

**PHYSICAL ACTIVITY, DISTRESSED BEHAVIOR, AND TIME ON TASK
IN A CHILD WITH AUTISM**

by

Knolan C. Rawlins

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This Thesis was presented

by

Knolan C. Rawlins

It was defended on

1/14/2009

and approved by

Mary Duquin, PhD

Paula Wolf, M.S.

William J. Helsel, Ed.D.

Jere Gallagher, PhD

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Knolan C. Rawlins B.S., M.S.
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The term autism refers to a group of disorders known as Autism Spectrum Disorder (ASD). ASD is described as impairment in one or more of the following three categories: reciprocal social interaction, communication, and specific pattern of behaviors, interest, and activities. For any of these impairments, the child has the potential to display distressed behaviors (5). Distressed behaviors can include verbal outburst, self stimulatory behaviors, aggression, etc. and various other behaviors of concerns. Distressed behaviors, such as hand flapping, appear to form a functional response to stimuli this response often negatively impacts others. These behaviors are more likely among persons who are receiving aversive stimulation, such as having to engage in non preferred academic task. (5). Of concern in this paper is can the use of physical activity decrease distressed behavior.

The literature demonstrates that increasing physical activity can has also demonstrated decreased distressed behaviors; unfortunately physical education programs have been decreasing in many public schools (11). Along with academic and behavioral benefits, there is a well established link between physical activity and positive health outcomes. A large part of this risk is associated with physical inactivity. The majority of literature regarding physical activity involves children who are typically developing. This study will apply these findings to a student with Autism.

A single subject design was utilized to observe a student with autism in a classroom setting. This research will introduce three ten minute bouts of noncontingent physical activity per

day and monitor the effect of physical activity in the classroom. It was hypothesized that a correlation exists between physical activity, distressed behavior, and time-on-task.

During this study a wealth of data were collected regarding the impact of physical activity on distressed behaviors and time-on-task. The Fischer exact probability test was significance ($p = .025$); from base line through intervention the subject decreased the number of disruptive behaviors. This study demonstrated that physical activity should be implemented amongst students with Autism to decrease distressed behaviors for a single subject.

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PREFACE

I dedicate this thesis to my wife for her continued support in all my endeavors.

I thank my advisor Jere Gallagher for her time on this task and perpetual support through my academic career.

I thank all the committee members for their contributions, time and support.

I must acknowledge the support from my colleges, Jesse Smith and Bill Chersky who helped me along the way.

1.0 BACKGROUND INFORMATION

This year more children will be diagnosed with autism than cancer, diabetes, and aids combined. Autism occurs in all ethnic and social groups equally; however boys are diagnosed four times more often than girls (2-4). Currently, one in every 150 children is diagnosed with autism (1) with 1.5 million people living with various degrees of autism in the United States (2). The term autism refers to not one, but a group of disorders known as autism spectrum disorders (ASD) (1). ASDs are described as impairment in one or more of the following three categories: reciprocal social interaction, communication, and specific pattern of behaviors, interest, and activities (2-4, 6). The first category, reciprocal interaction, refers to the ability to recognize and respond to social stimuli (such as turning toward a speaker), appropriate expression of emotion, and/or participate in social play. The second category, communication, can be subdivided into spoken language and nonverbal gestures such as pointing and reaching. In fact, 55 percent of people with autism never speak (7). The third category, specific patterns of behaviors, refers to non-functional repetitive movements (also known as self-stimulatory behaviors), such as hand flapping or rocking.

Autism is typically diagnosed between the ages of two and three, but there is growing evidence that some cases can be diagnosed as early as six months (1). Some children with autism appear typically developing, but may not engage with the environment. The lack of reciprocal

interaction and delay in specific developmental milestones can lead to an early diagnosis. One of the earliest milestones is the ability to display meaningful facial expressions. For the typically developing infant this display of emotions can be seen as early as six months. Also at six months the infant should be able to use simple gestures, such as reaching. Reaching should be demonstrated by 12 months. At 24 months the child should be able to construct two word meaningful phrases (2-4). Although these milestones are important in identification of autism, a psychologist, neurologist, psychiatrist, or a developmental pediatrician must conduct an evaluation before a child can be officially diagnosed (1).

The education of children with Autism was accepted as a public responsibility as part of the Education Act of all handicapped Children in 1975. Education is defined as fostering skills or knowledge – including not only academic learning, but also socialization, adaptive skills, language and communication, and reduction of behavior problems – to assist a child in the development of independence and personal responsibility (8).

Research has shown physical activity is not only vital to positive health outcomes, but also aids academic performance. Yet, few studies examine physical activity and academic performance in students with Autism. More critical than the implementation of physical activity is the change in classroom behaviors in students with Autism. The aim of this study is to decrease distressed behaviors through physical activity and to increase the student's time-on-task. Stress, as measured by distressed behavior, has been shown to be a contributor to the occurrence of behaviors of concern such as self-stimulatory behavior and the absence of learning skills as with time-on-task.

