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The Relationship Between Frequency of Physical Activity and Stereotypical Behaviors
Among Adolescents with Autism

by

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Thesis

Submitted to the Department of Health Promotion and Human Performance

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ABSTRACT

Background: Obesity in adolescents continues to rise at alarming rates. Students with Autism Spectrum Disorder (ASD) display stereotypical behaviors that inhibit learning. Decreasing these behaviors will allow for more “on-task” time which will then lead to greater amounts of academic learning time.

Purpose: To explore the relationship between frequency of physical activity and self-stimulating behaviors among adolescents with ASD.

Setting: A southeast Michigan special education program center.

Participants: Sixteen male and female adolescents with ASD who have previously displayed the self-stimulating target behaviors.

Intervention: Participants were randomly assigned three treatment groups. Group 1 performed a 30-minute moderate to vigorous walk every school day for three weeks. Group 2 performed the same walks only Tuesday and Thursday. Group 3 was a control.

Research Design: Quasi-experimental.

Data Collection and Analysis: Daily recording logs were used to track target behaviors. Results were analyzed using descriptive statistics, Pearson Correlation method and a one way ANOVA.

Findings: There was no significant relationship between the variables of treatment group and behaviors and no significant relationship between Body Mass Index (BMI) and behavior.

Conclusions: Further research is needed on this topic, and it is suggested that the experiment be carried out for a longer period of time as well at a higher intensity physical activity treatment.

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Introduction

Individuals with Autism Spectrum Disorder (ASD) show great variability in their behaviors and in their skill levels (Heflin & Aliamo, 2007). The spectrum consists of the same three deficits commonly shown by individuals with ASD. Heflin and Aliamo describe them as the triad of deficits: Communication, Socialization, and Interest and Activities (2007). Language can range from lack of spoken language from an individual all the way up to sophisticated communication. Individuals with ASD could have a lack of eye contact which can be present at an early age. Their socialization skills are not the same of their typically developing peers. Last, individuals with ASD show a narrow range of interests. Often they will repeat tasks or skills instead of progressing to another task or skill (Heflin & Aliamo, 2007). In the literature by Heflin and Aliamo (2007), they make mention of how a child with ASD might turn a toy car over and turn the wheels repetitively instead of using it on the ground rolling it around. These deficits are usually present by the age of three.

Adolescents in the United States of America are more overweight and obese than ever before (Samuels, 2007). These children are also at risk for many health concerns as they enter into adulthood (Rimmer, Rowland & Yamaki, 2007; Samuels, 2007). This population is tempted by such things as fast food, candy, and video games. With a sedentary lifestyle and an unhealthy diet, adolescents will carry detrimental behaviors into their adulthood years. Adolescents need to be more active to reduce the risk for serious and even chronic health problems. Food and television tempt adolescents with autism just as much as their typically developing peers (Samuels, 2007). This is of concern because adolescents with ASD lead a typically more sedentary lifestyle. This

lifestyle is due in part to children with autism possessing poor motor functioning and low levels of interest in games, especially those with peers (Todd & Reid, 2006).

Furthermore, adolescents with autism also display self-stimulating stereotypical behaviors that interfere with daily skills (Prupas & Reid, 2001).

Physical Activity Among Adolescents

For children to grow and develop into healthy adults, physical activity is essential (Sit, McKenzie, Lian, & McManus, 2007; O'Connor, French, & Henderson, 2000).

Physical activity can be done in a wide range of manners. Walking, running, swimming, and playing with friends are just a few types of physical activity. It is recommended that children be active for at least 60 minutes a day for most days of the week at a moderate level (Sit et al.; NASPE, 2009). Most school districts do not offer this amount of activity that is needed. Adolescents need to acquire the skills to participate in physical activity outside of the school setting.

Stereotypical Behaviors Among Adolescents with Autism

Adolescents with ASD most often present stereotypical behaviors such as hand flapping, repetitive vocalization, pacing, rocking, and head weaving (Prupas & Reid, 2001). In past research it has been discovered that these behaviors have been shown to inhibit learning (Prupas & Reid, 2001). A student with ASD may not be able to participate in physical activity if these self-stimulating behaviors are too severe. Additionally, it has been noted by Prupas and Reid (2001) that these behaviors provide the child with sensory feedback, which is why they may be difficult to reduce.

Obesity Concerns Among Adolescents with and without Autism

Much research has been done on the obesity concerns among adolescents, but much more is needed to be done among those with disabilities. Those with physical limitations such as poor motor functioning are at a higher risk for being overweight (Samuels, 2007). Students with ASD experience more difficulty becoming physically active due in part to all of the stimuli they are experiencing (O'Connor et al., 2000). If adolescents with autism are already at a higher risk for obesity and they have difficulty adapting to physical activity surroundings, then they will also have a high risk for chronic and secondary health conditions. These secondary health conditions could include further mobility limitations, extreme levels of deconditioning, pain, depression, and social isolation (Rimmer et al., 2007).

Frequency of Physical Activity and Stereotypical Behaviors

The purpose of this study was to examine the relationship between frequency of physical activity and these stereotypical behaviors among adolescents with autism. Physical education teachers can provide a variety of physical activity outlets to all students. If students require a particular type of outlet or activity to accommodate their individualized needs, those teachers should be aware of it. Studies have found that those with intellectual disabilities have a lower level of fitness than those of the general population. However, few studies have reported on the fitness levels of those with ASD, even though this falls into that category of disability (Todd & Reid, 2006).

Statement of the Problem

The study was concerned with the relationship between frequency of physical activity and behavior among adolescents with autism. Research indicates that self-

stimulating stereotypical behaviors such as hand flapping, repetitive vocalizing, pacing, rocking, and head weaving can be reduced with increased physical activity (Prupas & Reid, 2001). If the self-stimulating behaviors are decreased, then there will be an increase in the amount of “~~real~~” time, which will allow for students to focus and concentrate. This increase in time will create greater academic learning time (Utah State University, 2009; Beauchamp, Darst, & Thompson, 1990). It is important for physical educators to appropriately adapt their curriculum to ASD students’ needs.

Statement of the Purpose

The purpose of this study was to use a daily recording data tracking sheet to examine the relationship between the frequency of physical activity and behavior among adolescents with autism (see Appendix A). Specifically, the tracking sheets were used on school days only and tracked behaviors such as hand flapping, repetitive vocalizing, pacing, rocking, and head weaving. The study took place during the 2009 - 2010 school year. The participants were male and female adolescents with ASD ages 12 – 19 who attended a southeast Michigan special education program center.

Significance

The extent of research done on this topic is not sufficient, and this study helped gain better knowledge in this area of need. Obesity is rising at alarming rates among our adolescents (Samules, 2001). In addition, those with disabilities are at an even higher risk for becoming obese because of their sedentary lifestyles (Sit et al., 2007). For students with autism, learning is inhibited by their stereotypical behaviors, and they also have a more difficult time adjusting to physical activity due to the present stimulus (O’Connor, 2000; Prupas & Reid, 2001). Furthermore, each public school in Michigan is now

required to have a wellness plan for schools receiving free-reduced lunch funding. This study helps to implement physical activity towards a wellness plan. Currently, the students at the school receive only one thirty-minute adapted physical education session per week. If physical educators could evaluate and reduce these self-stimulating stereotypical behaviors, then they could then reduce the risk of those adolescents becoming obese and developing major health problems.

Research Hypotheses

Hypothesis 1. If the frequency of physical activity is increased, then there will be a significant change in the frequency of the self-stimulating behaviors of hand flapping, repetitive vocalizing, pacing, rocking, and head weaving among adolescents with autism.

Null: There will be no significant relationship between the frequency of physical activity and the self stimulating behaviors of hand flapping, repetitive vocalizing, pacing, rocking, and head weaving among adolescents with autism.

Hypothesis 2. If there is a high Body Mass Index (BMI) score, then there will be a higher frequency of the self-stimulating behaviors of hand flapping, repetitive vocalizing, pacing, rocking, and head weaving among adolescents with autism.

Null: There is no significant relationship between obesity and the frequency of the self-stimulating behaviors of hand flapping, repetitive vocalizing, pacing, rocking, and head weaving among adolescents with autism.

Study Delimitations

The study was delimited to:

1. Sixteen adolescents with autism who previously displayed stereotypical behaviors of hand flapping, repetitive vocalizing, pacing, rocking, and head weaving.

2. The subjects were randomly assigned to one of three groups as follows: Exercise Group One, Exercise Group Two, and Control Group.
3. Exercise group one walked at a moderate to vigorous physical activity pace, five days per week, and 30 minutes per day for three weeks. Exercise group two walked at a moderate to vigorous physical activity pace, two days per week, and 30 minutes per day for three weeks. The control group did not participate in any formal physical activity program.
4. Stereotypical behaviors were measured by observations of the trained research assistants, not the researcher.
5. Observations of behaviors were recorded using a data tracking sheet created by the researcher which consisted of frequency of behaviors and types of behaviors exhibited.

Study Limitations

The study was limited by:

1. The sample size of this study was small (n=16).
2. Daily physical activities outside the school setting were not able to be controlled.
3. The instrumentation was limited to observations of the trained research assistants, not the researcher, so bias might play a factor. This type of reporting measure can at times be inaccurate and unreliable.
4. The sample was limited to adolescents with autism ages 12 - 19 who attended a southeast Michigan special education program center during the 2009 – 2010 school year.

Definition of Terms

Hand Flapping: Wagging one's hands sharply up and down from the wrist; one of the repetitive and possibly self-stimulating behaviors associated with individuals having an autism spectrum or other mental disorder (Interactive Autism Network, 2008).

Repetitive Behaviors: Actions that one carries out over and over again, such as repeatedly spinning the wheel of a toy car around or verbal patterns (Interactive Autism Network, 2008).

Rocking: The act of rhythmically moving one's body back and forth or side to side; one of the repetitive and possibly self-stimulating behaviors associated with individuals having an autism spectrum disorder (Interactive Autism Network, 2008).

