©Copyright 2012

Shane K. Herriott

Evaluating Interventions to Increase Physical Activity in Preschool Children With and Without Disabilities

Shane K. Herriott

A dissertation
submitted in partial fulfillment of the
requirements for the degree of

Doctor of Philosophy

University of Washington
2012

Reading Committee:

Ilene Schwartz, Chair

Carol Davis

Gail Joseph

Program Authorized to Offer Degree:

Special Education

University of Washington

Abstract

Obesity is a worldwide problem occurring at earlier and earlier ages. Although obesity is a complex problem with multiple contributing factors, one potential component that may be relatively easy for educators to impact is the amount of physical activity children engage in during the school day. Currently, studies show that many preschool-aged children with and without disabilities are not reaching the recommended daily guidelines for physical activity. This study investigated two ways to increase physical activity during recess for 15 preschoolers – 8 with disabilities, 7 without – using an alternating treatment design. Effects of teacher directed activities and increased presence of playground materials on physical activity levels were evaluated using an Actigraph© accelerometer and observational data was recorded using a modified version of the Observational System for Recording Activity in Children – Preschool Version (OSRAC-P). Results showed that both interventions were effective in increasing moderate to vigorous (MVPA) physical and decreasing sedentary activity for most participants. Individual results as well as group comparisons are discussed.

Evaluating Interventions to Increase Physical Activity in Preschool Children With and Without Disabilities

Shane K. Herriott

Chair of the Supervisory Committee:
Professor Ilene Schwartz
Special Education

TABLE OF CONTENTS

LIST OF FIGURES

Figure Number Page

LIST OF TABLES

Table Number Page

Acknowledgements

I would like to acknowledge my chair and committee members, Ilene Schwartz, Carol Davis, Gail Joseph, and Tracy Jirikowic, for their guidance and assistance through this process. In addition, I would like to thank my research assistant, Kelley Cade, for helping things run as smoothly as possible. Your attitude and motivation helped tremendously!

I would also like to thank the teachers and students who participated in my study for their enthusiasm and cooperation. I always felt welcomed and good about the work I was doing, thanks to you.

Finally, I would like to whole heartedly express my gratitude to my friends and family for their unending support during all phases of this dissertation process. Many thanks especially to my brother, Andy Herriott and grandparents, Al and Audrey LeMieux, who always asked about my research, and friends Kathryn Lachenmaier, Beth Younger, and Heather Wallace Suarez, who brought coffee and calmness to my chaotic life.

Dedication

This paper is dedicated to four very special people.

First, to Austin Mooney, the little boy with autism who started me on this amazing journey of learning. I will always appreciate what you taught me.

To my parents, Tom and Laurel Herriott, who are wonderful role models for lifelong learning and enrichment and have enthusiastically supported every choice I have made.

Finally, to my fiancé, Joey Miramontez, who has been incredibly kind, phenomenally patient, and a truly wonderful partner. You have earned this degree right along with me.

CHAPTER I

Introduction

The current trends in childhood obesity nationwide are alarming. Among children and adolescents in the United States ages 2-19 years, 16.3% are obese while the prevalence of children being overweight is 31.9% (Ogden, Carroll, & Flegal, 2008). The numbers are even higher for African American and Hispanic children (Seo & Sa, 2010). The World Health Organization's (2000) international classifications of BMI (Body Mass Index) are: <18.5 for underweight, 18.5-24.9 for normal weight, 25-29.9 for overweight, and a BMI of 30 or greater for obese. This widespread issue is affecting children at younger ages, as an increasing number of children under the age of four present with abnormally high body mass index (BMI) (Bundred, Kitchiner, & Buchana, 2001) and studies show that children who are overweight or obese in preschool will continue to be overweight as they get older (Guo, Wu, Chumlea, & Roche, 2002; Nader at al., 2006). In a retrospective review of children who were already overweight or obese, Harrington and colleagues (2010) found that more than half of the participants in their study became overweight before age 2, and all patients were obese or overweight by age 10. Unlike some medical conditions, obesity is difficult to treat once acquired, so much of the focus is on prevention and increased awareness of evidence-based health and wellness practices. For this reason, early intervention is critical as obesity trends can begin as early as three months of age (Harrington, et al., 2010). Because the obesity epidemic is beginning at such an early age (Harrington, et al., 2010; Ogden et al., 2008), public health experts stress the importance of intervening early to expose young children to lifestyle practices that may have a favorable influence on overall health and physical development.

One of those recommended practices is physical activity. There are many documented health benefits for children who participate in physical activity, include building and maintaining strong bones (Janz, et al., 2001), controlling weight, building lean muscles, reducing fat (National Center for Chronic Disease Prevention and Health Promotion (NCCDPHP), 1999), and increasing cardio respiratory fitness. Physical activity also can reduce the risk of developing high blood pressure (NCCDPHP, 1999), diabetes (Sothern, Loftin, Suskind, Udall, & Blecker, 1999) and dying from coronary heart disease (NCCDPHP, 1999). In addition to physical health benefits, studies have also shown social and cognitive benefits of physical activity in both children and adults (Burdette & Whitaker, 2005; Strong et al., 2005). In adults, physical activity is correlated with lower levels of depression and higher levels of self-esteem (Strong et al., 2005), while attention, problem solving skills, creativity, and emotional health in children are all thought to improve as a result of access to physical activity, especially activity outdoors (Burdette & Whitaker, 2005).

Because children spend a large part of their day in school or out of home care, educators and early care providers are being encouraged to promote appropriate health and wellness practices. Even younger children are away from home more often. Approximately 75% of U.S. children between the ages 3 to 6 years are cared for by someone other than their parents, with over half (56%) receiving some sort of center-based care. The children who attend center-based programs spend an average of 22.5 hours there each week (McWilliams, et al., 2009). Thus, schools and childcare centers are an appropriate and promising place to implement recommended practices regarding physical activity and health development.

In an effort to build awareness and encourage physical activity at earlier ages, several outlets and organizations – including the first lady of the United States – have created guidelines and advice for increasing physical activity. Michelle Obama's *Let's Move* initiative (http://www.letsmove.gov/) is committed to reducing childhood obesity and is part of the first ever Task Force on Childhood Obesity, established by President Barack Obama (2010). This objective of the task force is to educate and empower children towards healthier lifestyles with an end goal of reducing childhood obesity to 5% by 2030. In 2010, the Department of Health and Human Services launched Healthy People 2020. The mission of this education and public awareness campaign is to create awareness of health and wellness through measurable goals at the local, state, and national level. The criteria for these goals increase incrementally until the year 2020. The proposal has approximately 1200 objectives spread across 42 topic areas. One such topic area is physical activity where there are 15 objectives, including 7 directed related to elementary aged children. Neither of these initiatives however, addresses physical development or provides health plans for preschool-aged children, where research shows the lifelong health patterns can begin. The Let's Move campaign is aimed at children and teens between 6 and 17, while Healthy People 2020 focuses on children starting at kindergarten, or age 5.

Despite the lack of focused intervention attention on this age group, there are physical activity guidelines for preschool children. The National Association for Sport and Physical Education (NASPE) recommends that preschoolers engage in at least 60 minutes and up to several hours of unstructured physical activity each day and participate in at least 60 minutes per day of structured physical activity (2002). The NASPE also recommends that preschool children are not sedentary for more than 60 minutes at a time, unless they are sleeping.

Statement of the Problem

Although the popular notion is that young children are highly active, researchers report relatively low levels of physical activity (PA) in this population (Brown, Googe, McIver, &

Rathel, 2009; Pate, Pfeiffer, Trost, Ziegler, & Dowda, 2004; Tucker, 2008). These low levels of physical activity, when combined with increased sedentary behaviors, such as television viewing and other screen time activities, may play a key role in childhood obesity (Dennison, Erb, & Jenkins, 2002; Epstein, Paluh, Gordy, & Dorn, 2000). In a review of 39 articles examining physical activity levels of preschoolers, Tucker (2008) found that almost half of the students reported physical activity results that did not meet NASPE guidelines of 60 minutes a day of physical activity. Other studies show that many children are spending just over three-quarters of every hour engaged in sedentary behavior and between three and five percent of their day engaged in moderate to vigorous physical activity (MVPA) (Reilly et. al., 2004). Assuming a 14 hour, this translates into around 45 minutes of any type of MVPA a day, well below NASPE guidelines.

Children with disabilities require the same dosage of daily physical activity as their typically developing counterparts, yet they are less likely to engage in physical activity due to lack of skills, means, resources, or reinforcement to participate in such activities (Murphy & Carbone, 2008). For example, a child with autism, who suffers from communication and social deficits, may have difficulty understanding the multi-step directions and unspoken social norms involved with fully participating in a game of tag at recess. Or a child with limited vision or mobility skills may shy away from slides or climbing apparatus on the playground because they cannot do them without support. Subsequently, children with disabilities are more likely (in some cases up to three times more likely) to be overweight or obese than their typically developing counterparts (De, Small, & Baur, 2008; Neter, Schokker, de Jong, Renders, Seidell, & Visscher, 2011) due in part to a more sedentary lifestyle. Similar to teaching academics such as reading and math, information and instruction around exercise, diet, and physical development is critical for all young children. Therefore, it is imperative that adults play a large role in facilitating and supporting physical activity participation for all children, especially those with disabilities.

Researchers have spent a great deal of time studying physical activity levels and patterns in young children. There is an abundance of literature describing preschooler's sedentary and active behaviors (McKenzie et al., 1997; Pate, McIver, Dowda, Brown, & Addy, 2008; Ridgers, Sainta Maurice, Welk, Siahpush, & Huberty, 2011; Trost, Pate, & Sallis, 2002) as well as exploring variables that contribute to activity or inactivity (Brown et al., 2009b; Brownson, Baker, & Housemann, 2001; Bower et al., 2008; Dowda, Pate, Trost, Almeida, & Sirard, 2004; Finn, Johannsen, & Specker, 2009). In addition, researchers have conducted several packaged interventions/curriculums aimed at increasing the overall health and well-being of preschool and elementary aged children (Fitzgibbon, Stolley, Schiffer, Van Horn, KauferChristoffel, & Dyer, 2005; Fitzgibbon, Stolley, Schiffer, Van Horn, KauferChristoffel, & Dyer, 2006; Sharma, Chuang, & Hedberg, 2011; Trost, Fees, & Dzewaltowski, 2008). Results from these interventions have not shown strong effects and multi-component interventions make it difficult to determine which component(s) had the greatest effect. The research is much more limited when it comes to specifically evaluating physical activity outcomes as the main dependent variable amongst the preschool population. To date, and to my knowledge, only three school-based, single component intervention studies (Brown et al., 2009; Hannon & Brown, 2008; Wadsworth, Robinson, Beckham, & Webster, 2012) conducted with preschool participants in the United States have been published. None of these interventions have explicitly addressed increasing physical activity levels for preschoolers with disabilities. Clearly, there is a need for effective, evidence based interventions for teachers of preschool children with and without disabilities.

Purpose of the Study

The purposes of this study are to increase the body of research around physical activity practices for preschool aged students with and without disabilities by investigating effective and feasible ways for classroom teachers and their staff to increase physical activity levels in preschool-aged children with and without disabilities during recess.

Specifically, the research questions are:

1. What are the differences between physical activity characteristics (i.e. type of play and context) and intensity for preschool children with and without disabilities?
2. What effect will two different interventions (increased access to portable equipment and teacher planned and directed activities) have on the physical activity patterns (intensity, type, and who they participate with) of children with and without disabilities?
3. Will participation in the two different interventions designed to increase in physical activity have an effect a child's Body Mass Index (BMI)?
4. Are the proposed interventions socially valid for the classroom teachers and students?

Hypotheses

It is hypothesized that children without disabilities will be more active that children with disabilities. Pan (2008) has shown that elementary aged children with ASD are less active on the playground than their typically developing counterparts. Though this study was conducted with older children as participants, it is hypothesized that the same trend will occur in preschool-aged children. The hypothesis for the second research question is that teacher led physical activity will see a greater increase in MVPA than increased presence of playground equipment for children with disabilities. Though research has shown both practices to be effective with preschool and elementary aged children (Brown et al., 2009; Hannon & Brown, 2008; Ridgers, Stratton, Fairclough, & Twisk, 2007; Stratton & Mullan, 2005; Verstraete, Cardon, De Clercq, & De Bourdeaudhuji, 2006), increased portable equipment has also had limited effect on children's activity level (Cardon, Van Cauwenberghe, Labarque, Haerens, & De Bourdeaudhuij, 2008). Assuming that children with disabilities, especially those with autism, may be less motivated to participate in activities without teacher support and guidance, it seems more likely that teacher led activities will yield greater increases in physical activity. While some studies have shown that an increase in physical activity does affect a child's BMI (Fitzgibbon et al., 2006), it is hypothesized that the limited time for this intervention – 20 to 30 minutes each week for approximately 5 weeks – will not yield any noticeable BMI changes. For the fourth and final research question, it is hypothesized that teachers will find physical activity to be an important part of a child's day, but that planning and preparing for such activities would seem burdensome with an already busy schedule.

