an overall enjoyment survey, or the Video Game Training Effect Questionnaire. Each measure used a 5-point Likert Scale to determine the enjoyment levels of the participants (Maloney et al., 2008; Noah et al., 2011; Sell et al., 2008; Trout et al., 2008). The data showed up to 95% of the participants enjoyed the AVG DDR sessions at high levels. In fact, 81% rated playing DDR a 4 out of 5, with 5 being the highest level of enjoyment. Experienced players significantly enjoyed DDR more when compared to inexperienced players, and all enjoyed DDR more than treadmill walking. In addition, most of the participants responded to DDR engagement as fun, easy to learn, and they were willing to continue to use it as exercise and enjoyed the competiveness (Maloney et al., 2008; Noah et al., 2011; Sell et al., 2008; Trout et al., 2008).

Enjoyment is an important factor to examine because an increasing number of individuals are becoming physically inactive by not engaging in the recommended amount of daily PA. Research shows individuals are not physically active because traditional physical activities are not enjoyable. Therefore, to increase PA, there needs to be other enjoyable options (Kraft et al., 2011). In the Maloney et al. (2008), Noah et al. (2011), Sell et al. (2008), and Trout et al. (2008) studies, most of the participants responded by stating they enjoyed, felt challenged, and wanted

to continue AVG. This is important because exercise adherence has been linked with exercise enjoyment (Trout et al., 2008).

Findings

There were significant increases in EE when compared to SST (Lanningham-Foster et al., 2006; Lanningham-Foster et al., 2009; Maddison et al., 2007). In-home studies showed significant increases in self-reported PA and decreases in SST in the intervention groups (Maloney et al., 2008; Mhurchu et al., 2008). Some preliminary data demonstrated how AVG could produce similar metabolic and physiological responses to those of traditional physical activities (Graf et al., 2009; Graham et al., 2011; Kraft et al., 2011; Willems et al., 2009). Contrary to these results, the Naugle et al. 2014 study found that AVG intensity levels do not reach the same intensity levels as traditional physical activities. Next, the Grieser et al. (2012), Noah et al. (2011), and Worley et al. (2011) studies provided data demonstrating that AVG at higher in-game difficulty levels produced higher levels of EE, thus increasing PA and PF. Finally, in the Maloney et al. (2008), Noah et al. (2011), Sell et al. (2008), and Trout et al. (2008) studies, most participants said they enjoyed, felt challenged, and wanted to continue AVG, which is important because exercise adherence has been linked with exercise enjoyment (Trout et al., 2008).

Limitations

Most of the studies had small sample sizes and used convenience, volunteer, or snowball participant selection techniques that impede generalizing the results to the general population. This could affect the results by motivating the participants to do well and lead to data bias. Because of these limitations, we need to remain cautious about the potential benefits of AVG and understand there is a need for quality randomized controlled trial studies in the area of AVG.

Most of the studies involved collecting data over short periods-of-time. Even when significant results were reported, the underlying question is "Will these significant results be sustained over time?" Many of the studies were implemented in laboratory settings with all types of equipment to measure all types of data, which might affect data by influencing effort, enjoyment, and comfort of a participant. Lastly, many of the studies used self-report questionnaires, which may lead to bias in the data results and not allow generalization to the general population.

Implications

A purpose of this review of research was to examine what effects AVG has on PA and PF of students with intellectual disabilities. Since there are no studies involving this population, I feel this would be an opportune time to continue future research examining students with intellectual disabilities and other populations not represented in past studies. There is a need for further quality research on AVG to see if it could be used as an effective instrument to increase PA and PF levels, thus improving one's overall health. In addition, we should remain cautious about the potential benefits of AVG until there are quality randomized controlled trial studies replicating the results. Further research should examine the effects of different AVG systems and other home-based AVG systems, for example the PlayStation Move or the Xbox Kinect. In addition, future interventions should examine the long-term efficacy of AVG in the home environment using quality randomized controlled trials. To conclude, further quality research is needed to overcome the limitations and explore the above critical areas in anticipation of increasing PA and PF.

The purpose of this literature review was to examine what effects AVG has on PA and PF of students with intellectual disabilities. Due to the growing popularity of AVG, a number of

research studies have examined the effects AVG has on PA and PF. With the continued development of AVG comes many new opportunities for educational research. AVG provides individuals with an innovative way to play video games by getting people up and physically active. PA and PF are critical areas that require quality research in AVG. This literature review examined the following areas of importance: sedentary screen time, traditional activities, in-game difficulty levels, and enjoyment.