There are few studies specifically with children with Autism in the classroom. However, there is a growing body of research amongst other special needs groups and typically developing

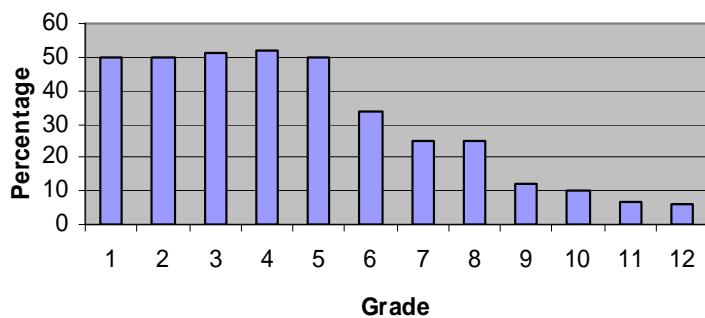
peers regarding stressful behaviors and physical activity. This study will build on research on students who are typically developing and apply these findings to students with Autism.

In addition to behavioral improvements, the benefits of physical activity on overall health well documented. One of these benefits is the decreased risk of becoming obese. In the next section the risk of becoming obese amongst students with Autism is discussed.

1.1 AUTISM AND OBESITY

Growing pressure on educators to increase performance in “core academics” has decreased time allocated for physical education classes as seen in Figure 1 (8). This trend has impacted students with autism more than their typically developing peers, because it dramatically decreases the opportunity for students with autism to engage in regular physical activity (8).

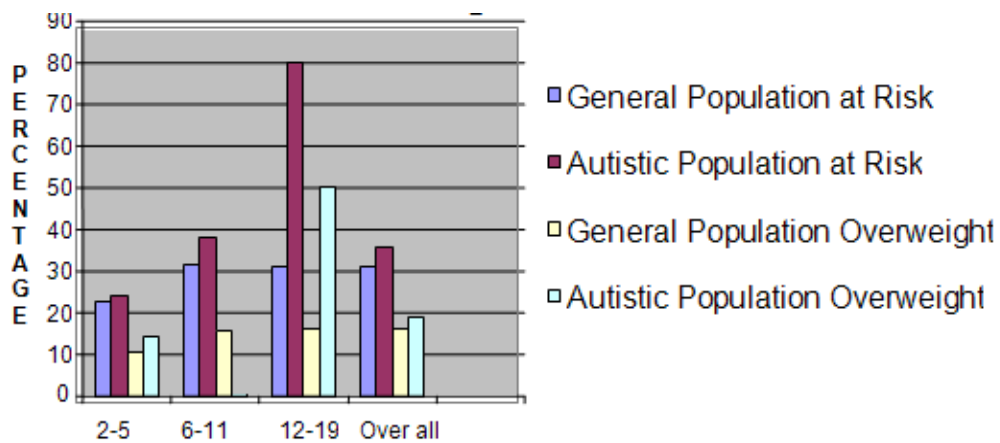
Figure 1 Percentage of Schools that Require Physical Education



Figures 2 and 3 show how the risk of becoming overweight relates to decreased physical education in schools. Figure 2 displays findings from Curtin et al (10), which compares the risk

of obesity amongst children with attention deficit hyperactivity disorder (ADHD) and autism spectrum disorders (ASD) to the general population. Data for ADHD [98] and ASD [42] children were collected from clinical files. The data for general population was taken from age reference population from the National health Nutrition Examination Survey 1999-2002 (10).

Figure 2 Autistic Population vs General Population Percentage of Overweight or at Risk of Becoming Overweight



Approximately, 16 percent of American children between the ages of 6-to-11 years are overweight (BMI \geq 95th percentile) and 31 percent are at risk of being overweight (BMI \geq 85th percentile). Similarly, children ages 6-to-11 years in the autistic population share this trend with 36 percent who are at risk of being overweight and 19 percent currently overweight. Of even greater concern is the discrepancy that occurs between the two groups during adolescence. Only 30 percent of children between the ages of 12 – 19 in the general population are at risk of being overweight, while 80 percent of aged matched children with ASD are at risk of being overweight (11). A small number of the subjects in the ASD group were on medication. Medication for autism such as Risperidone can increase body weight. Hellings et al found that 11 children between the ages of 8 – 16 on Risperidone, gained an average of 8.3 kg (12).

In addition to medication, decreased access to opportunities to participate in physical activity is another factor contributing to increased obesity amongst children with ASD. Children with ASD spend less time in moderate activity than children without ASD (10). With opportunities for physical activity decreasing as children get older the risk of becoming overweight dramatically increases with age (11). Decreasing time allocated to physical activity in the classroom is neither healthy for the child (regardless of development) nor effective in increasing academic performance. (10, 11, 14) In the next section the correlation between physical activity and academic performance is discussed.