Chapter II

Review of Related Literature

Definition of Key Terms

The terms exercise, physical fitness, physical activity, and physical education are often used interchangeably, but have slightly different meanings. Caspersen, Powell, and Christenson (1985) define physical activity as "any bodily movement produced by skeletal muscles that results in energy expenditure" (p 126). This can encompass housework, gardening, play, and other leisure activities, as well as biking, running, and sports. For preschool-aged children, playing at recess, digging in the dirt, and moving around while building a tall block structure can all be considered physical activity. Exercise is more narrowly defined as physical activity “that is planned, structured, repetitive, and purposive in the sense that improvement or maintenance of one or more components of physical fitness is an objective” (p 128). This often involves creating a routine around going to the gym or training for a marathon or triathlon. Because the patterns of physical activity for preschoolers differ from adults, exercise in its’ purest form (planned vigorous activity for extended periods of time with the intent of maintaining fitness) is often difficult to achieve. However, one could argue that exercise, at the preschool age, often occurs through adult initiation and supervision such as an obstacle course during gym time or a morning activity routine complete with toe touches and arm movements. Individuals’ level of physical fitness refers to their “ability to carry out daily tasks with vigor and alertness, without undue fatigue and with ample energy to enjoy leisure-time pursuits and to meet unforeseen emergencies" and often has an effect on their energy expenditure during certain activities. Physical fitness in the preschool classroom may mean the ability to engage in expected amounts of physical activity (i.e. recess participation, school bus stairs, or hallway transitions) with the same intensity and latency as a majority of the students. For a child with low muscle tone or motor planning deficits, achieving classroom level physical fitness without adult support may be difficult. Physical education often refers to systematic planning and subsequent evaluation of health knowledge and motor skills development. Similar to academic instruction, lessons are created and implemented based on a scope and sequence of skills and data is collected to ensure that students are meeting the goals set forth. Most preschool children are too young to participate in mandatory physical education classes, but teachers and physical therapists (when applicable) begin implementing health development lessons at this age. Most, if not all, of the research done on activity in preschool-aged children investigates components of the more broadly defined term physical activity.

Physical activity (PA) is often categorized into four types: sedentary, light, moderate, and vigorous. Definitions of each often vary based on age and source of information. Sedentary activity occurs when a child is still such as when watching television or sleeping. Light activity involves movements of the limbs or trunk or slow translocation and often occurs when children are playing dress up, exploring the block area, or transitioning between classroom activities. For preschoolers, moderate activity can be defined as repetitive or more involved translocation such as a brisk walk, climbing, or a light jog. Vigorous activity can include some of the same behaviors as moderate activity with faster actions or increased intensity such as a running, three or more repetitions of jumping, and three or more repetitions of fast cycling. Because preschoolers typically exhibit such low levels of high intensity activity, moderate output is sometimes combined with vigorous output to create a moderate to vigorous physical activity (MVPA) category. This holds true for the current study in which physical activity intensity will be categorized into sedentary, light, and MVPA.

The amount of energy a person expends during activity is typically based on their body mass index and physical fitness level. This energy expenditure (EE) is expressed in METs (metabolic equivalent of task), which becomes a useful way to compare output from people of different weights. A MET is not, however, an exact measurement because energy cost for the same activity will differ based on an individual's level of fitness. By convention 1 MET is considered as the resting metabolic rate, which is exhibited when someone is sitting quietly, not engaged in anything. MET values of physical activities range from 0.9 (sleeping) to 18 (running at 17.5 km/h or a 5:31 mile pace). Typically behaviors are categorized as sedentary, light, moderate, and vigorous with cutoff points for each category. For example, sedentary (sleeping, sitting) activity is thought to use <1 met while light activity (typing, writing, slow walking on a level surface) is between 1 and 3, moderate activity (brisk walking, biking for pleasure, minimal effort calisthenics) is between 3 and 6 and vigorous activity (running/jogging, jump roping, high effort calisthenics) are >6 (Ainsworth, et al., 1993). Though METs are used frequently in physical fitness measurement, there is some variability in scores, especially with children. Globally METS are statically based measurements based on energy expenditure based on an individual's height, weight and body mass index, but this is not exact for everyone. With children, the METS used can be even more variable due to frequent changes in height and weight that occur in young children as they grow. Another component that makes measurement difficult is that different definitions of physical activities are used by different researchers and the levels used to define categories appear to be somewhat arbitrary. For example, the MET levels are often lowered when studying children (Guinhouya et al., 2006; Trost et al., 2002) as are cut-points intensity measured by accelerometers (Pate, Almeida, McIver, Pfeiffer, & Dowda, 2006).

Body mass index (BMI) is a reliable was to indirectly measure body fatness in people (Mei, Grummer-Strawn, Pietrobelli, Goulding, Goran, & Dietz, 2002). BMI is calculated based on a person's height and weight. As with many measurement tools, children's BMI is not calculated in the same way as an adult. For example, an adults' BMI is typically classified by arbitrary cut-off points based on trends of large sample populations. As previously stated, the World Health Organization's (2000) international classifications of BMI for adults are: <18.5 for underweight, 18.5–24.9 for normal weight, 25–29.9 for overweight and a BMI of 30 or greater for obese. For children, BMI-for-age percentile is used to interpret the BMI number. This number is sensitive to both age and gender, which is not taken into account when interpreting adult scores. According to the Center for Disease Control (CDC) BMI-for-age percentile charts (see below), children are underweight if their BMI puts them in less than the 5th percentile, healthy weight if they are between the 5th and less than the 85th percentile, overweight if they are between the 85th to less than the 95th percentile and obese if equal to or higher than the 95th percentile (2010).

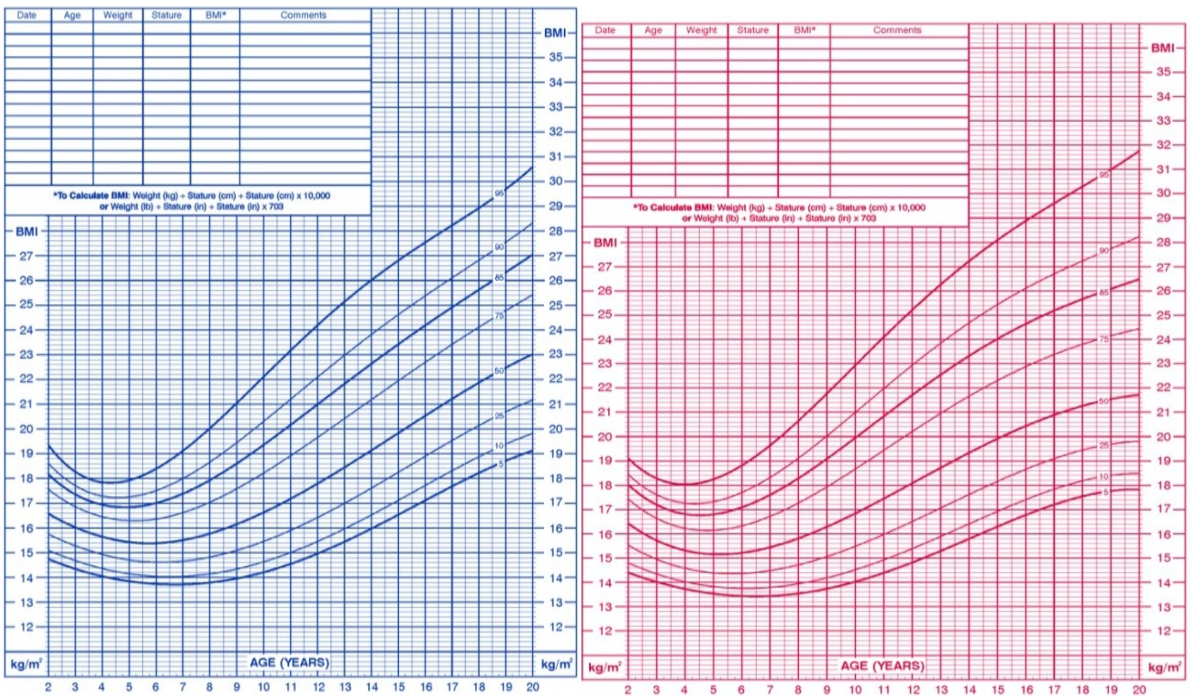


Figure 1. CDC Body Mass Index-for-age percentile for boys (left) and girls (right) 2 to 20 years old

Measuring Physical Activity in Young Children

When conducting research, it is critical that measures used are valid and reliable. Accurately measuring PA in young children is difficult, due in part to young children's movement patterns that include sporadic, short bouts of activity. There is also such a range of maturity and development that happens during preschool years (ages two to five), making consistent accurate measurement difficult (Bender, Brownson, Elliott, & Haire-Joshu, 2005; Hands, Parker, & Larkin, 2006; McIver, Brown, Pfeiffer, Dowda, & Pate, 2009; Oliver et al., 2007, Pate, O'Neill, & Mitchell, 2010). This has led Oliver, Schofield, and Kolt (2007) to state that, "the underlying issues facing researchers trying to understand both prevalence and dose-response relationships are based on being able to measure amounts and types of physical activity that young children engage in…the greatest challenge is identifying what to measure, how to define what is measured, and how to ensure consistency across studies" (p 1046).

To date, a consensus "gold measure" standard has yet to be determined when measuring levels of PA in preschoolers. In the past, direct observation tools have been the most widely used method for collecting data. Recently, technological advances have seen an increased use of objective measures such as pedometers and accelerometers. Current measures of physical activity in children include self- report, proxy report, and objective measures such as direct observation, heart rate monitoring, pedometry, and accelerometery.

Self-report. A self-report measure is inexpensive and easy to administer. Participants are asked to recall information or provide a written diary of activities that determine their level and amount of energy expenditure over a given period of time. Children tend to overestimate their levels of PA. Researchers have shown a range of reliability coefficients (0.56 to 0.93) and an even lower and wider range of validity coefficients (0.03 to 0.88) (Loprinzi & Cardinal, 2011), making this method a less reliable way of collecting data from young children.

Proxy-report. While self-report is often still used for adolescents and adults, children between the ages of 2 and 5 (Hands et al., 2006) and even up to age 10 (Baranowski et al., 1986) are not accurate self-reporters. An alternative method to use is proxy report, meaning a parent, teacher, or other caregiver supplies information on a child's physical activity performance (Hands, et al., 2006). Proxy reports have seen some correlation to activity counts and accelerometery but not with direct observation (reported in Loprinzi & Cardinal, 2011). As with any subjective survey, results of proxy reports should be combined with more objective measures when possible.

Direct observation. Direct observation is yet another method that is frequently used when studying young children's physical activity patterns (Pate, O'Neill, & Mitchell, 2010). Direct observation involves training observers on a pre-determined coding system for a set amount of time or set intervals of time. Information such as type, intensity, context, location, and adult support can all be collected via direct observation methods. Some types of direct observation assessments include the Children's Activity Rating Scale (CARS), the Children's Activity Time sampling Survey, the Children's Physical Activity Form (CPAF), the Behaviors of Easting and Activity for Child Health Evaluation System (BEACHES) and the Observation System for Recording Activity in Children – Preschool Version (OSRAC-P) (Brown et al., 2009; Pate et al., 2010). Many of these direct observation systems have been tested against other measure for validity and reliability. For example, the CARS has been validated against two different accelerometers, while the CPAF has been validated against HR monitors. The BEACHES and OSRAC-P both have reliability percentages above 80% (Oliver et al., 2007).

Heart rate monitoring. Heart rate monitoring is an example of an objective measure that provides information about a person's heart rate during activity. The information is recorded over time on a monitoring device that stores information at one minute increments. It was one of the first objective measures used on children. However, despite its' objective nature, heart rate monitors cannot measure pattern or intensity of physical activity and other factors such as the environment/weather, stress, or level of physical fitness can effect heart rate outcomes (Rowlands, Eston, & Ingledew, 1997). In addition, there are several different ways of analyzing heart rate data making comparisons between studies difficult.

Pedometry. Technology such as pedometers and accelerometers have seen promising, but still somewhat inconsistent results when used on preschool aged children (De Bock et al., 2010; Pate et al., 2010). Pedometers are objective measurement tools that measure acceleration and deceleration in one direction. They are unable to measure the intensity of a movement. Additionally there have been instances where the position of the pedometer on a person's body has affected the measurement, making it a less reliable tool (Oliver et al., 2007). Despite significant correlations between both pedometer and accelerometer data and direct observation scores, Hands, Parker, and Larkin (2006) found a stronger correlation between pedometer counts and direct observation scores.

Accelerometry. Accelerometers remain the most valid, reliable, way of measuring physical activity in adults, and are becoming increasingly more popular when studying young children (Oliver et al., 2007). Advantages of accelerometers include an unbiased way of collecting both frequency and intensity of physical activity data (Pate et al., 2010; Oliver et al., 2007). In a review of several measurement articles, Oliver and colleagues (2007) found accelerometers to have high correlations with VO2 (a person's maximum capacity to take in and use oxygen during exercise) and direct observation. Additionally in an updated review of 32 articles, DeVries and colleagues (2009) found that all 12 motion sensors (accelerometers and pedometers) evaluated showed strong validity in one or more studies. The Actigraph, a brand of accelerometer, had moderate to good validity for children ages 2-8. However, DeBock and colleagues (2010) found the combination of accelerometer readings and heart rate (HR) monitoring to accurately capture MVPA, but not sedentary behavior. There are a few additional disadvantages when using accelerometers with children. Children's quick bouts of physical activity require the computer time sampling intervals be decreased from the typical one minute increment to a 15-second time interval (Pate et al., 2010). Additionally, consensus on cut-off points for classifications for physical activity (i.e. moderate to vigorous, light, sedentary) have yet to be determined (Guinhouya, et al., 2006; Oliver et al., 2007; Trost, et al., 2002). Thus individual researchers often create their own cut-off distinctions, making comparisons a little more burdensome. Finally, accelerometers are expensive measurement tools (Oliver et al., 2007), so a study with a large population often does not use them, making generalization and validity more difficult. Because no single measurement tool currently consistently portrays accurate physical activity levels in young children, especially preschoolers, Oliver and colleagues (2007) recommend using multiple ways of gathering information – if possible – to create a more comprehensive and accurate picture of physical activity prevalence.