Chapter 3: Method

This quantitative experimental research study collected and analyzed numerical data and had control over the physical fitness test (dependent variable) and active video gaming (AVG) systems (independent variable), which may have influenced the response of the participants. The purpose was to use the AVG systems to investigate a causal relationship with the physical fitness test (McMillan, 2012). This study used a single-group, pretest-posttest design. A single group of participants with intellectual disabilities was given repeat measures on a physical fitness test before and after the AVG intervention, to investigate the influence AVG has on physical fitness (PF) of the participants (McMillan, 2012).

There were two possible threats. First, because this study does not have a control group, it was not certain whether the participant's improvement or regression would have occurred anyway, even without the intervention. This may have led to incorrect conclusions about the effectiveness of the intervention (McMillan, 2012). Second, the experimenter and subject effects may have occurred if the participants wanted to work harder to please the investigator, who was also their physical education teacher (McMillan, 2012). The investigator planned to reduce these possible threats by having each participant serve as his or her own control, and all numerical data were entered at the conclusion of the study (McMillan, 2012).

The research study received approval from the Eastern Michigan University Special Education Department (see Appendix A), Eastern Michigan University Human Subjects Review Committee (see Appendix B), and the school's administrator. The research study was implemented between October 21, 2016, through November 7, 2016, and all of the participants provided written informed consent before data collection began.

Participants

The participants came from an adapted physical education class taught by the investigator at a school in Southeast Michigan. The school provides vocational services for special education students, ages 18 through 26, with additional curriculum of academics, social skills, community skills, and independent living skills to help each student make a successful transition into adult life. The class selected was from one of the six vocational classes that remain in the school daily, which enabled the investigator to have access to the participants each day of the study.

The initial contact was a meeting at the school, with the students from the class selected and the investigator, to discuss details of the study and discover which students wanted to participate. The class selected was comprised of 12 students; of those 12 students, six students decided to participate in the research study.

To participate in the research study, each potential participant was required to meet the following five requirements: did not have a photosensitive form of epilepsy, did not have a pacemaker or other implanted medical device, was 18 years or older, was able to provide informed consent, and had a moderate intellectual disability (IQ range: 40-55). The investigator reviewed each of the six potential participant's school files and records to see which students met all five requirements, thus enabling them to join the research study. The review revealed that each potential participant, four males and two females between the ages of 19 and 22 years, met all of the requirements to be able to participate in the research study. Each provided written informed consent before the beginning of data collection.

Prior to the first day of the research study and on each day of the research study, the investigator thoroughly explained the detailed procedures used for the testing and intervention sessions. The 12-day research study schedule (see Appendix C) included four of the regularly

scheduled physical education classes for the participants (two 40-minute classes per week) and eight 40-minute research testing and intervention sessions added to their weekly schedule. The time added was taken from their weekly classroom duties, responsibilities, and/or activities. The 12-day research study schedule was separated into two 40-minute testing sessions—one on the first day and one on the last day of the study---and ten 40-minute intervention sessions implemented between the testing sessions.

The study used a convenience sample approach to recruiting the participants. The disadvantage of this technique is there is no exact way to generalize to a population, which may bias the results (McMillan, 2012). To reduce this disadvantage, the investigator limited the analysis of the findings to the types of participants in this study, which helped the investigator better understand the relationships that may have existed within these participants (McMillan, 2012).

Measures

Instrumentations and procedures. The study used the Brockport Physical Fitness Test (BPFT); (Winnick et al., 1999) to test PF and the Nintendo Wii AVG system as the intervention. The equipment necessary to implement the fitness test and intervention sessions were available for use at the research study site. Other recommended and/or different fitness tests and interventions were not selected because the needed equipment was not available. In addition, the fitness test and intervention used in this study were consistently implemented in the participant's current physical education classes and typical of those used in other physical education programs.

BPFT. The BPFT is a health-related, criterion-referenced test of fitness. The test was designed as a fitness test for individuals with disabilities between the ages of 10 and 17. The

BPFT was adopted by the American Alliance for Health, Physical Education, Recreation, and Dance (AAHPERD) as a recommended test for health-related PF. This test has been found to have adequate estimates of reliability and validity. Components of the BPFT include aerobic functioning, body composition, and musculoskeletal functioning (Winnick et al., 1999).

Pacer 20m. The Pacer 20m was the fitness test selected for the research study. According to the BPFT manual, the Pacer 20m fitness test is appropriate for individuals with intellectual disabilities and targeted the area the study is researching, aerobic functioning. The procedures for the Pacer 20m fitness test were developed by using the suggestions from the BPFT manual and were used to implement the pretest and posttest.