Autism: A complex neurobiological disorder that typically lasts throughout a person's lifetime. Autism impairs a person's ability to communicate and relate to others. It is also associated with rigid routines and repetitive behaviors, such as obsessively arranging objects or following very specific routines. Symptoms can range from very mild to quite severe (Interactive Autism Network, 2008).

Adolescent: A young person who has undergone puberty but who has not reached full maturity (Kaplan, 2004)

Moderate-intensity physical activity: On an absolute scale, physical activity that is done 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, 2008). This pace was set by the research assistants, and the participants followed their lead. The researcher trained and demonstrated for research assistants what pace to walk at during the orientation meeting.

Vigorous-intensity physical activity: On an absolute scale, physical activity that is done at 6.0 or more times the intensity of rest. On a scale relative to an individual's personal capacity, vigorous-intensity physical activity is usually a 7 or 8 on a scale of 0 to 10 (CDC, 2008). This pace was set by the research assistants and the participants followed their lead. The researcher trained and demonstrated for research assistants what pace to walk at during the orientation meeting.

Academic Learning Time: Time spent by a student engaged in a task in which few errors are produced and where the task is directly relevant to an academic outcome (Utah State University, 2009).

Academic Learning Time in Physical Education: A measure of the amount of time pupils are engaged in motor activity at an appropriate level of difficulty (Beauchamp, Darst, & Thompson, 1990).

CHAPTER II

Review of the Literature

Introduction

The purpose of the study was to examine the relationship between physical activity levels and behavior among adolescents with developmental disabilities. The study examined what factors affected this stated relationship. This chapter presents a review of the current literature pertaining to this topic. The first section presents information on current stereotypical behaviors of adolescents with developmental disabilities. The following sections present literature on how characteristics such as accessibility and availability, finances, attitudes, parental roles, and obesity affect physical activity levels of adolescents with developmental disabilities. Last, the literature examines the relationship between being physically active and the behaviors associated with adolescents with developmental disabilities. A summary of the research findings concludes the chapter.

Stereotypical Behaviors

Adolescents with developmental disabilities display a wide variety of distracting behaviors which inhibit learning (Prupas & Reid, 2001). Behaviors are exhibited vocally and physically. Hand flapping, repetitive vocalizations, pacing, rocking, and head weaving are a few of these self-stimulating stereotypical behaviors (Prupas & Reid, 2001). This type of distraction in the class setting is a difficult one to deal with. However, this type of behavior is providing the individual with a type of sensory feedback, so it is very difficult to reduce these unwanted behaviors (Prupas & Reid, 2001).

Extent of the Problem

Recent literature indicates that self-stimulating stereotypical behaviors inhibit learning in the classroom setting (Prupas & Reid, 2001). Unfortunately, in most cases, one cannot learn new behaviors until the old ones are extinguished. This can make for a very difficult transition into appropriate responses (Prupas & Reid, 2001). As mentioned previously, the stereotypical behaviors that students exhibit provide them with a sensory feedback and therefore one can replace that sensory feedback with another type. Physical activity is essential to the growth of all children (Sit, McKenzie, Lian & McManus, 2007). Physical activity could provide these students with that outlet for sensory feedback. However, it has been found that children with disabilities are insufficiently active to begin with (Sit et al., 2007). Furthermore, research has shown that those with disabilities are at an even greater risk for obesity than their typically developing peers (Samuels, 2007). Disabled students are not being provided with the outlets needed to help develop appropriately. There becomes a problem in this matter when the students who need to be active to help control unwanted responses cannot be active for various reasons.

Types of stereotypical self-stimulating behaviors

Hand flapping.

It is very difficult for students with these stereotypical behaviors mentioned to be socially active. Students display such behaviors as hand flapping which create distractions to their normal routines. People with autism generally have a challenge being physically active due to poor motor functioning (Todd & Reid, 2006). The combination of hand flapping and poor motor functioning would not allow an individual the freedom

to participate in such activities as free weights as often as might be needed. This is a self-stimulating behavior for a person with autism and is very difficult to change.

Repetitive vocalizing.

Another stereotypical behavior presented by students with autism is repetitive vocalization. Such a behavior would sometimes exclude a child from using a fitness center freely. Residents who are not accommodated to such behaviors could complain to staff members. If a staff member gets many complaints it could affect the time this student is being physically active. Addressing an issue like this is not a quick easy process with someone who has no knowledge on the subject. This could create barriers for these individuals (Rimmer, Rowland & Yamaki, 2007).

Pacing.

Additionally, the stereotypical behavior of pacing could also create barriers for an individual. If students are off task because of a behavior such as pacing it could hamper their activity level. It is recommended that children participate in at least 60 minutes of exercise almost every day (Sit et al., 2007). Students who are pacing are creating gaps in their activity and therefore would have to increase the time amount to get the recommended amount. This process could be exhausting for anyone trying to help these students and for the student themselves.

Rocking.

A typical behavior exhibited by someone with autism is to rock back and forth (Brown-Irish, 2007). This behavior is prevalent for this population and creates many distractions and leads to being off task. The repetitiveness of it is stimulating to the

individual. This behavior could limit an individual's ability to be active (Brown-Irish, 2007).

Head weaving.

Head weaving could disconnect one from their activity at hand. Focus is a crucial part to each bout of exercise and it is even more difficult to focus while these behaviors are exhibited. It is also unsafe for a student to be using certain exercise equipment if their head is not fully focused. Again, this off task behavior leads to a diminished workout (Todd & Reid, 2006).

Environmental Factors

A key component to quality of life is being physically active. Unfortunately, if one does not have access or availability to the equipment or materials needed to be physically active, then he may be at a disadvantage (Rimmer, 2002). The following section will examine which environmental factors serve as barriers or facilitators to frequency of physical activity.

Finances

Being physically active in a gymnasium setting or a fitness center setting can become expensive. Therefore, many individuals who are living with a disability simply cannot afford another expense. The very best equipment and the very best help becoming active has a price. If schools were to incorporate activity programs into the school day, then students with ASD could become more active at the place where they spend the majority of their day. This is just one barrier that adolescents with ASD might face (Todd & Reid, 2006).

Facilities

Not all fitness centers are equipped properly. The Americans with Disabilities Act has been passed to help create a fair environment for those with disabilities, but not all facilities have followed the regulations (Feldblum, Barry, & Benfer, 2008). Sporting events, bowling, and swimming at local pools can all be a source of exercise for these individuals and yet they are not all accessible even if they have the finances for them. Furthermore, Rimmer explains that some may live in an unsafe neighborhood where even a walk around the block could be dangerous (2002).

Assistance

Many individuals with disabilities need assistance from others for most or part of the day. It could become difficult for a family to plan for assistance of their adolescent with autism specifically for exercise. The demands for assistance could become too high in many instances (Rimmer, Rowland & Yamaki, 2007). This can serve as a barrier or a facilitator towards exercise. If a family is planned and organized and determined, the assistance can be found.

Transportation

The low income families could be without reliable transportation. Families with reliable transportation could be facing a scheduling conflict. Living with a disability can mean many medical appointments and it could be difficult to schedule transportation to a park or a fitness center. If a student with autism could take public transportation unattended then this could serve as a facilitator towards exercise. However, people with disabilities still report that a lack of transportation is hindering them from fully participating in all aspects of community life (National Council on Disability, 2009).

Obesity Epidemic Among Adolescents

Obesity is a major issue in the United States for children and adolescents. More than 5.5 million children and adolescents are disabled and obese (Rimmer, Rowland & Yamaki, 2007). More than half of individuals with disabilities are overweight (Rimmer, 1996). These individuals are not only at risk for chronic conditions but also are at a greater risk for developing a secondary condition that is associated with the primary disability. All adolescents are tempted by food and television whether they have a disability or not. The issue at hand is that there is a lack of outlets and activities designed for these individuals to engage in physical activity (Samuels, 2007). Play and recreation are great ways to be physically active. Unfortunately, a majority of these individuals do not participate in these beyond the school day (Samuels, 2007). This is due in part to the lack of knowledge that most instructors or even the general population have about individuals with disabilities (Rimmer, 1996). The research on this issue is limited. In 2002, in a report from the Surgeon General, it was stated that those with mental retardation were more likely to receive fewer medical examinations than those without (Samuels, 2007). Prevention can help change these uncontrollable rates.

The Link Between Frequency of Physical Activity and Behaviors

Prupas and Reid (2001) examined the relationship between the occurrence of stereotypical behaviors and physical activity programs. The purpose of this study was to see if multiple exercise sessions reduced self-stimulating stereotypical behaviors exhibited. Four children with developmental disabilities participated. They were enrolled in early childhood classrooms in Montreal, Canada. The participants ranged from ages 5-9 and two were children with autism. After initial baseline was established there was a

five-phase program. Instrumentation used included heart rate monitors and pedometers. Exercise sessions included games of tag and follow the leader. Also, jogging was used, which was led by the experimenter. All four subjects did demonstrate a decrease in stereotypical behaviors. These decreases were due to a single bout of exercise. It was mentioned that further research needs to take place on this topic and possibly three exercise sessions per day rather than one session per day. These results were consistent with other research that has been posted even though it is limited.

Several other researchers have examined how exercise manages stereotypical behaviors for those with ASD (Allison, Basile, & MacDonald, 1991; Kern, Kroegel, & Dunlap, 1984; Levinson & Reid, 1993; Waters & Waters, 1980). The study by Allison and Basile followed a boy named Nicolas for nine months during a walk/run program. Nicolas used a chest strap to monitor heart rate to ensure a vigorous level was being obtained during his bouts of exercise. After nine months there was a decrease in aggressive behavior and an increase in distance covered during the twelve-minute exercise bouts (1991).