1.2 ACEDOMIC PERFORMANCE AND PHYSICAL ACTIVITY

A correlation between physical activity, test scores and I.Q. (14) has been found. A meta-analysis examining the relationship between physical activity and cognition synthesized 44 studies. The analysis concluded that the type of physical activity did not matter; any physical activity benefited cognitive performance. Cognitive assessment included perceptual skills, academic readiness, IQ, achievement, math test, verbal test and memory. All measures except memory improved significantly with increased physical activity. This data supports the notion that allocating classroom time to physical activity positively impacts academic performance. Middle-school-aged children demonstrated the biggest improvement followed by elementary age children. Unfortunately, our current trends in education reduce the amount of physical education in the middle school. Only a small sample of children with special needs was included in the

various studies; however, these children responded similarly to typically developing children (14).

In summary, the two biggest areas of interest, intelligence quotient and academic achievement, were elevated with higher levels of physical activity. The meta-analysis found not only improvements in the general population, but suggests that students with a learning disability also benefit from the inclusion of physical activity in their education program (14). The next section discusses the inclusion of physical activity amongst students with Autism.

1.3 AUTISM, THE CLASSROOM, AND THE IMPACT OF PHYSICAL ACTIVITY

Amongst a number of challenges teaching children with Autism this study focuses on distressful behaviors and time-on-task, both of which hinder the students' academic achievement. This section defines and explains distressful behaviors and time-on-task. In Addition, this section will discuss the impact of physical activity

Distressed Behaviors

Difficulty communicating and/or an inability to interact socially contribute to stress. This increased stress can manifest as distressed behavior. Distressed behaviors can include verbal outburst or aggression that appears to perform a functional response to a stimulus. (5).

Luce et al. administered a physical activity intervention to reduce verbal outburst and physical aggression. Two subjects in this study were diagnosed by a psychologist as severely emotionally disturbed. These children participated in brief bouts of physical activity after inappropriate verbal or aggressive responses during academic instruction. After the subject

engaged in inappropriate behavior (either verbal outburst or aggression) they were required to run for 20 seconds or quickly stand up and sit down ten times (16). Although this intervention successfully decreased verbal outbursts and aggression, there was a potential side effect to the treatment. The exercise was punishment to the child thus the decrease the inappropriate behaviors, however, using exercise as a punishment will deter the student from engaging in physical activity.

The autistic population needs opportunities to engage in physical activity they enjoy. Although exercise is less aversive than other measures of correction, off task behaviors can be decreased with antecedent exercise, as demonstrated in the following study by Celiberti et al.

Celiberti et al worked with a five-year-old boy with autism. The researchers compared the effects of two exercise preconditions on a forty-minute academic setting. The first precondition consisted of 6 minutes of continuous walking. There was no significant reduction in distressful behaviors during an academic session when it preceded walking compared to base line. However, there was a significant difference between base line and the second precondition (prior to academic performance), which consisted of 6 minutes of moderate and continuous jogging. The second precondition showed that maladaptive self-stimulatory behaviors decreased immediately after exercise and did not return to base line levels over a forty-minute time interval (17).

The findings by Celiberti are consistent with Rosenthal-Malek and Mitchell (18) who reported improvements in the reduction of self-stimulatory behaviors and an increased number of correct responses among autistic children after 20 minutes of jogging. In this study five students with severe autism, ranging in age from 13- to 15-years-of-age, participated in two preconditions. The first was an academic precondition consisting of an assortment of academic

subjects which was primarily a teacher driven lesson on coin values. The second was an aerobic exercise precondition, consisting of 20 minutes of jogging. Each subject took part in both conditions ten times (20 trials overall). Researchers found a significant decrease in self-stimulatory behaviors after the aerobic exercise condition when compared to the academic condition.

The time the student spends actively off task include aggression, self-stimulatory and other distressful behaviors. This study as well as others also considers the possibility of the student being passively off task. Rosenthal-Malek and Mitchell did not assume that if a child was not engaging in self-stimulatory behaviors they were on task. Instead, they also measured academic achievement by completion of work.

Time-on-task

Academic achievement increased as measured by correct responses on a work sheet assigning coin values following aerobic exercise condition versus following another academic task. Finally, efficiency increased as measured by completion of assignments after the aerobic exercise condition versus the academic condition (18).

Another study by Mahar et al. has examined the role of physical activity and time-on-task with typically developing students. Mahar and colleagues looked at classroom efficiency by measuring the effect of physical activity and “on-task behavior”. The study observed 135 students who received 10 minutes of physical activity incorporated into a school day over a 12 week period. Verbal and motor behaviors that followed the class rules and were appropriate to the learning situation were recorded as “on-task behavior”. “Off-task behavior” was recorded as any activity that was not on-task and coded as either motor off-task, noise off-task, or passive/other off-task. The mean measurement of time spent on-task increased by 8 percent

amongst all students (15). Students who demonstrated low on-task behavior were defined as students who were on-task less than half of the time, on-task behavior increased by 20 percent. In other words, students who typically were not on task improved on-task time by 20 percent. There was a small sample of individuals with intellectual disabilities who also decreased occurrences of self-stimulatory behavior and increased academic performance over a base line period when physical activity was systematically implemented throughout the class day.