Current Physical Activity Trends

Activity levels in preschoolers. Despite these measurement challenges, most research supports the fact that young children do not engage in enough activity throughout their day (Brown et al., 2009b; Hinkley, Salmon, Hesketh, Okely, & Crawford, 2009; Pate, et al., 2008; Tucker, 2008; Pate, et al., 2004). In the United States, a study of nine preschool classrooms (n = 247 students) in South Carolina, Pate et al. (2004), found that children engaged in sedentary activities for a little more than 40 minutes every hour for recorded intervals and engaged in moderate to vigorous physical activity (MVPA) less than 8 minutes every hour they were in preschool. Data was collected with Actigraph accelerometers worn on each participants' hip during preschool hours. In another study involving preschool students in South Carolina, Brown and colleagues (2009b) found that children engage in sedentary behaviors (sitting, standing, and laying down) 89% of their preschool day, while a little more than 10% was spent in active behaviors (walking, running, climbing, crawling, and skipping/jumping). Direct observation of

438 preschool students showed that, excluding nap time, children engaged in stationary (46.4%) or stationary with limb movement (37.0%) behavior in approximately 85% of observed intervals and only engaged in light (10.5%) and MVPA (3.4%) 14% of the observed time (Pate et al. 2008). While alarming, these numbers must be evaluated with caution as they come from the same area of the United States and may not be entirely generalizable to other areas across the nation.

However, research in other countries continues to support the findings out of the Carolinas. In a review of 39 studies worldwide examining whether or not preschool children met the Nation Association of Sport and Physical Education (NASPE) physical activity guidelines previously mentioned, Tucker (2008) found that almost half (46%) of the studies reported data that did not meet NASPE guidelines. Children between the ages of three and five (n = 427) living in Melbourne wore accelerometers for eight days and results from the study showed that the children spent an average of 84% of their waking time being sedentary, 11% in light intensity activity, and only 5% in MVPA (Hinkley et al., 2009).

Preschool children are typically more active when outdoors (Bower, et al., 2008) but even during time periods when physical activity is expected, such as recess, children still engaged in MVPA less than half the time (McKenzie et al., 1997). A study conducted in San Diego county involving 287 preschool students (McKenzie et al., 1997), found that students engaged in MVPA 41% of the allotted recess time (M = 25.9, SD = 5.5 minutes). In the baselines phases of a teacher-directed intervention (Brown et al., 2009), the five participants engaged in MVPA approximately 18% of directly observed playground intervals.

Some studies have found that children tend to engage in less vigorous activity as they age (Pate et al., 2008). A class of children ages three to five showed that three year olds were observed in more intervals of MVPA the four and five year olds (Pate et al, 2008). In addition, a study that measured a child's activity level in preschool and then again two years later in elementary school (McKenzie at al., 1997) found that children were twice as active as preschoolers. Perhaps the decrease of unstructured free time and the focus on structured seat work play a role in the decline of physical activity.

Activity levels in elementary-aged children. There are several variables at the elementary school age that make physical activity data comparisons difficult. One large difference across studies is school policy surrounding physical activity. In Europe, where a large amount of PA research occurs, schools report a range of recess time ranging from 20 to 102 minutes (Ridgers et al., 2011), while in the United States, regularly schedule recess in elementary schools is mandatory in less than 12% of states though most schools (~97%) report to have daily recess for at least one grade (Lee, Burgeson, Fulton, & Spain, 2007). Thus, opportunity for routinely more (or less) PA while at school is a variable to consider when analyzing data. A second variable that makes comparisons difficult is the measurement tool used. Within the literature for this age (elementary school), parent report (Deforche, Bourdeaudhuiji, D'hondt, & Cardon, 2009), accelerometers (Deforche et al., 2009; Trost et al., 2002), heart rate monitoring (Al-Nakeeb), and pedometers (Stellino, Sinclair, Partridge, & King, 2010) have all been used to collect data.

Even with these challenges, the concerning trend that mirrors findings from the preschool population is that many youth are not participating in enough physical activity during their school day, especially MVPA, to meet recommended practices. An international survey (The Health Behaviour in School-aged Children) conducted in 35 countries across Europe and America, found that 40% of boys and only 27% of girls ages 11-15 reported engaging in moderate or vigorous activity for an hour or more at least five days a week (A United Kingdom guideline) (Roberts, Tynjala, & Komkov, 2004). Baseline levels of activity in other studies (Verstraete et al., 2006; Ridgers et al., 2007) have supported similar findings that children engage in MVPA approximately one third to half of any given recess period. Approximately half the children in Deforche and colleagues' (2009) study of 9 to 11 year olds (*n=47*) did not maintain moderate physical activity for a single 15 minute bout. Bouts of continuous physical activity is yet another way of measuring PA and a guideline that many people fail to meet (Pate, Freedson, Sallis, Taylor, Sirard, Trost, & Dowda, 2002). Pate and colleagues (2002) found that while 90% of students wearing accelerometers met criteria for engaging in at least 30 minutes of moderate activity a day for at least five days of the week (an objective from the Healthy People 2010 initiative), only 3% met the criteria for engaging in vigorous activity for 20 or more continous minutes. This data shows implies that while children may experience increased levels of activity throughout the day (i.e. running to catch up with a friend or temporarily participating in a physical education activity), planned, continuous exercise is rarely occurring.

While studies support findings that physical activity declines as children get older (McKenzie et al., 1997; Pate et al., 2002; Trost et al., 2002), some studies have found slightly contrary results (Ridgers et al., 2011; Stellino et al, 2010). Children in grades 3 and 5 tended to be more active than children in grades 4 and 6 (Ridgers et al, 2011) and Stellino showed that first and second graders were less active than third and fourth graders during recess. This may have been because the weekly intervention was less familiar to the younger students who may have spent more time learning the game and less time actually playing. Overall however, the evidence found in both preschool and elementary aged children demonstrates the importance of early physical activity intervention and opportunities to maintain PA as children age.

A trend that begins in preschool aged children (Cardon et al., 2008) and continues as children age is that boys tend to be more active than girls (Beighle, Morgan, Le, Pangrazi, 2006; Purslow, Hill, Saxton, Corder, & Wardle, 2008; Ridgers et al., 2011; Ridgers et al., 2009; Stellino et al., 2010; Zask et al., 2001). Using accelerometers to measure physical activity, Purslow and colleagues (2008) found that 72% of boys ages eight and nine but only 30% of girls the same age reached recommended levels of MVPA. Additionally, Stellino and colleagues (2010) found that elementary aged boys had a significantly larger overall step count during their intervention. Studies have also found that girls have higher levels of sedentary behavior (as opposed to just lower levels of activity), suggesting that girls may use recess as a time to socialize rather than be active (Ridgers et al., 2011). Additional when light or moderate levels are compared, girls often engage in the same amount of PA as boys, suggesting that boys engage in higher levels of vigorous PA (Zask et al., 2001).

It is believed that children who are obese are less likely to be active than children who are not obese (Purslow et al., 2008; Deforche et al., 2009; Trost, 2001) and that these more sedentary lifestyles contribute to the maintenance of obesity and subsequent health problems. Obese sixth graders engaged in lower daily total counts of activity (as measured by an accelerometer) in addition to significantly lower 5, 10, and 20 minute segments of MVPA throughout the day (Trost et al., 2001). In addition to the use of accelerometers, Deforche and colleagues surveyed parents of 6 to 10 year olds who reported overweight children were two times less likely to participate in sports and watched more television than reports from parents of their normal weight counterparts. Al-Nakeeb and colleagues (2007) found differing results, as their research – using heart rate monitors – showed no relationship between percentage of body fat and time spent in MVPA. More research seems needed in this area.

Additionally, research has shown that children are typically the most active when they first get out to the playground and then their activity levels dramatically drop off (McKenzie et al., 1997). Children are normally most active the first five minutes or so, perhaps due to a need to release energy after sitting during instruction for extended periods of time. This information could play a critical role in helping teachers know when to intervene to support increased PA.

Activity levels in people with disabilities. In general, research shows that both adults and children with disabilities consistently engage in lower levels of physical activity (Phillips & Holland, 2011; Foley, Bryan, & McCubbin, 2008; Pan, 2008) than their typically developing counterparts. Lower cognitive levels, lower skill set, a routinely sedentary lifestyle, and lack of support may all contribute to this. Much of the research around people with neurological disabilities and physical activity occurs outside of school hours. Wagner, Cadwallader, and Marder, (2003) found that 76% of youth with disabilities ages 13 through 17 were reported by parents to have participated in an extracurricular activity during the past year. Sports teams were the most common activity, with half of the surveyed youth with disabilities playing on one. It is interesting to note that participation on sports teams was the most common activity for youth in every disability category. Another study (Orsmond, Krauss, & Seltzer, 2004) of adolescents with autism showed that approximately 75% walked or got exercise at least once a week, while over 35% reported participating in group recreational activities at least once a week. Additionally, an online statewide survey of special education teachers showed that students with moderate to severe disabilities were also participating – in limited capacities – in community activities (Kleinert, Miracle & Sheppard-Jones, 2007). One out of every four teachers reported that they had at least one student on their caseload participating on a community sports team, while 14% reported they had at least one student participating on a parks and recreation sports team (the difference between these two types of teams was not explicitly stated in the article and is unknown by this author). Yet another 12% of the sampled teachers had students participating on a church sports team. Many youth with disabilities are involved in large national or international organizations, such as Special Olympics, that give athletes an opportunity to participate – and compete – in sports. In 2004, Special Olympics served 512,804 people with intellectual disabilities (ID) in the United States and more than 1.73 million athletes in 150 countries worldwide (Special Olympics).

Looking specifically at levels of activity amongst young (preschool and elementary aged) children with disabilities during school hours school, limited research has shown that children with autism (Pan, 2008), Down's syndrome (Sharav & Bowman, 1992), and intellectual disabilities (Foley et al., 2008) all engage in lower levels of physical activity than their typically developing counterparts. Research conducted on children ages 7 – 12 with and without autism spectrum disorder (ASD), found that while children in both categories engaged in MVPA less that 40% of the time they were at recess and children with ASD engaged in MVPA significantly less time (27.7%) than their peers (Pan, 2008). In a study of twins, one with and one without Down's syndrome, Sharav and Bowman (1992) found that the sibling with Down's syndrome was less active. Finally, a study of 9 children with mental retardation and 33 children without MR found that those with MR engaged in significantly ($p<0.001$) less activity (as measured by accelerometers) during both recess and physical education classes (Foley et al., 2008).

One study (Pitetti, Beets, & Combs, 2009) that found that all 15 participants with ID (intellectual disabilities) exceeded recommended daily MPVA levels (students averaged 83.5 minutes across three school contexts during the school day), has limitations. Using a heart rate monitor, the authors created cutoff points for MVPA that, by their own admittance, were low.

However, their rationale was that an additional recess opportunity to engage in high levels of PA had not been counted towards data results, (likely insuring participants to still meet MVPA recommended guidelines), and so the cutoff points were still valid.

Environmental predictors for preschoolers. Several studies have looked at the setting itself and what factors contribute to children being more or less physically active (Bower et al., 2008; Brown et al., 2009b; Dowda et al., 2009; Dowda et al., 2004; Finn et al., 2002). Finn and colleagues (2002) examined at global factors that were associated with physical activity in preschoolers and, using an Actiwatch activity monitor as well as direct observation as a measure of validity, found that the child care center itself was a strong predictive factor of physical activity in children, accounting for 46% of the variation in steps taken between 9am and 5pm. There is additional evidence that a high quality child care center leads to increased physical activity (Bower et al., 2008; Dowda et al., 2009; Dowda et al., 2004). Centers that were rated high on childhood environmental rating scales, such as the ECERS, had children who engaged in lower levels of sedentary activity and higher levels of MVPA (Boldemann at al., 2011; Dowda et al., 2004). Particularly interesting is that staff education is highly correlated with higher levels of physical activity. Though not statistically significant (.07), Dowda and colleagues (2004) found that children in childcare centers that employed a higher percentage of college educated staff displayed higher levels of MVPA. Other large contributors to higher MVPA levels were the participation in field trips and the amount of outdoor time that children engaged in (Dowda et al., 2004). Both of these were statistically significantly correlated (.01 and .04, respectively). Students who went on field trips four or more times a month showed higher levels of physical activity. This suggests that centers which have more monetary funds and recourses – to pay for equipment, better educated teachers, and the ability to attend more field trips – are more likely to have children who are more physically active.

An additional interesting note on staff interactions with students is that some studies have found that the presence of adults during recess decreases the amount of physical activity by students (Cardon et al., 2008), while others have shown that staff presence increases physical activity (Brown et al., 2009). Several distinctions and explanations however need to be made to further unpack these assertions. In the studies that showed lower levels of physical activity, staff presence did not necessarily mean planned activities were taking place. In fact, it was suggested that girls tended to talk more with staff members who were present, limiting their physical activity (Cardon et al., 2008). In the studies where staff presence increased physical activity, it was because staff members had planned activities and encouraged and prompted students to engage in the physical activities (Brown et al., 2009). Even in the absence of planned activities, researchers suggest that staff members with college degrees are correlated with higher levels of physical activity, as they are more likely to prompt and encourage students. Other trends on the playground show that fewer children in the area promotes PA (Gubbels, 2011; Cardon et al., 2008) as does space with varied topography such as trees, shrubs, and uneven ground (Boldemann, 2011). While Cardon and colleagues (2008) found that play equipment did not affect physical activity levels for children, they did find that playground size had a significant effect on the physical activity levels of children. Brown and colleagues (2009b) differed on their analysis of play equipment, but their findings that open space was likely to be associated with increases in physical activity support prior research (Cardon et al., 2008).

