The Efficacy of an Eight Week Walking Program on Increasing Daily Physical Activity Levels and Weight Reduction for Adolescents with Autism Spectrum Disorder

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Dedication

This dissertation is dedicated to the memory of my mother Kathleen Solomon. Although she was my inspiration to pursue my doctoral degree and the one who helped me in all things great and small, she was unable to see my graduation. This is for her.

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This dissertation holds far more than the culmination of many years of doctoral studies. The following pages also reflect the relationships and lived experiences with many inspiring and generous and people I have met since I started my graduate work. I appreciate each contribution to my development as a professional and future scholar. However, the pages do not allow for mentioning each and every person who at one time or another supported me in this venture, but several individuals do deserve special mention for their contributions to this dissertation. I want to first thank the chairman of my committee, Dr. Nathan Murata giving me the opportunity to fulfill this chapter in my professional career. Dr. Murata has been a supportive and strong adviser to me throughout my doctoral program, providing me with guidance but at the same time giving the freedom to pursue independent work. I am honored to have had one of the leaders in my professional field as an adviser and mentor never accepting less than my best effort. In reviewing my writings, he offered critical comments and a continuous voice of encouragement but always valuing my ideas. I read his comments on my work with gratitude and somewhat jealousy because he always found ways to significantly improve it. Dr. Murata also has helped me immeasurably in my professional development, through supporting me attending professional conferences, introducing me to people within my field of study, and showing support and faith in my work. His vision and motivation have deeply inspired me. He has taught me the methodology to carry out the research and to present the research works as clearly as possible. It was a great honor and privilege to work and study under his guidance. I am extremely grateful for what he has offered me and thank him for his friendship and great sense of humor. I am extending my heartfelt thanks to his wife, family for their acceptance and patience during this time on the research and preparation of this dissertation.

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Abstract

The purpose of this study was to examine the efficacy of an eight week walking program on increasing daily physical activity levels and weight reduction for adolescents with Autism Spectrum Disorder (ASD). Two adolescents with ASD attending a central Ohio Community Mental Health Facility (CMHF) served as participants. The study implemented a single subject range-bound changing criterion design. The range bound changing criterion design and physical activity behavior was measured through the use of Walk4Life MVPA four function digital pedometers. Data were analyzed through visual analysis and descriptive statistics. Results showed that the intervention exerted functional control over the target behavior (i.e., time spent in a bout of physical activity). With the lack of physical activity research among adolescents with ASD and the continuous national efforts to promote physical activity among children and adolescents with disabilities, additional physical activity intervention research is warranted.

Keywords: autism, physical activity, weight reduction

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CHAPTER I: INTRODUCTION

Autism Spectrum Disorder (ASD) and the increase in childhood obesity are the two most topical public health issues in the United States. Autism, is defined as "a developmental disability significantly affecting verbal and nonverbal communication and social interaction, generally evident before the age of three that adversely affects a child's educational performance" (US Department of Education, 2004). The Centers for Disease Control and Prevention (CDC) estimated that an average of 1 in 68 children in the U.S has ASD with the prevalence of autism in U.S. children increased by 119.4 percent from 2000 1 in 150 to 2010 1 in 68 with about 1 percent of the world population having autism spectrum disorder (CDC, 2015). Autism is the fastest growing developmental disability with more than 3.5 million Americans live with an autism spectrum disorder (CDC, 2020; Buescher, Cidav Z, Knapp, Mandell, 2014). Autism services cost U.S. citizens $236-262 billion annually with a majority of costs in the U.S. are in adult services between $175-196 billion, compared to $61-66 billion for children (Buescher et al., 2014). The U.S. cost of educating and supporting a person with autism over the lifespan is about $2.4 million compared to $1.4 million for a person without ASD (Buescher et al., 2014). Lavelle, Weinstein, Newhouse, Munir, Kuhlthau, & Prosser, (2014) report it costs more than $8,600 extra per year to educate a student with autism and parent-reported children with ASD had higher levels of health care office visits and prescription drug use compared with children without ASD.

The Center for Disease Control (2015) estimated that 16% of U.S. children are obese and these obesity rates for children have tripled since 1980. The benefits of daily physical activity are well documented as an important part of a healthy lifestyle. Daily physical activity promotes health and fitness for all people. The U.S. Department of Health and Human Services (2008) physical activity guidelines for children and adolescents recommend they engage in at least 60

minutes or more of developmentally-appropriate physical activity daily. Adolescents should engage in a minimum of continuous moderate to vigorous physical activity (MVPA) three or more times per week in addition to their daily activity (United States Department Health Human Services [USDHHS], 2008). The same requirements apply to adolescents with ASD. However, there is no consensus regarding whether such requirements are being met. Adolescents who are regularly active are less likely to develop chronic diseases, such as heart disease, hypertension, type 2 diabetes, or osteoporosis and also have a better chance of a healthy adulthood (USDHHS, 2008). Adolescents with ASD can also benefit from increased regularly physical activity.

The benefits of cardiovascular exercise on an individual's cardiopulmonary system have been well established. For individuals with ASD, such physical activity generates far greater outcomes than just physical fitness. Researchers have shown that vigorous cardiovascular exercise increases appropriate behaviors and decreases inappropriate behaviors (Kern, Koegel & Dunlap, 1984; Watters & Watters, 1980) in the ASD populations. Curtin, Anderson, Must and Bandini (2010) reported that the prevalence of obesity in children with Autism is higher (30.4%) than the prevalence of obesity in children without Autism (23.6%). Compared to typically developing individuals, individuals with ASD engage in less physical activity (Pan, 2008). As a result, their sedentary lifestyle places them at risk of heart disease, diabetes and obesity (Hildebrandt, Chorus & Stubbe, 2010). It is universally understood that physical exercise is an effective way of preventing such health problems. With the increase of childhood obesity and ASD rates in the United States, there is a critical need for effective programs that increase the physical activity levels and weight loss of adolescents with ASD. Therefore, the goal of this research is to explore the benefits of a walking program in preventing secondary conditions such

as obesity in adolescents with ASD.

Significance of the Problem

Adolescents with ASD lead more sedentary lifestyles than typical developing peers. MacDonald, Esposito, and Ulrich (2011) report older children with ASD are significantly more physically inactive, compared to younger children and therefore interventions are needed to increase physical activity programs for this population. Hill, Zuckerman and Fombonne (2015) state that the prevalence of unhealthy weight among children with ASD is significantly greater compared with the general population. In this connection, more research is needed to confirm that increase physical activity can influence sedentary lifestyles while also decreasing obesity rates for adolescents with ASD. The combination of inactivity and weight gain may prove to be risky for healthy living; hence, research is necessary to understand the risks of developing chronic diseases that are associated with idleness and inactivity in individuals with ASD. Furthermore, it is important to know if the unique characteristics of individuals with ASD present more risks for inactivity in comparison to other types of disabilities and with those who have no disabilities whatsoever.

To address this problem, a behavioral single subject range-bound changing criterion design study was implemented to increase the daily physical activity levels and to reduce body weight among adolescents with ASD. The results of the study will contribute to the field of adapted physical education by confirming that a walking program can reduce the risk of secondary illnesses in adolescents with ASD.

Purpose of the Study

The purpose of this single subject range-bound changing criterion design was to examine

the effects of a walking program on daily physical activity levels, moderate to vigorous intensity physical activity (MVPA) and body mass index for two adolescents with ASD at a Community Mental Health Facility located in central, Ohio.

Research Questions

1. What effect did the intervention have on the daily physical activity levels among the adolescents with ASD?
2. What effect did the intervention have on the acquisition of moderate to vigorous intensity physical activity (MVPA) time among the adolescents with ASD?
3. What effect did the intervention have on the weight of the adolescents with ASD?

Delimitations and Limitations

The study will be delimited by the following factors:

1. One school setting was purposely selected based on population of interested adolescents with ASD.
2. This study targets physical activity of a voluntary nature.
3. This walking program consists of eight weeks and forty sessions with a range of seven to forty minute sessions.
4. The study will delimit to six participants who attend the school.

The study will delimit to physical activity during the walking program at school and will not focus on physical activity during the rest of the day and weekends.

The following limitations should be considered when interpreting the results of the study:

1. The results of the study may not be generalized to all adolescents with ASD who may be overweight or obese; however, it may be suggestive of the effects of regular walking

exercise on weight loss.

2. Another limitation is measuring the effect of the walking program only on weight reduction, and will not deal with the participants' dietary requirements.
3. It is assumed that whatever changes in weight of the participants that will occur within the duration of the eight-week program will be attributed to the walking program.
4. Seasonal factors associated with the weather in Ohio may affect walking program results.
5. Unavoidable constraints by the setting could be: (a) school programming, (b) role of staff, and (c) issues related to school calendar and weather events.

Definition of Terms

Autism Spectrum Disorder- "Autism spectrum disorder (ASD) is a complex developmental disorder that can cause problems with thinking, feeling, language and the ability to relate to others. It is a neurological disorder, which means it affects the functioning of the brain. The effects of autism and the severity of symptoms are different in each person" (American Psychiatric Association, 2016).

Board Certified Behavior Analyst® (BCBA®) - "is a graduate-level certification in behavior analysis. Professionals who are certified at the BCBA level are independent practitioners who provide behavior-analytic services. In addition, BCBAs supervise the work of Board Certified Assistant Behavior Analysts, Registered Behavior Technicians, and others who implement behavior-analytic interventions" (Behavior Analyst Certification Board, 2017).

Body Mass Index - "Body Mass Index (BMI) is a simple index of weight-for-height that is commonly used to classify underweight, overweight and obesity in adults. It is defined as the weight in kilograms divided by the square of the height in meters (kg/m^2)" (World Health

Organization, 2015).

Developmental Disability - having a physical or mental impairment (such as mental retardation, autism, cerebral palsy, or spina bifida) that becomes apparent shortly after birth or during childhood and delays, limits, or prevents the progression of normal development (as in language, learning, or mobility) (Merriam-Webster, 2015).

Moderate-intensity physical activity - On an absolute scale, physical activity that is performed at 3.0 to 5.9 times the intensity of rest. On a scale relative to an individual's personal capacity, moderate-intensity physical activity is usually a 5 or 6 on a scale of 0 to 10 (CDC, 2015).

Overweight - excess body fat by an estimate of the BMI. A BMI over 25 kg/m^2 is classified as overweight (CDC, 2015).

Obesity - Excess body fat measured by an estimate of the BMI. A BMI of 30 kg/m^2 or more is classified as obese (CDC, 2015).

Pedometer - an instrument usually in watch form that records the distance a person covers on foot by responding to the body motion at each step (Merriam-Webster, 2015).

Registered Behavior Technician™ (RBT®) - "is a paraprofessional who practices under the close, ongoing supervision of a BCBA, BCaBA, or FL-CBA. The RBT is primarily responsible for the direct implementation of behavior-analytic services. The RBT does not design intervention or assessment plans. It is the responsibility of the RBT supervisor to determine which tasks an RBT may perform as a function of his or her training, experience, and competence. The BACB certificant supervising the RBT is responsible for the work performed by the RBT on the cases they are overseeing" (Behavior Analyst Certification Board, 2017).

CHAPTER II: REVIEW OF RELATED LITERATURE

This chapter provides an overview of the literature related to physical activity levels and obesity rates among individuals with developmental disabilities and ASD. Physical activity levels for individuals with developmental disabilities and its influence on fitness will be highlighted, along with physical activity levels for youths with ASD. In addition to reporting on physical activity levels, a review of obesity levels for individuals with developmental disabilities in general and individuals with ASD in particular will be presented. In relation to obesity, individuals' body mass indexes will be reported. Finally, a chapter summary is provided.

Physical Activity among Individuals with Developmental Disabilities

Physical inactivity is a leading contributor to chronic health problems in the United States. Physical inactivity is particularly prevalent among individuals with a developmental disability, who are at increased risk for secondary health conditions that can result from their disabilities or from their behavior, lifestyle, or environment (Kinne, Patrick & Doyle, 2004). Booth, Roberts, and Laye, (2012) list 35 chronic conditions including obesity, type 2 diabetes, coronary heart disease, hypertension, stroke, congestive heart failure, cognitive dysfunction, depression and anxiety, osteoporosis, osteoarthritis, and rheumatoid arthritis. Durstine, Gordon, Wang and Luo (2013) suggest physical activity and exercise are now considered principal interventions for use in primary and secondary prevention of chronic diseases.

Physical activity significantly decreases during adolescence but varies according to the weekly schedule maintained by the adolescent (Gordon-Larsen, McMurray, & Popkin, 2000). One reason for the decline in physical activity may be due to the lessening of time allocated to physical education and recess with age (USDHHS, 2000). Although limited research on daily

physical activity of children with developmental disabilities is available (Fernhall & Unnithan, 2002; Frey, Stanish & Temple, 2008) it has been assumed to be lower than children without disabilities.