Similarly, there was a reduction of stereotypical behaviors in the participants in the 1980 study done by Waters and Waters. In 1997, Rosenthal-Malek & Mitchell used twenty-minute jogging bouts and showed similar results. In this study there were five male adolescents diagnosed with ASD with a mean age of 14.88. Each bout of exercise was performed independently and on a coned-off area to help with control of the experiment. There was a significant increase in academic performance and an improvement in behavior reported. These were noticed post-intervention. These findings are consistent with other research in the field. The study performed by Kern, Kroegel,

Dyer, Blew, and Fenton in 1982 produced the same result with mild intensity of exercise. In this study, participants jogged for five minutes at the start of the experiment and increase up to twenty minutes at the end of the experiment.

Celiberti, Bobo, Kelly, Harris, and Handleman (1997) examined the comparative effects of exercise on the aggressive behavior of one subject who was male. This study used both walking and jogging bouts with a five year old boy. The study noticed there were sharp reductions in several aggressive behaviors. These reductions were noticed for up to forty minutes following bouts of exercise. The study did, however, indicate that further research would be needed dealing with the appropriate intensity of exercise for the population of ASD.

In 1993, a Canadian study looked into the effects of exercise intensity on the stereotypic behaviors of individuals with autism. This study was performed with three individuals with ASD. All participants were eleven years old and male. The participants performed bouts of exercise for fifteen minutes at a time. They performed both walking bouts of exercise and jogging bouts of exercise. The jogging bouts showed a decrease in stereotypical behaviors, but the walking did not. This is evidence that vigorous activity can produce decreases in undesired behaviors, whereas mild activity does not. The effects in behavior were noticed for up to ninety minutes post-exercise. The greatest decreases were in motor stereotypes such as body rocking, biting, and hand flapping (O'Connor, French & Henderson, 2000).

Examples of activities that can be used include but are not limited to the following: large muscle activities, hopping, jumping, cycling, and low fitness activities (O'Connor et al., 2000). Video tapes can also be very helpful for students with ASD. This

can provide visual cues for these individuals (O'Connor et al., 2000). Yogakids is also a program that helps educate the whole child. This program can help those with attention issues since they prefer visual and tactile experiences.

Summary

Generally speaking, a limited amount of research has been done on this topic, yet all results have indicated a decrease in stereotypical behaviors after a bout of exercise. Additionally, many studies were completed more than fifteen years ago, so new research is needed. Further studies can be done to obtain a more definite plan of action to present to those working with adolescents displaying these stereotypical behaviors. Research suggests that possibly several bouts of exercise will yield even greater improvements with these behaviors. The intensity of exercise bouts should also be further studied. It is important to note that cardiovascular gains can take several months to achieve. True success of these exercise bouts can be more accurately measured over longer time intervals.

CHAPTER III

Methodology

The purpose of this study was to use a daily recording data tracking sheet to examine the relationship between the frequency of physical activity and behavior among adolescents with autism. This chapter presents the methods and procedures that were used in this study. This includes the research design, participant background information, instrumentation, sample and sample recruitment, data collection procedure, funding, and data analysis.

Research Design

The research design was Quasi-experimental. It implemented two treatment groups and one control group as well as pre-and post-tests. It obtained information used to describe the relationship between the frequency of physical activity and behavior among adolescents with ASD. This information was obtained by using a daily observation data tracking sheet. Specifically, the tracking sheets were used on school days only and tracked self-stimulating behaviors such as hand flapping, repetitive vocalizing, pacing, rocking, and head weaving for 16 students.

Data Collection

Instrumentation

The following was used to address the research questions guiding this research study:

Inter-rater reliability

The research assistants viewed a video segment of adolescents with autism who are displaying self-stimulating behaviors such as hand flapping, repetitive vocalizing,

pacing, rocking, and head weaving (see Appendix B). The research assistants were asked to tally the behaviors they detected during the video segment onto a daily recording sheet. Previously, the same video segment was also viewed by an expert in the field and the researcher. The school district's special education director served as the expert and the standard of a one hundred percent score. Research assistants needed to obtain an eighty percent score or higher to be eligible for this study. The research assistants were allowed to view the videos on their own time and then submit the recording sheet of their score to the researcher at a later time as long as it was before the beginning of the study.

Body Mass Index

The researcher measured students for height and weight to obtain pre-intervention Body Mass Index (BMI) scores (see Appendix C). The researcher then again took measurements of participant's height and weight to obtain post-intervention BMI scores (see Appendix D). Measurements were calculated using the National Heart Lung and Blood website's BMI calculator (2009).

Exercise Programs

For this study the researcher implemented three exercise programs for the participants. *Exercise Group One* walked at a moderate to vigorous physical activity pace, five days per week, and 30 minutes per day for three weeks. *Exercise Group Two* walked at a moderate to vigorous physical activity pace, two days per week on Tuesdays and Thursdays, and 30 minutes per day for three weeks. *The Control Group* did not participate in any formal physical activity program. The exercise groups with formal physical activity sessions performed their exercises during the school day with their research assistant. The walks could have been taken at any time during the day. Walk

times were noted on the data collection sheets. All walks were a minimum of five minutes in duration. Activity outside of these sessions could not be controlled and could have affected the validity of the results.

Daily Recording Data Tracking Sheet

The tracking sheets were used for a two-day period pre-intervention. Following this baseline data collection, the data tracking sheets were used for a three-week time period in which the exercise programs were implemented. The tracking sheets were used on school days only and tracked behaviors such as hand flapping, repetitive vocalizing, pacing, rocking, and head weaving. These self-stimulating stereotypical behaviors were not measured by the researcher but by the research assistants. The tracking sheets allowed the research assistants to record the number of occurrences of these stereotypical behaviors. The tracking sheet was a table; in the columns were the stereotypical behaviors, and in the rows were 30-minute time intervals. These time intervals span through the course of the school day (8:00am-3:00pm; see Appendix A). If any behavior was observed during one of the 30-minute time intervals, the research assistant marked a line into the corresponding box. If there were multiple occurrences, there were multiple lines to note such activity. The reliability of this information was based upon the research assistants' commitment to the study.

Participants and Participant Recruitment

The sample for this research study consisted of 16 adolescents with autism spectrum disorder (ASD) who previously displayed self-stimulating stereotypical behaviors of hand flapping, repetitive vocalizing, pacing, rocking, and head weaving between the ages of 12 and 19 who were students during the 2009 - 2010 school year.

Participants were recruited from a special education program center. This program center hosts students who have severe disabilities that include cognitive impairments, emotional impairments, multiple severe disabilities and ASD.

Recruitment took place during late September and early October 2009. The researcher contacted the special education program center to gain permission to distribute informed consent forms to teachers at the school to send home for the students with autism. Those willing to participate returned their informed consent forms to the special education program center for the researcher to pick up (see Appendix E).

Obtaining Informed Consent From Parents/Caregivers

The researcher developed an informed consent form, in accordance with the office of research guidelines and from district materials, which was given to each parent/guardian/caregiver. This is a form that details what the research study entailed (see Appendix E).

Obtaining Informed Consent From Participants

The researcher developed an informed consent form, in accordance with the office of research guidelines and from district materials, which was given to each participant and their parent/guardian/caregiver. This is a form that details what the research study entailed (see Appendix F).

Research Assistants and Research Assistants Recruitment

Research assistants were highly trained certified teachers with endorsements in teaching students with ASD. All research assistants were current teachers for the 2009-2010 school year at the special education program center. Lead paraprofessionals in each

teacher's classroom were also recruited and trained in the event the teacher was absent from a data collection day.

Obtaining Informed Consent From Research Assistants

The researcher developed an informed consent form, in accordance with the office of research guidelines and from district materials, which was given to each research assistant. This is a form that details what the research study entailed and the importance of research confidentiality. The informed consent form acknowledged that each research assistant was responsible for upholding the terms of confidentiality (see Appendix G).

Funding

This research study was self-funded by the researcher and there was no grant funding. The researcher provided no compensation of any form to any research assistant, participant, parent/guardian, or caregiver involved in this study.

Data Collection Procedure

The researcher first obtained baseline data pre-intervention. These data included height, weight, BMI scores and average behavior score. The height and weight was measured by the researcher and then computed using the National Heart Lung and Blood BMI calculator online (2009). The mean and standard deviation were obtained for each participant based upon the data collected. The researcher then obtained the mean and standard deviation of the entire makeup of participants as well as each treatment group with the same sample of data. During pre-intervention behavior data were also being taken using the data recording sheets. These data were collected by the research assistants for two school days. These data were analyzed by the researcher to obtain mean and

standard deviations of each participant, the entire makeup of participants as well as per treatment group.

Additionally, the researcher compiled a frequency count table of each behavior type for each participant. This table also indicates each participant's pre-intervention behavior score for each individual behavior type. During the three-week intervention, each research assistant was instructed to observe for self-stimulating stereotypical behaviors and record them using the Data Tracking Sheet provided for 15 consecutive school days. If students were absent or they had prolonged illnesses, there would be no additional data collected past the planned 15 consecutive school days. This process followed current trends already used in the classrooms at this special education program center. To help obtain more accurate results, the researcher visited the school each week to obtain the completed forms. Furthermore, research assistants were able to scan and send observation forms daily via email to the researcher. Weekly phone calls and/or emails during the middle of the week served as reminders to research assistants to complete the data sheet daily as well as to see if there were any questions or concerns. At the end of the study the researcher compiled all the data into one master data sheet for each student. The data were compiled by weeks as well to compute a mean behavior score for each participant. This process was also carried out for each participant to reflect behavior scores for each behavior type. The data were examined from week to week to reflect any changes in behavior over the course of the study via a Pearson Correlation, 95% CI. Additionally, an ANOVA test was run to depict the relationship between treatment groups and behavior score. This test was also performed, 95% CI.

Next, a MANOVA was performed to depict the relationship between the six various behavior types and the three treatment groups, 95% CI. Post-intervention data were again taken by the researcher on participant's height, weight, and BMI. This sample of data produced a mean and standard deviation for each individual in the study, the groups as a whole as well as per treatment group. The relationship between pre-BMI scores and post-BMI scores were then correlated as well. Last, a Pearson Correlation was performed to show the relationship between pre-intervention behavior score and post-intervention behavior score, 95% CI. It should be noted that students did receive incentives for performing the walks. These incentives were part of pre-existing classroom interventions. This was a reward system for students who followed daily expectations.