The Pacer 20m fitness-testing procedures were as follows: in the pretest Pacer 20m (Day 1) and the posttest Pacer 20m (Day 12) fitness testing sessions, each participant completed one trial of the Pacer 20m fitness test in the school gymnasium. The Pacer 20m fitness-testing sessions were comprised of three trials; each trial consisted of two participants participating in the fitness test. The data collected were the total number of 20 meter laps each participant completed on each Pacer 20m fitness testing session. One lap was equal to one 20-meter distance. If the participant fell behind the pace and then regained the pace, it was scored as one lap. The overall score was equal to the total number of 20-meter laps completed.

The necessary equipment to implement the Pacer 20m fitness tests were a CD player, Pacer 20m beeper test CD, four orange marker cones, yellow floor tape, one pencil, and the pretest (see Appendix D) and posttest (see Appendix E) data sheets.

Prior to each Pacer 20m fitness testing session, the school gymnasium floor was dry mopped to ensure the test was implemented on a flat, non-slippery surface, and the testing area boundaries were marked with orange cones and yellow floor tape. In addition, all participants

completed a warm-up/cool-down session by using the investigator's current physical education class warm-up/cool-down routine (see Appendix F). This routine consisted of a 6-minute walk and 6-minute series of 19 different muscle stretches from head to toe.

The design of the Pacer 20m fitness test required the participants to run as long as possible back and forth across the 20-meter distance at a specified pace, which became faster each minute. At the beginning of each Pacer 20m fitness test trial, the investigator cautioned the participants to begin the Pacer 20m fitness test at a slow pace and not to start too fast. During the Pacer 20m fitness test sessions, the participants were continually encouraged with praising, positive comments and cheers.

The participants began the Pacer 20m fitness test at the first yellow line at one end of the 20-meter distance. They ran across the gym floor to touch the second yellow line at the other end of the 20-meter distance by the time the beep from the CD sounded. When the beep sounded, the participants turned around and ran back across the gym floor to the first yellow line where they started. If a participant arrived at the line before the beep was sounded, the participant stopped and waited for the beep and then began to run back to the other end. The participants continued to run the 20-meter laps in this manner until they were unable to reach the yellow line before the beep sounded. If the participant was unable to reach the yellow line when the sound beeped, they were allowed to catch up to the pace. Once they missed two beeps, they were withdrawn from the Pacer 20m fitness test.

The Pacer 20m beeper test CD allowed the participants nine seconds to run the 20-meter distance during the first minute and eight and a half seconds to run the 20-meter distance during the second minute. The time continued to decrease by a half-second after each subsequent minute. In addition, the Pacer 20m fitness test CD sounded a single beep to indicate the end of a

lap and a triple beep to indicate the end of a level and a decrease in time to complete a lap. The investigator alerted the participants of the time decrease by telling them the time was becoming faster.

Participants who lost pace or completed the test then walked to the designated cool-down area, being careful not to interfere with other participants who may have been still running laps, and obtained a drink of water. Finally, after all participants completed the Pacer 20m fitness test, a cool-down session was implemented by using the investigator's current physical education class cool-down routine.

Nintendo Wii. The Nintendo Wii is a video gaming system promoted as a way to get individuals physically active, and AVG has been integrated into many physical education programs across the nation (O'Hanlon, 2007). The Nintendo Wii is a video gaming system that offers simulated sports games, fitness programs, and other physically active games. A unique part of the system is the wireless controller, called the Wiimote, which can be used as a pointing device and can sense acceleration and orientation in three dimensions (Coyne, 2008). These functions allow individuals to play the game by using physically active movements. In addition, there is a smaller controller, the Nunchuk, which connects to the Wiimote and features an accelerometer, joystick, and two game buttons (Coyne, 2008). The amount of exertion is about what the individual chooses to do and how much effort they want to exert (Samuels, 2008).

Just Dance. The Just Dance video games were selected because the students are familiar with these games from their physical education classes, the games seem to bring the students great enjoyment, and many students are able to play at the same time. The school also holds five dances per year, which students attend and seem to enjoy. In Just Dance, the participants follow on-screen, choreographed dancers in a variety of dance modes set to dance songs from the past

60 years (Ubisoft Entertainment, 2015). In addition, the students may be more likely to play with family and friends at home and in the community, attend community dances, join a community dance class, and/or participate in physical activities for longer periods. Finally, the Just Dance video games have an "E10+" rating, which means the game content may be suitable for everyone ages 10 and older (Nintendo of America Inc., 2006).

The procedures for the Nintendo Wii intervention sessions were developed from the *Nintendo Wii Operations Manual* (Nintendo of America Inc., 2006) and the Just Dance game manual (Ubisoft Entertainment, 2015), and the procedures were used during each of the 10 Just Dance sessions.