In the next section academic performance and physical inactivity are discussed. Due to the lack of research regarding this topic and how it relates to children who are autistic, the reviewed research is primarily amongst typically developing children.

1.4 RESEARCH QUESTION AND HYPOTHESIS

Given the research presented above, this research study will use a single subject design to observe a student with autism in a classroom setting. Critical periods will be defined in which physical activity will be administered and intensity of physical activity will be monitored implemented during a school day. All these changes will be monitored with regard to distressful behaviors and time-on-task. It is hypothesized that a correlation exists between physical activity, distressed behavior, and time-on-task. Where introducing three short bouts of physical activity per day will decrease distressed behavior and increase time-on-task. By closely monitoring the subject through the day, this study will determine the most effective strategy to writing an exercise prescription for a student with autism.

2.0 METHODS

In this section the subject and behaviors of concern are outlined and instrumentation reviewed. The intervention is described in detail and the procedures are discussed. Lastly, design and data analysis are reviewed.

2.1 SUBJECT CHARACTERISTICS

One subject was selected from a partial hospital service school to participate in an exercise intervention. The child is a male, 12.5 years of age, and diagnosed by a psychiatrist with autism using the DSM-IV criteria. The child has a history of engaging in the following distressed behaviors:

- **Aggression** – as measured by the subject grabbing, pinching, or striking students and teachers with force enough to leave a red mark or indentation.
- **Loud vocal verbal behavior** – as measured by the subject raising his voice to a point it can be heard throughout the classroom.
- **Slamming furniture** – as measured by the subject picking up objects (chair, desk, ect.) and banging them with force enough to move the object from its point of origin and/or noise heard throughout the classroom.

- **Self injurious behavior** - (Head banging) - as measured by the subject contacting his forehead to staff, students or objects in the classroom, with force enough to leave a red mark or indentation.
- **Self Stimulatory behavior** – as measured by the subject placing his palm to chin with elbow extending between 45 degrees to 115 degrees, lasting three or more seconds.
- **Body tension** – as measured by the subject’s hands to side at hips, fist with palm down fingers touching palm for three seconds or longer. This posture can occur while sitting or standing.

2.2 INSTRUMENTATION

2.2.1 Physical Activity

A **Pedometer (Accusplit Eagle AE120XL)** was used to measure the amount of physical activity. The Pedometer was attached to the subject’s pants at waist band. The subject successfully wore the pedometer during all three phases of this intervention. Heart rate was recorded.

A **Heart Rate Monitor (Polar E600)** was used to measure intensity of physical activity. A strap was worn around the chest and a wristwatch on the left wrist.

2.2.2 Distressful Behaviors and Time-on-Task

The **Environmental Event Analysis (EEA) Form (see appendix A)** was used to assess distressed behaviors and time-on-task. The EEA analysis records events in minute segments. The

minute is further broken down into 12 increments lasting 5 seconds in duration. If a distressed behavior occurs at any time during the interval a slash was drawn to indicate such.

There were three, one minute samples collected during each hour of the school day. The time of all minute samples were selected before base line data was collected. A random numbers table was used to determine when observations were taken for all three phases. After each minute observation regarding the environment were made. The following definitions were used to gather additional data on the environment event form (19).

- Demands/instructions/prompts (given): Any request made to the subject either to engage in a behavior or to stop engaging in some behavior. This category does not include prompts to stop engaging in stereotypic behavior, which were recorded as “attention contiguous” with behavior.
- Attention (contiguous): Any verbal and/or physical attention directed to the subject concomitant with occurrence of stereotypic responding (includes prompts to cease engaging in behavior, but not other demands)
- Materials (present): Any materials within arm’s length of the subject that can be used to engage him/herself. This includes toys, training materials, etc.
- Activity (Engaged): Any activity other than stereotypic the subject engaged in, including interacting with others, appropriate manipulation of materials (which would also be scored as present). Etc.
- Subject Alone: Subject not in close proximity (within arm’s length) of other clients/staff. Even if there were other clients or staff in the room, the client would be recorded as being alone so long as no one was within arm’s length.

- Subject Calm: Absence of observable emotional behaviors. Examples include facial expressions indicating anger, fear, general excitation, etc.
- Environment Calm: Absence of any clients' aggression or disruption of environment e.g., yelling or screaming, in vicinity of subject(s). Noise level must be low enough that staff can provide prompts/instructions in a normal conversational voice tone.
- Area Size: "Small" – room area is less than 13 square m (approximately 3.3m by 3.3m). "Medium" – room area is between 13 square m and 36 square (approximately 3 to 6m by 3 to 6m). "Large" – room area larger than 36 square m, including outside areas.
- Prior to Meal: 30 min or less prior to a meal.

An inter-reliability check was conducted before the initiation of the study. The principle investigator and psychologist practiced recording data on the EEA form. All of the above definitions were compared as well as distressful behaviors observed during each of the 12 intervals per minute. During this practice there were nine EEA forms compared. For these observations the principle investigator and psychologist achieved 93 percent agreement.