Data Analysis

This study focused on answering two key questions using the descriptive statistics of mean, range and standard deviation as well as Pearson Correlation and ANOVA:

(1) Is there a significant relationship between frequency of physical activity and behaviors such as hand flapping, repetitive vocalizing, pacing, rocking, and head weaving among adolescents with autism?

(2) Is there a significant relationship between obesity and frequency of behaviors such as hand flapping, repetitive vocalizing, pacing, rocking, and head weaving among adolescents with autism?

The researcher computed BMI scores using the National Heart Lung and Blood (2009), BMI calculator online. The mean and standard deviation were obtained for each of the following areas: pre-intervention BMI, pre-intervention behavior score, post-intervention BMI, and post-intervention behavior score. These results were calculated for

each participant, the participants as a whole (n=16) and per treatment group. The Data Tracking Sheet provided was used by research assistants for 15 consecutive school days. Mean behavior scores were reported for each participant, the study as a whole and per treatment group. A Pearson Correlation was used to examine the relationship between pre-and post-BMI scores, pre-and post-behavior scores, and behavior scores through the weeks of the study, 95% CI. An ANOVA test was run to depict the relationship between treatment groups and behavior score after the study concluded. Similarly, a MANOVA test was conducted to examine the relationship between types of behaviors and groups, 95% CI. The researcher then drew conclusions based on the information obtained. The information obtained helped to determine the answers to the two questions listed above.

CHAPTER IV

Results

Recruitment

The school for this study was chosen based upon close proximity to the researcher. The individual classes that were given treatment groups were chosen from this school based upon their student population. These three classes are the only classes in the school that have students with autism spectrum disorder (ASD). The sample for this research study consisted of 16 adolescents with ASD who previously displayed self-stimulating stereotypical behaviors of hand flapping, repetitive vocalizing, pacing, rocking, and head weaving, and who were between the ages of 12 and 19. The students attended a special education program center in southeast Michigan. On October 5, 2009, informed consents went home with the students. Thirteen informed consents were returned by October 8th and the remaining three on October 16th. The last three informed consents obtained were all members of group two. The study began October 8, 2009, with the researcher obtaining pre-intervention BMI scores. The same day the research assistants began collecting two days of pre-intervention data on target behaviors. The three-week intervention began on October 12, 2009, and ended on October 30, 2009. On the last day of the study, the researcher obtained post-intervention BMI scores.

Participant Flow

The study started with sixteen participants. They all met the criteria for the study. The students were already in pre-existing classrooms, so the treatment groups were assigned to the classrooms rather than the students. Group 3, the control group with no formal walking times, was assigned to the classroom of a research assistant who currently

did not implement physical activity into the school day routine. This was done to ensure no participant was denied physical activity he or she would have normally had access to during the school day. Group 1, those who walked daily, had 5 participants. Group 2, those who walked only on Tuesdays and Thursdays, had 6 participants. Group 3 had 5 participants. Participants 1, 2, 3, 6 and 10 were assigned to Group 1. Participants 11, 12, 13, 14, 15, and 16 were assigned to Group 2. Participants 4, 5, 7, 8, and 9 were assigned to Group 3. All participants completed the study. However, three members, participants 13, 14, and 16, started late into the study. There were no pre-intervention data on these three participants. Additionally, this delayed start only allowed for partial data to be obtained during the first week of intervention on these three participants.

Baseline Data

The mean age of participants in the study was 15.4 years (SD = 2.34) and ages ranged from 12 to 19. There were 6 female participants and 9 male. The mean behavior score exhibited by participants pre-intervention was 21.58 (SD = 28.59). The frequency of behavior types for this pre-intervention data can be found in Table 1. All behavior types were exhibited during pre-intervention data except for head weaving. The behavior type with the highest incidence was rocking. The category of "other" was also high compared to the remaining behavior types. The category labeled as "other" included behaviors such as biting, kicking, and spitting. Only participant number 6 displayed the behavior of pacing. The study consisted of three treatment groups.

Table 1

Pre-Intervention Frequency Count of Stereotypical Behaviors

Participant	Hand Flapping	Repetitive Vocalization	Pacing	Rocking	Head Weaving	Other
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	-	-	-	-	-	-
4	0	0	0	0	0	28/14.0
5	3/1.5	0	0	0	0	15/7.5
6	0	4/2.0	6/3.0	0	0	6/3.0
7	-	-	-	-	-	-
8	-	-	-	-	-	-
9	5/5.0	15/15.0	0	87/87.0	0	3/3.0
10	-	-	-	-	-	-
11	0	26/13.0	0	35/17.5	0	0
12	6/3.0	5/2.5	0	30/15.0	0	0
13	-	-	-	-	-	-
14	-	-	-	-	-	-
15	-	-	-	-	-	-
16	-	-	-	-	-	-

Note: This table indicates two numbers, the first is the total number of occurrences for each type of behavior for each participant during the pre-intervention data collection period, the second is the behavior score for that behavior type. A – indicates no score.

Group 1 was a walking group who performed thirty minutes of exercise every school day. This group was composed of three females and two males. The ages ranged from 14 to 19. The mean age was 16.6 years (SD = 2.30). The mean pre-intervention BMI score for group one was 19.33 (SD = 3.16). Last, Group 1 participants obtained a mean pre-intervention behavior score of 8.7.

Group 2 participants also performed walks in their group but only on Tuesdays and Thursdays. There were 6 males in this group. Ages ranged from 13 to 18. Group two participants had a mean age of 15.7 (SD = 1.86). The mean pre-intervention BMI score was 24.18 (SD = 5.19). The mean pre-intervention behavior score for group two was 29.33. Table 2 depicts these data.

The third group was a control group who did not perform any formal walking program. The ages in this group ranged from 12 to 18. The mean age of these 3 females and two males was 14.00 (SD = 2.55). Additionally, Group 3 participants showed a mean pre-intervention BMI score of 24.53 (SD = 3.87) and a pre-intervention behavior score of 29.8 (see Table 2).

Statistics and Data Analysis

The first analysis came with the interpretation of the research assistants' inter-rater reliability score sheets. The maximum score for these sheets was 23, which served as a perfect score. This score of 23 was put forth by the district expert who first took the assessment. All the research assistants met the minimum requirement of 80%. After collecting pre-intervention data, it was shown that an average behavior score for the participants was 21.58. The average behavior score refers to the number of target behaviors exhibited daily. The pre-intervention behavior score range was very large (2.5 - 110). Group 1's pre-intervention behavior score was 8.7. Group 2 and 3 showed a pre-intervention behavior score of 27.13 and 29.8, respectively. These pre-intervention behavior scores were then compared to their pre-intervention BMI scores. The correlation showed no significant relationship between the two variables (.502; see Table 2). This

correlation represents a direct moderate level relationship although not significant (Safrit & Wood, 1995).

Table 2

Correlation of Pre-Intervention BMI and Behavior Scores

Participant	Pre BMI	Pre Behavior Score
1	19.37	3.5
2	18.95	2.5
3	14.60	9.0
4	22.31	14.0
5	19.73	9.0
6	20.38	8.0
7	23.80	3.0
8	29.29	13.0
9	27.50	110.0
10	23.36	20.5
11	30.34	30.5
12	24.54	20.5
13	-	-
14	-	-
15	28.13	37.0
16	-	-

Table 2 *continued*

Descriptive Stats	Mean	Std. Deviation	N
Pre BMI	23.2538	4.65907	13
Pre Behavior Score	21.5769	28.58602	13
Correlations		Pre BMI	Pre Behavior Score
Pre BMI	Pearson Correlation	1	.502
	Sig. (2-tailed)		.081
Pre BehScore	Pearson Correlation	.502	1
	Sig. (2-tailed)	.081	

Note: N is only 13 due to three late starters; tests is ns.

There was, however, a significant correlation between the two variables of BMI and behavior score post-intervention (.597; see Table 3). This relationship would be considered direct and moderately high according to the Safrit and Wood scale (1995). After collecting post-intervention data, it was shown that an average behavior score for the participants was 13.68 per day. The post-intervention range was much smaller than the pre-intervention range partly due to a larger sample of data (1.13 - 31.57). Group 1's post-intervention behavior score was 5.71, down from pre-intervention numbers. Groups 2 and 3 showed a post-intervention behavior score of 20.2 and 13.82, respectively. The scores observed were again much lower than those from pre-intervention. Table 4 depicts the changes in behavior scores pre-and post-intervention. Notice 61.5% of the

participants recorded lower behavior scores after the intervention, and 62.5% of those in walking groups notice a similar change.

Table 3

Correlation of Post-Intervention BMI and Behavior Scores

Participant	Post BMI	Post Behavior Score
1	19.37	4.2
2	19.31	1.27
3	14.29	10.6
4	21.30	3.53
5	19.73	1.13
6	20.38	8.33
7	23.80	12.03
8	29.43	31.57
9	27.50	20.82
10	22.79	4.13
11	29.55	15.47
12	24.40	15.65
13	25.71	21.13
14	17.89	25.33
15	27.81	35.40
16	17.74	8.22

Table 3 *continued*

Descriptive Stats	Mean	Std. Deviation	N
Post BMI	22.5625	4.55663	16
Post Behavior Score	13.6756	10.66880	16

Correlations		Post BMI	Post Behavior Score
Post BMI	Pearson Correlation	1	.597*
	Sig. (2-tailed)		.015
Post BehScore	Pearson Correlation	.597*	1
	Sig. (2-tailed)	.015	

*Note: * Correlation is significant at the 0.05 level (2-tailed).*

Table 4

Participants Pre and Post-Behavior Scores

Participant	Group	Pre-Behavior Score	Post-Behavior Score
1	1	3.5	4.2
2	1	2.5	1.27
3	1	9.0	10.6
4	3	14.0	3.53
5	3	9.0	1.13
6	1	8.0	8.33
7	3	3.0	12.03
8	3	13.0	31.57
9	3	110.0	20.82
10	1	20.5	4.13
11	2	30.5	15.47
12	2	20.5	15.65
13	2	-	21.13
14	2	-	25.33
15	2	37.0	35.40
16	2	-	8.22

Note: Not all participants had informed consents in during the pre-BMI scoring session thus did not receive a score. A – indicates no score; although not significant, there is a positive trend of self-stimulating behaviors being reduced.