Environmental predictors for elementary-aged students. There are several factors thought to contribute or detract from physical activity at the elementary school level including time of day (Zask et al., 2001), school size (Zask et al., 2001), weather (Ridgers, 2010; Duncan, 2008), playground size and materials (Ridgers et al, 2010, Willenberg et al., 2010; Beighle et al., 2006; Zask et al., 2001) and adult participation (Parrish, Yeatman, Iverson, Russell, 2012). Allowing ample time for children to be active (between 50 and 60 minutes of recess each day), especially during the lunch hour (Zask et al., 2001), was an effective strategy for schools in one study (Parrish et al, 2012). In addition, the presence of portable equipment such as balls and jump ropes increases the likelihood that children will be more active (Ridgers et al, 2010; Willenberg et al., 2010). Some studies have found contrasting results (Zask et al., 2001) or have found PA to increase in only one gender (Beighle et al., 2006). Beighle and colleagues noted that the types of play that boys chose to engage in (football or soccer) were more active for the group than the activities with portable equipment that the girls chose to engage in (wall ball, which required players to stand in line and wait their turn). In a study using only interviews, 5 out of 6 principals, 11 out of 16 teachers, and all 50 students believed non-fixed equipment would increase PA.

Evidence Based Practices and Recommendations

The low levels of physical activity in young children, especially those with disabilities, show a need for interventions designed to increase physical activity levels. Yet, despite the extensive research on physical activity frequency, the evidence-based research on effective interventions to increase physical activity in preschoolers is somewhat limited, especially in the United States. Research conducted on elementary aged students is more common and will be discussed first as some of the interventions may be applicable to the younger age group. School based interventions can be categorized into two categories: adult directed intervention or curriculums and environmental modifications.

Curriculums/interventions packages for elementary aged students. In 2010, the Center for Disease Control (CDC) released a report titled "The Association Between School Based Physical Activity, Including Physical Education, and Academic performance" (CDC, 2010). Of the over 50 studies reviewed, six intervention studies examining recess effects and nine intervention studies examining classroom physical activity effects all yielded positive or no associations with academic performance. Of the six recess interventions, three found that physical activity increased concentration and on-task behavior and one decreased fidgeting (as cited in CDC, 2010, p. 20). One study (Pellegrini, Huberty, & Jones, 1995) which implemented three different experiments within the same school found that types of activities at recess did not seem to correlate with attention after recess, but inattention prior to recess was significantly higher than after recess.

For classroom based physical activity interventions reviewed by the CDC (2010), outcome measures ranged from on-task behavior, attention, and memory to reading, math, and standardized test scores. The interventions themselves included short, planned breaks from cognitive, desk tasks to engage in physical activity as well as a range of academic lesson plans that incorporated physical activity within the lesson itself. For example, when learning geography, students could move across a large map to identify the location of the place called out by the teacher. Or, during math students could hop or skip a certain number of laps and learn multiplication by calculating their laps with groups of peers' laps. Five of the eight studies measuring standardized test outcomes saw improvements in test scores. Additional improvements were found in visual skills, concentration, and classroom conduct. Other studies in the report (2010) found no correlations between classroom PA and cognitive/academic outcomes. There are a few additional interventions that support to the findings from the CDC report. Curriculum based interventions including Texas I CAN (Grieco, Jowers, & Bartholomew, 2009), the Physical Activity Across the Curriculum (PAAC) project (Donnelly & Lambourne, 2011), and Take 10! (Kibbe, Hackett, Hurley, McFarland, Schultz, & Harris, 2011) are additional classroom based interventions that involved incorporating activity into academic lesson plans. Using the "Texas I-CAN" curriculum, children in third grade classrooms participated in 10 to 15 minute lessons covering math, science, social studies, and language arts while engaging in MVPA. Results showed that time on task (TOT) decreased significantly after inactive lessons and increased slightly after active lessons. Results from the study using the PAAC curriculum (Donnelly & Lambourne, 2011) showed participants in the experimental group improved performance on standardized test score by 6% while students in the control group decreased scores by 1%. In addition, BMI increased at a slower rate with students in the experimental group. Results from Take 10!, also showed improvement in test scores as well as decreased time off task (Kibbe et al., 2011). Another program, SPARK (Sports, Play, and Active Recreation for Kids) (Sallis, McKenzie, Kolody, & Faucette, 1997), creating physical education (PE) lessons and implemented them at least three days a week for over a year. The results from this study found that children at schools that used the SPARK curriculum were more physically active and that girls were in better cardiovascular shape and had better endurance than girls in the control schools.

Curriculums/adult-directed interventions for preschool-aged students. Research conducted with older students has shown the importance of adult support in order to achieve adequate doses of physical activity (Donnelly & Lambourne, 2011; Kibbe et al., 2011; CDC, 2010; Grieco et al., 2009; Sallis et al., 1997). Curriculum based research is also being conducted at the preschool level, with the hopes of replicating some of the results found at the elementary age. A 2010 review of the literature by Ward, Vaughn, McWilliams, and Hales found 14 studies (eight from the United States, two from Israel, one from Thailand, one from Greece, and two from Scotland) which implemented what the authors referred to as “specific curriculum” within child care (classified by authors as preschool, nursery school, or day care settings). The authors divided studies into three groups based on physical activity outcomes, physical activity related outcomes, or motor development related outcomes. The curriculums were implemented anywhere from 1 day to 12 months, with a majority lasting last about 12 to 14 weeks. Children participated between one and six days each week in the specific curriculum. Activities from the curriculums included, but were not limited to: swimming, hopping, skipping, free play with equipment, and exercise circuits. A variety of measurement tools were used including accelerometers (2), pedometers (1), heart rate monitors (2), parent report (3), and various direct measure tests (6). Findings from 11 of the 14 studies showed the set curriculum was effective in its goal (goals included increasing PA, decreasing sedentary behavior, television viewing, and obesity). All four studies categorized as motor development-related yielded improvements in motor skills, while all five studies in the physical activity-related category showed favorable outcomes (increases in physical fitness or decreases in TV watching). Two out of the five studies in the physical activity category showed positive findings with increases in vigorous physical activity (VPA) and increase in steps taken as measured outcomes. The other three studies found no difference between physical activity levels of children in the intervention and control groups. While the data from a majority of these studies is positive, the wide variety of measurement tools, curriculum used, and time spent involved in various activities makes it difficult to make comparisons between curriculums and thus definitive recommendations regarding effective curriculum components. What this review does expose us to is the idea that a set of planned activities is helpful in increasing physical activity in young children.

Other studies involving curriculum or adult instruction, but not discussed in Ward et al.'s (2010) review, include adult led activities on the play-ground (Brown et al., 2009), and physically active academic lessons (Wadsworth et al., 2012). In Brown and colleagues' study (2009) of typically developing preschool students, researchers found teacher-directed activities during recess lead to increased levels of physical activity. Teachers were taught the "plan, do, and review" method of engagement in which they talked about an activity the students were going to do, supported students as they played, and then reviewed what the students had experienced. Results showed increases in activity during the "plan, do, and review" stages of intervention for all three participants involved in the study. Wadsworth and colleagues (2012) integrated 2, planned and structured 10 minute activity breaks into a preschool schedule. The 10 minute breaks included a 2 minute warm-up, a 6 minute activity, and a 2 minute cool down. These breaks greatly increased physical activity at the two preschool sites, accounting for 69% of MVPA at one center and 90% of MVPA at the second center.

Environmental manipulation. Several studies have investigated the effects that stationary playground structures (Bower, et al., 2008; Brown et al., 2009b; Ridgers et al., 2007; Gabbard, 1983), open space (Brown et al., 2009b; Cardon et al., 2008), playground markings (Ridgers et al., 2007), and portable equipment (Bower et al., 2008; Brown et al., 2009b; Cardon et al., 2008; Hannon & Brown, 2008) have on levels of activity in preschoolers and elementary aged children. In general opportunities to play, either on fixed structures or with portable equipment, increases a child's nonsedentary behaviors. The addition of hurdles to jump over, tunnels to crawl through, balance beams, bean bags, and balls decreased children's sedentary activities by 16% while significantly increasing light, moderate, and vigorous physical activity (Hannon & Brown, 2008). In addition, "game equipment" such as jump ropes, balls, racquets, and Frisbees, showed statistically significant increases in the intervention group, while the control group which received no additional playground equipment saw a decrease in moderate physical activity levels (Verstraete et al., 2006). Fixed play structures such as basketball hoops, soccer goals (Ridgers et al., 2007) and hanging and climbing apparatus (Gabbard, 1983) also saw significant increases in physical activity and hang time, respectively.

Physical activity interventions specific to children with disabilities. Though some of the interventions discussed above may involve children with disabilities, none specifically mention this population. The studies specifically involving children with neurological disabilities or disorders are discussed below. To my knowledge, no school based experimental intervention studies on increasing physical activity for preschoolers with disabilities exists. What the literature does offer is information on the effects that physical activity has on young students with disabilities.

Effects of changes in physical activity levels. Increases in physical activity and decreases in sedentary behaviors can not only thwart obesity and other health concerns (Janz et al., 2001; NCCDPHP, 1999), they can affect behavior and cognition as well (Strong et al., 2005). Studies specific to those with neurological disorders or disabilities have also show great promise. Physical activity helps prevent off-task behavior (Grieco, Jowers, & Bartholomew, 2009) and, in some cases, increases on-task behavior (Jarrett, Maxwell, Dickerson, Hoge, Davies, & Yetley, 1998; Mahar, Murphy, Rowe, Golden, Shields, & Raedeke, 2006). Students with ADHD (Jarrett et al., 1998), emotional-behavioral disorders (Medcalf, Marshall, & Rhoden, 2006) and autism

(Kern, Koegel, Dyer, Blew, & Fenton, 1982; Rosenthal-Malek & Mitchell, 1997) have also seen an increase in appropriate responding following sessions of physical activity.

Behavior. Physical activity has benefits in multiple domains and has been used as an effective intervention tool for many adaptive and behavioral behaviors. One of the most documented behavioral benefits, especially for those with ASD, is the decrease of self-stimulation. Self-stimulatory behaviors are often regarded as behaviors that interfere with learning and pro-social behaviors (Kern et al, 1982) and can include hand flapping, body rocking, mouthing objects and pacing or self-injurious behavior (SIB) such as head-banging or biting. To date, there is a great deal of research that supports using physical activity to decrease self-stimulatory behavior in students with autism and/or developmental delays (Baumeister & MacLean, 1984; Celiberti, Bobo, Kelly, Harris, & Handleman, 1997; Elliott, et al., 1997; Kern et al., 1982; Kern, et al., 1984; Rosenthal-Malek & Mitchell, 1997; Watters & Watters, 1980). In some of these studies, vigorous exercise was found to have a greater effect on reducing self-stimulatory behaviors than gross motor tasks (Elliott et al., 1997) or mild exercise (Celeberti et al., Kern et al, 1984). Vigorous exercise was defined as jogging for 15 minutes to 20 minutes with adult support as needed (Kern et al., 1984) and elevated heart rates above 130 beats per minute, achieved by using a treadmill at the speed of 4.0 miles per hour (Elliott et al., 1997). Mild or moderate activities included ball playing (Kern et al., 1984) and heart rates between 90 and 120 beats per minute, achieved by riding an exercise bike or using a stair-stepper (Elliott et al., 1997). While the studies did show that exercise had an effect on the immediate decrease in self-stimulatory behaviors, effects of the intervention wore off 40 minutes after the intervention took place (Celiberti et al., 1997) or when the program was terminated (Baumeister & MacLean, 1984).

Cognition. Complimentary to decreasing inappropriate behaviors is the increase in appropriate behaviors and work tasks. Physical activity interventions have seen positive effects for increasing appropriate behaviors (Kern, Koegel, & Dunlap, 1984; Rosenthal-Malek & Mitchell, 1997) and decreasing inappropriate behaviors (Baumeister & MacLean, 1984; Celiberti, Bobo, Kelly, Harris, & Handleman, 1997; Elliott, et al., 1997; Kern et al., 1982; Kern, et al., 1984; Rosenthal-Malek & Mitchell, 1997; Watters & Watters, 1980). In addition to showing a decrease of self-stimulatory behaviors, two studies also showed that participants exhibited an increase in appropriate responding (Kern et al., 1982) and increased number of tasks performed (Rosenthal-Malek & Mitchell, 1997). In Kern et al.'s study (1982), results showed that after 15 minutes of vigorous exercise (defined as jogging alongside an adult), the participants (four children under the age of 8) showed a decrease in self-stimulation and an increase in appropriate responding to academic tasks and play activities. The academic tasks included imitating gross motor actions and matching colors and shapes, while the play activity was defined as playing catch with an adult. Results of the visual analysis showed that during sessions where the classroom/work condition followed exercise, appropriate responses to play and academic tasks increased *every* time when compared with responses prior to exercise conditions. Rosenthal-Malek and Mitchell (1997) found in their study that the five male participants (mean age = 14.88) showed a significant difference in the number of tasks completed after the aerobic exercise condition compared with tasks completed after the workshop condition (individualized functional skills activities such as placing eggs in a carton and counting items to put into a box).

In summary, the varied research on young children's physical activity levels is abundant is some areas, while leaving gaps in others. There is a great deal of research around reliability and validity of measuring physical activity, especially in preschoolers (DeBock et al., 2010; DeVries et al., 2008; Oliver et al., 2007) and these measurement tools show that children are often not engaging in the recommended levels of physical activity (Brown et al., 2009; Hinkley et al., 2009; Pate et al., 2008; Pate et al., 2004; Tucker, 2008). Several effective curriculums and interventions aimed at increasing PA levels in elementary aged children (CDC, 2010; Ridgers et al., 2007; McKenzie et al., 1997; Sallis et al., 1997) exist. The literature is less robust at the preschool level, both in number and strength of findings. Preschool interventions (Wadsworth et al., 2012; Brown et al., 2009; Hannon & Brown, 2008; Fitzgibbon et al., 2005; Mo-suwan et al., 1998) have mixed results due in part to measurement issues and nature of young children's physical activity. An additional gap in the literature is around school based PA interventions for young children with disabilities. The present study intends to begin to fill both of these gaps.

CHAPTER III

Method

This study was approved by the human subject committee at the University of Washington. All participants had consent from their parents for the program.