Compared to children and adolescents without disabilities, individuals with developmental disabilities have been shown to be less physically active (Longmuir & Bar-Or, 2000). Data also show that age and disability type play a role in the patterns and lifestyle behaviors of this less physically active group. Fox and Riddoch (2000) surmise that social and behavioral deficits could limit opportunities for individuals with developmental disabilities to participate in physical activity. Similar research on individuals with disabilities indicates that those with mental retardation (Suzuki, Tasaki, Shimomura, Makishima & Hosoy, 1991), physical disabilities, sensory impairments, and other health impairments (Longmuir & Bar-Or, 2000) are generally more sedentary than peers without disabilities when compared to the physical activity guidelines.

The participation of individuals with developmental disabilities in sports and recreational activities promotes inclusion, optimizes physical functioning, and enhances overall well-being but despite these benefits, individuals with disabilities are more restricted in their participation, have lower levels of fitness, and have higher levels of obesity than their peers without disabilities (Murphy & Carbone, 2008). For instance, Faison-Hodge and Porretta (2004) used the System for Observing Fitness Instructional Time (SOFIT) to measure physical activity levels of individuals with and without mild mental retardation and found that moderate to vigorous physical activity levels for participants were significantly higher during recess than physical education. However, participants with mental retardation were considerably less active than those without disabilities.

Other studies results have been similar, individuals with developmental disabilities engage in low amounts of physical activity daily (Kozub, 2003, Pan & Frey, 2005, 2006; Rosser-Sandt & Frey, 2005; Takken, Van der Net, Kuis, & Helders, 2003), and a relationship exists between increased age and decreased physical activity levels (Pan & Frey 2005; Takken et al., 2003). Regardless of the physical activity measure, lower levels of physical activity have been reported for individuals with disabilities when compared to individuals without disabilities. The available evidence base strongly supports the high need for the establishment of community based, easily accessible physical activity programs for individuals with developmental disabilities (Lotan, Henderson & Merrick, 2006).

According to the National Association for Sport and Physical Education (2005), guidelines for the FITT principle are the following: Frequency: How often a person participates in physical activity (up to all or most days of the week); Intensity: How hard a person exercises during a physical activity, which may vary from light, moderate, or vigorous. This is monitored by the increase of a person's heart rate; Time: How many minutes a person participates in physical activity; Type: What is the physical activity (e.g., walking, running, cycling, swimming, resistance training, or any other activity in which energy is expended). Measuring and changing the frequency, intensity, time, and type of an activity can increase individuals' physical activity and fitness. Fittipaldi-Wert & Brock (2006) suggest due to various abilities of people with disabilities modifications to the FITT principle may be needed to meet the unique needs of students with disabilities. Examples of how the FITT principle can be modified for students with disabilities are as follows: frequency of physical activity may need to gradually progress from one day a week to three or more days a week; intensity of physical activities should begin by

increasing resting heart rate by 10 beats per minute and progressing to 20 – 30 beats per minute above their resting heart rate; time will depend on current levels of physical activity. Individuals that are more sedentary will require short bouts (5 to 10 minutes) of low intensity physical activities. Short breaks interspersed between intervals may be required, with a continued increase in time until the desired time is achieved; and type of activity is dependent on the student's ability (Fittipaldi-Wert & Brock, 2006).

Physical Activity among Individuals with Autism Spectrum Disorder

The increase in the prevalence of individuals with ASD necessitates more programs to encourage physical activity for this population (Dawson & Rosanoff, 2009). It is reasonable to assume that whatever health guidelines for physical activity recommended for the general population in terms of achieving physical and mental well-being would likewise apply to the youth with ASD. However, there is a dearth of research on healthy living, specifically engagement in physical activity to combat idleness and weight gain for this population. This should be a cause for concern because individuals with ASD have a strong tendency to be inactive, and weight gain may be a common side effect of the medications they take to treat their symptoms (Scahill & Koenig, 1999).

It is not surprising then that individuals with ASD would tend to live sedentary lifestyles with fitness levels far below the general population (Draheim, Williams & McCubbin, 2002; Gillespie, 2003). Individuals with ASD have been known to have cognitive and social deficits; however, their motor deficits have not been given much attention. Motor functioning in the ASD population has limited research despite the fact that physical activity brings several benefits such as the increased opportunity for social interaction (Berkeley, Zittel, Pitney, & Nichols, 2001) and

increased appropriate responding (Kern,Vorndran, Hilt, Ringdaht, Adelman, & Dunlap, 1998). Antecedent physical activity for individuals diagnosed with ASD improved academic engaged time (Nicholson, Kehle, Bray, & Heest, 2011), reduced maladaptive behaviors (Celiberti, Bobo, Kelly, Harris, & Handleman, 1997) and the reduction of stereotypic movements (Levinson & Reid, 1993; Prupas & Reid, 2001). Poor motor functioning, low motivation levels, difficulty in planning and generalization and difficulty in self-monitoring discourage them from engaging in physical activity (Reid & Todd, 2006).

Berkeley et al. (2001) found that individuals with ASD aged six to eight years, in their study on locomotor and object control skills scored very poorly in the categories of the *Test of Gross Motor Development* (Ulrich, 1985). The *Test of Gross Motor Development* is a norm-referenced measure of common gross motor skills divided into two subgroups locomotor and object control. In another study for individuals with ASD aged 8 to 15 years, Ghaziuddin and Butler (1998) found that they scored lower on the *Bruininks-Osertesky Test of Motor Proficiency* than their peers with Asperger syndrome and pervasive developmental disorder- not otherwise specified (PDD-NOS). All three groups under the ASD umbrella scored lower than general population norms. In an attempt to describe motor ability in individuals with ASD, studies have compared typically developing individuals (Ming, Brimacombe, & Wagner, 2007; Pan, Tsai, & Chu, 2009; Provost, Lopez, & Heimerl, 2007; Staples & Reid, 2010; Whyatt & Craig, 2012) and found the overall motor performance was lower for the individuals in the ASD group as compared to the typical groups. Additional studies showed that individuals with ASD have lower

motor performance than their peers (Baranek, 2002; Dewey, Cantell and Crawford, 2007; Piek & Dyck, 2004; Todd & Reid, 2006).

Individuals with ASD have difficulty interacting with peers and participating in physical activities and various sports and exercise due to repetitive/restricted interest and activities, peer and social integration difficulties and communication difficulties (Block, Block & Halliday, 2006; Reid, 2005). Therefore, this physical inactivity may lead to social and behavioral deficits that bring about difficulties in understanding social cues, establishing eye contact, playing imaginative and social games, learning turn-taking and sharing with others, reciprocating conversation and making friends (National Center on Physical Activity and Disability, 2010). In addition to the existing social and communication difficulties of individuals with ASD, limitation of support for physical activity opportunities for individuals with ASD are frequently observed issues in the literature (Reid, 2005; Sandt & Frey, 2005; Pan & Frey, 2006). Still, it is recommended that 30 minutes of daily moderate to vigorous physical activity be done by this population in order to acquire substantial health benefits.

Todd and Reid (2006) recommend physical activities that do not require environments that necessitate team dynamics or high skill levels for individuals with ASD because of poor motor functioning and low motivation. They suggest activities with complex motor skills and team activities may be contraindicated for some individuals due to social interaction and physical skill requirements of these activities. Individuals with ASD cannot sufficiently benefit from leisure skills such as sports and physical activities due to social isolation, restricted communication skills, poor eye contact, stereotypic movements and behaviors, inadequate opportunity for activity, and difficulties to maintain activity (Yanardag, Yilmaz & Aras, 2010).

The authors report that physical activities for individuals with ASD should be developed according to their preferences and requirements in the natural environments. They also state that environmental factors such as the size and noise in the sports arenas, number of people in the setting and maintaining routines are essential topics for performing sports and acquiring benefits from physical activity for individuals with ASD.

When the individuals with ASD are successfully introduced into physical exercise, several benefits come into place. Apart from the improvement of physical fitness, motor function and behavior, there are also social benefits in engaging in sports and exercise such as the promotion of self-esteem and an increase in general levels of happiness that may lead to positive social outcomes (Sowa & Meulenbroek, 2012). Dawson & Rosanoff, (2009) suggest for individuals with ASD who are able to engage in team sports, they have the opportunity to develop social relationships with teammates, coaches or trainers. They may also learn to recognize social cues needed for successful play on the field or court (Dawson & Rosanoff, 2009). Researchers have shown the multiple benefits of exercise on individuals with ASD which includes the reduction of stereotypic behavior (Levinson & Reid, 1991; Prupas & Reid, 2001), increased appropriate responding (Kern et al., 1998), and the potential for social interaction (Berkeley et al., 2001). Much of the activities for which individuals with ASD engage parallel those they also encounter in their treatments and behavioral interventions. One example breaking down activities into smaller, organized tasks and then rewarding them for successful attempts, a practice which is a core component of applied behavior analysis.

In order to facilitate participation of individuals with developmental disabilities in physical activities, strategies combining external reinforcement, self-monitoring and verbal cuing

from adults, teachers or peers are suggested (Firman, Beare, & Loyd, 2002; Hughes, Copeland, Agran, Wehmeyer, Rodi, & Presley, 2002). External reinforcers such as computer privileges or additional time for television watching, may initially be utilized to motivate individuals with ASD until such time when external reinforcers can be replaced by internal operant that promote independence. Todd and Reid (2006) defined self-monitoring as systematically observing one's behavior and recording the occurrence or nonoccurrence of a specific response in some way. The authors reported that self-monitoring, when complemented with prompting and closer attention brings about independence and increased participation for individuals without disabilities. However, for students with ASD, limited research has been conducted regarding impact of self-monitoring (Todd & Reid, 2006). To address this, the authors conducted a study on adolescents and a young adult with ASD using a physical activity intervention package that included the physical activities of snowshoeing and walking/jogging to promote sustain physical activity participation. They investigated the impact of an intervention program that consisted of edible reinforcement, verbal cuing and self-monitoring on the participants' sustained physical activity. Consistent with classroom practices, the individuals were given preferred edibles such as gummy bears, chips and gumballs every time they complete a quarter of a circuit of walking/ jogging for four sessions during baseline intervention, then decreased it during the program at a rate of one edible per complete circuit (Todd & Reid, 2006). This was coupled with the placement of a happy face marker on the board, serving as the self-monitoring factor. They justified the use of candy as reinforcers to be consistent with what was done in school, and since the intervention was done during school hours, the researchers had to comply even if candy (edible) was against their purpose of trying to decrease the weight of the participants. Examples of verbal cuing

included strategies to motivate them in exercising such as “Good job!”, “Bravo!” or “You are a champion” (Todd & Reid, 2006). These were given when individuals were slowing down in the pace and as a congratulatory gesture when they finished a circuit. It was also the verbal directives used to guide individuals around the circuit and to redirect them in the task in case they went off-task. Todd and Reid (2006) found that collectively, the combination of self-monitoring, edible reinforcers, verbal cuing and extra attention and its corresponding enhanced physical fitness all contribute to the individual’s increased distance in walking or jogging during the 30-minute sessions. As physical activity increased throughout the program, verbal cuing and edible reinforcement decreased. The only element that remained constant was the self-monitoring component.

Lotan, Isakov and Merrick (2004) and Pitetti, Rendoff, Grover, and Beets (2007) conducted studies pertaining the use of a treadmill walking program for individuals with disabilities and ASD. Their purpose was to determine its efficacy on their exercise capacity and BMI reduction. In Lotan et al.’s study, a two-month treadmill walking program was implemented with four individuals aged 8.5-11 years with Rett’s syndrome while Pitetti et al.’s study, treadmill walking program went on for nine months for individuals with severe ASD. In both, it was found that the treadmill walking intervention was effective in lowering BMI. Specifically, Pitetti et al.’s found that individuals were taking the medication Risperidone, which is a noted side effect for weight gain. Despite this, the treadmill walking program in this study was very beneficial for controlling body weight and BMI (Pitetti et al., 2007). Routine and predictability are comforting to individuals with ASD so working to turn physical activity into a routine, whether a daily walk or setting a timer that breaks up periods of inactivity with some fun

movements, will benefit both the body and the mind of a person with ASD. Lotan et al. (2004) found their treadmill training method could be operated with the support of an unskilled staff person under real-life conditions, enabling relatively easy implementation type of exercise that is easy to operate without entailing long-term budgetary expenses and might improve the health status of individuals with developmental disabilities, who are a population at risk for developing heart-related diseases at a young age.