The Just Dance intervention procedures were as follows: During the research study, 10 Just Dance intervention sessions were implemented on Days 2 through 11, and during each dance session, the participants completed two 10-minute dance trials in the school gymnasium. The Just Dance intervention sessions were comprised of two 10-minute dance sessions separated by a five-minute break, and each trial consisted of two groups of three participants participating in the dance intervention. The data collected were the number of minutes danced per session and the total number of minutes each participant danced during the each Just Dance intervention session.

The necessary equipment to implement the Just Dance intervention were two Nintendo Wii Video Game Systems, six Wiimotes, two televisions, eight different Just Dance active video games, floor tape, pencil, and Just Dance data sheets (see Appendix G).

Prior to each Just Dance intervention session, the school gymnasium floor was dry mopped to ensure the intervention was implemented on a flat, non-slippery surface, and the dancing areas were marked using yellow floor tape. In addition, all participants completed a

warm-up/cool-down session by using the investigator's current physical education class warm-up/cool-down routine. This consisted of a 2-minute walk and 5-minute series of 19 different muscle stretches from head to toe.

Each Just Dance intervention session began with the investigator providing instructions to the participants on how to hold the Wiimote in their hand, put their wrist through the Wiimote wrist strap, and fasten it securely. During each Just Dance intervention session, the participants were required to wear the Wiimote wrist strap fastened securely to their wrists. The investigator put the Just Dance active video game into the Nintendo Wii video gaming systems, turned on the six Wiimotes and two televisions, navigated to the Just Dance Song Selection screen, and selected the Non-Stop Shuffle mode for 10 minutes. This mode had songs that automatically played without interruption for a specified amount of time.

During the Just Dance intervention sessions, the participants tried to follow the on-screen dancers as if they were looking in a mirror and used their upper and lower bodies to mimic the on-screen dancer's movements as closely as possible. In addition, the dance intervention area had enough room to allow the participants to move around with the Wiimote and separated into six 6'x4' personal dance areas using yellow floor tape.

When a Just Dance intervention session was completed, each participant carefully took off the Wiimote wrist strap, placed the Wiimote in the designated place, walked to the designated cool-down area, and obtained a drink of water. Finally, after all of the participants completed the Just Dance intervention session, a cool-down session was implemented by using the investigators current physical education class cool-down routine.

Timeline

Implementation of the research study began on Friday, October 21, 2016, and continued through Monday, November 7, 2016, a total of 12 days for the study. The 12-day research study schedule was separated into two 40-minute Pacer 20m fitness testing sessions (pretest on Day 1 and posttest on Day 12), and ten 40-minute Just Dance intervention sessions, implemented between the testing sessions, Day 2 through Day 11.

The following was the timeline of the daily research study schedule and procedures. First, on Day 1, the Pacer 20m fitness test session activities were implemented in the following order: a 6-minute walk, a 6-minute whole-body stretch, Pacer-20m instructions and fitness pretest, a 6-minute water and rest break, a 6-minute walk, and a 6-minute whole-body stretch. Next, on Days 2 through 11, the Just Dance intervention session activities were implemented in the following order: a 2-minute walk, a 5-minute whole-body stretch, one-minute set of instructions, a 10-minute Just Dance session, a 5-minute water and rest break, a 10-minute Just Dance session, a 2-minute walk, and a 5-minute whole-body stretch. Lastly, on Day 12 the Pacer 20m fitness test session activities were implemented in the following order: a 6-minute walk, a 6-minute whole-body stretch, Pacer-20m instructions and fitness posttest, a 6-minute water and rest break, a 6-minute walk, and a 6-minute whole-body stretch.

Measures to Ensure Safety for Human Subjects

The Brockport Physical Fitness Test and Nintendo Wii are considered safe activities, have been implemented in the participant's physical education classes, and are typical of those activities used in other physical education programs. However, physical injuries can occur during any type of physical activity. To minimize the risk of physical injury, warm-up and cool-down routines were implemented each day of the research study, and the experiment was to be

postponed and/or terminated if a participant experienced any of the following symptoms: dizziness or nausea, pain, disorientation, electric shock, seizures, tired or sore muscles, joints, skin or eyes, tingling, numbness, and burning or stiffness.

The investigator administered the Pacer 20m fitness test and monitored for correct performance technique, appropriate gym attire, and suitable gym temperature and lighting. The investigator also set up the Nintendo Wii video game systems and television monitors for intervention implementation. In addition, the investigator monitored the participants to ensure the wrist strap was fastened securely around the wrist, had towels available for drying moist hands, stood at least five feet from the television, checked for appropriate gym attire, and checked each day for suitable gym temperature and lighting. In case a physical injury occurred, the school nurse was to be radioed to come to the gym to evaluate the participant. In case an emotional injury such as hurt feelings, anger, anxiety, or embarrassment occurred, the participants had the option to meet with the school social worker or school behavior specialist.