2.3 INTERVENTION

This study was four weeks in duration and included three phases: base line, intervention, and post intervention. During the first week base line data was recorded using the Environmental Event Analysis form. This data was analyzed for behaviors of concern and time-on-task. Three periods of time were identified as "critical periods" where the subject demonstrated the highest rates of distressed behaviors and the lowest time-on-task.

During the intervention phase the subject engaged in three bouts of moderate physical activity during the school day. During these periods the subject engaged in the physical activity intervention. The subject and principle investigator walked briskly for 10 minutes. This walk was part of a previously established routine walk. The subject had a history of daily walking the same route with teachers and classmates. The phase lasted for two weeks. After the intervention, post intervention data were collected for an additional three days.

2.4 PROCEDURES

The distressed behaviors were recorded using an environmental event analysis data collection form (see appendix A) as established by Pyles, Riordan, & Bailey.(19) Three one minute samples during each hour of a school day (six hours per day) were selected from a random numbers table. There were a possible 18 observations for each day, making 90 observations for each of the base line, and 54 observations for post intervention phases and 180 observations for the intervention phase. There were a possible 294 total observations during the course of this investigation. The times for all 294 observations were selected from a random numbers table prior to the initiation of this study. Demand (or instructions by staff) placed on the child during the observation time were monitored, as well as, time spent engaged in appropriate activity.

Throughout the investigation the subject wore a pedometer; a heart rate monitor was supposed to have been worn but upon request of the mother was removed after day three of the intervention. This request was made due to a concern that the heart rate monitor might be causing anxiety. The pedometer was worn through base line, intervention, and post-intervention.

For all phases, the pedometer was placed on the subject as soon as he arrived to school and removed upon his departure.

After base line data was collected “critical periods” were identified. Critical periods refer to the time of day distressed behaviors were most common. In turn, these time periods were selected for implementation of physical activity each day. During the intervention week 10 minutes of physical activity was incorporated around each of three established critical periods per day. The subject’s teachers were informed of the intervention; however they were not involved with administering physical activity.

2.5 DESIGN AND DATA ANALYSIS

During this investigation an A-B-A withdrawal individual case design was used to monitor the single subject. Observations from base line and post intervention were recorded for one week and three days, respectively. The intervention was two weeks in duration. Physical activity was recorded using a pedometer for base line, intervention, and post intervention. The mean number of behaviors of concern and the time spent engaged on task during intervention was compared from base line and post intervention. A Fischer Exact Probability test of base line vs. intervention and intervention vs. post intervention were used to assess the data collected from the Environmental Event Analysis Form. Therefore the dependent variables were disruptive behaviors and time-on-task.

3.0 RESULT

During this study a wealth of data were collected regarding the impact of physical activity on distressed behaviors and time-on-task. The procedures called for a possible 360 total observations and the principle investigator achieved 87 percent collection for a total of 313 direct observations. The 13 percent of observations missed were due to the subject being late (one day during the investigation) and the principle observer missing the observation time. In the next section the impact of physical activity on distressed behaviors, then the impact of physical activity and time-on-task are reviewed.

3.1 VERIFICATION OF INTERVENTION

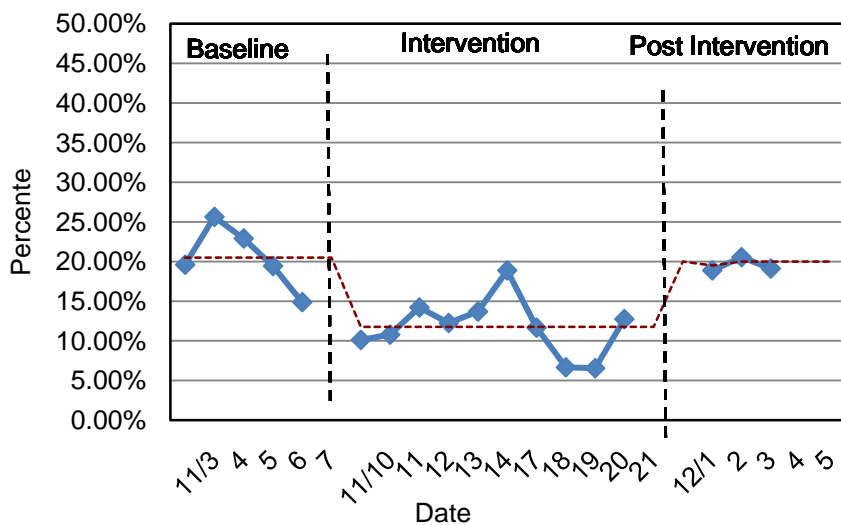
To ensure that during the intervention phase the subject increased their level of physical activity, heart rate monitoring was initially recorded and pedometer data was recorded throughout. Heart rate monitoring started the first week of the study and the subject had an average heart rate throughout the day of 112 beats per minute with a minimum value of 95 beats per minute and a maximum value of 202 beats per minute. The school psychiatrist and psychologist were notified of this and prompted the principal investigator to relay this information to the parent. During the discussion with the parent's general physician, it was decided that the heart rate monitor may be causing anxiety and elevating the subject's heart rate. Given this suggestion, the subject was no longer asked to wear the heart rate monitor.