Obesity among Individuals with Developmental Disabilities

Obesity is a global concern that affects all populations including those with disabilities (World Health Organization, 2015). Obesity is reported to affect more than one-third of adults within the United States (CDC, 2015). Adults that have a body mass index (BMI) of 30 or higher are considered to be obese (CDC, 2015). The CDC equates that this is approximately 34.9% of the adult population (CDC, 2015). Researchers have recognized that obesity is a major health issue in individuals with developmental disability (Horwitz, Kerker, Owens and Zigler, 2000; Janicki, Davidson, Henderson, McCallion, Taets, Force, Sulkes, Frangenberg, & Lardrigan, 2002; Rimmer, Braddock, & Fujiura, 1993; Rubin, Rimmer, Chicoine, Braddock, & McGuire, 1998; Traci, Seekins, Szalda-Petree, & Ravesloot, 2002). Population-level prevalence data indicate that the obesity levels of adults with developmental disability are either similar to or higher than general population (Emerson, 2005; Yamaki, 2005). Ellis, Lang, Shield, Wilkinson, Lidstone, Coulton and Summerbell (2006) suggest that individuals with developmental disabilities may be more susceptible to obesity. Adult individuals with developmental disability have the additional risk of obesity due to the decreased motivation to engage in physical activity increasing their rates of obesity by 10% to 12% (Froehlich-Grobe & Lollar, 2011). As obesity

rates skyrocket the concern over secondary disease become an equal concern (Mokdad, Serdula, Dietz, Bowman, Marks, & Koplan, 1999) and the continual rise of health care costs of obesity related to a disability are approximately $44 billion annually (Finkelstein, Trogdon, Cohen, & Dietz, 2009). CDC (2016) reported individuals with developmental disabilities can find it more difficult to always eat healthy, control their weight, and be physically active. They report that some of this might be due to; lack of healthy food choices; difficulty with chewing or swallowing food, or with the taste or texture of foods; medications that can contribute to weight gain, weight loss, and changes in appetite; physical limitations that can reduce a person's ability to exercise; a lack of accessible environments that can enable exercise; and a lack of resources. Lack of healthy eating habits and regular physical activity, common factors associated with obesity in the general population (U.S. Department of Health and Human Service, 2001) are also growing problems among persons with developmental disability (Braunschweig, Gomez, Sheean, Tomey, Rimmer, & Heller, 2004; Draheim et al., 2002; Emerson, 2005).

Childhood obesity is a national epidemic with 12.7 million children and adolescents aged 9 to 19 being obese in the United States (CDC, 2015). Bandini, Curtin, Hamad, Tybor, and Must (2005) report children and adolescents with physical and cognitive disabilities have a higher prevalence of overweight compared to their non-disabled peers. This health risk can lead to a greater number of obesity-related secondary conditions (e.g., fatigue, pain, deconditioning, social isolation, difficulty performing activities of daily living) and can impose significant personal and economic hardship on the child and family (Bazzano, Zeldin, Shihady-Diab, Garro, Allevato, & Lehrer, 2009; Rimmer, Rowland, & Yamaki, 2007). Researchers suggest effective strategies for

reducing the risk of overweight/obesity in individuals with disabilities must begin with greater awareness of the environmental and behavioral antecedents and future research on interventions to reduce obesity among adolescents with disabilities is an important area (Rimmer et al., 2007).

Obesity among Individuals with Autism Spectrum Disorder

Despite a growing literature on the problem of childhood obesity in the general population, little research has been done to examine this problem in children with ASD, since these children may be particularly vulnerable to become obese by virtue of the complex physical, behavioral, and psychosocial difficulties that they experience (Curtin et al., 2010). According to Phillips et al., 2014 obesity is 50 percent more common in individuals ages 12 to 17 with developmental disabilities as compared to typically-developing individuals. The researchers go on to report that individuals with learning and behavioral developmental disabilities were about one and half times more likely to be obese than individuals without developmental disabilities and individuals with ASD were about two times more likely to be obese than individuals without developmental disabilities. Curtin et al., 2010 report that individuals with autism are more likely to be obese than individuals without developmental disabilities. Hill et al., 2015 research indicates that the prevalence of unhealthy weight is significantly greater among individuals with ASD compared with the general population. Currently, there are no specific recommendations for preventing obesity among individuals with ASD. Obesity prevention and management approaches for this at-risk group need further consideration.

Summary

Individuals with ASD are at greater and earlier chance of obesity and tend to live more inactive lives. The research has shown that physical activity levels among individuals with ASD

are less physical active than youth without disabilities. The research has also shown that obesity rates are higher among individuals with ASD compared to the general population. Consequently, the research is clear in that intervention such as walking is the most natural and popular leisure-time activity for adults. Walking is convenient, requires no special skills or equipment and can be accommodated as part of a person's daily routine. According to the Center for Disease Control and Prevention (2012) more than 145 million adults include walking as part of a physically active lifestyle with 6 in 10 people who walk for transportation or for fun, relaxation, or exercise. The percentage of people who report walking at least once for 10 minutes or more in the previous week rose from 56% (2005) to 62% (CDC, 2012). It is a year-round, habit-forming activity and an excellent option for increasing physical activity in sedentary people. Weuve, Kang, Manson, Breteler, Ware, and Grodstein (2004) found additional benefits of walking to include significantly better cognitive function and less cognitive decline in older women. Walking also has a positive boost to a person's mood (Ensari, Sandroff, & Motl, 2016; Thayer, 2001). Richardson, Newton, Abraham, Sen, Jimbo, and Swartz (2008) reported that pedometer-based walking programs result in a modest amount of weight loss with longer programs leading to more weight loss. Walking throughout adulthood reduces the long-term weight gain that occurs in most adults (Gordo-Larson, Hou, Sidney, Sternfeld, Lewis, Jacobs, & Popkin, 2009). Keeping a routine of physical activity such as daily walking could help to prevent weight gain and promote weight loss. Rosser and Frey (2003) report less time spent in moderate activity in individuals with ASD compared to individuals without ASD. Opportunities to engage in structured activities may be limited and may further decline with age for individuals with ASD.

CHAPTER III: METHOD

This chapter described the method used to study the effects of the intervention on daily physical activity levels (i.e., duration and intensity) and weight reduction among adolescents with autism. The chapter included the following sections: design of the study, participants, setting, definition and measurement of the dependent variable, description of the independent variable, data collection and data analysis.

Research Design

This study employed a single subject range-bound changing criterion design to examine intervention effects on daily physical activity levels and weight reduction among adolescents with autism (Cooper, Heron, & Heward, 2007). McDougall (2005) explained that a range-bound changing direction design is a variation of the classic changing direction design with the difference lying on the number of criteria within a specific intervention phase. More specifically, the range-bound changing criterion design demonstrated experimental control by increasing criterion during intervention phases. The range-bound changing criterion design examined the intervention's effects on daily physical activity levels and weight reduction among adolescents with ASD (Cooper, Heron, & Heward, 2007). McDougall (2005) described that a range-bound changing design is a variation of the classic changing direction design with the difference lying on the number of criteria within a specific intervention phase. Range-bound versions have both a lower and upper criterion in each intervention phase. McDougall (2005) suggested possible application for this design to gradually improve the daily exercise of sedentary, overweight or obese adults and suggests gradually increasing the range-bound criterion promotes reasonable increase in daily exercise. The study used the upper or ceiling value, as the maximum minutes

that the participants can walk per session. This upper limit reduced the likelihood of injuries due to walking too much too soon during the program while, the lower limit established the minimum number of minutes the participant walked per session. Range-bound versions have both a lower and upper criterion in each intervention phase. McDougall (2005) noted possible application for this design to improve gradually the daily exercise of sedentary, overweight or obese adults and suggests gradually increasing the range-bound criterion promotes reasonable increase in daily exercise.

Participants

Participants for this study were two adolescents with ASD (one male; one female) ranging in age from 14 to 17, receiving special education services at a CMHF in Central, Ohio. These participants were selected based the American Psychiatric Association's Diagnostic and Statistical Manual, Fifth Edition (DSM-5) which provides standardized criteria to diagnose ASD, their physical readiness for the walking program based on the Physical Activity Readiness Questionnaire (PAR-Q) (Appendix C), and their weight and body mass index, which are above average to higher than what is expected of their age and height. Table 3.1 displayed the students' demographic information, including (a) age, (b) gender, (c) disability, (d) race, and (e) ethnicity.

Table 3.1

Demographic Information for Students

Student	Age	Gender	Disability	Race	Ethnicity
One	17	M	ASD	White	**Hispanic**
Two	14	F	ASD	White	**Not Hispanic**

Student 1 (male) His primary mode of communication was verbal but very limited to one word answers usually prompted by support staff. He demonstrated various behaviors such as hand-flapping, jumping and covering his ears during the walking program. The student was always supported by a staff member in a one-to-one ratio.

Student 2 (female) Her primary mode of communication was verbal but very limited to one or two word answers usually prompted by support staff. She demonstrated various behaviors such as hand-flapping, repeating phases and covering her ears during the walking program. The student was always supported with two staff members in a two to one ratio.

Before being allowed to participate in the study, the procedures were reviewed and approved by the Internal Review Board (IRB) (Appendix A) at the University of Hawaii at Manoa and Board of Directors at the Community Mental Health Facility (CMHF) (Appendix B). . Each participant, with the help of his or her parent or guardian completed a Physical Activity Readiness Questionnaire (PAR-Q) (Appendix C) and signed a written informed consent (Appendix D) form before participating in the study. Pseudonyms were used to safeguard the privacy of each participant. Upon IRB and parental approval of their participation in the study, their height was measured using a Health-O-Meter and weight was also assessed in light clothing using a calibrated physician's scale. Pedometer placements were standardized by placing it on the belt or waistband, in the mid-line of the thigh, consistent with the manufacturers' recommendations.

Settings/Instruments

The study was conducted at the CMHF located in Central Ohio. The walking program was delivered during treatment hours Monday through Friday on the facilities grounds. The

facilities grounds include 45 acres with multiple walking paths, fields and a gymnasium. During program delivery CMHF staff was present at all times. The CMHF served approximately 125 students on a daily basis and has approximately 200 staff members.

Instruments included Walk4Life MVPa four function digital pedometers, stop watch, and Health-O-Meter Physician Scale. Physical Activity Readiness Questionnaire (PAR-Q): This was a self-screening tool which anyone can use before planning an exercise program. Typically, it was used by fitness trainers or coaches in assessing an individual's safety or possible risk in engaging in the exercise program. This instrument was created by the British Columbia Ministry of Health and the Multidisciplinary Board on Exercise (Quinn, 2008). The self-screening tool had a list of questions about the health history of the individual. To ensure the accuracy of the answers, parents or guardians who are aware of the health history of the participants assisted them in filling it out.

Definition and Measurement of Dependent Variables

The primary dependent variables were daily physical activity time during the walking program. Duration (minutes) and intensity (MVPA) of physical activity was recorded using a small lightweight pedometer. Activity Logs (Appendix F) was used to chart number of steps, total amount of activity time and the amount of MVPA per session recorded on the pedometer. The dependent variables were described as daily physical activity time as measured by minutes walked each session, number of steps recorded by a pedometer and BMI of the participants. In addition to the physical activity data BMI information was collected before the walking program starts and again when the walking program was completed on the Walking Program Log (Appendix G).

Pedometer. The Walk4Life MVPa four function digital pedometers were used in this study. The Walk4Life MVPa four function digital pedometer is a small lightweight unit that measures vertical acceleration and is, capable of collecting steps taken, activity time and MVPA. The pedometers measure MVPA via step frequency (steps per minute). Participants wore the pedometer on an adjustable belt positioning it close to the midline of their thigh in and an upright position according to manufactory's recommendations. The pedometers measure MVPA via step frequency (steps per minute). MVPA was determined by the students walking briskly for one minute and recording the number of steps taken and that became the students MVPA threshold level. Participants wore the pedometer on an adjustable belt positioning it close to the midline of their thigh in and an upright position according to manufactory's recommendations (*Walk4Life*, 2013).

Body Mass Index. The Health-O-Meter Physician Scale was used to measure the height and weight of the participants to determine their BMI. The BMI was calculated by using weight in kilograms divided by the square of the height in meters (kg/m^2).