Finally, to maximize the safety of the participants, district and school policies were followed which allowed participation in physical education and parental approval of the health status of participant.

Measures to Ensure Confidentiality for Human Subjects

To protect participant privacy, a participant code number was created for each of the participants, and the investigator developed a master list of the participants' names with their code numbers.

The written data sheets were only identified by the participants' code numbers, and at no time were the participants' names associated with the written data sheets. The written informed

consent forms were only identified by the participants' names, and the written informed consent forms were the only records linking the participants to the study.

To keep participant data confidential, electronic data and back-up electronic data were stored on individual flash drives. A laptop computer was used to develop any necessary forms, charts, and papers, and the information developed for the research study was only stored on the original flash drive and the back-up flash drive.

To further safeguard data confidentiality, the written data sheets, electronic data on the original flash drive, and the written informed consent forms were stored in a locked filing cabinet in the investigator's office, in drawer numbers 1, 2 and 3, respectively. In addition, the written master list of the participants' names with the code numbers and the back-up flash drive were stored in the locked office of the co-investigator, Dr. Philip Smith, professor of Special Education at Eastern Michigan University.

Data Analysis

Statistical data were analyzed using the IBM SPSS Statistics 24 software program (IBM Corp., 2016) to investigate what effects the intervention sessions might have on the physical fitness of the participants. Descriptive statistics were generated for participant data (gender and age), fitness data (Pacer 20 laps completed), and intervention data (number of minutes danced). The Pacer 20m physical fitness data was separated into pretest and posttest trials, and a paired sample t-test was used to examine the mean differences between the pretest Pacer 20m laps completed and the posttest Pacer 20m laps completed, using an alpha level set at $p < .05$.

Chapter 4: Results

The purpose of this research study was to examine if there was a statistically significant difference in the means between the number of Pacer 20m laps completed on the pretest and the number of Pacer 20m laps completed on the posttest. The hypothesis was that students with intellectual disabilities would show significant improvements in physical fitness (PF) after dancing for 20 minutes per day for 10 school days using the Nintendo Wii active video gaming (AVG) system.

Each participant completed the Pacer 20m running tests and the Just Dance intervention sessions without any problems, and each participant seemed to enjoy participating in the research study.

The participant descriptive statistics are shown in Table 1. The participants ranged in age from 19 to 22, females represented 33% of the overall sample, and the number of minutes danced ranged from 170 minutes to 200 minutes. Three of the participants completed a lower number of laps on the posttest, two completed the same number of laps, and one increased the number of laps completed on the posttest.

Table 1

Participant Descriptive Statistics

Participant #	Gender	Age	Min. danced	Pretest laps	Posttest laps
1	M	22	170	41	33
2	M	21	200	10	8
3	F	19	200	20	16
4	F	20	200	6	6
5	M	19	170	10	10
6	M	20	180	10	12

A paired sample t-test was used to evaluate if a statistically significant difference existed between the means of the pretest Pacer 20m laps completed and the posttest Pacer 20m laps completed, using an alpha of .05.

Examination of the results of the paired sample t-test, t (5) = 1.37, p = .23, indicate there was a non-significant statistical difference in the number of Pacer 20m laps completed from the pretest (M = 16.17, SD = 13.03) to the posttest (M = 14.17, SD = 9.85), as shown in Table 2. More specifically, by exploring the difference between the pretest and posttest number of Pacer 20m laps completed, it can be concluded that on average the participants completed 2.00 fewer laps on the posttest as compared to the pretest.

Table 2

Pretest/Posttest Pacer 20m Statistics

Pacer 20m	Pretest (n = 6)	Posttest (n = 6)
Total laps completed	97	85
Mean	16.17	14.17
SD	13.03	9.85

These results suggest that the Nintendo Wii AVG intervention had little to no effect on the PF of these six participants with intellectual disabilities. The decrease in the mean for the number of Pacer 20m laps completed from the pretest to the posttest was most likely due to chance and/or sampling variability.

Therefore, the hypothesis that students with intellectual disabilities would show significant improvements in PF after dancing for 20 minutes per day for 10 school days using the Nintendo Wii AVG system was rejected.

Chapter 5: Discussion

The purpose of this research study was to examine the effects the Nintendo Wii active video gaming (AVG) system had on the physical activity (PA) and physical fitness (PF) of individuals with intellectual disabilities. The data collected from the research study were from a small number of participants, so the results should be viewed as a guide to the kind and extent of future research.