Participants and Sample

Participants for this intervention were preschool aged children (3.7 years old to 5.7 years old) with and without disabilities who attend a comprehensive early childhood program on a university campus in a large city. There were 15 children total, 7 children without disabilities (5 boys and 2 girls), and 8 children with disabilities (5 boys and 3 girls). Overall, 10 boys and 5 girls participated in the study (see Table 1 for details). Eight of the children attended morning preschool in one of three classrooms and seven children attended preschool in the afternoon, in one of three classrooms.

To stratify groups for random assignment, individual class lists were given to the lead investigator by a school administrator. These class lists grouped students into two categories; those students on an Individualized Education Plan (IEP) and those not on IEPs, who are presumed to be typically developing. Children who did not meet criteria – physical disabilities impeding independent walking – were excluded from the randomization. Children who qualified for specially designed instruction (SDI) in speech only were moved from the IEP list to the non-IEP list. The rationale for this was that children with only speech delays (who did not qualify for cognitive and/or social instruction) were more similar to the typically developing students as opposed to those who had social, cognitive, and/or adaptive delays. From the remaining children who fit criteria, two children per class per category (i.e. two children who were not on IEPs or just qualified for speech and two children who were on IEPs qualifying for services in at least two areas) were chosen at random to participate in the study. Of the 24 consent forms sent out, 16 were returned (Appendix A). One student (a typically developing female) did not complete the study due to tardiness and attachment concerns (to the parent who dropped her off) that made data collected from her during baseline invalid. The intent prior to the commencement of the study was to recruit new participants via randomization until the sample size of 24 was reached. However due to time constraints, the study design, and funding (mainly for accelerometers), the sample of 15 was deemed sufficient. The two categories of students will be referred to as TDK for the non-IEP students and DD for the students on IEPs throughout this paper.

Group	Child	Gender	Age	Documented Disability	Pre-test BMI
1	ML	Male	5.3	none	16.6
1	HM	Female	4.8	none	16.3
1	AM	Male	3.9	none	15.5
1	SE	Male	4.3	DD	15.3
1	DV	Male	3.8	ASD	***
1	VH	Female	4.9	DD	16.3
1	SP	Male	5.7	ASD	14.9
1	IH	Female	4.9	DD	16
2	JS	Male	4.7	none	17.5*
2	TFO	Male	5.1	none	16.8
2	NB	Female	3.7	none	13.4
2	HS	Male	4.6	none	16
2	KW	Male	4.4	ASD	16.3**
2	AC	Male	4.1	DD	17.6*
2	MW	Female	5.1	DD	16
* above the 95th percentile, considered overweight by the CDC					
**calculated differently than others, due to behavior					
***data not available					

Table 1. Participant demographics and BMI

Classroom staff were also participants in this study. Each classroom has a head teacher, an assistant teacher, related service personnel, and one to three additional classroom aides. The head teacher and assistant teacher in each classroom were the only staff members to lead intervention activities, while other classroom staff supported and prompted study participants when directed by the head or assistant teacher. The head teacher in every classroom holds a Master's degree in special education and has a teaching credential. The assistant teacher in each classroom is pursuing their master's degree in early childhood special education or a related field. All classroom staff signed consent forms (Appendix B) prior to the implementation of the intervention.

Research Design

This study employed a single subject, alternating treatment research design, with random assignment of participants and of treatment conditions. Single subject designs are often used in educational research to compare individual skills or behaviors under certain conditions (Kazdin, 1978). Baseline data is collected to determine an individual's current behavior or level of functioning and then treatment phase(s) are introduced with the intention of showing experimental control over the studied behavior. Strong effects are shown if data points from baseline do not overlap with data points from the intervention phase(s). Because this study involved 15 participants, typically a large *n* for a single subject design, the intervention was conducted with a group of eight students first (five on IEPs and three not on IEPs), followed by a waitlisted group of seven students (three on IEPs and four not on IEPs) who began the intervention one month after the first group started. An alternating treatment design to examine the effects of two recess interventions – teacher directed physical activity and increased presence of portable playground equipment – on physical activity levels and trends was used. For all participants, a baseline phase with at least three data collection sessions was conducted. After a baseline phase, the two treatments were randomly assigned throughout the course of the study. Two to three intervention sessions were conducted each week and prior to the start of the week, head teachers and assistants were e-mailed by the lead investigator with the phase assignments for that given week.

Another component of single subject design is determining the effectiveness of an intervention though visual analysis of the data. Graphs that can show changes in behavior upon implementation of the intervention are frequently used. A time series graph was created for each participant in order to visually analyze accelerometer data. In addition to the single subject design, group and individual means were calculated and analyzed, both visually and statistically. Group comparisons were also made to using percent of change.

Instrumentation

The main dependent variable was the intensity of physical activity. This was objectively by an accelerometer. Secondary dependent variables were the type and context (both where and with who) of recess physical activity. This was measured through direct observation. Specific descriptions of the variables as well as measurement systems are described below. In addition, children's height and weight was measured by a Continental upright scale with height rod. Finally, a social validity measurement tool was used for both teachers and students at the conclusion of the intervention. Classroom head teachers and assistant teachers were asked to fill out a survey, while children were also surveyed by the lead investigator using a choice board which had pictures of the different activities and toys available during the study.

Intensity of physical activity. As stated above, physical activity is measured in many different ways such as MET's, energy expenditure, and categorically. A person who engages in a higher level of activity, (i.e. running as opposed to walking, moving up an incline instead of a flat service, or lifting a heavier weight) exerts more energy. Physical activity intensity can be measured in many ways. For this study, accelerometers (Actigraph GT3X and GT3X+)[1] were used to monitor the intensity of physical activity. Commonly used on adults, accelerometers are being used with greater frequency and more reliability on young children (Pate, McIver, Dowda, Brown, & Addy, 2008). The Actigraph Accelerometer is a small device that measures activity on three different planes (up and down, back and forth, and side to side) and provides multiple physical activity measurements including energy expenditure, activity counts, steps taken, activity intensity levels, and MET's. The device is typically worn on the wrist or the right hip to provide valid measures of physical activity intensity. Participants in this study wore the

[1] Due to cost of equipment and number of participants, two GT3X accelerometers that were used in a previous university study were used in addition to the six GT3X+ accelerometers that were purchased for the purpose of this study.

Actigraph Accelerometers on their right hip, attached by an elastic belt. Percentage of time spent in a given activity intensity level (sedentary, light, moderate, vigorous) was the only outcome measurement used for data analysis. Due to the irregular bursts of movement displayed by young children, accelerometer data was collected in 15 seconds intervals.

Accelerometers were worn for the duration of recess each data collection session. After each session, data was downloaded onto the author's personal computer and analyzed using Actilife v5.10.0 software. Activity count cut points were manually imputed to accurately reflect activity intensity of preschoolers. Cut points (shown in the table below) were based on cut points validated by Pate and colleagues (2006).

Intensity Level	Minimum Count	Maximum Count
Sedentary	0	799
Light	800	1679
Moderate	1680	3367
Vigorous	3368	∞

Table 2. Preschool cut points used in the current study, validated by Pate et al., 2006

Characteristics of physical activity. A preschooler is involved in many types of physical activity throughout the day. It can range from moving around the block area in order to build a tall tower to running about the playground at recess. Play and movement can also be done with peers, with adults, or in isolation. Looking at the types of play children engage in, with what intensity, and with who can help teachers plan interventions and provide support in meaningful ways.

To observe student behavior, a modified version of the Observational System for Recording Physical Activity in Children – Preschool Version (OSRAC-P) was used. The

OSRAC-P is a measurement tool that uses direct observation to monitor levels, types, and context of children's physical activity (Brown et al., 2009). The system uses momentary time sampling – 5 seconds of observation followed by 25 seconds of recording – to record an individual child's behavior in eight different categories. The OSRAC-P categories include: physical activity level, physical activity type, location, indoor educational/play context, outdoor/gym educational/play context, initiator of activity, group composition, and prompt for physical activity (OSRAC-P Manual, 2003). Since this study occurred for a short period of time in a specific context (recess), a modified version was used that included only the level, type, outdoor play context, group composition, and prompt categories. In addition, activities or contexts that were not typically observed during recess (i.e. snack), were not included in the modified version. For a detailed description of the coding system and the data collection chart, please see Appendix C and D, respectively. Observational data was collected by the lead researcher and a trained research assistant at least one time in each phase per participant.

Body mass index. Though not a primary dependent variable, each participant's (BMI) was taken pre and post-intervention to 1) determine the percentage of the sample that was overweight or obese and 2) mark any noticeable trends in BMI change from pre to post-intervention measurements. Children's height and weight were measured in the nurse's office at the school by the lead investigator and the school nurse, when available. Fourteen out of the fifteen students were able to independently participate in this activity. Weight for one student, who had difficultly standing on the scale independently for any period of time, was calculated by having the lead investigator stand on the scale while holding the child and then subtracting the lead investigator's weight by the total weight. Height for the same child was calculated using the height chart hanging on the door upon exiting the nurse's office. The height and weight measurements were then inputted to the CDC BMI calculator (http://apps.nccd.cdc.gov/dnpabmi/) which equated BMI for each child. According to CDC guidelines, two children in the study were overweight (AC and JS), as their weight/height proportion puts them above the 85th percentile for children their age.

Procedure

This study was a single subject, alternating treatment design, with random assignment and a staggered waitlist. After baseline, half of the children (n=8) began the intervention and the other half (n=7) received the treatment approximately one month later. Most of the second group had one more baseline treatment prior to the beginning the intervention. Some participants did not due to absence. Treatment included at least 10 sessions of alternating conditions (Condition A is teacher-led physical activities, Condition B is increased presence of portable equipment on the playground) for all participants and was conducted by classroom staff, usually the head or assistant teacher. A social validity questionnaire for teachers and a social validity interview with students was administered upon completion of the intervention. Each activity lasted for 10 minutes of the child's recess time and accelerometers were worn throughout this time to collect intensity data. Teachers were responsible for taking the accelerometers on and off of the participants in their classrooms. In addition, at least one direct observation, using the OSRAC-P, per child per phase was conducted for descriptive data purposes.

Pre-baseline. Prior to baseline, the lead researcher met with head teachers and available assistant teachers on two occasions; once to provide an overview of the intervention and once to review the intention of the study and provide detailed lesson plans and fidelity checklists for the intervention. The second meeting included reviewing intervention expectations (i.e. putting accelerometers on and taking them off each session), explaining each lesson plan, sharing fidelity checklists and what each step entailed, and answering any questions the teachers had (Please see Appendix E and F for lesson plans and fidelity checklists). Teachers also knew that they could contact the researcher with questions or concerns throughout the course of the study.

Prior to the first day, the target students were shown the accelerometer and gave assent to participate in the intervention. Students were given three days, during which the lead researcher and assistant became reliable on the modified OSRAC-P coding system, to acclimate themselves to the device. Some children did seem hesitant at first, but all children easily accepted and wore the accelerometers and elastic belts by the third day. The head researcher put the accelerometers on the participants the first day, followed by the classroom staff all subsequent data collection days. Staff were also responsible for taking the devices off and returning them to a marked bin on the playground.

Baseline. Baseline data was collected at least three and up to five times for each individual. During this time, teachers were asked to conduct "business as usual" on the playground. This meant that teachers could interact with children and provide encouragement, but did not provide any additional support (visuals, physical prompting) to start or maintain a playground activity. According to the schedules provided by head teachers, recess for each class was between 15 and 20 minutes long. For one teacher, recess occurred immediately upon arrival at school and, due to varied times of parent drop-off and bus arrival, schedule recess for this classroom was the shortest (15 minutes). For all classrooms, baseline data was collected during the middle 10 minutes, insuring students and teachers where on the playground. For both baseline and intervention phases, any sessions where the participants were not present the entire 10 minutes, data for the day was discarded. This happened on at least two occasions for participants in the first classroom. Also during baseline, each participant's height and weight was measured in the school nurse's office to calculate pre-intervention BMI.

Intervention. Based on previous research conducted on preschool students (Brown et. al, 2009; Hannon & Brown, 2008), two effective ways of increasing physical activity are the use of extra portable equipment and teacher led activities. These two alternating interventions took place during the treatment phase of this study. Alternating treatments were decided by a coin toss (heads for teacher-led activity and tails for increased portable equipment). It was decided a priori that an intervention could not occur more than two consecutive data collection sessions. If the same side of the coin was flipped two consecutive times, the alternate intervention was automatically chosen for the next intervention session.

Teacher-led activity. With lesson plans provided by the researcher, teachers implemented a modified and abbreviated "Plan, Do, Review" model of providing instruction around one of three activities: dance party, activity dice, and an obstacle course. Teachers were expected to first introduce the activity either while walking to the playground or once on the playground by explaining the name of the activity and the objective. Teachers would then model the activity and begin engaging with the students. All classroom students were welcome to participate, but classroom staff was instructed to specifically call over the study participants and support these target students to maintain engagement for the entire 10 minutes of the activity. Social praise and, if needed, tangible reinforcement was provided throughout the ten minutes. At the end, teachers concluded the activity by providing behavior specific praise and giving access to the "treasure box" for all students who participated in the entire activity. A treasure box was provided and replenished by the researcher and included stickers, bouncy balls, bubbles, and noise makers, amongst other things. Some teachers preferred to use their own classroom treasure box on occasion.

The three choices of activities were used to provide options for teachers and so that students do not get bored of the activity during the intervention. Dance party was defined as children and adults dancing to a variety of songs. The researcher provided a CD of familiar and unfamiliar songs as well as a portable CD player for the classrooms. An obstacle course was defined as a "follow the leader" type activity where a teacher leads the class around the playground over, under, and around the fixed equipment. Examples were listed on the lesson plans. Finally, the activity dice are two, sixed sided stuffed cloth die, one with a number and one with an activity. Children and/or adults were asked to roll both dice and perform the activity that was rolled the number of times shown on the second die (i.e. seven jumping jacks). Modifications to this activity (also listed on the lesson plan) included rolling only the number die and making up an action.