Description of the Independent Variable

The independent variable was an eight week walking program adapted from the National Heart Lung and Blood Institute (2015) eight-week sample walking program. It was adapted to meet their recommendations for total amount of walking time for each week. The independent variable of the walking program was defined as organized walks five days a week during treatment hours at the center. Each week the students walked within the range-bound intervention for that week. According to the National Heart Lung and Blood Institute (2015), the weekly schedule consists of the following:

1. Week one the students walked within the range-bound intervention of 7–10 minutes a day Monday through Friday for a total of 35-50 minutes a week.
2. Week two the students walked within the range-bound intervention of 7-10 minutes a day Monday through Friday for a total of 35-50 minutes a week.
3. Week three the students walked within the range-bound intervention of 10-15 minutes a day Monday through Friday for a total of 50-75 minutes a week.
4. Week four the students walked within the range-bound intervention of 15-20 minutes a day Monday through Friday for a total of 75-100 minutes a week.
5. Week five the students walked within the range-bound intervention of 20-25 minutes a day Monday through Friday for a total of 100-125 minutes a week.
6. Week six the students walked within the range-bound intervention of 25-30 minutes a day Monday through Friday for a total of 125-150 minutes a week.
7. Week seven the students walked within the range-bound intervention of 30-35 minutes a day Monday through Friday for a total of 150-175 minutes a week.
8. Week eight the students walked within the range-bound intervention of 35-40 minutes a day Monday through Friday for a total of 175-200 minutes a week.

Interobserver Agreement, Treatment Integrity and Effect Size

The degree of measurement consistency of an instrument is referred to as reliability (Thomas, Nelson, & Silverman, 2015). Interrater reliability involves two or more independent observers recording data, while observing the same event. The goal in such observing is to have observers agree on what was observed. Cooper el at. (2007) advise that inter-rater reliability be obtained by taking the number (#) of agreements divided by # of agreements + disagreements

and then multiplying that figure by 100. The percent of agreement formula would be:

$$\frac{\text{Agreements}}{\text{Disagreements + Agreements}} \times 100 = \%\ \text{Agreements}$$

It is also prudent to suggest that observers must be trained prior to observing the event and that at least a 90% agreement be met prior to commencing with any formal observations. First, the researcher familiarized observers with the intervention components during a 30-minute training prior to the study. The observers were trained the week prior to the start of the walking program. Both observers were staff members at the CMHF with bachelor degrees and five years of experience working with people with ASD. During the training, observers met the pre-established criterion of 90% agreement. Moreover, observers were also retrained during the course of data collection to address "observer drift" which can produce inaccurate and inconsistent observations. Observer drift training is necessitated despite any exemplary training and expertise an individual may possess. Observers sometimes unknowingly sway from accurate observation procedures, thus generating threats to a study's reliability. Also, additional training was completed at the completion of week four of the walking program to address observer drift. Results from randomly selected sessions (i.e., sessions 3, 6, 12, 19, 21, 27, 35 and 39) indicated 100% of interrater reliability across each session for the study. Target IOA was set at 90% as suggested by Cooper et al. (2007).

Treatment Integrity. The degree to which an independent variable is implemented as intended is known as treatment or procedural integrity (Cooper et al., 2007). A treatment integrity checklist (Appendix J) was used along with the training of observers. Such training and

procedures used for inter-rater reliability were used with treatment integrity. An estimated 25% of the total data set was targeted for treatment integrity. Two observers were trained by the researcher to use the treatment integrity checklist and used throughout the study. The observers monitored researcher's data collection and procedures of the study such as: Was the pedometer reset to zero?; Was the pedometer placed on the participant correctly?; Did the researcher remove the pedometer after the walk and record the physical activity time?; Did the researcher remove the pedometer after the walk and record the number of steps taken?; Did the researcher remove the pedometer after the walk and record the amount of MVPA per session?; and Did the participant walk within the range-bound intervention?

Effect Size. Heyvaert, Wendt, Van den Noortgate, and Onghena (2015) suggested that effect size (ES) be reported for all single subject research. The researcher analyzed the extent to which data points within each intervention phase conformed to the established the range of acceptable performance for the respective intervention phases. This analysis further verified the extent of experimental control; that is, the number of minutes the participants actually walked conformed very closely to the within-phase ranges established for each intervention phase. To this end, the percentage of conforming data (PCD) was used to determine ES for each subject (Parker, Vannest, & Davis, 2010). More specifically, the calculation of PCD includes a three-step process: "adding the number of data points within intervention phases meeting criterion ranges, dividing that number by the total number of data points within that phase, and multiplying by 100" (Haegele & Hodge, 2015, p. 298). PCD scale used for this study (a) 90%+ = Highly Effective, (b) 70%-90% = Moderately Effective, (c) 50%-70% = Minimally Effective and (d) >50% = Ineffective.

Procedures

The researcher recruited and contacted study's participants. The recruitment plan involved the researcher send out a flyer (Appendix E) to parents with adolescents enrolled at the CMHF. Once students were identified the researcher met with each parent and/or guardian to explain the study. Next each student, with the help of his or her parent or guardian completed a Physical Activity Readiness Questionnaire (PAR-Q) to see if they are able to participate in the study. Then upon parental approval of their participation in the study, their height and weight were measured using a Health-O-Meter. Height and weight were assessed in light clothing using a calibrated Health-O-Meter physician's scale to gather participant's BMI. Then the pedometer placements were standardized by placing it on the belt or waistband, in the mid-line of the thigh, consistent with the manufacturers' recommendations by the researcher. Then the students began the walking program as described in the independent variable section that was an eight week walking program adapted from the National Heart Lung and Blood Institute (2015) eight week sample walking program.

After the completion of the eight week walking program the researcher took height and weight of the students using the same Health-O-Meter physician's scale to gather students' BMI and recorded on the Walking Program Log. Lastly the researcher had the staff and parent or guardian complete the Parent Social Validity Questionnaire (Appendix H) or Staff Social Validity Questionnaire (Appendix I).

Data Collection

Prior to using the pedometers were tested for accuracy. Researcher placed the pedometer on the students' adjustable belt along the waistline in front of the right hip before each session.

Researcher was trained on how to properly place the pedometer on the students. For consistency the students wore the same pedometer during each session. Students wore the pedometer on an adjustable belt along the waistline in front of the right hip. After each session researcher removed the pedometer and track the number of minutes of activity time and amount of MVPA on walking program log.

Data Analysis

Quantitative data were analyzed with visual inspection of graphs. Richards, Taylor, Ramasamy, and Richards (1999) suggest the use of visual analysis when continuous numerical data are gathered, the data are graphically depicted, and the researcher wishes to make formative and summative analyses. For each participant, graphic representations of dependent variables within the bounded criteria were reported. As data are collected, information was graphed and analyzed on a continuous basis until the research was completed. Information from each session was plotted in a graphic display, patterns and trend lines in the data were studied to decide as to what criteria should change. A trend was a relatively consistent change in data set and data path in one direction (Johnston & Pennepacker, 1993). In this regard, the researcher was able to visually inspect the trend direction for each participant across conditions.

CHAPTER IV: RESULTS

This chapter presents the results of the effects of the intervention on daily physical activity levels and acquisition of MVPA time among two adolescences with ASD during school hours. In the first section of this chapter, treatment integrity and reliability results are reported. In the second section, data for both participants are presented followed by a summary of results. In the last section, results from the social validity questionnaires are presented and discussed.

Treatment Integrity and Interrater Reliability

Treatment integrity scores for 25% of the 40 total sessions were selected during program implementation. Treatment integrity and reliability checklist can be found in Appendix J. Two independent observers were used to ensure the intervention was applied as intended and in a consistent manner. The researcher trained the independent observers on the checklist. The training lasted 15 minutes. The independent observers were employees at the CMHF that were trained as RBTs with bachelor degrees. Interobserver agreement (IOA) was calculated by dividing the number of agreements by the summation of agreements plus disagreements and multiplied by 100. The target IOA was set at 90%. The overall mean score among observers for the sessions observed was 100% which was above the pre-established IOA percentage. The first and second independent observers had a mean of 100% for all sessions. Based on the obtained mean scores, treatment integrity was found to be acceptable.

Interrater reliability observers were trained the week prior to the start of the walking program. During the training observers met the pre-established criterion of 80% agreement. Also, additional training on the checklist was completed at the completion of week four of the

walking program to address observer drift. The researcher randomly selected sessions (i.e., sessions 3, 6, 12, 19, 21, 27, 35 and 39) and the results indicated 100% of interrater reliability across each session for the study.

Bouts of Physical Activity

Data in Figures 4.1 and 4.2 and Tables 4.1 and 4.2 indicated that time spent in a single bout of physical activity (PA) improved with few exceptions from baseline through each of the eight intervention phases for all students during the implementation of the intervention. Figures and concurrent tables portray evidence of experimental control as the criterion-ranged increased so did students' bouts of physical activity.

Student 1 (male) His primary mode of communication was verbal but very limited to one word answers usually prompted by support staff. The stereotypical behaviors he demonstrated were hand-flapping, jumping and covering his ears during the walking program. His MVPA threshold level was set at 137 steps per minute based on manufacturer's recommendations. He weighed 208 pounds and his height was five feet nine inches with a BMI of 30.7 at the start of the study. After the completion of the study his height remained the same, but his weight went down to 205 while his BMI decreased by 0.4 to 30.3. Employing the National Heart Lung and Blood Institute (2015) criteria as part of intervention, a total of 40 sessions was conducted at the CMHF site. He had a full time staff with him at all times when he attended the CMHF.

Figure 4.1

Changing Criterion Bouts of PA (Minutes) for Student 1.

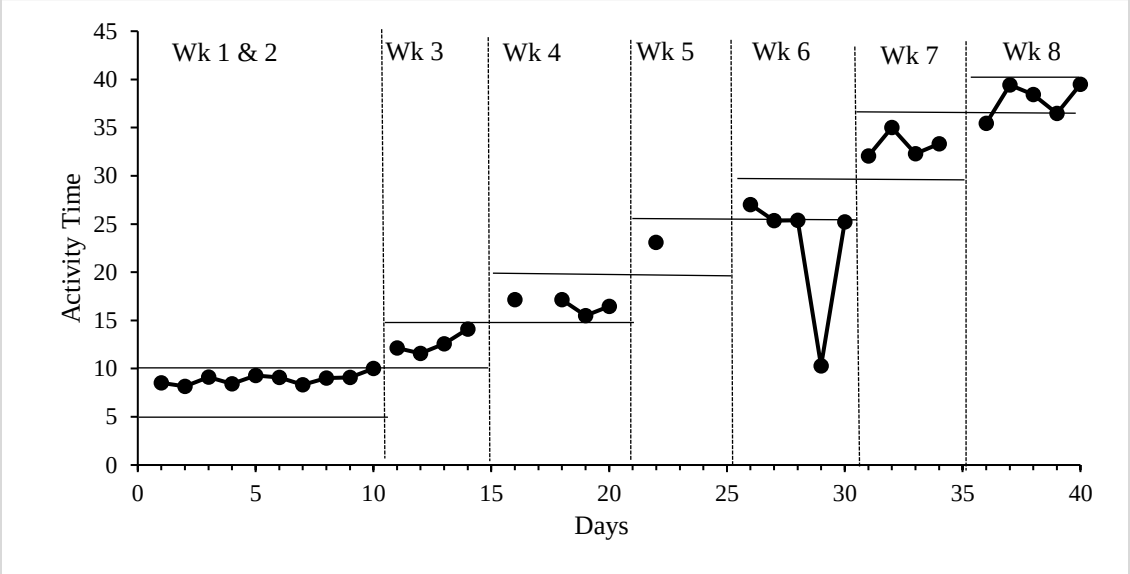


Table 4.1 provides a summary of mean scores and ranges for time spent in physical activity bout and effect size reported in PCD. During baseline, no actual data were recorded. Baseline was primarily used as a vehicle to begin a physical activity program for the participant.

Table 4.1

Summary Mean Scores and Ranges for Time Spent in a Bout of PA and PCD by Student 1 Across Phases.

Phase	**Within-phase criteria**	**Actual performance**		**PCD**
	Range-bound Criterion	*Range*	*Mean*	
Baseline	None	0.00	0.00	None
Week 1 and 2	7.0-10.0	8.16 - 10.00	8.90	10/10 = 100%
Week 3	10.0 - 15.0	11.58 – 14.11	12.6	4/4 = 100%
Week 4	15.0 - 20.0	15.50 – 17.14	16.56	4/4 = 100%
Week 5	20.0 – 25.0	23.09	23.09	1/1 =100%
Week 6	25.0 – 30.0	10.28 – 27.20	22.68	4/5 =80%
Week 7	30.0 – 35.0	32.05 – 35.00	33.17	4/4 =100%
Week 8	35.0 – 40.0	35.44 – 39.49	37.85	5/5 =100%

Weeks 1 and 2 were combined since ranged-bound criterion was the same. Moreover, this really allowed for more time to familiarize the participant with a physical activity program.