The subject averaged 11,675 (sd=712 steps) steps per day during base line, 13,911(sd=262 steps) steps a day during intervention and 9,907 (sd=650 steps) steps post-intervention. On the group walk the subject averaged approximately 4,000 steps. Therefore it was concluded that the intervention phase did cause an increase in the level of physical activity.

3.2 DISTRESSED BEHAVIOR

As shown in Figure 3, the mean (dashed line) percent of intervals spent displaying distressed behaviors at base line was 21.5 percent of intervals observed (sd= .04). The mean dropped to 11.76 percent of intervals observed during intervention (sd= .04). The mean elevated to 19.52 percent of intervals observed during post intervention (sd= .009). The Fischer exact probability test was significant ($p = .025$) when comparing the percent of intervals in distressed behavior between base line and intervention. The mean values are represented by the dashed line in Figure 3. The actual data sampled can be seen by the solid line.

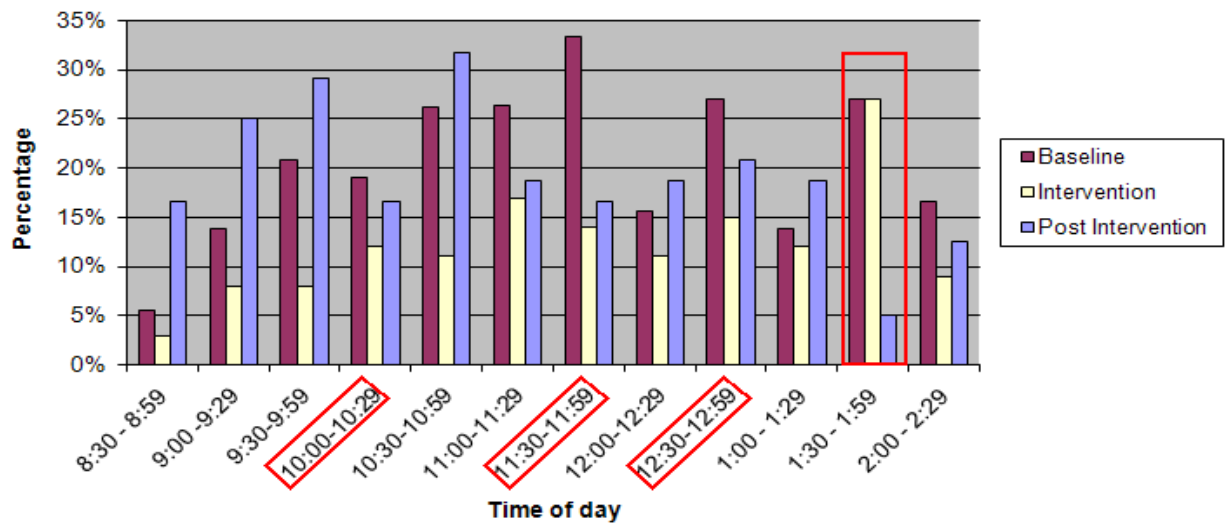
Figure 3 Percent of Time Spent Engaged in Distressed Behaviors per day



The data displayed in Figure 4, are the percentages of time the student is engaged in distressed behaviors relative to time of day. This data shows a decrease in distressed behaviors per half hour time sample for intervention compared to base line. The only exception was the 1:30-1:59 time period (outlined on the graph), which is discussed in the next section of this

paper. The times outlined on the horizontal axis are times recognized as critical periods. During the intervention phase these time segments contained a ten minute walk.

Figure 4 Percent of Time Spent Engaged in Distressed Behaviors relative to time of day.



3.3 ENGAGEMENT

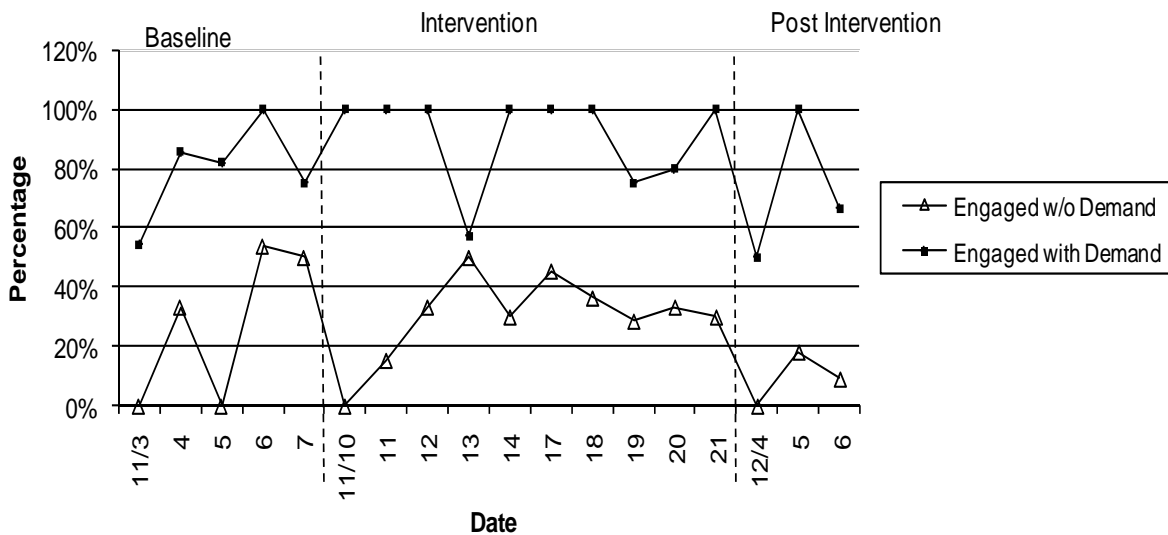
In this section the impact of physical activity on time engaged in activity is reviewed. Engagement is further divided into the amount of time the subject was engaged when instructed (engaged with demand) and the time the subject was engaged during leisure activity (engaged without demands).