Increased portable equipment. During this treatment phase, teachers were provided with a mesh bag of materials purchased by the researcher. The teachers were asked to spread at least 80% of the provided materials out on the playground and instructed to again "interact with children as usual", but not provide any additional support or prompting. Teachers were instructed to engage with students who had initiated conversation or were already participating in an activity. Equipment in the bag included: two jump ropes, three to four small hula hoops, a Stomp Rocket (children stomp on an air-filled plastic piece that shoots air through a tube and pushes a soft rocket type arrow into the air), a 3-D nylon target with accompanying balls, a Nerf football, three to four small (under 6") hurdles, a fabric tunnel, and two rubber playground balls.

Written feedback phase. During the interventions, data analysis showed that some students were in need of more intense intervention to increase physical activity. As a result, teachers received written feedback (via e-mail) following a teacher-led activity day to support/prompt teachers in implementing the intervention. The e-mails were specific to the students who were in need of a more explicit intervention. The written feedback phase was used for three students, IH, SP, and VH.

Data Collection Procedures

Data was collected with two different measurement tools, an Actigraph accelerometer and the Observational System for Recording Activity among Children – Preschool edition (OSRAC-P). Accelerometer data was taken each day of baseline and intervention for the entirety of the study (14-20 sessions). Accelerometers were set to record data only for the time the children were out on the playground for recess. If a child was not on the playground for at least 10 minutes, accelerometer data for that day was not counted.

Observational data was taken for each child at least once during each phase of the intervention to gather a snapshot of individual student behavior and performance under each condition. Per OSRAC-P protocol, observation data was collected as a momentary time sampling with 5 seconds of observation followed by 25 seconds of data recording. Each observation was 10 minutes in length. For baseline and intervention B (portable equipment), data collection began within two minutes of the child entering the playground. For intervention A (teacher-led activity), data collection began when the adult initiated the activity. All observations were conducted by the lead researcher and a research assistant, who observed the enclosed playground from one wall near the exit. Observers remained as unobtrusive as possible, not interacting with staff or students unless requested to do so.[2] The lead researcher and a research assistant became reliable on the OSRAC-P prior to the beginning of the intervention and each collected data throughout the course of the intervention. Inter-observer agreement was conducted on 20% of the observation sessions.

Reliability, Procedural Fidelity, and Social Validity

To monitor the fidelity with which classroom staff implemented the two interventions, procedural fidelity was collected for 25% of data collection session and was distributed evenly across both interventions. The fidelity checklists had 11 steps for teacher led activity and 4 steps for increased playground equipment. Average teacher fidelity for each intervention was 60%-100% for the teacher led activity and 75%-100% for increased playground equipment. A discussion of fidelity will be presented later in the paper.

Inter-observer (IOA) agreement for the OSRAC-P was also conducted on 20% of observational sessions. Two coders (the lead investigator and an assistant) became reliable with each other (three observation sessions with at least 80% agreement) prior to beginning baseline coding. Agreement was calculated by dividing the number of agreed upon occurrences of the behavior by the total number of observation opportunities and multiplying by 100. Total – all categories on the OSRAC-P – inter-observer agreement for the observations was 87% (range of 83% to 90%). Both coders were reliable with each other on the individual categories as well – 85% for activity level, 86% for activity type, 85% for where the activity took place, 95% for who the individual was with, and 86% for the support the individual was receiving.

Social Validity. Upon completion of the intervention, head teachers, assistant teachers, and occupational/physical therapists from each classroom were given a social validity survey

[2] When using a token system, teachers often ask the researcher to call out each minute that had elapsed in order to fill in a square on the chart. When all squares were filled, this indicated 10 minutes has passed and children participating in the entire intervention were given access to the treasure box.

(Appendix G) to fill out. The survey included questions about the intervention as whole as well as individual aspects of each intervention phase (teacher-led and increased portable equipment). Preschool students also completed a social validity interview (Appendix H). The lead researcher created a visual with the activities children participated in during the intervention to assist in decision making. Each child was pulled aside during class time and provided with the following verbal script (while pointing to each activity as it was being talked about), *"remember when you do lots of fun things on play court? You did things like play with toys, dance to songs, follow the leader or go on a mission, and do the activities the dice told you to. What thing did you like to do the best?"* Students' answers – a verbal response, a non-verbal point, or both – were accepted and recorded.

CHAPTER IV

Results

After two weeks of attempting to record at least three and preferably four baseline observations for each participant, intervention was started for Group 1, while Group 2 remained in a quasi-wait list control. After baseline, Group 1 received 11 days of intervention, 6 implementing the teacher-directed activity phase and 5 implementing the increased portable equipment phase. One more baseline point was collected for the participants in Group 2 before they then received 10 days of intervention, 6 implementing the teacher-directed activity phase and 4 implementing the increased portable equipment phase. Procedural fidelity was collected for 25% of data collection session and was distributed evenly across interventions (three observations per intervention). Inter-observer agreement (IOA) was collected for 20% of the observation sessions.

Individual data was collected and grouped to evaluate the effectiveness of both interventions on the whole group as well as the differences between participants with disabilities and participants without disabilities. The graphs below show the mean percentage of sedentary, light, and MVPA for each subgroup of participants. Figure 2 illustrates the means for accelerometer data for the whole participant sample collected across all baseline and interventions sessions. For the whole group (*n=15*), participants spent an average of 46.2% of baseline in sedentary behavior. This number was reduced to 27.6% and 29.7% for teacher led and increased equipment respectively. Participants engaged in moderate to vigorous physical activity 37.6% of the time during baseline and increased to 55% and 48.4% for teacher led and increased portable equipment.

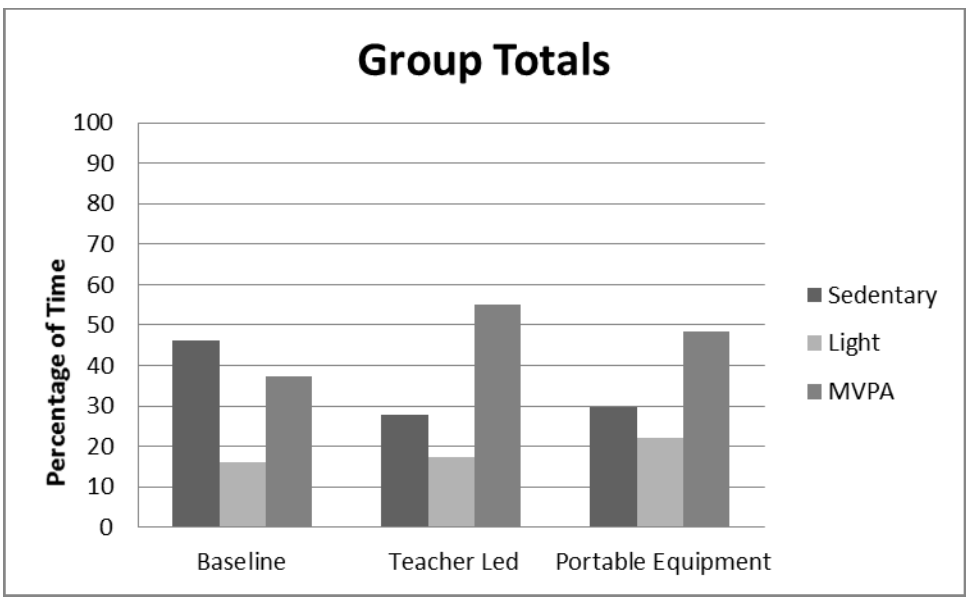
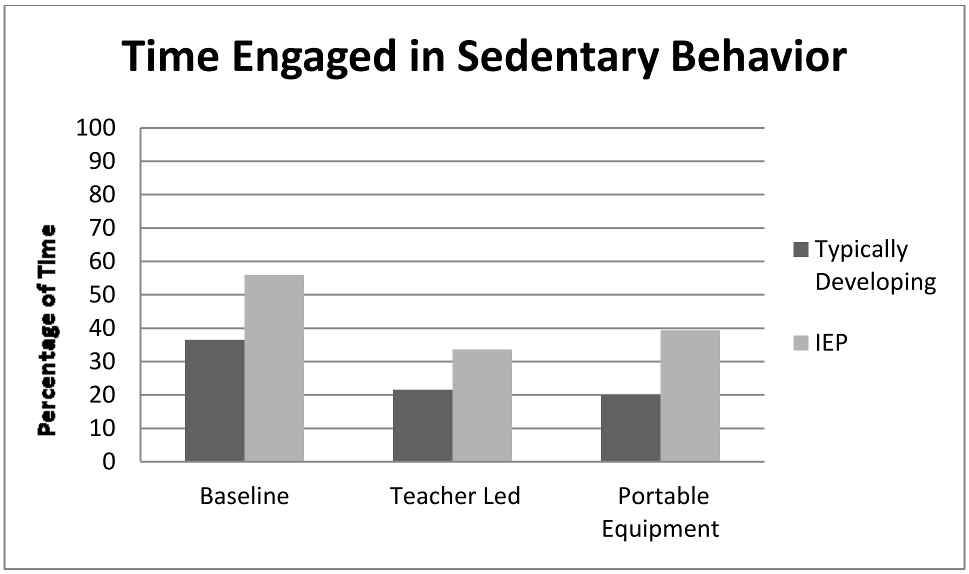
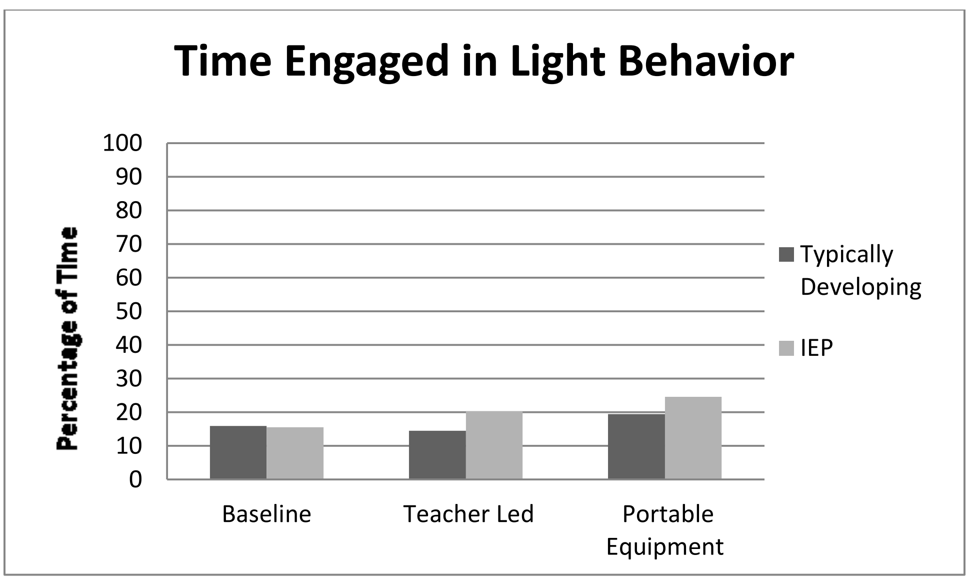


Figure 2. Whole group percentage of each intensity level during each phase of the study

Figure 3 compares the means of accelerometer data for children with IEPs and children without IEPs during each phase. Comparing students on IEPS to those who are typically developing showed that students on IEPs engaged, on average, in more sedentary behavior and less MVPA during recess. During baseline, students on IEPs spent an average of 55.96% in sedentary behavior while their typically developing counterparts spend 36.53% of their time engaged in sedentary behavior. Both groups saw decreases in sedentary behavior – about a 15% decrease for typically developing children and a 22% decrease for students on IEPs – when the teacher led activities were introduced. Non-IEP children's average sedentary behavior reduced slightly more with the presence of portable equipment (approximately 16.5% from baseline levels), while students on IEPs engaged in slightly more sedentary behavior when compared with teacher led activity, but still 16.5% less than baseline averages.