Graphic display of data for student 1 depicted steady state responding for Weeks 1 and 2 (Figure 4.1). Weeks 1 and 2 consisted of a walking program with no incentives for 7-10 range of minutes. Actual physical activity performance range, mean score and PCD for Weeks 1 and 2 suggested the following: range 8.16-10.00, *M*= 8.90, PCD=100% (See Table 4.1). During Week 3 participant met the criterion for time spent engaged in daily physical activity (walking) of 10-15 minutes. Actual performance data for Week 3 for physical activity suggested a range of 11.58-14.11, *M*=12.6, PCD=100%. More specifically, day15 was canceled due to severe thunderstorms in the area that precluded any outdoor activities. Visual inspection of graph for Week 4 indicated that engagement in physical activity was met with the exception of day 17 being out sick. Student 1 was able to walk consistently for 15-20 minutes and met the range bound criterion. Actual physical activity performance data suggested a range of 15.50-17.14, *M*=16.56, PCD=100% for time spent in bout. Data gathered for Week 5 showed only one day of data points. This was due to the fact that participant 1 was out sick and did not attend school on the following days 21, 23, 24 and 25. Data gathered for that one day had a mean score of 23.09, PCD=100% (one day only) of time spent in bout. Consequently, Week 6 participant 1 met the required criteria of 25-30 minutes of engaged physical activity (walking). In Week 6, day 29 the data point dropped due to a thunderstorm on that particular day which prevented him from meeting criterion due to the walk being cut short because of safety concerns. Week 7 found participant 1 meeting the criteria for engaged physical activity for four consistent days. Actual performance data for physical activity ranged from 32.05-35.00, *M*=33.17, PCD=100% in time

spent in bout. On day 35, participant 1 did not attend school due to illness. Finally, Week 8 visual inspection of graph data displayed student 1 meeting the criterion range of 35-40 minutes of engaged physical activity. Physical activity actual performance data ranged from 35.44-39-49, *M*=37.85, PCD=100%.

Student 2 (female). Her primary mode of communication was verbal but very limited to one or two word answers usually prompted by support staff. The following stereotypical behaviors she demonstrated hand-flapping, repeating phases and covering her ears during the walking program. Her MVPA threshold level was set at 124 steps per minute based on manufacturer's recommendations. She weighed 187.5 pounds and her height was five feet five inches with a BMI of 31.2 at the start of the study. After the completion of the study her height remained the same, but her weight went down to 185 while her BMI decreased by 0.4 to 30.8. Employing the National Heart Lung and Blood Institute (2015) criteria as part of intervention, a total of 40 sessions was conducted at the CMHF site. She has two full time staff assigned to her at all times while attending the CMHF.

Visual inspection of data for student 2 depicted a steady state responding for Weeks 1 and 2 (Figure 4.2). Weeks 1 and 2 consisted of a walking program with no incentives for 7-10 range of minutes. Actual performance range, mean score and PCD for Weeks 1 and 2 (range 7.01-8.53, *M*= 7.7, PCD=100%) (See Table 3). During Week 3 student met the criterion for time spent engaged in daily physical activity (walking) of 10-15 minutes. Actual performance data for Week 3 for physical activity suggested a range of 10.22-12.11, *M*=11.29, PCD=100%. More specifically, day15 was canceled due to severe thunderstorms in the area that precluded any outdoor activities. Graph display of data for Week 4 indicated that engagement in physical

activity was met with the exception of day 19 participant need to use the restroom in the middle of the walk and did not what to return to the walk when she was done using the restroom. Student 2 was able to walk consistently for 15-20 minutes and met the range bound criterion in four out of the five days. Actual physical activity performance data suggested a range of 11.17-16.57, *M*=15.38, PCD=80% for time spent in bout. Data gathered for Week 5 showed student 2 met the required criteria of 20-25 minutes of engaged physical activity (walking). Actual performance data suggested a range of 21.02-24.43, *M*=22.38, PCD=100% for time spent in bout. Consequently, Week 6 student 2 met the required criteria of 25-30 minutes of engaged physical activity (walking). Week 6 (i.e., day 29) the data point dropped due to a thunderstorm on that particular day which prevented her from meeting criterion due to the walk be cut short because of safety concerns. Graphed data for Week 7 found student 2 meeting the criteria for engaged physical activity for four consistent days. Actual performance data for physical activity ranged from 30.06-34.48, *M*=32.5, PCD=100% in time spent in bout. Finally, Week 8 visual inspection of graph data showed participant 2 meeting the criterion range of 35-40 minutes of engaged physical activity. Physical activity actual performance data ranged from 35.41-37-52, *M*=36.32, PCD=100%.

Figure 4.2

Changing Criterion Bouts of PA (Minutes) for Student 2.

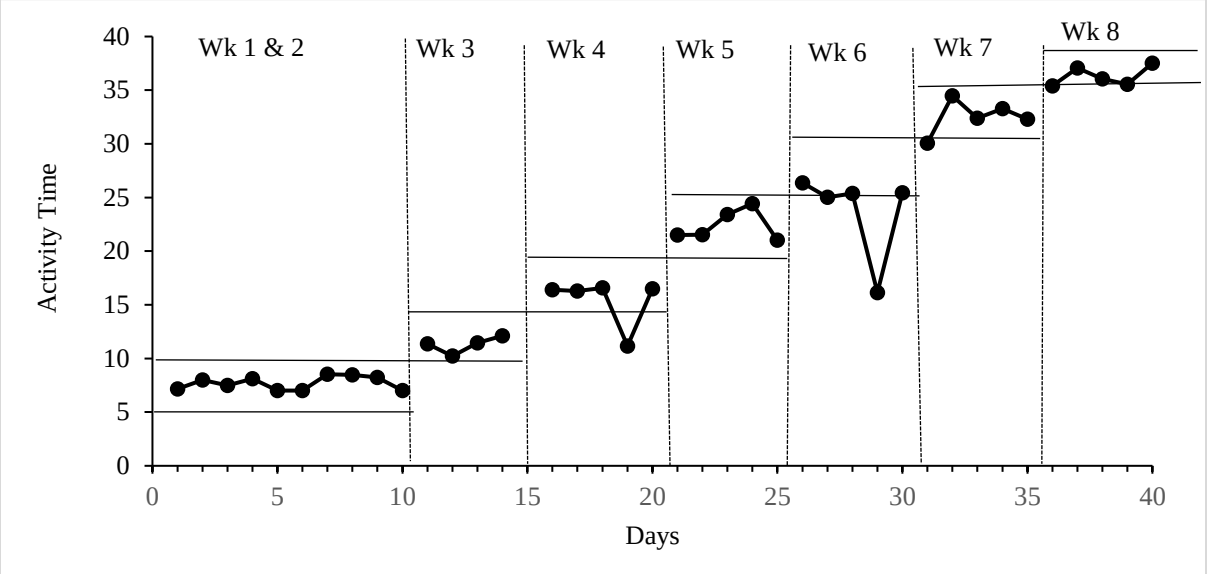


Table 4.2

Summarizes Mean Scores and Ranges for Time Spent in a Bout of PA and PCD by Student 2 Across Phases.

Phase	**Within-phase criteria**	**Actual performance**		**PCD**
	Range-bound Criterion	*Range*	*Mean*	
Baseline	None	0.00	0.00	None
Week 1 and 2	7.0-10.0	7.01 - 8.53	7.70	10/10 = 100%
Week 3	10.0 - 15.0	10.22 – 12.11	11.29	5/5 = 100%
Week 4	15.0 - 20.0	11.17 – 16.57	15.38	4/5 = 80%
Week 5	20.0 – 25.0	21.02 – 24.43	22.38	5/5 =100%
Week 6	25.0 – 30.0	16.14 – 26.37	23.67	4/5 =80%
Week 7	30.0 – 35.0	30.06 – 34.48	32.50	5/5 =100%
Week 8	35.0 – 40.0	35.41 – 37.52	36.32	5/5 =100%

Bouts of Moderate to Vigorous Physical Activity (MVPA)

Data for bouts of MVPA are gleaned in figures 4.3 and 4.4. Following the

implementation of the intervention students 1 and 2 engaged in bouts of MVPA. Student 1 engaged in a bout of MVPA in every session in each intervention phase, each bout averaging the following minutes per week: 4 minutes (week 1), 5 minutes (week 2), 7 minutes (week 3), 7 minutes (week 4) 16 minutes (week 5), 11 minutes (week 6), 14 minutes (week 7) and 14 minutes (week 8) (See Figure 4.3). The increase in times spent in MVPA between intervention phases was due to the increased time spent in PA reflecting the research design. Student 2 (Figure 4.4), engaged in a bout of MVPA during every session in each of the intervention phases with each bout averaging the following minutes per week: 1 minute (week 1), 1 minute (week 2), 5 minutes (week 3), 2 minutes (week 4) 9 minutes (week 5), 0.17 minutes (week 6), 2 minutes (week 7) and 5 minutes (week 8) (See Figure 4.4). Based on these data, it appeared that during intervention phases' time spent in bouts of MVPA were more evident for student 1 than 2.

Figure 4.3

Time Spent in Bouts of MVPA across Phases for Student 1.

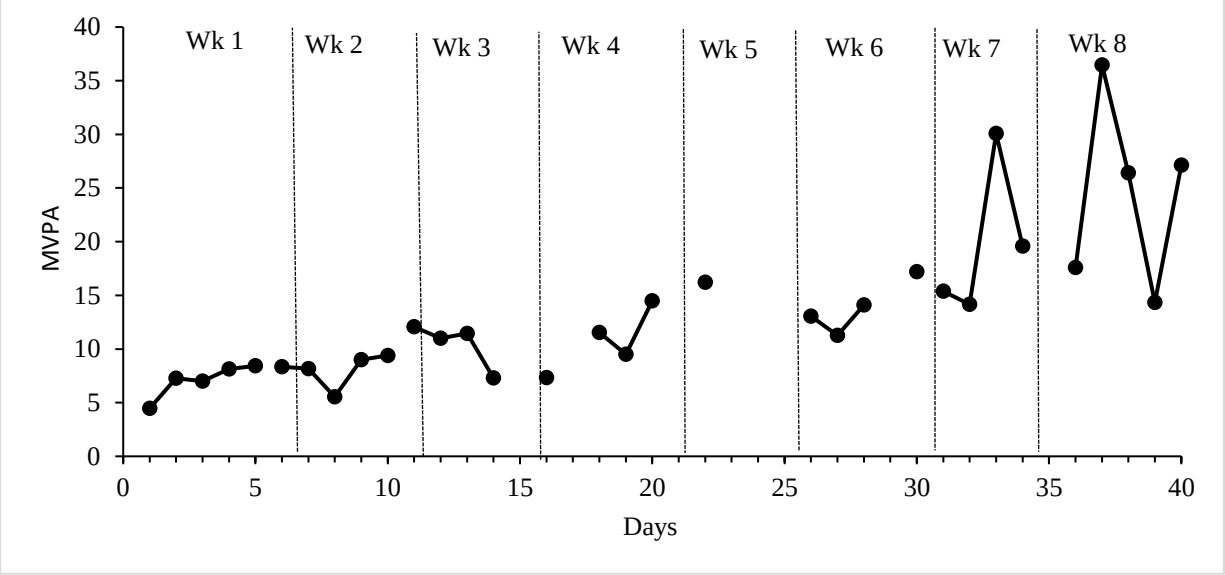
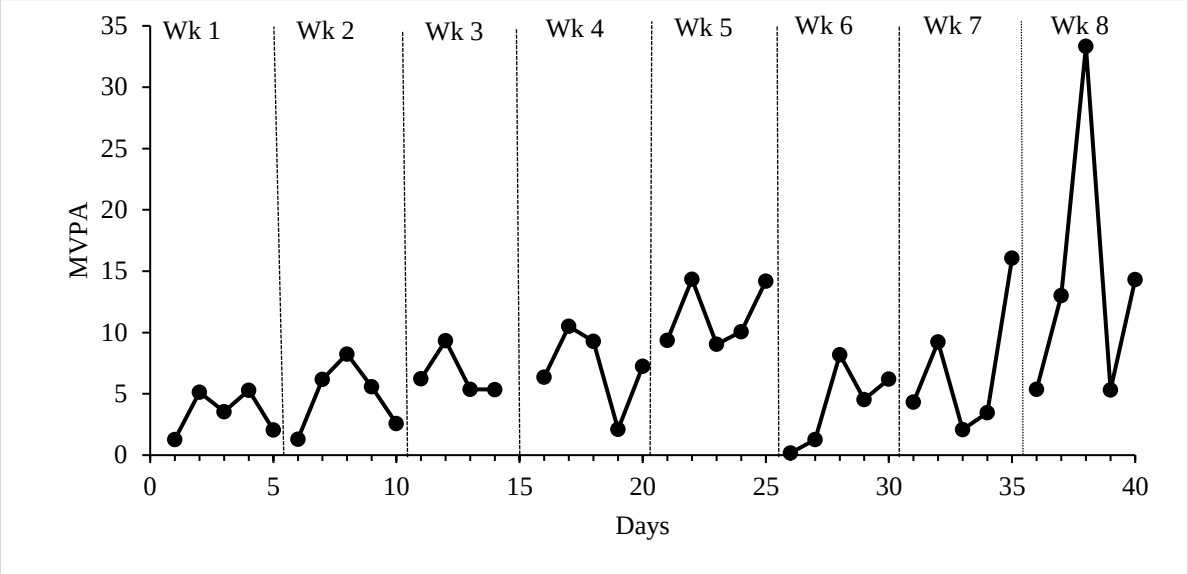


Figure 4.4

Time Spent in bouts of MVPA across Phases for Student 2.