Displayed in Figure 5, is the percent of time the subject was engaged in activity. The line with square points shows the percentage of time when a demand, or instruction, was given to the subject by an adult. During the base line phase the mean value of the percent of time the subject

was engaged was 79 percent. During the intervention phase the subject was engaged when instructed 91 percent of the time. Lastly, during the post intervention phase the subject was engaged 72 percent of the time.

Also, displayed in Figure 5, is the percent of time the subject was engaged in activity during leisure. In this study leisure is defined as any time where the subject is not awaiting, receiving, or responding to instructions given by an adult. The amount of time the subject spent in independent, self selected activity is represented by the line with triangle points. During base line the subject was engaged in independent activity 27 percent of the given leisure time. For intervention the subject spent 30 percent of their leisure time engaged in independent activity. In post intervention the subject spent 9 percent of leisure time engaged in independent activity.

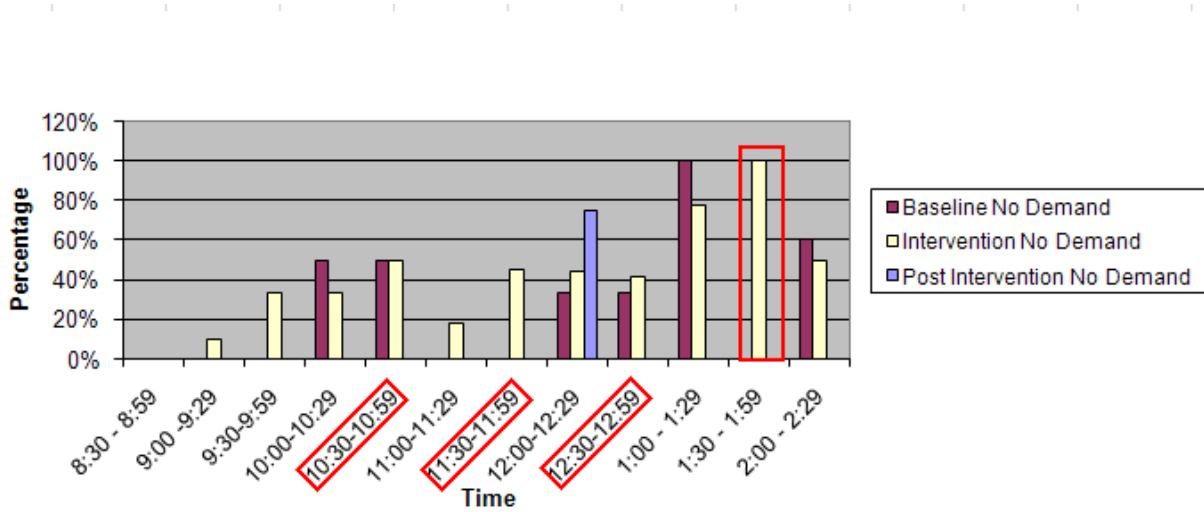
Figure 5 Percent of Time Engaged in Activity per day.



In Figure 6 the percent of time spent engaged in activity without demand is divided into specific half hour increments. From this data set one can observe that six periods of time, during the base line phase, exist where the subject was engaged in independent activity, there are 11

periods of independent activity during the intervention phase and only one period of independently engaged activity during the post intervention phase.

Figure 6 Percent of Time Engaged in Activity per day without demand.



4.0 DISCUSSION

A single subject design was utilized to observe a student with autism in a classroom setting. It was hypothesized that a correlation exists between physical activity, distressed behavior, and time-on-task. In the next section the hypothesis is reviewed, findings summarized, limitations highlighted, and future studies suggested.