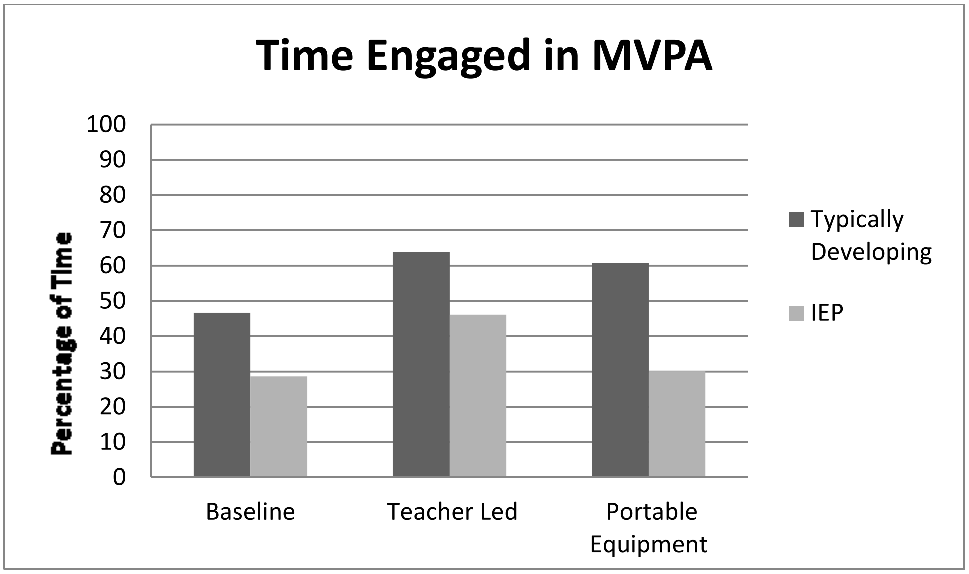
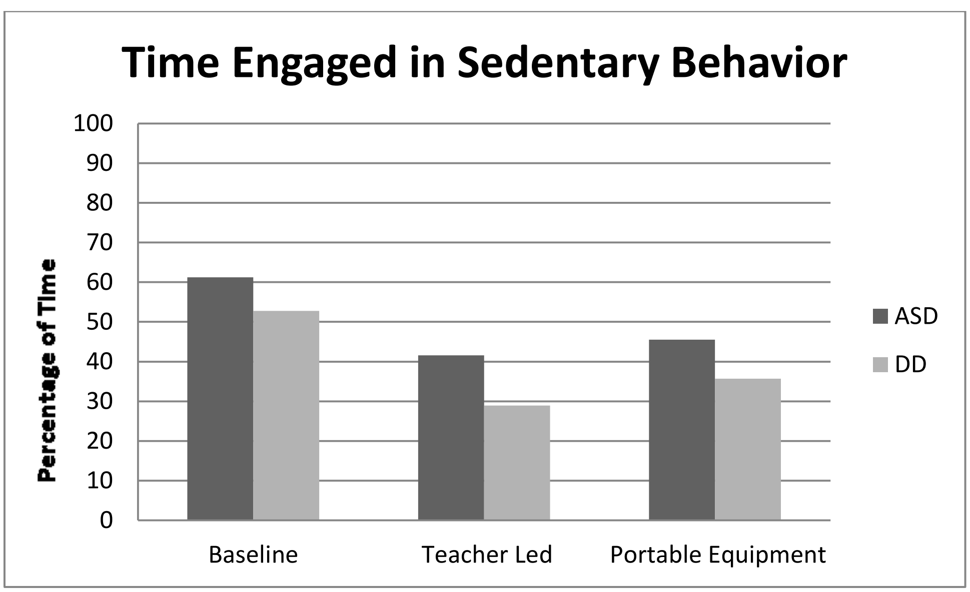
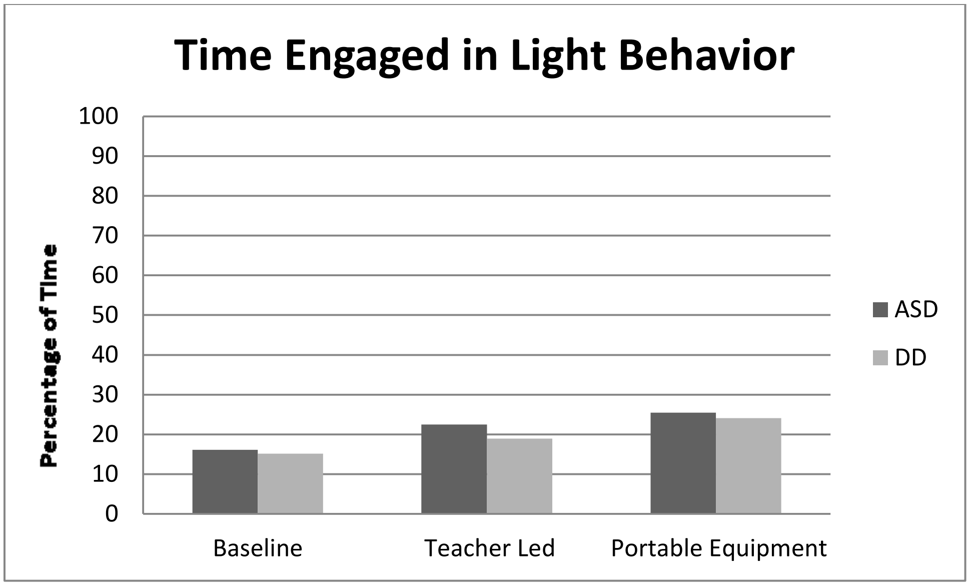


Figure 3. Comparison of percentage of time engaged in sedentary, light, and MVPA for typically developing participants and participants with IEPs

When children with ASD specifically are compared to non-ASD children on IEPs, the results are below in Figure 4. Students with ASD engaged in higher levels of sedentary behavior and lower levels of MVPA during baseline than those with developmental delays. Both groups did decrease sedentary behavior and increase MVPA during both interventions phases. However those with ASD did so at a lower rate than those with DD.





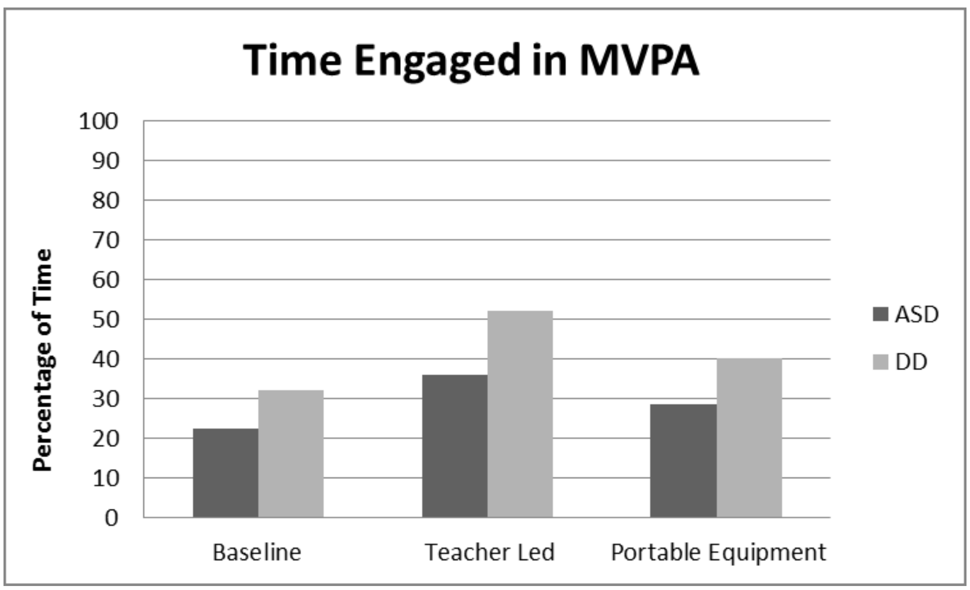
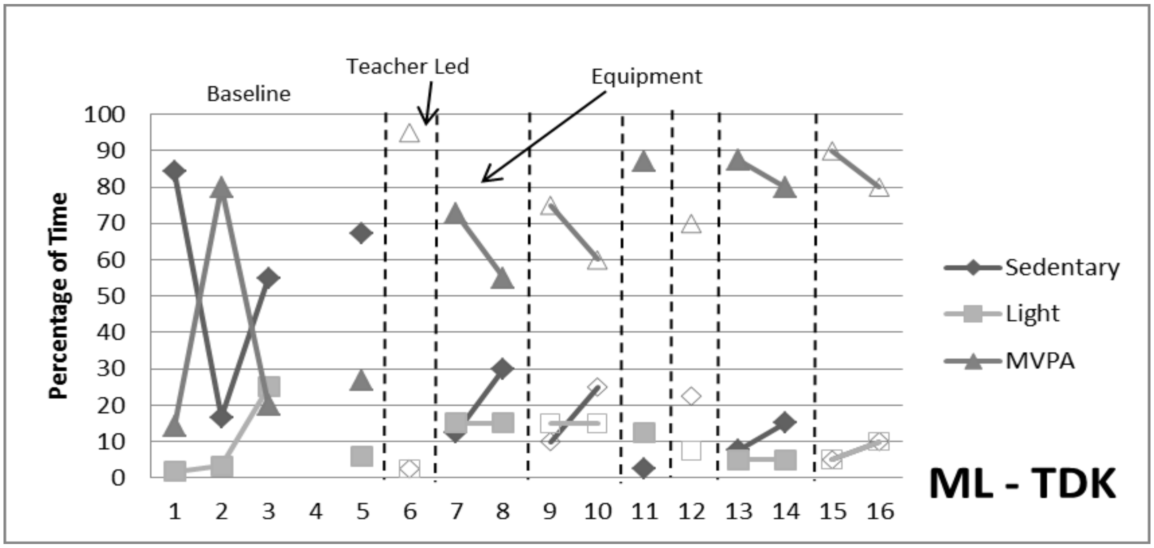


Figure 4. Comparison of percentage of time engaged in sedentary, light, and MVPA for participants with ASD and participants with DD

Figures 5-19 show individual accelerometer data collected for each child. The first of the two graphs shows the time series data throughout the course of the intervention, while the second graph illustrates the mean data during each intervention phase. Data is expressed as the percentage of time each child engaged in sedentary, light, and MVPA during each phase – baseline, intervention A, and intervention B – of the study.



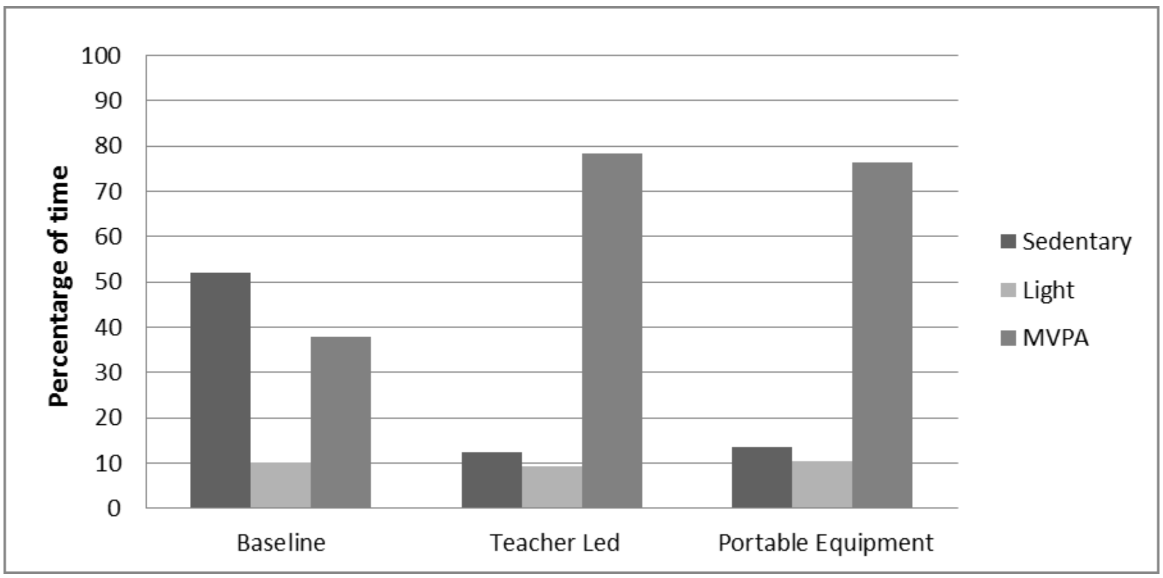


Figure 5. Time series and mean percentage of time engaged in sedentary, light, and moderate to vigorous physical activity by ML-TDK

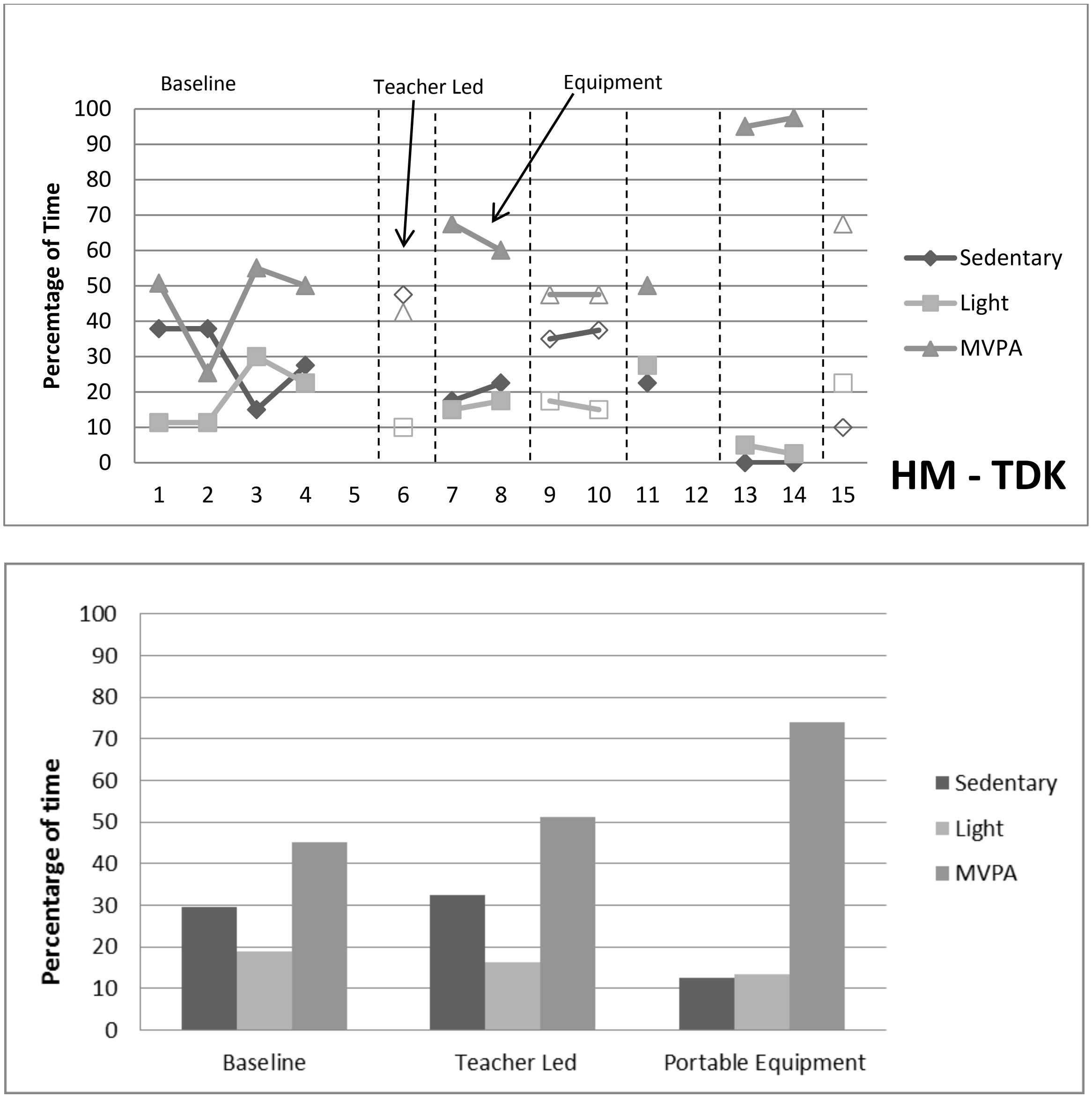
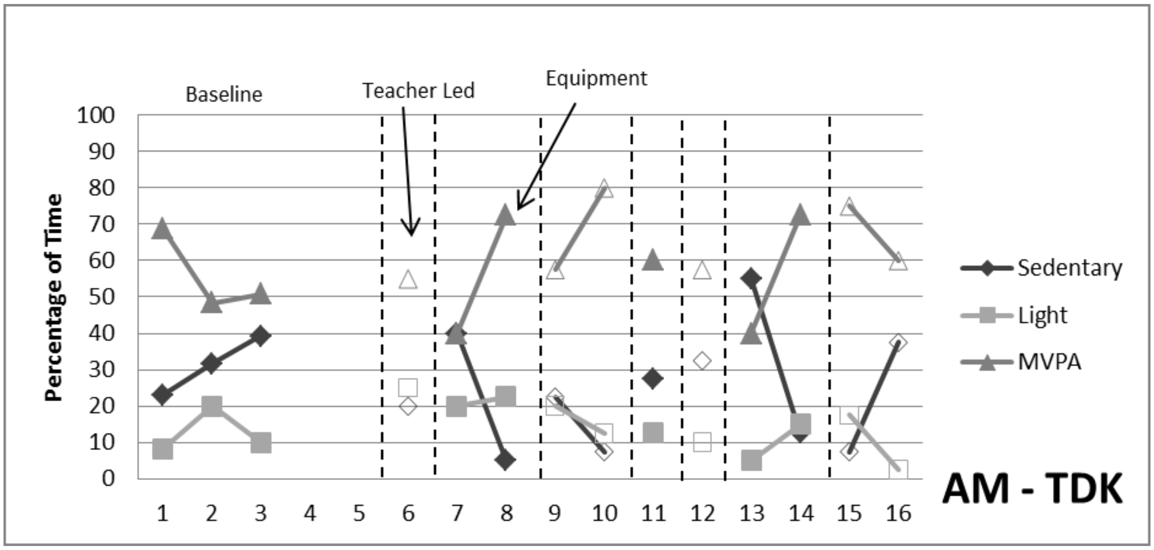