To determine whether significant differences existed between the intervention groups, an ANOVA test was conducted. The ANOVA groups were not equal groups from the start of the study. Table 5 shows the multiple comparisons from this test. The ANOVA looked at the significance between the treatment groups and the mean behavior scores amongst groups. The test revealed no significant relationship between the two variables, 95% CI. The significance between Groups 1 and 2 was .610. Between Groups 1 and 3 it was .509. Last, the significance found between Groups 2 and 3 was at 1.0.

Table 5

ANOVA Comparison of Group and Behavior

ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1347.656	2	673.828	.797	.477
Within Groups	8458.267	10	845.827		
Total	9805.923	12			

Post Hoc Tests- Tukey HSD

(I)	(J)	Mean Difference	Std. Error	Sig.	Lower Bound	Upper Bound
1	2	-20.63333	21.23929	.610	-78.8565	37.5898
	3	-21.10000	18.39377	.509	-71.5227	29.3227
2	1	20.63333	21.23929	.610	-37.5898	78.8565
	3	-.46667	21.23929	1.000	-58.6898	57.7565
3	1	21.10000	18.39377	.509	-29.3227	71.5227
	2	.46667	21.23929	1.000	-57.7565	58.6898

Note: Sig. =significance 95% CI; data not significant according to Tukey HSD procedure, high levels of variation are consistent with individuals with ASD.

There was no significant relationship between types of behaviors exhibited and treatment groups based on the results from the MANOVA (see Table 6). Of the four multivariate tests run, only two showed significant relationships. Furthermore, when analyzing the between-subjects effects, there were no significant values found on any of the six behavior types of hand flapping, repetitive vocalization, pacing, rocking, head weaving, and other (.162, .513, .318, .162, .530, and .083, respectively). Table 7 displays the data collected during the study on the frequency of behavior types.

The data were also compared week to week. A correlation was done to see if there was a significant relationship between the weeks of intervention. It was found that there was indeed a significant correlation, 95% CI. The relationship is direct and is a high one between week one and week two (.898; see Table 8). The data between week one and week three show a highly direct relationship as well (.730; see Table 8). There is also another high relationship between week two data and week three data (.759; see Table 8). The weekly behaviors scores for each participant are presented in Table 9 as well as Table 8.

All behavior types were displayed by the participants during the three-week data collection period. However, only participant number 7 displayed the behavior of head weaving. Rocking was again the highest tallied behavior as it was in the pre-intervention data. The behavior that fell into the categories of repetitive vocalization and “other” were the next largest amounts. It should be pointed out that participants number 4 and 10 displayed behaviors that fell into only one category. That category was the “other” category. Again, this category consisted of behaviors such as biting, kicking, and spitting.

Table 6

MANOVA Comparison of Group and Behavior Type

MANOVA

Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	.861	8.288*	6.000	8.000	.004
	Wilk's Lambda	.139	8.288*	6.000	8.000	.004
	Hotelling's Trace	6.216	8.288*	6.000	8.000	.004
	Roy's Largest Root	6.216	8.288*	6.000	8.000	.004

Effect		Value	F	Hypothesis df	Error df	Sig.
Group	Pillai's Trace	1.037	1.615	12.000	18.000	.174
	Wilk's Lambda	.146	2.152*	12.000	16.000	.077
	Hotelling's Trace	4.582	2.673	12.000	14.000	.041
	Roy's Largest Root	4.291	6.436*	6.000	9.000	.007

*Note: * exact statistic and test was performed 95% CI, ns*

Test of Between-Subjects Effects

Source	Dependent Variable	Sum of Squares	df	Mean Square	F	Sig.
group	hand flapping	42.768	2	21.384	2.103	.162
	repetitive vocal.	57.121	2	28.560	.581	.573
	pacing	49.925	2	24.963	1.252	.318
	rocking	150.051	2	75.026	2.101	.162
	head weaving	4.413	2	2.207	.666	.530
	other	8.176	2	4.088	3.037	.083

Note: ns 95% CI.

Table 7

Frequency Count of Stereotypical Behaviors

Participant	Hand Flapping	Repetitive Vocalization	Pacing	Rocking	Head Weaving	Other
1	0	3/0.6	1/0.2	0	0	7/1.4
2	0	2/0.4	0	0	0	7/1.4
3	0	104/10.4	8/0.8	0	0	0
4	0	0	0	0	0	53/3.53
5	4/0.27	0	0	0	0	13/0.87
6	13/0.73	52/3.47	27/1.8	0	0	27/1.8
7	0	0	0	5/0.5	66/6.6	0
8	13/1.3	0	0	55/5.5	0	7/0.7
9	27/1.8	76/5.07	0	144/9.6	0	42/2.8
10	0	0	0	0	0	39/3.9
11	0	60/4	0	172/11.47	0	0
12	24/1.6	41/2.73	0	152/10.13	0	0
13	0	0	178/17.8	0	30/3.0	0
14	0	0	56/5.6	219/21.9	0	0
15	96/9.6	268/26.8	0	0	0	8/0.8
16	7/0.7	11/1.1	0	6/0.6	16/1.6	2/0.2

Note: This table indicates two numbers: total number of occurrences for each type of behavior for each participant during the duration of the study; second, behavior score for that behavior type.

Table 8

Correlation of Intervention Weeks

Descriptive Stats	Mean	Std. Deviation	N
Week 1 Behavior Scores	14.8750	11.00980	16
Week 2 Behavior Scores	14.4644	12.45628	16
Week 3 Behavior Scores	11.1437	11.11215	16

Correlations	Week 1 Behavior Score	Week 2 Behavior Score	Week 3 Behavior Score
Week 1 Pearson Corr. Sig. (2-tailed)	1	.898* .000	.730* .001
Week 2 Pearson Corr. Sig. (2-tailed)	.898* .000	1	.759* .001
Week 3 Pearson Corr. Sig. (2-tailed)	.730* .001	.759* .001	1

*Note: * Correlation is significant at the 0.05 level (2-tailed).; shows consistency between the weeks of data.*

Table 9

Weekly Behavior Scores

Participant	Group	Week 1	Week 2	Week 3
1	1	6.20	4.20	2.20
2	1	0.80	1.20	1.80
3	1	9.40	11.80	10.60
4	3	2.20	5.00	3.40
5	3	1.00	1.20	1.20
6	1	12.00	8.00	5.00
7	3	8.25	12.33	6.80
8	3	35.20	44.00	15.50
9	3	24.00	26.25	12.20
10	1	4.60	4.40	3.40
11	2	25.80	12.80	7.80
12	2	17.75	16.40	12.80
13	2	20.00	23.00	20.40
14	2	23.00	23.40	29.60
15	2	31.80	33.20	41.20
16	2	16.00	4.25	4.40

Note: The table depicts the behavior scores for each week. Behavior score=average behaviors exhibited daily.

Post-intervention Group 1 mean BMI score was 19.23 SD 3.09, which is slightly lower than the pre-intervention score. Group 2, post-intervention, shows a mean BMI score of 23.85 (SD = 4.99), which is also lower than pre-intervention numbers. It should be noted that the larger change was noticed in Group 2, which walked only two days a week instead of every day as Group 1 did. The third group, who did no formal walking,

noticed a change in mean BMI score as well. Their mean BMI score post-intervention is 24.35 (SD = 4.08), which is slightly lower than pre-intervention. The observed amount of missing data for the three week intervention was 10.84%. These missing data were due to participant illness, doctor appointments, and hospital visits.

Critical Events

The critical events listed in this section are events that occurred that might have affected areas of the study. The special education program center held their annual walk-a-thon fundraiser on a school night during the first week of intervention. Participants 2 and 4 attended the program, which could have affected their results from that week. However, it should be noted that participant 4 has physical limitations that prevent her from walking at a moderate to vigorous pace which also affected her data collection. Also, as many schools are experiencing during the first few weeks of fall, the flu season had started to pass through the special education program center and had created some student and staff absences. Some of these absences were either from participants or research assistants. Although research assistants were trained and qualified before the study took place, there were still some inaccuracies in their reporting. Two research assistants marked down only total behaviors observed during their pre-intervention data and week one of the study. They did not indicate which types of behaviors were present. After this issue was addressed, one of the two teachers still recorded the data in a similar fashion during week two of the study. These inaccuracies led to missing data on behavior types for participants 1, 2, 3, 7, 8, 10, 13, 14, 15, and 16 during pre-intervention and week one recording. It also led to missing data on behavior types for participants 1, 2, 13, 14, and 15 during week two recording.

Summary

The results of this study led to the following conclusions. Although there was not a significant correlation between BMI and behavior score during pre-intervention data, there was a significant correlation produced between the variables of BMI and behavior score in the post-intervention data. Additionally, there was a significant correlation between the week-to-week data that were presented. When comparing the relationship between the variables of frequency of physical activity and behavior, no significant relationship was found. The same situation arose when comparing the data collected on behavior types and frequency of physical activity.

CHAPTER V

Discussion and Recommendations

Although this study was based upon previously successful studies, the research conducted does not support the original hypotheses. The first null hypothesis, that there will be no significant relationship between the frequency of physical activity and the self-stimulating behaviors of hand flapping, repetitive vocalizing, pacing, rocking, and head weaving among adolescents with autism, is accepted. There was no significant difference between the means of the groups at the 95% confidence level of the ANOVA or MANOVA tests conducted, so the null hypothesis was accepted.