Total Minutes Spent in Moderate to Vigorous Physical Activity Time

Data for total time spent in moderate to vigorous intensity in PA are displayed in Tables 4.3 Consistent with data regarding bouts of MVPA, student 1 had more MVPA than 2. Students 1 appeared to increased MVPA at onset of intervention and continued throughout all phases with the exception of week 5 when he was out sick four of the five days. Student 2 engaged in MVPA across all phases, but during intervention (weeks 6 and 7), performed at a lower rate than previous weeks. Both students accumulated most of MVPA time during week and engaged in substantially greater minutes of MVPA during intervention phases as the activity criterion increased.

Table 4.3

Total Time Spent in Moderate to Vigorous Intensity Physical Activity

Weeks	Student 1	Student 2
	Total Time Spent in MVPA (minutes)	
Week 1	35.31	17.31
Week 2	40.48	23.87
Week 3	41.80	26.28
Week 4	42.86	35.50
Week 5	16.21	47.66
Week 6	55.62	20.39
Week 7	79.20	35.17
Week 8	121.92	71.34

Summary

Visual inspection of graphed data (Figures 4.1 through 4.2) show that time spent in about of PA increased from baseline to criterion for both students. Functional control was established at onset of intervention compared to baseline; success was achieved when the students resided within the stipulated range criterion during all intervention phases of the study. Similarly, total time spent in PA was significantly higher during criterion weeks compared to baseline for each of the students.

Unfortunately, a potential weakness in results was noted with no maintenance and generalizable data for students 1 and 2. Single subject research added strength for treatment effects is the ability to demonstrate behavioral change and behavioral control across time and environments. For PA studies involving students with ASD, the ability to demonstrate such behavior change is important for health and quality of life (Sowa & Meulenbroek, 2012).

Body Mass Index

Body Mass Index (BMI) was assessed for each student. In addition to monitoring physical activity and MVPA, BMI measures were taken to address the notion of overweightness and perhaps even obesity concerns with this population (Broder-Fingert, Brazauskas, Lindgren, Iannuzzi, & Van Cleave, 2014). To this end, Table 4.4 offers a closer examination of students' weight at the start of the study and again at the end. While data suggest that weight loss did occur, I cannot state with confidence that the walking program (intervention) was the sole treatment for weight loss. I did not control of food intake at home or school which may have also influenced weight loss.

Table 4.4

Body Mass Index Across Participants

Participant	Week	Height	Weight	Weight Change	BMI	BMI Change
Participant 1	Week 1	69"	208lbs.		30.7	0.4
Participant 1	Week 8	69"	205lbs.	-3lbs.	30.3	
Participant 2	Week 1	65"	187.5lbs.		31.2	0.4
Participant 2	Week 8	65"	185lbs.	-2.5lbs.	30.8	

Social Validity

Social validity questionnaires were developed and administered to relevant participants of the program to assess their perceptions about the importance and relevancy of the intervention and program. Schwartz and Baer (1991) indicated the purpose of social validity assessment is to evaluate the acceptability or viability of an intervention, often accomplished by asking all

relevant consumers to complete some form of questionnaire. For this study, two categories of program participants were used: (a) indirect participants (i.e., parents) and (b) members of the immediate community (i.e., aides and CMHF administration) (Schwartz & Baer, 1991). Wolf (1978) suggests that social validity assessment should answer the following questions: (a) were the goals of the procedures important and relevant to the desired behavior changes? (b) Were the techniques acceptable to the consumers and the community or did they cost too much? And (c) were the consumers satisfied with the outcome, both with the predicted behavior changes and with any unpredicted side effects? The questionnaires were distributed to a total of seven individuals (2 parents and 5 CMHF personnel). Questionnaires were completed and returned by all seven of these individuals (100%).

Indirect Consumers: Parents

The social validity questionnaire for parents consisted of seven questions and a section for additional comments (Appendix H). Responses to each question are detailed and discussed below:

1. *Did you see a difference in your child's physical activity at home while he/she was participating in the walking program at school?* When asked this question the parent of student 1 selected "yes" and parent of student 2 selected "No".

   Can you please describe what this difference(s) is? Parent of student 1 stated "My son is naturally hyper and the hyperactivity is more manageable through walking and there is a noticeable difference when he does not walk".

2. *Did you see a difference in your child's behavior at home while he/she was participating in the walking program at school?* When asked this question the parent of student 1

selected “yes” and parent of student 2 selected “No”

Can you please describe what this difference(s) is? He was more eye contact, smiles and was more verbal. He was also had more engagement and was a better listener.

3. *Would you consider the use of the walking program to increase physical activity participation valuable for adolescents with autism?* When asked this question both respondents selected “yes”.
4. *Would you consider using the walking program at home to increase physical activity participation of your child?* When asked this question both respondents selected “yes”.
5. *During the past seven days, how many days was your child physically active for AT LEAST 60 MINUTES per day? (Add up all the time they spend in any kind of physical activity that increases their heart rate and makes them breathe hard some of the time.)* When asked this question parent of student 1 selected “5” and student of parent 2 selected “1”.
6. *On an AVERAGE SCHOOL DAY, how many hours do you watch TV?* When asked this question both parents selected “0”.
7. *On an AVERAGE SCHOOL DAY, how many hours do you play video or computer games or use a computer/tablet for something that is not schoolwork? (Include activities such as Nintendo, DS, Play Station, Xbox, Facebook, Twitter, computer games, and the internet.)* When asked this question parent of student 1t stated “all” and parent of student 2 stated “6”

Additional comments: Parent of student 1 stated “*My son was diagnosed with diabetes type 2 in*

November of 2015. His parents are fully aware of the importance of exercise and we have all benefited from daily walks. A chronic illness is a very good motivator to get walking and keep walking."

Members of Immediate Community: CMHF Staff

The social validity questionnaire for the CMHF staff consisted of four questions and a section for additional comments and recommendations (Appendix I). Responses to each question are stated below:

1. *Do you think there is a need for programs specifically designed to increase physical activity among adolescents with autism?* When asked this question, all respondents selected "yes".
2. *Can you tell if the walking program has made a difference for this individual? If so, what would these changes be?* When asked this question, all respondents selected "yes". Three staff members reported an increase tolerance to engage in longer walks and another staff reported consumer was easier to keep engaged in other activities after the walk.
3. *Do you think this type of program could have promise as part of the daily offerings for students with autism?* When asked this question, all respondents selected "yes".
4. *Do you believe the students enjoyed the walking program?* When asked this question, all respondents selected "yes".

Additional comments: *What do you consider were the benefits of the walking program?* Some of the comments regarding the benefits of the program as reported by the respondents included: "It allowed the consumer to active as part of her daily schedule while working on social interaction skills" "*something she looked forward to everyday*" and "*allowed student to burn off extra*

energy". Recommendations: *What could have been improved?* When asked this question, respondents indicated that using a variety of walking routes and changing the times of the walks would help the students become more flexible with their daily schedules.

In summary, results from the social validity questionnaires administered to parents and CMHF staff provided support for the implementation of the intervention. Parent of student 1 and CMHF staff observed changes in physical activity participation among students after the intervention was completed. Parent of student 2 noted no changes in physical activity or behaviors at home after the intervention was completed. CMHF staff as well as parents supported the implementation of specially-designed walking intervention to increase physical activity among youth with ASD. In particular, respondents believed the walking program was something the students enjoyed and could be incorporated into the daily schedules.

CHAPTER V: SUMMARY, RESEARCH QUESTIONS, DISCUSSION, IMPLICATIONS FOR PRACTICE AND RECOMMENDATIONS

Chapter V summarizes this research study and offers conclusions and recommendations. To that end, this chapter is divided into three sections. Section one summarizes the purpose and procedures of this study along with the results based on this study's research questions. Section Two offers conclusions based on the results of this study. The final section identifies areas in which future related research inquiry is recommended.

Summary

The purpose of this single subject range-bound changing criterion design was to examine the effects of an eight week walking program on daily physical activity levels, moderate to vigorous intensity (MVPA) and body mass index for two adolescents with ASD at an autism treatment center located in Central Ohio. The study implemented a range bound changing criterion design and physical activity behavior was objectively measured through the use of Walk4Life MVPA four function digital pedometers. All conclusions drawn from this study should be interpreted cautiously, however, in light of the study's small sample size. Future endeavors to increase physical activity among adolescents with ASD should focus on health promotion strategies that address barriers to physical activity for this population.

It is important to note, the Institutional Review Board from UH Manoa was received with strict recommendations on the potential recruitment of participants. At that time, the researcher also served as Executive Director and therefore issues specific to "power of authority" was a major issue with recruiting. Consequently, the researcher had very little contact and ability to actively recruit participants; hence the study ended up with only two students with ASD.

Strategic procedural highlights associated with this study included: (a) targeting students

with ASD; (b) students conducting an eight-week walking program as supported by the National Heart Lung and Blood Institute (2015); (c) data analysis consisting of visual inspection of graphs; (d) establishment of both interrater reliability and treatment fidelity; and (e) students, staff and family inputs via social validity surveys. Forty sessions were implemented across eight weeks of intervention (changing criterion ranges) without our ability to provide maintenance and generalizability data. The walking program was designed for outdoor activities. There was not enough open or gym space to conduct the walking program indoors; therefore, due to inclement weather cancellations were imminent. In light of the purpose, specific procedures and limitations associated with this study, the following summary of results is offered with regard to the research questions addressed in this study.

Research Questions

Question 1: What effect did the intervention have on the daily physical activity levels among the adolescents with ASD?

Visual analysis of graphed data suggested that the intervention demonstrated functional control by having the student**s** resided within the stipulated range criterion during all intervention phases of the study (i.e., time spent in a bout of physical activity). To demonstrate the effects of the intervention, a range bound changing criterion design was implemented. For student 1 change in mean performance across phases were observed. Similarly, changes in levels in which a shift in performance from last session of one phase to first session of next phase was observed across phases. Verification was demonstrated when changes occurred when intervention was introduced and replication achieved in each subsequent criterion phase. Experimental control was demonstrated for student 1 with all weeks of percentage of conforming data (PCD) reached

100% except for week 6 when it reached 80% due to one session cut short due to weather.

For student 2, changes in mean performance across phases were observed. Changes in levels were observed across phases. Verification was demonstrated when changes occurred when intervention was introduced and replication achieved in each subsequent criterion phase. Experimental control was demonstrated for student1 with all weeks of percentage of conforming data (PCD) reached 100% except for week 6 when it reached 80% due to one session cut short due to weather.

The intervention in this study led to physical activity behavior changes while it was implemented. This noted positive change was also echoed by staff and student's parents. For adolescents with ASD, the associated motor skill deficiencies coupled with minimal activity participation could lead to health issues and poor quality of life during adulthood. As such, increased physical activity behavior as seen in this study as a result of the intervention is important for the participants as it may be a first step in promoting physically active lifestyles, resulting in overall quality of life. Unfortunately, this study did not attempt to examine maintenance and generalization phases to determine if behaviors were actually learned by these students with ASD.

Question 2: What effect did the intervention have on the acquisition of moderate to vigorous intensity physical activity (MVPA) time among the adolescents with ASD?

Visual inspection of the data did show increased time spent in bouts of MVPA during intervention. During intervention, student 1 engaged in a total of 33 bouts of MVPA during the intervention conditions. Bouts ranged from 4 – 36 minutes. Student 2 engaged in a total of 39 bout of MVPA during the intervention conditions. Bouts ranged from 0.17 – 33 minutes.

Although time spent in a bout of MVPA was observed for these participants, short bouts of MVPA during each session may not lead to associated health benefits of engaging in long lasting bouts of MVPA on a regular basis such as higher levels of cardiorespiratory fitness, increased muscle strength, reduced body fatness, bone health, reduced symptoms of anxiety and depression, and a greater likelihood to lead a healthy adulthood (Strong et al., 2005; USDHHS, 2008). Visual inspection of the data for total time spent in MVPA each week showed that students may have benefited regarding total time spent in MVPA. Although both students increased their average time spent in total MVPA time during intervention, neither student achieved activity levels comparable to those recommended by the United States Department of Health and Human Service's physical activity guidelines for American youth (USDHHS, 2008) which is 60 or more minutes of MVPA during most days of the week, which indicate youth with ASD are at risk of not meeting daily recommend MVPA values. Future research efforts should be placed on encourage adolescents with ASD to engage in MVPA, at least, similar to that recommended for adolescent without disabilities.