A paired samples t-test was used to examine if there was a statistically significant difference between the Pacer 20m pretest and the Pacer 20m posttest number of laps completed. The results of the paired samples t-test between the Pacer 20m pretest and Pacer 20m posttest showed there was a decrease in the mean number of Pacer 20m laps completed; the result was shown not to be statistically significant. The difference in the number of laps completed from the Pacer 20m pretest to the Pacer 20m posttest showed one participant with an increase. Two of the participants showed no progress, and three of the participants showed a decrease in the number of Pacer 20m laps completed. The participant increases, decreases, and no progress could have been due to, but not limited to, learning or not understanding test procedures, changes in aerobic functioning, changes in physical wellness, changes in motivation to participate, and/or changes in exercise routines. Overall, the majority of the participants remained at the same fitness levels between the Pacer 20m pretest and the Pacer 20m posttest. It seems that the Nintendo Wii AVG system using the Just Dance video game does not elicit statistically significant differences in Brockport Physical Fitness Test Pacer 20m fitness test scores.

Limitations

There are three limitations in this research study, and each was examined closely when interpreting the research data collected. The first limitation was the use of a convenience

sampling procedure, and the second was the small sample size. Both limitations would impede generalizing the results to the general population and could affect the results by motivating the participants to do well because they were selected to participate, thus leading to data bias. Lastly, data were collected over a short time period. This could have affected the results by motivating the participants to work harder to do well because they wanted to please the investigator, who was their physical education teacher, and again, could lead to data bias.

Chapter 6: Conclusion

In conclusion, there is a need for further quality research on active video gaming (AVG) to see if they could be used as an effective instrument to increase physical activity (PA) and physical fitness (PF) for individuals with intellectual disabilities, thus improving one's overall health.

The findings indicate that using the Nintendo Wii Just Dance AVG system did not have any significant effects on the PA or PF levels of individuals with intellectual disabilities using the current study protocol. To the author's knowledge, this is one of the first research studies reporting on these effects.

To further this research, changes to the research methods should be considered. Possible methodology changes for the Brockport Physical Fitness Test (BPFT) could be to examine other fitness activities, change the number of fitness activities, and/or investigate other fitness testing options available. The possible methodology changes for the Nintendo Wii intervention could be to examine other AVG options available that focus on fitness, use different types of controllers, and/or investigate other AVG systems available. In addition, the research study could have used different groups of individuals, been done at a different time of year, and the monitoring of other PA attributes (such as heart rate, energy expenditure, experienced and non-experienced active video game players, and/or separated the results by gender). Finally, implementing the protocol for a longer period of time might have a more positive impact.

Thus, additional research is needed to further examine the effects the Nintendo Wii AVG system and AVG in general have on the PA and PF of individuals with intellectual disabilities.

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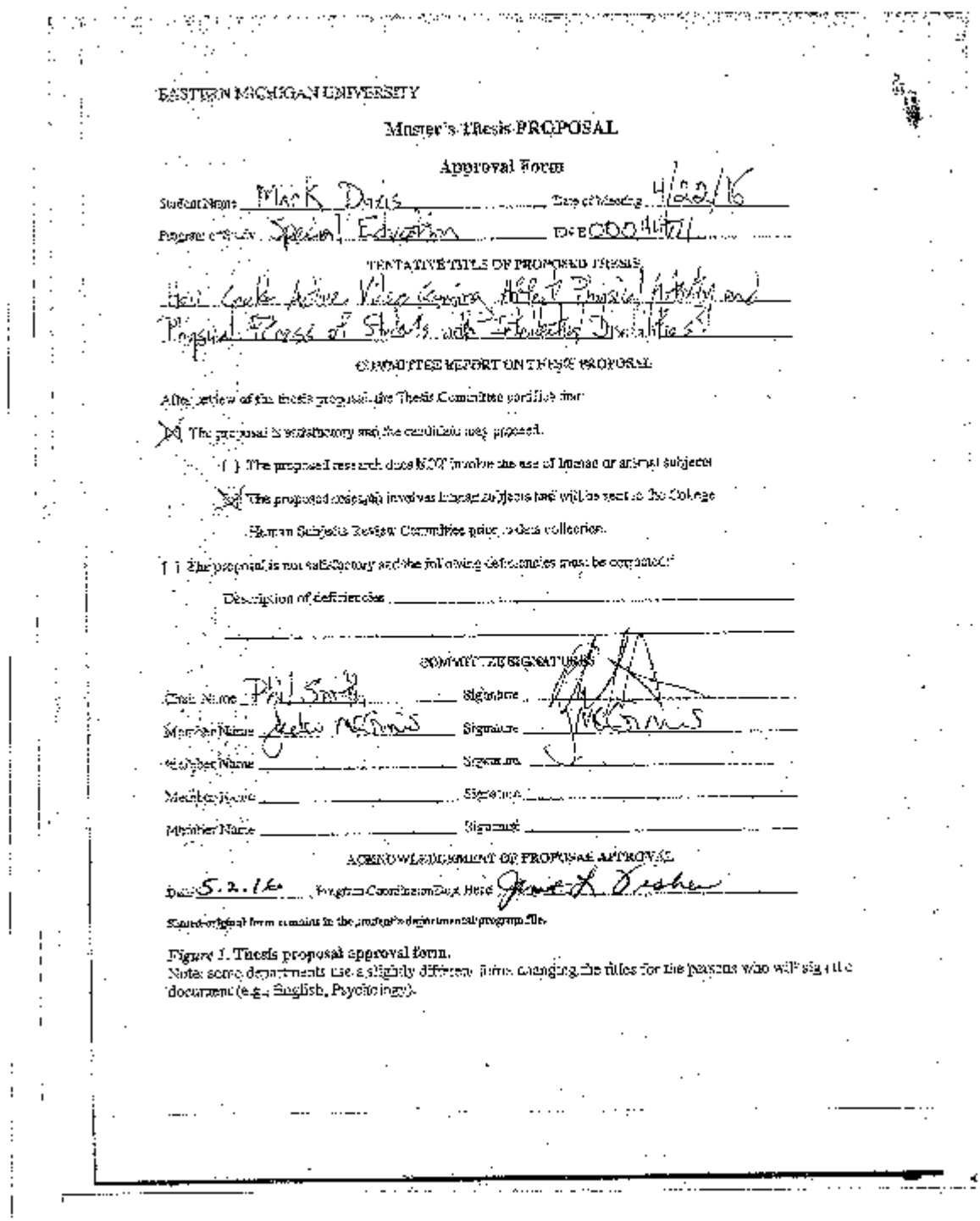
Appendix A: Master's Thesis Approval Letter