Decreases in unwanted behaviors were reported in several past studies post-intervention (Allison, Basile, & MacDonald, 1991; Celiberti, Bobo, Kelly, Harris, & Handleman, 1997; O'Connor, French, & Henderson, 2000; Rosenthal-Malek & Mitchell, 1997; Prupas, & Reid, 2001). The study conducted by Celiberti et al. (1997) showed decreases for up to 40 minutes after a single bout of exercise. There was an even greater decrease reported in research conducted by O'Connor et al (2000). These decreases were observed for up to 90 minutes beyond the treatment. Some of the successful studies implemented jogging interventions, whereas this current study implemented only a walking program.

The second hypothesis of the study was not supported, therefore the null hypothesis was accepted. There was no significant relationship between obesity and the frequency of the self-stimulating behaviors of hand flapping, repetitive vocalizing, pacing, rocking, and head weaving among adolescents with autism in this study. There was no significant correlation between the variables of BMI and behavior at the 95%

confidence level. This became evident after the Pearson Product Moment Correlation tests were conducted. It should be noted that there was a 36.6% drop in pre-test to post-test self-stimulating behavior scores. Also 61.5% of participants reduced their self-stimulating behavior scores post-intervention. Participants 2, 4, 5, 9, and 10 had a 50% or more reduction in their behavior scores when comparing pre-test and post-test data. Additionally, when comparing week-to-week data of behavior scores, 75% of the participants showed a drop in behavior scores at some point during the study.

Although there have been few studies on the relationship between Body Mass Index (BMI) and behavior among adolescents with ASD, there have been many studies indicating a concern over obesity in the population of individuals with disabilities (Prupas & Reid, 2001; Rimmer, 1996; Rimmer, Rowland, & Yamaki, 2007; Samuels, 2007). These studies have found similar results indicating a rising rate of obesity among those with disabilities. Students with ASD need to be better served in the area of physical activity in the school environment; therefore, further research is needed into appropriate practices for reducing obesity levels for students with ASD.

The study was limited by the sample size (n=16), daily physical activities outside the school setting were not able to be controlled, the instrumentation was limited to observations of the trained research assistants, not the researcher, so bias might have played a factor. The sample was limited to adolescents with autism ages 12 - 19 who attended a special education program center in southeast Michigan during the 2009 - 2010 school year. A key weakness of the study was that it was the research assistants' responsibility to carry out a moderate to vigorous walk for the appropriate groups as well as to track the target behaviors. These two items being carried out successfully ensures an

accurate and reliable study. However, it is challenging in that situation to ensure that everyone holds to the integrity of the study. Additionally, informed consent forms that were returned after the start date of the study contributed to missing data for three of the participants.

Sources of bias may have been present on the data collection. The treatment groups were assigned to pre-existing classroom rosters. These pre-existing classrooms were varied in their behavior levels. Treatment Group 2 was composed of males who had all previously exhibited aggressive behaviors often throughout the school day, which at times required one-on-one paraprofessionals. Pre-existing differences may have affected the results. The research assistants were trained and qualified professionals; however, they were volunteers with no compensation or incentives for their efforts. It is possible that behavior tracking could have imprecision throughout the groups due to lack of motivation to uphold the integrity of the study. Additionally, the groups that performed the walks were being led by the research assistants to ensure they were at a moderate to vigorous level. This aspect could have also been affected by imprecision. Research assistants who did not correctly tally data also led to inaccuracies. Last, one research assistant was absent during the data collection for one week. The research assistant did have a paraprofessional who was a trained research assistant in her room to take over. However, this change may have caused some inaccuracies in the data collection process.

From findings of this study it can be inferred that a longer study might be more likely to produce a significant change in behavior amongst groups. This is possible because there was a significant correlation among week-to-week data. The length of the study should be carefully selected to provide optimal results. In future research it is

suggested by the researcher that the study be extended from three weeks to two months minimum. This recommendation is based on knowledge that previous successful studies were longer than the current study. Some of these studies include those by Celiberti, Bobo, Kelly, Harris, and Handleman (1997) and by Allison, Basile, and MacDonald (1991). These studies were conducted for one year and 9 months, respectively, and each showed significant decreases in unwanted behaviors.

The type of activity should also be examined (i.e. jogging, bicycling, tag games, follow the leader; Rimmer, Rowland & Yamaki, 2007; Prupas & Reid 2001). Walking at a moderate to vigorous pace can produce slight fatigue in students who perform it correctly. However, it is suggested by the researcher that in future studies the walking groups be changed to jogging groups. This suggestion is based on previous successful studies conducted by Allison, Basile, and MacDonald (1991); Rosenthal-Malek and Mitchell (1997); Kern, Kroegel, Dyer, Blew, and Fenton (1982); and O'Connor, French, & Henderson (2000). Other activities such as hopping, jumping, and yoga have also been found to be successful in reducing self-stimulating behaviors (O'Connor, French & Henderson, 2000). The limitations with implementing these suggestions may be in the physical abilities of the participants. If some students are unable to perform at a moderate to vigorous jog, they may need to be excluded from that particular study or have individualized activities.

Another recommendation for future research is compensation or incentives for research assistants. It may be more likely for a compensated research assistant to complete recording sheets more accurately, submit data sheets in a timely manner, and uphold the integrity of the study by performing moderate to vigorous activity more so

than a non-compensated peer. It would also be helpful to obtain resting heart rates for each participant and then track their heart rate during the exercise if feasible. The limitation with this idea is the ASD population typically has higher resting heart rates than their typically developing peers (Allison, Basile, & MacDonald, 1991). This could create a challenge in finding a true resting heart rate for the participants. Communication is essential when relying on research assistants to collect data in a study. The exchange of communications between the research assistants and researcher diminished near the end of the study, which created a hectic last week of data collection.

Training for research assistants should be extended to at least two days instead of only one to better ensure understanding of study procedures and increasing the likelihood of proper implementation of the treatment protocol. This second day would also allow for research assistants to review what is expected of them and ask any additional questions face to face with the researcher. A second training day would also provide an opportunity for those who desire so to opt out of the study after exposure to what would truly be expected of them and required for the study to be successful. The researcher should also check in with the research assistants each day of the first week during data collection to ensure accuracy.

Future researchers are encouraged to explore possibilities of obtaining informed consent via email, fax, or scanned documents to expedite the informed consent process, allowing all participants to take part from the beginning of the study. Research assistants and participant absences led to missing data because the backup plan was not as effective as anticipated. Future studies should take the season of when data collection will occur into consideration; late spring or summer seasons are suggested. With warmer

temperatures it is possible that attendance will be higher, allowing for more complete data.

The use of music is also a suggestion to explore for future studies. The music could be used as a pacer to ensure a moderate to vigorous pace of activity. Many times, students with ASD can be very distracted by musical sounds. If so, a cadence could be implemented to still ensure a moderate to vigorous pace of activity.

This topic is important to the field of education because if the self-stimulating behaviors that students with autism display are decreased, then there may be an increase in the amount of ~~–ealm~~” time, allowing for students to focus and concentrate better. This increase in time will create greater academic learning time (Beauchamp, Darst, & Thompson, 1990; Utah State University, 2009).

Rising obesity rates among adolescents with and without disabilities is another reason continued research in the area of benefits of physical activity for students with Autism Spectrum Disorders is needed (Samules, 2007). Adolescents with disabilities are at an even higher risk for becoming obese because of their sedentary lifestyles (Sit, McKenzie, Lian, & McManus, 2007). It is important for physical educators and physical activity directors to adapt their programs appropriately to our students with ASD. Rimmer (1996) states that instructors often need assistance when programming for students with disabilities because of their lack of experience in the field of special education. The current research allows for programming concerns to be addressed which in turn allows for better implementation of appropriate activities.

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Table 10

Behavior Scores Exhibited During The Study

Week 1 Data

Participant	Day 1	Day 2	Day 3	Day 4	Day 5	Behavior Score
1	14	3	8	4	2	6.2
2	0	3	0	1	0	0.8
3	12	14	8	4	9	9.4
4	3	3	0	2	3	2.2
5	0	0	3	0	2	1
6	17	10	10	11	12	12
7	11	9	5	8	-	8.25
8	88	33	20	15	20	35.2
9	28	30	21	20	21	24
10	4	3	5	5	6	4.6
11	30	24	21	29	25	25.8
12	19	25	22	5	-	17.75
13	-	-	-	-	20	20
14	-	-	-	23	-	23
15	33	29	35	31	31	31.8
16	-	-	-	-	16	16

Note: The daily cells show the total behavior score for each participant of the study. The behavior score cell indicates the average amount of behaviors exhibited per day for that week. A - = no score

Table 10 *continued*

Week 2 Data

Participant	Day 1	Day 2	Day 3	Day 4	Day 5	Behavior Score
1	4	3	5	3	6	4.2
2	0	0	3	1	2	1.2
3	12	11	10	13	13	11.8
4	5	3	8	4	5	5
5	2	2	1	1	0	1.2
6	6	5	11	-	10	8
7	-	12	-	12	13	12.33
8	44	-	-	-	-	44
9	-	35	31	16	23	26.25
10	6	7	4	3	2	4.4
11	16	12	10	16	10	12.8
12	16	18	20	16	12	16.4
13	22	24	22	21	26	23
14	25	28	23	22	19	23.4
15	33	32	20	42	39	33.2
16	-	4	3	1	9	4.25

Note: The daily cells show the total behavior score for each participant of the study. The behavior score cell indicates the average amount of behaviors exhibited per day for that week. A - = no score