Question 3: What effect did the intervention have on the weight of the adolescents with ASD?

While data suggest that weight loss did occur, student 1 loss two pounds and student 2 loss two and half pounds over the course of the study, I cannot state with confidence that the walking program (intervention) was the sole reason for the weight loss. The study did not control for the student's food intake at home or school which may have also influenced weight loss. Others factors that could influence weight gain or loss are medications the students were taking and before week 6 of the study student 2 had a change to her medication which could have influence

the loss of weight in her case.

Discussion

The purpose of this single subject range-bound changing criterion design was to examine the effects of a walking program on daily physical activity levels, moderate to vigorous intensity (MVPA) and body mass index for two adolescents with ASD at a Community Mental Health Facility located in central, Ohio. Moreover, the findings presented in this dissertation are susceptible to limitations and restrictions commonly associated with single subject research (Cooper, Heron & Heward, 2007). Consequently, every attempt was made to address the restrictions and limitation of this study.

Walking is a simple health behavior that has the potential to have a large public health impact due to its accessibility and its documented health benefits (Lee & Buchner, 2008). Walking is an activity that requires little equipment and can be carried out in local parks and neighborhoods. Also, Berkeley et al., (2001) report that because children with autism often have poor motor skills, programs that do not require high skill and can incorporate individuals of different skill levels are beneficial. This study demonstrated that a range-bound criterion intervention (walking) was associated with increased sustained participation in PA for students with ASD. Students with ASD engaged in a range of 7 minutes to 39 minutes of PA five times per week. For instance, both students were able to meet the increased criterion across all phases of the study. Student 1 steadily increased his average time in PA each week and reached a single bout high of 39 minutes of PA at the end of the program. Student 2 was also able to steadily increase her average time in PA each week and reached a single bout high of 37 minutes of PA during the last week of the program. At the end of the program, Student 1 and student 2 had

average time spent in PA of 37.85 minutes and 36.32 last week of the program compared to week one of 8.90 minutes and 7.70, respectively. Students may have initially participated in PA in response to external motivators (verbal prompts and change to daily schedule), but in time, internal motivators may have replaced the external motivators. Developing some degree of internal motivation is a positive step toward increasing sustained participation in PA (Todd & Reid, 2006). The staff of both students reported 2 weeks following the study that the students requested to go on daily walks which may be a sign of the students developing internal motivation. Student 1 was requesting to walk 5 days a week for 75 minutes and the parent also reported the student was walking 7 days a week at home up to 60 minutes a day. Student 2 requested to walk 5 days a week for 180 minutes, but the parent reported no changes occurred at home with student not request to go on any walks. Similar to Obrusnikova and Cavalier's (2011) study, which found family to be strong influence on participation in PA, student 1 's parent took the student on daily walks after the study was completed whereas student 2 parent did not. With regard to MVPA, students in the study engaged up to 36 minutes of MPVA five times per week. For instance, student 2 was not able to engage in high level of bouts of MVPA, but her average time in spent in bouts of MVPA increased each week. Student 2 steadily increased is average time in MVPA each week and reached a single bout high of 36 minutes of MVPA at the end of the program. At the end of the program, Student 1 and student 2 had total time spent in MVPA of 121.92 minutes and 71.34 in 40 minutes compared to week one of 35.31 minutes and 17.31, respectively. In addition, the activity was carried out over an eight-week period, while the students did not reach the necessary continuous moderate exercise for 30 minutes as recommend by USDHHS (2008) except on days 33 and 37 for student 1 and day 38 for student 2 to reap

health benefits associated with physical activity. Individuals with autism often lack the motivation to exercise for sustained periods (Todd & Reid, 2006). Parents and staff support by stating the use of the students' iPads were their most preferred activity and lack interest of other activities without being prompted to engage in other activities. Similarly, Orsmond and Kuo (2011) who reported that adolescents with ASD with a co-morbid diagnosis of intellectual disability spent little time engaged in conversations or doing activities with peers and spent more time alone and more time with their parents and paid professionals than those without intellectual disability. Finally, core symptoms of ASD (i.e., social-communication deficits and repetitive and restrictive patterns of behavior and interests, sensorimotor, and language) and the need for specialized trained staff to effectively work with individuals with ASD may present barriers to implementing PA. These barriers include both internal factors and external factors. Within this study, internal factors included the students' individualized sensory difficulties. The students demonstrate behaviors that may be related to sensory difficulties such as self-stimulation (hand-flapping and jumping) and avoiding behaviors (such as placing hands over ears in response to leave blower and lawn mowers) which is consistent with past research studies (Rogers et al., 2003; Tomchek & Dunn, 2007). External factors included the support or lack of support from family and environmental included distractors that were present in the various PA locations. The overall results across students 1 and 2 during intervention do suggest an increase in PA with a moderate gain in MVPA. MVPA was measured throughout the study in an effort to possibility increase health related benefits by walking with students with ASD. In this connection, both students did in fact demonstrate weight loss over the duration of the study.

Implications for Professional Practice

Bandura (2004) has argued that schools have a vital role in promoting health behavior, including physical activity, as they are the only place where most youth can be reached. That is also the case for specialized schools for students with ASD in which the needs can be met in a barrier free environment particularly with regard to physical activity as students with ASD will have more leisure time. However, for physical activity behavior change to be realized a collaborative approach is advocated. A collaborative approach would be for staff, community members and parents to interact, share and work together to design physical activity programs that place emphasis on providing physical activity opportunities that are moderate to vigorous in nature. Based on the findings of this study, a specially designed physical activity program can benefit adolescents who are known to be sedentary. These activities should be individualized in nature, supported by staff or typical peer and generalizable to other environments and settings. Staff can be instrumental in helping adolescents with ASD engage in physical activity. Staff has the opportunity to add daily physical activity into the students' daily schedules. Orsmond and Kuo (2011) reported that adolescents with ASD with a co-morbid diagnosis of intellectual disability spent little time engaged in conversations or doing activities with peers and spent more time alone and more time with their parents and paid professionals than those without intellectual disability. Finally, even with the short duration of the study it appears that a walking program can be implemented to affect positive change in physical activity behavior in students with ASD.

Recommendations for Future Research

While this study has shown that a school-based walking program can have functional control over physical activity behavior change among adolescents with ASD, there is still a need

for additional intervention research. It is suggested that future research should:

1. Examine the barriers to implantation of PA intervention for adolescents with ASD.
2. Examine the role of school related factors (e.g., physical education, after school programming, staff) potentially influencing physical activity behavior among adolescents with ASD.
3. Implement interventions with a longer period of time to ascertain its plausible effects on maintenance and generalization of physical activity behavior among adolescents with ASD.
4. Examine the applicability of recommended physical activity guidelines for children and adolescents (i.e., 60 minutes of MVPA all days of the week) as well as Healthy People 2010 national objectives for youth among adolescents with ASD, and those with disabilities in general. That is does it take 60 minutes or more of moderate to vigorous physical activity on a regular basis for adolescents with ASD to obtain health-benefits and/or acquired physically active lifestyles? Or is it less or more activity? And/or is it moderate to vigorous or just simply being active?
5. Identification of barriers to increasing physical activity levels for adolescents with ASD.

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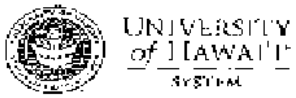
Appendix A

IRB Human Subject Review



Office of Research Compliance
Human Studies Program

MEMORANDUM

July 17, 2016

TO: John Solomon
Nathan Murata
Principal Investigators
Curriculum Studies

FROM: Denise A. Lin-DeSheller, MPH, MA
Director

SUBJECT: 23707 - "The Efficacy of an Eight Week Walking Program on Increasing Daily Physical Activity Levels and Weight Reduction for Adolescents with Autism"

This is to acknowledge receipt of your response dated June 7, 2016 to the stipulations issued by the Human Studies Program during its review of the project identified above at its meeting on April 22, 2016. The information you provided satisfactorily addressed the Human Studies Program stipulations, and the project is approved for one year, effective July 17, 2016.

This memorandum is your record of the Human Studies Program approval of this study. Please maintain it with your study records.

The Human Studies Program approval for this project will expire on July 16, 2017. If you expect your project to continue beyond this date, you must submit an application for renewal of this Human Studies Program approval. The Human Studies Program approval must be maintained for the entire term of your project.

If, during the course of your project, you intend to make changes to this study, you must obtain approval from the Human Studies Program prior to implementing any changes. If an Unanticipated Problem occurs during the course of the study, you must notify the Human Studies Program within 24 hours of knowledge of the problem. A formal report must be submitted to the Human Studies Program within 10 days. The definition of "Unanticipated Problem" may be found at: https://manoa.hawaii.edu/researchcompliance/policies-guidance, and the report form may be downloaded here: https://manoa.hawaii.edu/researchcompliance/report-protocol-violation-or-unanticipated-problem.

You are required to maintain complete records pertaining to the use of humans as participants in your research. This includes all information or materials conveyed to and received from participants as well as signed consent forms, data, analyses, and results. These records must be maintained for at least three years following project completion or termination, and they are subject to inspection and review by the Human Studies Program and other authorized agencies.

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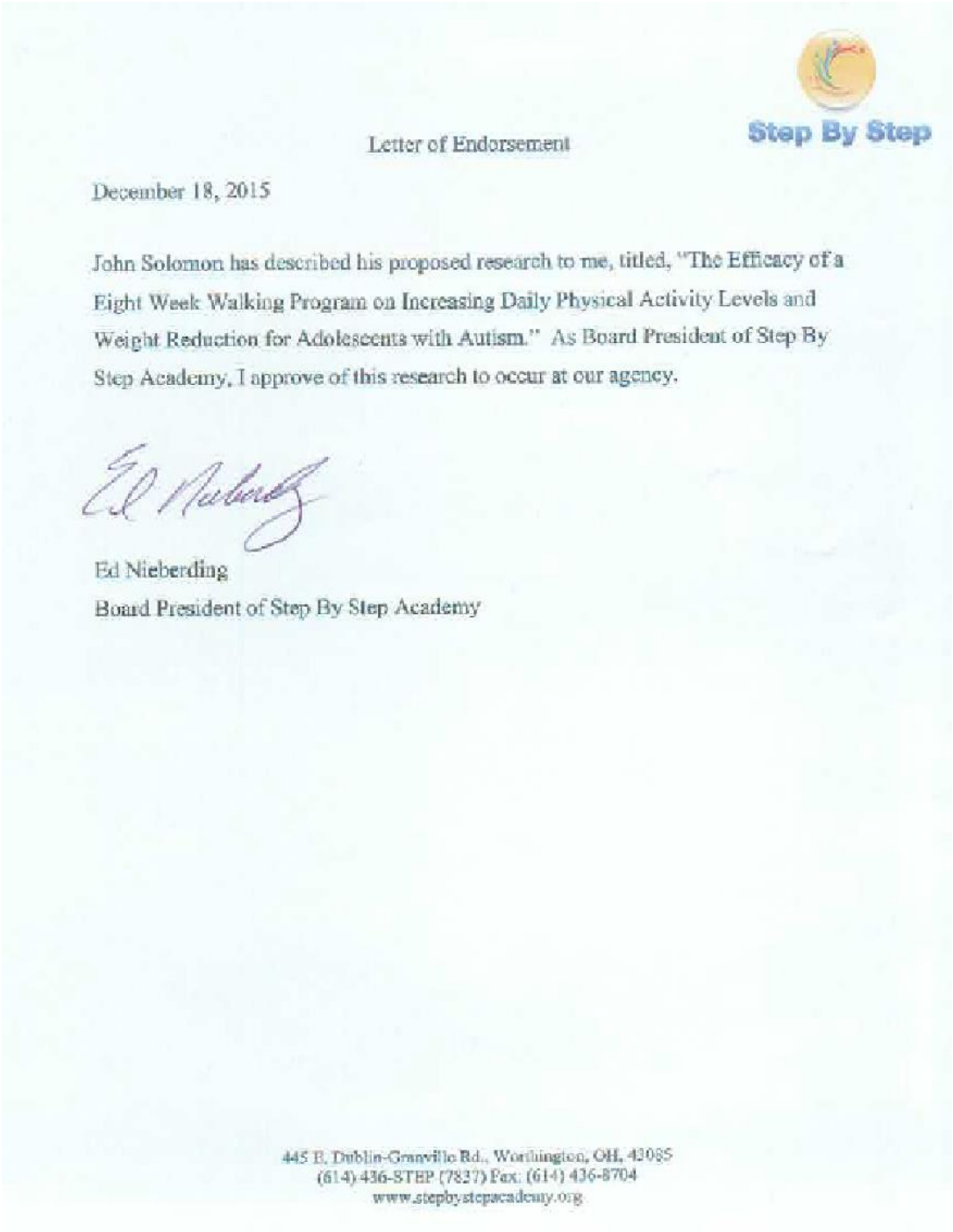
An Equal Opportunity/Affirmative Action Institution

Appendix B

School Approval for Research Study



Step By Step

Letter of Endorsement

December 18, 2015

John Solomon has described his proposed research to me, titled, "The Efficacy of a Eight Week Walking Program on Increasing Daily Physical Activity Levels and Weight Reduction for Adolescents with Autism." As Board President of Step By Step Academy, I approve of this research to occur at our agency.