EASTERN MICHIGAN UNIVERSITY

Master's Thesis PROPOSAL

Approval Form

Student Name: Mark Davis Date of Meeting: 4/22/16

Program of Study: Special Education ID#: 00044171

TENTATIVE TITLE OF PROPOSED THESIS:

Hair Cooks Active Voice Comics Effect Physical Activity and Physical Fitness of Students with Emotional Disabilities

COMMITTEE REPORT ON THESIS PROPOSAL

After review of the thesis proposal, the Thesis Committee certifies that:

[X] The proposal is satisfactory and the candidate may proceed.

[ ] The proposed research does NOT involve the use of human or animal subjects

[X] The proposed study(s) involves human subjects and will be sent to the College Human Subjects Review Committee prior to data collection.

[ ] The proposal is not satisfactory and the following deficiencies must be corrected:

Description of deficiencies: _____

COMMITTEE SIGNATURES

Chair Name: Phil Smith Signature: _____

Member Name: Debbie Mathis Signature: _____

Member Name: _____ Signature: _____

Member Name: _____ Signature: _____

Member Name: _____ Signature: _____

ACKNOWLEDGMENT OF PROPOSAL APPROVAL

Date: 5.2.16 Program Coordinator/Dept. Head: Jane L. Doucher

Signed original form remains in the student's departmental program file.

Figure 1. Thesis proposal approval form.
Note: some departments use a slightly different form, changing the titles for the persons who will sign the document (e.g., English, Psychology).

Appendix B: UHSRC Approval Letter

RESEARCH @ EMU

UHSRC Determination: **EXPEDITED INITIAL APPROVAL**

DATE: **May 26, 2016**

TO: **Mark Davis, BS**
Department of Special Education
Eastern Michigan University

Re: **UHSRC: # 904379-1**
Category: Expedited Category 7
Approval Date: May 26, 2016
Expiration Date: May 25, 2017

Title: **How could active video gaming affect physical activity and physical fitness of students with intellectual disabilities?**

Your research project, entitled **How could active video gaming affect physical activity and physical fitness of students with intellectual disabilities?,** has been approved in accordance with all applicable federal regulations.

This approval included the following:

1. Enrollment of *up to 15* subjects to participate in the approved protocol.
2. Use of the stamped *student consent form and parent information letter.*

Renewals: This approval is valid for one year and expires on 5/25/17. If you plan to continue your study beyond 5/25/17, you must submit a Continuing Review Form by 4/20/17 to ensure the approval does not lapse.

Modifications: All changes must be approved prior to implementation. If you plan to make any minor changes, you must submit a **Minor Modification Form.** For any changes that alter study design or any study instruments, you must submit a **Human Subjects Approval Request Form**. These forms are available through IRBNet on the UHSRC website.