Table 10 *continued*

Week 3 Data

Participant	Day 1	Day 2	Day 3	Day 4	Day 5	Behavior Score
1	2	2	4	1	2	2.2
2	6	0	2	1	0	1.8
3	10	8	10	10	15	10.6
4	2	5	2	5	3	3.4
5	2	2	1	1	0	1.2
6	5	3	8	4	5	5
7	11	8	3	4	8	6.8
8	15	-	-	-	16	15.5
9	10	14	15	9	13	12.2
10	3	4	5	3	2	3.4
11	8	10	10	6	5	7.8
12	12	10	16	12	14	12.8
13	21	23	20	20	18	20.4
14	28	32	31	28	29	29.6
15	35	41	39	47	44	41.2
16	8	3	6	0	5	4.4

Note: The daily cells show the total behavior score for each participant of the study. The behavior score cell indicates the average amount of behaviors exhibited per day for that week. A - = no score

Table 10 *continued*

Overall Data

Participant	Day 1's	Day 2's	Day 3's	Day 4's	Day 5's	Behavior Score
1	20	8	17	8	10	4.2
2	6	3	5	3	2	1.27
3	34	33	28	27	37	10.6
4	10	11	10	11	11	3.53
5	4	4	6	2	2	1.13
6	28	18	29	15	27	8.33
7	22	29	8	24	21	12.03
8	147	33	20	15	36	31.57
9	38	79	67	45	57	20.82
10	13	14	14	11	10	4.13
11	54	46	41	51	40	15.47
12	47	53	58	33	26	15.65
13	43	47	42	41	64	21.13
14	53	60	54	73	48	25.33
15	101	102	94	120	114	35.4
16	8	7	9	1	30	8.22

Note: The daily cells show the total behavior score for each participant of the study for that given days total through the 3 weeks. The behavior score cell indicates the average amount of behaviors exhibited per day for the entire 3 week study. Beh.Score=behavior score; A - = no score

Table 11

BMI Categories

BMI is less than 18.5	falls within the "underweight" range
BMI is 18.5 to 24.9	falls within the "normal" or Healthy Weight range
BMI is 25.0 to 29.9	falls within the "overweight" range
BMI is 30.0 or higher	falls within the "obese" range

Source: <http://www.cdc.gov/healthyweight/assessing/index.html>, BMI data collected was analyzed using calculator located at <http://www.nhlbisupport.com/bmi/>

Table 12

Research Study Timeline

Week 1	Week 2	Week 3	Week 4
Orientation Meeting/ Training	3 group study week 1	3 group study week 2	3 group study week 3
Inter-rater Scoring			Post BMI calculations
Pre BMI calculations			
Baseline data pre intervention			

Note: BMI calculations were done by the researcher not research assistants.

Table 13

Hypotheses Layout

	<i>Data Collection</i>	<i>Data Analysis</i>
Hypothesis Number 1	<ul style="list-style-type: none"> • Frequency Chart 	<ul style="list-style-type: none"> • Descriptive Statistics • ANOVA
Hypothesis Number 2	<ul style="list-style-type: none"> • BMI calculations • Frequency Chart 	<ul style="list-style-type: none"> • Descriptive Statistics • Pearson Correlation

Note: This table depicts how data collection and data analysis will occur for each hypothesis.

Appendices

Appendix A Daily Recording Sheet

Daily Recording Sheet

Instructions: If a target behavior is observed please place the corresponding number in the matching time interval.

If there is more than one occurrence during the same time interval then please place another number.

Participant Number:

Date:

Week #:

Target Behaviors:

1. Hand Flapping

3. Pacing

5. Head Weaving

2. Repetitive Vocalization

4. Rocking

6. other

TIME	Day _____		
8:00 – 8:30			
8:30 – 9:00			
9:00 – 9:30			
9:30 – 10:00			
10:00 – 10:30			
10:30 – 11:00			
11:00 – 11:30			
11:30 – 12:00			
12:00 – 12:30			
12:30 – 1:00			
1:00 – 1:30			
1:30 – 2:00			
2:00 – 2:30			
2:30 – 3:00			
TOTALS:	1- 2-	3- 4-	5- 6-

Walk Times: (please list the time and duration of all walks taken during this day only)

Appendix B Inter-rater Reliability Video

The following website was used to determine inter-rater reliability for the research assistants.

The video shows individuals with ASD displaying the target behaviors that were tracked in this study. An expert (Dr. Carla Harting) was used to determine an inter-rater score. The research assistants were required to obtain at least an 80% to be eligible for the study.

<http://www.autismspeaks.org/video/index.php>

The link to the video is listed as Autism Every Day and only the first 3 minutes and 40 seconds was used to determine scores.

Appendix C Pre-Intervention BMI

Participant Number	Group Number	Height	Weight	BMI
1	1	5'6"	120	19.37
2	1	5'3"	107	18.95
3	1	5'8"	96	14.6
4	3	5'5¼ "	131	22.31
5	3	5'7"	126	19.73
6	1	5'9¼ "	140	20.38
7	3	5'7"	152	23.8
8	3	5'11"	210	29.29
9	3	5'6½ "	173	27.5
10	1	5'10¼"	164	23.36
11	2	6'1"	230	30.34
12	2	5'11"	176	24.54
13	2	6'2 ¼'	205	26.14
14	2	6'4"	148	18.01
15	2	5'5 ¾ "	173	28.13
16	2	5'2"	98	17.92

Note: Pre-BMI data was calculated using BMI data collected was analyzed using calculator located at <http://www.nhlbisupport.com/bmi/>

Appendix D Post-Intervention BMI

Participant Number	Group Number	Height	Weight	BMI
1	1	5'6"	120	19.37
2	1	5'3"	109	19.31
3	1	5'8"	94	14.29
4	3	5'5½ "	130	21.3
5	3	5'7"	126	19.73
6	1	5'9¼ "	139	20.38
7	3	5'7"	152	23.8
8	3	5'11"	211	29.43
9	3	5'6½ "	173	27.5
10	1	5'10¼"	160	22.79
11	2	6'1"	224	29.55
12	2	5'11"	175	24.4
13	2	6'2 ½ "	203	25.71
14	2	6'4"	147	17.89
15	2	5'5 ¾ "	171	27.81
16	2	5'2"	97	17.74

Note: Pre-BMI data was calculated using BMI data collected was analyzed using calculator located at <http://www.nhlbisupport.com/bmi/>

Informed Consent

Project Title: The Relationship Between Frequency of Physical Activity and Stereotypical Behaviors Among Adolescents with Autism

Investigator: Eastern Michigan University

Purpose of the Study: The purpose of this research study is to gain a better understanding of the relationship between frequency of physical activity and self stimulating behaviors among adolescents with Autism. The study will use a daily observation log to track behaviors shown by students with Autism.

Procedure: The study will take place in a southeast Michigan city. All participants will be either male or female adolescents ages 12 – 19 with Autism who attend a southeast Michigan special education program center during the 2009 – 2010 school year. The researcher will obtain each participants Individual Education Plan (IEP) to gain knowledge about their background. The research will measure your students' height and weight and will track behaviors that interfere with learning. Behaviors will only be track during the hours of 8am and 3pm while at school and will be collected for three consecutive weeks or fifteen school days. Each student that becomes a participant in the study will be randomly placed into one of three groups. The first group will go for a daily 30 minute walk each of the days the data is being collected. The second group will go for a 30 minute walk every Tuesday and Thursday during the data collection period. The first and second group will be randomly drawn from a container with the principal present in order to determine assignment. The last group will not go for any planned walks during this time period. This group will be assigned to the research assistant that is not planning any formal physical activity sessions.

Confidentiality: All information collected about the student during the course of this study will be kept confidential. The student will be indentified by only a number not their name. These

numbers will be only accessible by the investigator. Names and numbers will never be kept together and will be stored separately. All information will be kept in locked file cabinets.

Stress Possibility: The stress levels encountered in this study would compare to those of a physical education class session. There could be muscle discomfort from fatigue following a walk. Medical conditions such as asthma and mobility issues will be taken into account during the study.

Expected Risks: There are no foreseeable risks to the student for participation in this study. But should an unforeseeable event occur school policies will be followed for injuries or discomfort associated with physical activity or emotional concerns.

Expected Benefits: Possible benefits to the student for taking part in this study include increased learning time and increased physical well-being.

Voluntary Participation: Participation in this study is voluntary. You may choose not to have the student participate. If you do decide to have the student participate, you can change your mind at any time and withdraw from the study without negative consequences.

Cost: There are no costs to you or the student to participate in this study.

Compensation: You and the student will not be paid for taking part in this study.

Use of Research Results: No names will be revealed. Results may be presented at research meetings and conferences, in scientific publications, and as part of a master's thesis being conducted by the principal investigator.

Future Questions: This research protocol and informed consent document has been reviewed and approved by the Eastern Michigan University Human Subject Review Committee for use from _____ to _____ (date). If you have questions about the approval process, please contact Dr. Deb de Laski-Smith (734.487.0042, Interim Dean of the Graduate School and Administrative Co-Chair of UHSCR, <mailto:humansubjects@emich.edu>).

Informed Consent to Participate: The principal investigator (PI) is asking for your cooperation by completing and returning the form below to your student’s school. Doing so will enroll the student in the research study.

Tear Off

If you wish to have the student participate in the study, you may fill out the form below and return it to the school.

I allow my student _____ to participate in “**The Relationship Between Frequency of Physical Activity and Stereotypical Behavior Among Adolescents with Autism**” research study. Furthermore, by signing this I understand that I am giving the researcher permission to obtain my students IEP.

printed name of parent/guardian/caregiver

signature of parent/guardian/caregiver

date

Student Informed Consent

I am asking students at this school to help me with my project. My project involves walking for 30 minutes a day. Some students are going to walk every day they come to school. Another group of students will walk just two days a week while at school. Your teacher is also going to help me with my project. While you are at school your teacher is going to watch you and see what you do during the day. They will mark down what you do at school and will give it to me for my project. If you would like to help me with my project and you understand how much you will be walking and that your teacher will write down what you do each day then please put your signature in the box.