Ed Nieberding

Board President of Step By Step Academy

445 E. Dublin-Granville Rd., Worthington, OH, 43085
(614) 436-STEP (7837) Fax: (614) 436-8704
www.stepbystepacademy.org

Appendix C

PAR-Q

CSEP approved Sept 12 2011 version

PAR-Q+

The Physical Activity Readiness Questionnaire for Everyone

Regular physical activity is fun and healthy, and more people should become more physically active every day of the week. Being more physically active is very safe for MOST people. This questionnaire will tell you whether it is necessary for you to seek further advice from your doctor OR a qualified exercise professional before becoming more physically active.

SECTION 1 - GENERAL HEALTH

	Please read the 7 questions below carefully and answer each one honestly: check YES or NO.	YES	NO
1.	Has your doctor ever said that you have a heart condition OR high blood pressure?	☐	☐
2.	Do you feel pain in your chest at rest, during your daily activities of living, OR when you do physical activity?	☐	☐
3.	Do you lose balance because of dizziness OR have you lost consciousness in the last 12 months? Please answer NO if your dizziness was associated with over-breathing (including during vigorous exercise).	☐	☐
4.	Have you ever been diagnosed with another chronic medical condition (other than heart disease or high blood pressure)?	☐	☐
5.	Are you currently taking prescribed medications for a chronic medical condition?	☐	☐
6.	Do you have a bone or joint problem that could be made worse by becoming more physically active? Please answer NO if you had a joint problem in the past, but it does not limit your current ability to be physically active. For example, knee, ankle, shoulder or other.	☐	☐
7.	Has your doctor ever said that you should only do medically supervised physical activity?	☐	☐

If you answered NO to all of the questions above, you are cleared for physical activity.

Go to Section 3 to sign the form. You do not need to complete Section 2.

- Start becoming much more physically active – start slowly and build up gradually.
- Follow the Canadian Physical Activity Guidelines for your age (www.csep.ca/guidelines).
- You may take part in a health and fitness appraisal.
- If you have any further questions, contact a qualified exercise professional such as a CSEP Certified Exercise Physiologist® (CSEP-CEP) or CSEP Certified Personal Trainer® (CSEP-CPT).
- If you are over the age of 45 yrs. and NOT accustomed to regular vigorous physical activity, please consult a qualified exercise professional (CSEP-CEP) before engaging in maximal effort exercise.

If you answered YES to one or more of the questions above, please GO TO SECTION 2.

Delay becoming more active if:

- You are not feeling well because of a temporary illness such as a cold or fever – wait until you feel better
- You are pregnant – talk to your health care practitioner, your physician, a qualified exercise professional, and/or complete the PARmed-X for Pregnancy before becoming more physically active OR
- Your health changes – please answer the questions on Section 2 of this document and/or talk to your doctor or qualified exercise professional (CSEP-CEP or CSEP-CPT) before continuing with any physical activity programme.

Appendix D

University of Hawai'i

Parent's/Guardian's Consent for Child to Participate:

The Efficacy of an Eight Week Walking Program on Increasing Daily Physical Activity Levels and Weight Reduction for Adolescents with Autism

My name is John Solomon. I realize that I am both the researcher, and at the same time the Executive Director at Step By Step Academy and I am also a graduate student at the University of Hawai'i (UH) in the Department of Education. One requirement of my doctorate's degree program is to conduct a research project. The purpose of my project is to compare the efficacy of an eight-week walking program on increasing daily physical activity levels and weight reduction for adolescents with autism. I want to assure you that the choice to participate in this project will have no impact on [Name]_____ placement/job at the academy, relationship with me, or relationship with the academy.

I am asking for your permission (consent) for your child, [Name] _____, to participate in this project. I also must ask and obtain [Name] _____ agreement before starting this project.

Activities & Time Commitment: If your child participates in this project, here is what (he or she) and I will do and how long it will take:

1. First, I will measure [Name] _____ height and weight to assess their body mass index.
2. Next, [Name] _____ will begin the weekly walking schedule consisting of the following: Week one the participants will walk within the range-bound intervention of 7-10–ten minutes a day Monday through Friday for a total of 35-50 minutes a week. Week two the participants will walk within the range-bound intervention of 7-10 minutes a day Monday through Friday for a total of 35-50 minutes a week. Week three the participants will walk within the range-bound intervention of 10-15 minutes a day Monday through Friday for a total of 50-75 minutes a week. Week four the participants will walk within the range-bound intervention of 15-20 minutes a day Monday through Friday for a total of 75-100 minutes a week. Week five the participants will walk within the range-bound intervention of 20-25 minutes a day Monday through Friday for a total of 100-125 minutes a week. Week six the participants will walk within the range-bound intervention of 25-30 minutes a day Monday through Friday for a total of 125-150 minutes a week. Week seven the participants will walk within the range-bound intervention of 30-35 minutes a day Monday through Friday for a total of 150-175 minutes a week. Week eight the participants will walk within the range-bound intervention of 35-40 minutes a day Monday through Friday for a total of 175-200 minutes a week.
3. After we finish the eight week walking program, [Name] _____ height

and weight measurements will be taken again to assess their body mass index.

Afterwards, I will compare information from before and after the walking program. This will help me determine if [Name's]_____ daily physical activity levels increased and their body mass index decreased.

Risks and Benefits: I believe there is little risk to your child in participating in this project. If [Name] _____ becomes stressed or uncomfortable as a result of being in this project I will contact you. You and I will determine if we should continue or discontinue your child's participation in this project.

I believe that participating in this project may directly benefit your child. This benefit may improve (his or her) health and fitness. I also believe that the results of this study will help identifying a program that can reduce the risk of secondary illnesses.

Voluntary Participation: [Name's]_____ participation in this project is voluntary. Your decision is voluntary about permitting or not permitting (him or her) to participate. At any time, your child can stop participating in this project. You can withdraw your consent without any loss of benefits or rights.

I realize that I am both the researcher, and at the same time, the Executive Director of Step By Step Academy. I want to assure you that the choice to participate or not participate in this project will have no impact on [NAME's] _____ placement.

Confidentiality and Privacy: When I report results of my research project, I will not use your child's name or any other personal information that could identify your child. Instead I will use a pseudonym/fake name. During this project, I will keep information that I collect in a safe place. Only my advisor and I will have access to research records. Other agencies that have legal permission have the right to review research records. The University of Hawaii Human Studies Program has the right to review research records for this study.

Questions: You can contact me at 614-436-7837 if you have any questions about this study. You can also contact my UH advisor, Dr. Nathan Murata, at 808-956-7606. If you like, please contact me and I will provide you a project report/summary after the project is finished.

If you have any questions about your or your child's rights as research participants, you can contact the UH Human Studies Program, by phone at (808) 956-5007 or by e-mail at uhirb@hawaii.edu.

Please keep the prior portion of this consent form for your records.

If you agree for your child to participate in this project, please sign the following signature portion of this consent form and return it to John Solomon.

Signature(s) for Consent:

I give permission for my child to participate in the research project entitled, *The Efficacy of an Eight Week Walking Program on Increasing Daily Physical Activity Levels and Weight Reduction for Adolescents with Autism.* I understand that, in order to participate in this project, my child must also agree to participate. I understand that my child can change his/her mind about participating in this project. I understand I can change my mind about participating, at any time, by notifying the researcher to end participation in this project.

Name of Child (Print): _____

Name of Parent/Guardian (Print): _____

Parent/Guardian's Signature: _____

Date: _____

Appendix E

The University of Hawai`i is conducting a study:

The Efficacy of an Eight Week Walking Program on Increasing Daily Physical Activity Levels and Weight Reduction for Adolescents with Autism

Is your child between 12 and 19 years old?

If the answer is **YES**…

John Solomon would like to invite you and your child to participate in a research study.

The purpose of this study is to examine the effects of a walking program on daily physical activity levels, moderate to vigorous intensity (MVPA) and body mass index for adolescent with Autism.

To learn more about the study,

Please call John Solomon at 614.436.7837

Appendix F

Activity Log

Participant Initials_____ Date Started_____ Date Completed_____

Week **Date:**	**# of Minutes**	**# of Pedometer Steps**	**Amount of MPV Activity Time**
Monday			
Tuesday			
Wednesday			
Thursday			
Friday			
Total for the week			
Staff Signature		*Date Completed*	
Week **Date:**	**# of Minutes**	**# of Pedometer Steps**	**Amount of Activity Time**
Monday			
Tuesday			
Wednesday			
Thursday			
Friday			
Total for the week			
Staff Signature		*Date Completed*	

Appendix G

Walking Program Log

Participant Initials_____ Date Started_____

Age_____ Sex____ Height_____ Weight_____ BMI_____

Week One **Date:**	**# of Minutes**	**# of Pedometer Steps**	**Amount of Activity Time**

Participant Initials_____ Date Completed_____

Age_____ Sex____ Height_____ Weight_____ BMI_____

Week Eight **Date:**	**# of Minutes**	**# of Pedometer Steps**	**Amount of Activity Time**

	Height	**Weight**	**BMI**
Before			
After			
Net Change			

Totals for Program	**# of Minutes**	**# of Pedometer Steps**	**Amount of Activity Time**

Appendix H

Parent/Guardian Social Validity Questionnaire

Based on your child's participation in the walking program and the outcomes from his or her participation, please answer the following questions by marking an "X" on the line to indicate the best answer.

1. Did you see a difference in your child's physical activity at home while he/she was participating in the walking program at school?

   _____Yes

   _____No

   Can you please describe what this difference(s) is?

_____

_____

2. Did you see a difference in your child's behavior at home while he/she was participating in the walking program at school?

   _____Yes

   _____No

   Can you please describe what this difference(s) is?

_____

_____

3. Would you consider the use of the walking program to increase physical activity participation valuable for adolescents with autism?

   _____Yes _____No

4. Would you consider using the walking program at home to increase physical activity participation of your child?

   _____Yes _____No

5. During the past seven days, how many days was your child physically active for AT LEAST 60 MINUTES per day? (Add up all the time they spend in any kind of physical activity that increases their heart rate and makes them breathe hard some of the time.)

   1 2 3 4 5 6 7

6. On an AVERAGE SCHOOL DAY, how many hours do you watch TV?

7. On an AVERAGE SCHOOL DAY, how many hours do you play video or computer games or use a computer/tablet for something that is not schoolwork? (Include activities such as Nintendo, DS, Play Station, Xbox, Facebook, Twitter, computer games, and the internet.)

Comments:

_____

_____

_____

_____

_____

_____

_____

_____

_____

Appendix I

Staff Social Validity Questionnaire

Please answer the following questions by marking an "X" on the line to indicate the best answer.

1. Do you think there is a need for programs specifically designed to increase physical activity among adolescents with autism?

   _____Yes _____No

2. Can you tell if the walking program has made a difference for this individual?

   _____Yes _____No

   If so, what would these changes be?

_____

_____

3. Do you think this type of program could have promise as part of the daily offerings for students with autism?

   _____Yes _____No

4. Do you believe the participants enjoyed the walking program?

   _____Yes _____No

Please use the following space to provide comments on the following:

A. What do you consider were the benefits of the walking program?

B. What could have been approved?

Appendix J

Treatment Integrity Checklist

Date:_____ Observer Name:_____

1. Was the pedometer reset to zero? Yes_____No_____

2. Was the pedometer placed on the participant correctly? Yes_____No_____

3. Did the aide remove the pedometer after the walk and record the physical activity time?

   Yes_____No_____

4. Did the aide remove the pedometer after the walk and record the number of steps taken?

   Yes_____No_____

5. Did the aide remove the pedometer after the walk and record the amount of MVPA per session? Yes_____No_____

   Did the participant walk within the range-bound intervention? Yes_____No_____