Problems: All major deviations from the reviewed protocol, unanticipated problems, adverse events, subject complaints, or other problems that may increase the risk to human subjects **or** change the category of review must be reported to the UHSRC via an **Event Report** form, available through IRBNet on the UHSRC website

Follow-up: If your Expedited research project is not completed and closed after **three years,** the UHSRC office requires a new **Human Subjects Approval Request Form** prior to approving a continuation beyond three years.

Please use the UHSRC number listed above on any forms submitted that relate to this project, or on any correspondence with the UHSRC office.

Good luck in your research. If we can be of further assistance, please contact us at 734-487-3090 or via e-mail at human.subjects@emich.edu. Thank you for your cooperation.

Sincerely,

Sonia Chawla, PhD
Research Compliance Officer

Appendix C: Research Study Schedule

RESEARCH STUDY SCHEDULE

Pretest–Intervention–Posttest

FITNESS PRETEST	Break	INTERVENTION	Break	INTERVENTION	Break	FITNESS POSTTEST
Day 1: Friday	T	**Day 2 through Day 6**	T	**Day 7 through Day 11**	T	**Day 12: Monday**
6-minute walk	W	2-minute walk	W	2-minute walk	W	6-minute walk
6-minute whole-body stretch	O	5-minute whole-body stretch	O	5-minute whole-body stretch	O	6-minute whole-body stretch
Pacer 20m instructions & test		Just Dance instructions & 10 min session		Just Dance instructions & 10 min session		Pacer 20m instructions & test
6-minute rest/water break	D	5-minute rest/water break	D	5-minute rest/water break	D	6-minute rest/water break
6 minute-walk	A	Just Dance instructions & 10 min session	A	Just Dance instructions & 10 min session	A	6 minute-walk
6-minute whole-body stretch	Y	2-minute walk	Y	2-minute walk	Y	6-minute whole-body stretch
	S	5-minute whole-body stretch	S	5-minute whole-body stretch	S	

Appendix D: Research Study Data Sheet: Pretest

RESEARCH STUDY SUMMARY DATA SHEET: PRETEST

# of Laps	Pretest
1	
2	
3	
4	
5	
6	

Appendix E: Research Study Data Sheet: Posttest

RESEARCH STUDY SUMMARY DATA SHEET: POSTTEST

# of Laps	Posttest
1	
2	
3	
4	
5	
6	

Appendix F: Research Study Warm-Up & Cool-Down Routine

RESEARCH STUDY WARM-UP & COOL-DOWN ROUTINE

Class: Physical Education Unit: Warm-Up & Cool-Down Skill Level: Beginner		Teacher/Investigator: Mark E. Davis Time A: Fitness Test - 12 minutes Time B: Intervention - 7 minutes	Facilities: Jo Brighton Gym Sample Size: 6 to 8 participants Equipment: 4 orange cones
TIME	PROGRESSIONS-ACTIVITIES	FORMATION-ORGANIZATION-EXPLANATION	TEACHING CUES-IMPORTANT POINTS
Time A: 12 minutes Time B: 7 minutes	ROUTINE	Place 4 orange cones around the North-half of gym	"walk outside the orange cones"
Time A: 6 minutes Time B: 2 minutes	1. Walking Around the gym	monitor during walking activity walk outside of the orange cones	"feel the heart pump" feel your body waking-up
Time A: 6 minutes Time B: 5 minutes	2. Stretching NECK back front side side ARM & FINGERS each arm SHOULDER & BACK each arm HIPS & BACK trunk twists w/reach and grab LEGS & FEET leg lunges each leg reach between & behind legs heel to butt knee to chest heel raises	standing arms length apart from others hold each for a 10 count chin to chest look-up ear to shoulder other ear to other shoulder hold each for a 10 count arm out fingers up & pull back slightly arm out fingers down & pull back slightly hold each for a 10 count pull arm across front of body twist from front to side to front to other side: 10X reach arms out and grab air on each side legs wide apart & turn body and feet to one side bend front leg & keep back leg straight hold each for a 10 count reach hands between and behind legs hold each for a 10 count grab ankle/foot & pull-up hold for a 10 count bend knee up to chest hold for a 10 count raise heel of foot to stand on toes: 10X	"feel the stretch" keep back straight feet shoulder with apart keep arm straight stretch should not "hurt" grab by wrist or pull elbow stretch arm is straight stand with back straight arms form a "t" shape reach and grab with twist feet face direction of stretch front leg bent at 90 degrees stretch whole body - down feet apart & knees straight no bouncing pull foot to buttocks try to balance on 1 foot pull knee to chest with hands try to balance on 1 foot push up with toes

Appendix G: Research Study Data Sheet: Intervention

RESEARCH STUDY DATA SHEET: INTERVENTION

# of Minutes	D2		D3		D4		D5		D6		D7		D8		D9		D10		D11	
1																				
2																				
3																				
4																				
5																				
6																				