Informed Consent-Research Assistants

Project Title: The Relationship Between Frequency of Physical Activity and Stereotypical Behavior Among Adolescents with Autism

Investigator: Eastern Michigan University

Purpose of the Study: The purpose of this research study is to gain a better understanding of the relationship between frequency of physical activity and self-stimulating behaviors among adolescents with Autism. The study will use a daily observation log to track targeted behaviors typically shown by students with ASD.

Procedure: The study will take place in a southeast Michigan city. All participants will be male and female adolescents ages 12 – 19 with Autism who attend a southeast Michigan special education program center during the 2009 – 2010 school year. The investigator will obtain each participants IEP to gain knowledge about their IQ, height and weight. The research assistants will be interviewed to check inter-rater reliability. The research assistants will track behaviors that interfere with learning such as hand flapping, repetitive vocalization, pacing, rocking and head weaving. Behaviors will only be track during the hours of 8am and 3pm, every half an hour while at school. Data will be collected for three consecutive weeks or fifteen school days. Each student that becomes a participant in the study will be randomly placed into one of three groups. The first group will go for a daily 30 minute walk each of the days the data is being collected. The second group will go for a 30 minute walk every Tuesday and Thursday during the data collection period. The first and second group will be randomly drawn from a container with the principal present in order to determine assignment. The last group will not go for any planned walks during this time period. This group will be assigned to the research assistant that is not planning any formal physical activity sessions. The investigator will collect data weekly and will call and email reminders.

Confidentiality: All information collected about the student during the course of this study will be kept confidential. The student will be identified in the research records by a code number. These code numbers will be only accessible by the investigator and names and numbers will never be kept together and will be stored separately. All information will be kept in locked file cabinets. Materials containing names and number codes will be shredded at the completion of the study.

Voluntary Participation: Participation in this study is voluntary. You can change your mind at any time and withdraw from the study without negative consequences.

Compensation: Research assistants will not be paid for taking part in this study.

Use of Research Results: No names or individually identifying information will be revealed. Results may be presented at research meetings and conferences, in scientific publications, and as part of a master's thesis being conducted by the principal investigator.

Future Questions: If you have any questions concerning your participation in this study now or in the future, you may contact the principal investigator, Justin Keyes, at 734.759.6400 or via email at keyesj@wy.k12.mi.us. This research protocol and informed consent document has been reviewed and approved by the Eastern Michigan University Human Subject Review Committee for use from _____ to _____ (date). If you have questions about the approval process, please contact Dr. Deb de Laski-Smith (734.487.0042, Interim Dean of the Graduate School and Administrative Co-Chair of UHSCR, <mailto:humansubjects@emich.edu>).

Informed Consent to Participate: The principal investigator is asking for your cooperation by completing and returning the below form. Doing so will enroll you as a research assistant for this study.

Tear Off

I (please print) _____ wish to participate in **The Relationship Between Frequency of Physical Activity and Stereotypical Behavior Among Adolescents with Autism** research study as a research assistant and understand what is expected from my assistance. Additionally, I give permission to the investigator to use the data that I collect as a result of this study.

By signing this I understand it is my responsibility to uphold the confidentiality of this study as listed above.

signature

date

Appendix H Research Assistants Numbers

Participant Numbers

NOTE: *This list is kept confidential and only the researcher and the individual research assistant who has this group of participants have access.*

Name	Participant Number	Group Number	Age	Gender

Appendix I Researcher's Master Group Behavior Log

Master Sheet Totals---Groups

Target Behaviors:

- | | | |
|-----------------------------------|-------------------|------------------------|
| <i>1. Hand Flapping</i> | <i>3. Pacing</i> | <i>5. Head Weaving</i> |
| <i>2. Repetitive Vocalization</i> | <i>4. Rocking</i> | <i>6. other</i> |

Group 1

WEEK	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	TOTAL
1						
2						
3						

Group 2

WEEK	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	TOTAL
1						
2						
3						

Group 3

WEEK	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	TOTAL
1						
2						
3						

Appendix J Human Subjects Review Committee Approval Letter



EASTERN MICHIGAN UNIVERSITY

2 October 2009

Mr. Justin Keyes
Dr. Roberta Faust
Eastern Michigan University
School of Health Promotion and Human Performance
Ypsilanti, Michigan 48197

Dear Mr. Keyes.

The CHHS Human Subjects Review Committee has reviewed your proposal (The Relationship Between Physical Activity and Behavior Among Adolescents with Autism - #10-002) and recommends the following change:

- Clarify the closing comment in section I that states "Furthermore, physical educators could increase educational learning time." The committee did not know what this means.

Your study is approved by the committee with the revision requested above. Please return your documents with revisions at your earliest convenience to <chhs_human_subjects @emich.edu>.

Good luck in your research endeavors.

Sincerely,

[Signature Removed]

George U. Liepa
Chair, CHHS Human Subjects Review Committee

Appendix K Participant Narratives

Participant 1

She is a 15-year-old who resides in Brownstown, MI. She is diagnosed with Autism Spectrum Disorder as well as a Cognitive Impairment. Her strengths include receptive language and family supports. She is a very friendly teenager who requires several verbal prompts for directions to be followed. Occupational services as well as speech therapy are part of her school day. The Brigance Diagnostic Inventory reflects a developmental level of .7 – 2.3 years old.

Participant 2

Participant number 2 lives in Taylor, MI, and is 14 years old. Her primary diagnosis is ASD and she is also diagnosed with a cognitive impairment and an emotional impairment. She receives both speech and occupational services. She can feed herself and can match colors and shapes. She enjoys going for walks for exercise. It takes staff several attempts each day to get her to comply with simple one-step directions.

Participant 3

This 16-year-old female lives in Allen Park, MI. Her primary diagnosis is ASD and she has a secondary diagnosis of cognitive impairment. She is friendly and very curious, her staff reports. One of her interests includes movement of any type (e.g. walking, bouncing, and dancing). She displays deficits in the areas of communication and affective behaviors. Occupational and speech services are part of her school routine. Her staff also reports that she has troubles with her gaze and very rarely makes eye contact with staff and students.

Participant 4

Participant 4 has a primary diagnosis of ASD and a secondary diagnosis of cognitive impairment. She is a Southgate, MI, resident and is currently 13 years old. One of her major

strengths is with puzzles and she enjoys bike rides. She can be self-injurious at times and has also hit staff. One goal area of hers includes self-help skills.

Participant 5

She is a 15-year-old who lives in Dearborn, MI. She is a student with ASD as well as Cognitive Impairment (CI). She uses signs consistently to communicate and she enjoys music during choice time. Physical therapy, occupational therapy, and speech therapy are all part of her school routine. She displays deficits in affective behavior.

Participant 6

This 19-year-old male resides in Brownstown, MI. His primary diagnosis for special education is ASD. He has a cognitive impairment as well as an emotional impairment. He is very polite and friendly. His interests include community-based trips. He scored in the moderately cognitive impaired range of the Stanford-Binet Intelligence Scale (36).

Participant 7

This female participant is 18 years old. She lives in Wyandotte, MI, and has a diagnosis of ASD. Her strengths include good verbal skills, works diligently, and fine motor skills. When tested in the Brigance Diagnostic Inventory she reflected 6 -7 year old developmental age. She participates in a JC Penny work program where she helps sort and fold clothing items.

Participant 8

This Wyandotte, MI resident is 12 years old and is male. He receives special education services for his diagnosis of ASD. He works best with one on one instruction. He enjoys math and computers. His greatest weaknesses are in communication and behavior. He receives Occupational and Speech services.

Participant 9

This male participant lives in Romulus, MI. He is 12 years old and is diagnosed with ASD. Transitions were listed as difficult for this participant. His strengths include self-care skills and gross motor activities. His affective behavior is prohibiting him from participating in the general education curriculum as he rarely interacts with other students or staff members.

Participant 10

He is a 19-year-old Southgate, MI, resident. His only diagnosis is ASD. The participant's strengths include cooperation with staff and following directions. He receives speech and occupational services. He does exhibit physical outbursts which interfere with his progression towards goals. His aggression has been noted to be due to a particular paraprofessional within his classroom.

Participant 11

This Allen Park resident is a male student at TLC and is 17 years old. His special education services are required for his diagnosis with ASD. His strengths include good work skills, and he is very likeable. He does receive physical therapy and speech and occupational therapy services while at school. His Brigance scores indicate a general development of 4.7 years.

Participant 12

Participant 12 is a male who lives in Wyandotte, MI. His diagnosis is in ASD and his strengths include his sense of humor. He prefers to complete his work using a computer. He receives occupational therapy services as well as speech services. He is functioning at a 5.0 to 6.0 level. Social stories are used by staff to help him get through anxious and frustrating situations.

Participant 13

This 16-year-old male lives in Ecorse, MI., and his only special education diagnosis is ASD. He shows good social skills and is very flexible as reported by staff. His interest includes using the internet and NASCAR. He receives speech and occupational therapy while at school. He has functional interpersonal skills but is limited because he is non-verbal.

Participant 14

Participant 14 is a resident of Allen Park who is 14 years old. ASD is the only special education diagnosis of this male participant. Staff has reported that he follows directions well and loves to count and sort items. Speech services are a part of his school day as well as behavior intervention services on an as need basis. His Brigance Diagnostic Inventory performance is as follows: Gross Motor Skills 3.3, Fine Motor Skills 3.3, Self-help Skills 3.4.

Participant 15

Participant number 15 is male and lives in Southgate, MI. The only diagnosis is ASD for this participant. The strengths observed are gross motor and fine motor functioning. He enjoys music and books. At times he can be physically aggressive and partakes in sexually inappropriate behaviors several times per day. This participant will benefit from the continuation of a one on one paraprofessional to help achieve his goals.

Participant 16

This male participant is diagnosed with ASD and an emotional impairment. He lives in Wyandotte, MI. His strengths include reading and handwriting. He enjoys watching “Wheel of Fortune” and “Jeopardy!”. He receives both speech and occupational therapy services. Testing

for his overall developmental level has been difficult to complete due to his behavior. He has exhibited a deficit in maintaining self-control.