4.1 DISTRESSED BEHAVIOR

As the base line week progressed the subject showed a decrease of time spent engaged in distressed behaviors. This trend was evident in three out of four weeks and is consistent with the subject's history of having elevated distressed behaviors on Mondays that lessen by Thursdays. On weeks one, three, and four the subject spent 19.61 percent, 18.89 percent, and 18.89 percent of time engaged in distressed behaviors. There was an increase in time spent engaged in distressed behaviors from Monday to Tuesday and then a decrease begins on Wednesday. During week three (the second week of intervention) there was an immediate decrease after Monday which lasted through Wednesday but increased on Friday. This increase on Friday could be due to the cancellation of the community outing or impending weekend. On four of the days during the study the group was unable to go on routine walks due to weather or lack of appropriate staff. In the next section the amount of time engaged in distressful behavior are discussed, relative to the time of day.

When the school day is broken down into twelve (half hour) increments of time a trend developed. The data is taken by averaging all time samples taken in the given half hour increment. In all but the 1:30 – 1:59 time sample a decrease of distressed behavior can be seen

from base line to intervention and an increase of distressed behavior from intervention to post intervention. There are at least two feasible explanations for this trend. The walk with the group may not have been initially reinforcing. However, after the intervention the subject may have selected walking as a preferred activity and which subsequently became reinforcing thus a decrease in distressed behavior. The second explanation could be the subject is now in better physical condition to endure a long walk and the walk is not as physically difficult resulting in a decrease in distressed behavior.

These results support the primary hypothesis which stated: increasing physical activity will decrease distressed behavior. The secondary hypothesis stated that increasing physical activity will also increase academic performance by increasing time-on-task. Time-on-task was measured as time spent engaged in activity.

4.2 ENGAGEMENT

Engagement was measured during instruction and leisure. During instruction, engagement increased 11 percent from base line to intervention and decreased by 19 percent from intervention to post intervention. Most notably is the consistency of the subject from day-to-day. During the one week base line period, there was only one day the subject was engaged while instructed 100 percent of the time. During the two week intervention the subject had seven days where he was engaged while instructed. Independent engagement also increased during the intervention phase when compared to base line and post intervention.

During base line the subject only engaged in independent activity in six of twelve time samples. These samples included gym class, lunch, classroom walks, and getting ready to go home. During intervention subject engaged in independent activity eleven out of the twelve time

samples. During post intervention the subject engaged in independent activity one out of twelve time samples. The independent activity consisted of eating lunch unprompted. This data supports the secondary hypothesis that states: with an increase in physical activity time-on-task (as measured by time engaged in a task) increases. The remaining sections will include a summary of findings, limitations of the study and suggestions of future studies.

4.3 SUMMARY

This study demonstrated successfully that increased levels of physical activity decreased distressed behaviors for a single subject. Group walks did not reduce distressed behaviors until after the intervention. This suggests that the intervention successfully established walking as a preferred activity.

4.4 LIMITATIONS

The post intervention phase of this study was limited to three days instead of the intended five, due to the Thanksgiving holiday schedule. The extra time away from school may have impacted the results. The pre-determined start and end times could have impacted the results. As seen by the decelerating base line. If more time would have been allotted for the base line, the data could have leveled off yielding stronger results. Although, this study was successful there was only one participant. A broader study including more participants would be necessary to solidify findings.

4.5 FUTURE STUDIES

Future studies should include a bigger sample size with multiple base lines. A larger sample can eliminate the risk for a false positive outcome, associated with single subject design. Subjects of different ethnicities and genders could potentially have different results. A more diverse pool of subjects could rule out these variables and strengthen the correlation between physical activity and classroom performance. Additionally, future studies should allow for a flexible time frame

driven by at least three weeks of data in each of the three phases. Future studies could also include an intervention of ten minute video game breaks during the school day and compare against ten minutes of physical activity. This could eliminate the possibility that the break from academic work was the cause for performance increase instead of the physical activity.

APPENDIX A

ENVIRONMENTAL EVENT ANALYSIS FORM

ENVIRONMENTAL EVENT ANALYSIS DATA COLLECTION FORM

Client:					
Date:					

Demands/Instruct./Prompts	<input type="checkbox"/>	Given	<input type="checkbox"/>	Not Given	5	Time of Obs.	
Attention (to stereotypy)	<input type="checkbox"/>	Contiguous	<input type="checkbox"/>	Not contiguous	10	Activity	
Materials	<input type="checkbox"/>	Present	<input type="checkbox"/>	Not present	15	# of staff present	
Activity	<input type="checkbox"/>	Engaged	<input type="checkbox"/>	Not engaged	20	# of clients present	
Client	<input type="checkbox"/>	Alone	<input type="checkbox"/>	With others	25		
Client	<input type="checkbox"/>	Calm	<input type="checkbox"/>	Agitated	30		
Environment	<input type="checkbox"/>	Calm	<input type="checkbox"/>	Disruptive	35	# of Intervals (of the 12 engaged in stereotypy)	
Area <input type="checkbox"/> Small	<input type="checkbox"/>	Medium	<input type="checkbox"/>	Large	40		
Time	<input type="checkbox"/>	Prior to meal	<input type="checkbox"/>	Not prior	45	Notes:	
Other _____	<input type="checkbox"/>	()	<input type="checkbox"/>		50		
					55		
					60		

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