Figure 6. Time series and mean percentage of time engaged in sedentary, light, and moderate to vigorous physical activity by HM-TDK



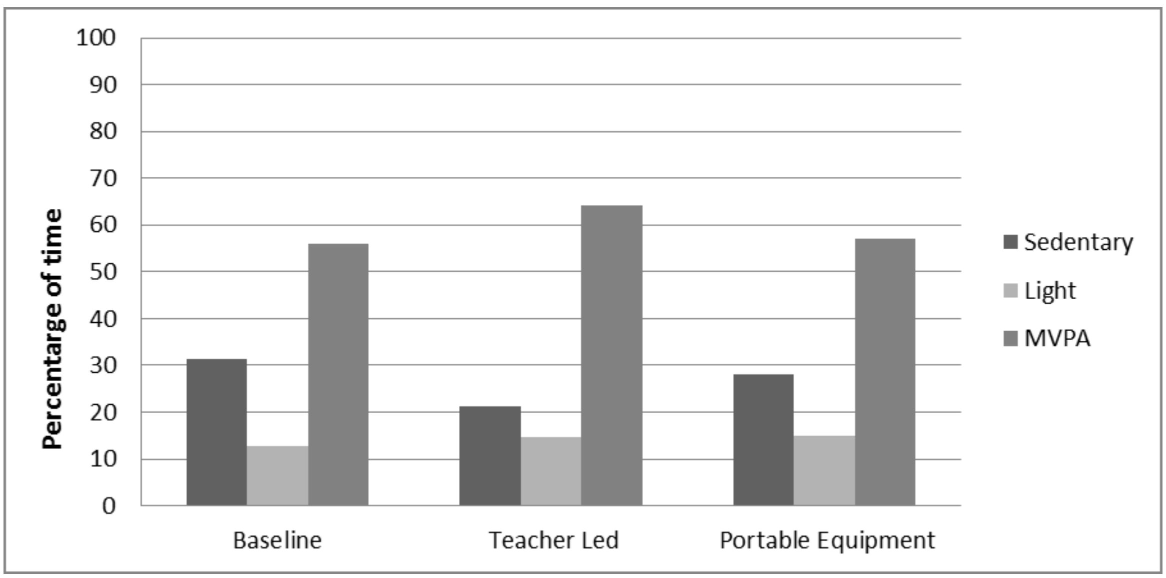
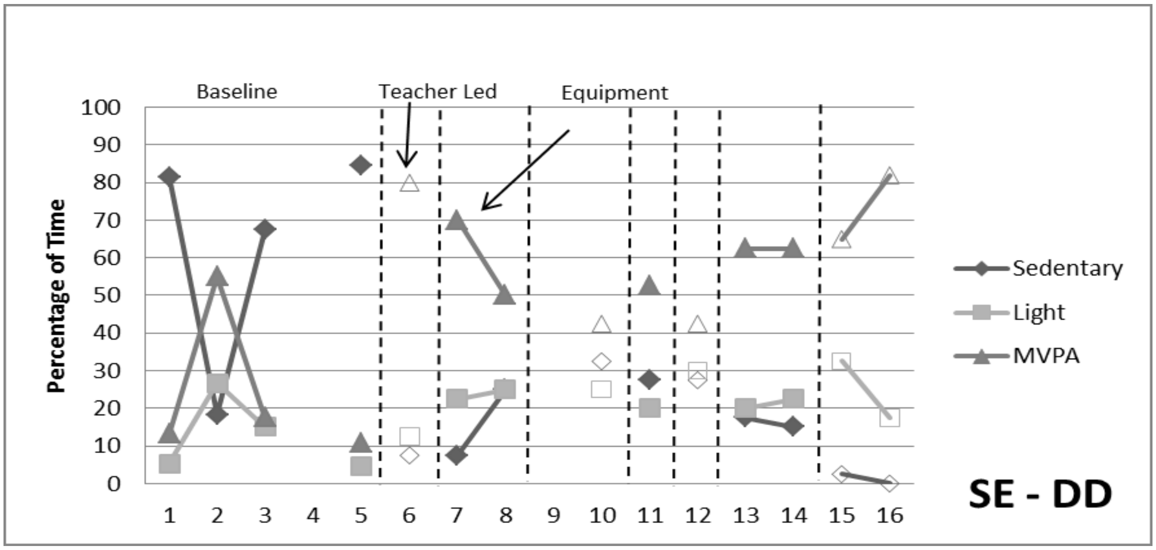


Figure 7. Time series and mean percentage of time engaged in sedentary, light, and moderate to vigorous physical activity by AM-TDK



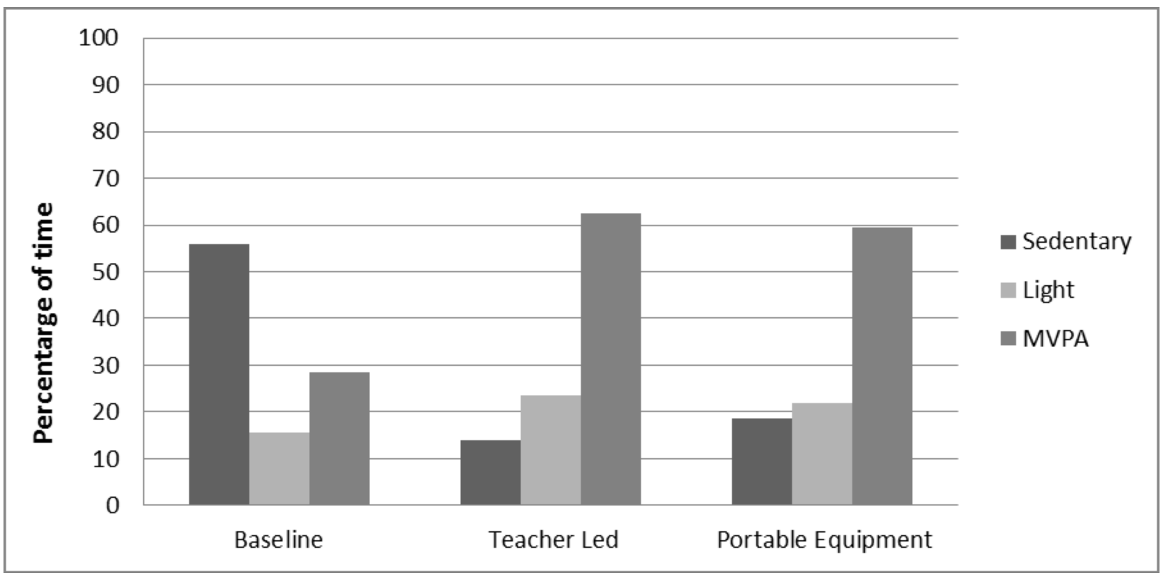
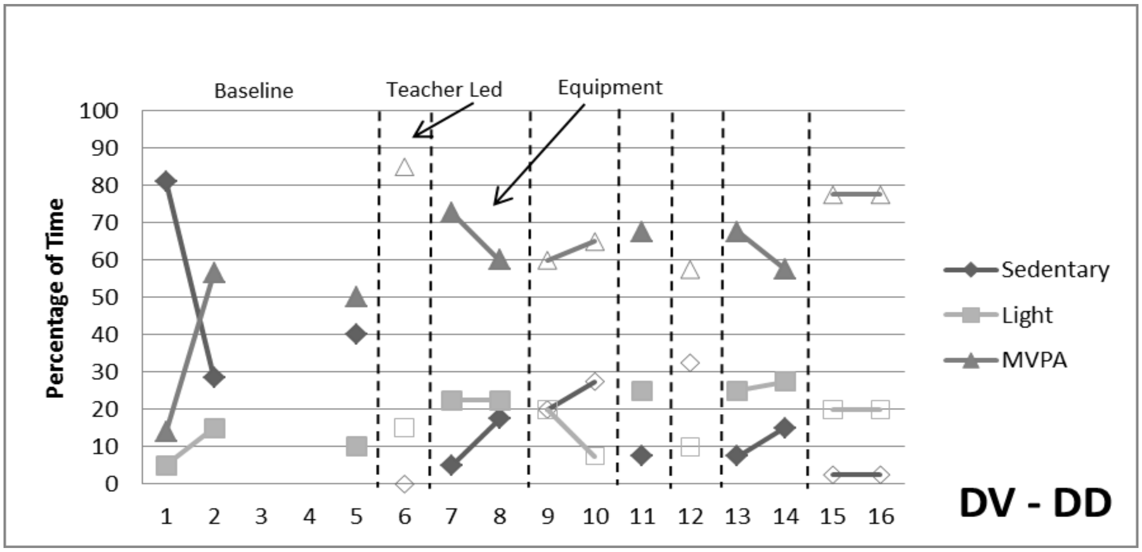


Figure 8. Time series and mean percentage of time engaged in sedentary, light, and moderate to vigorous physical activity by SE-DD



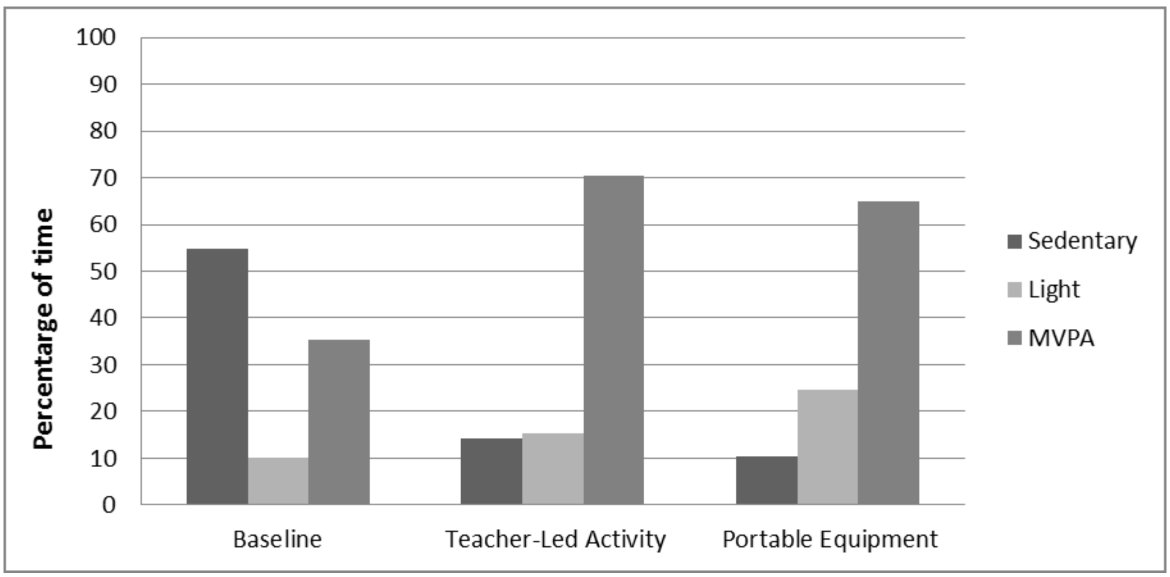
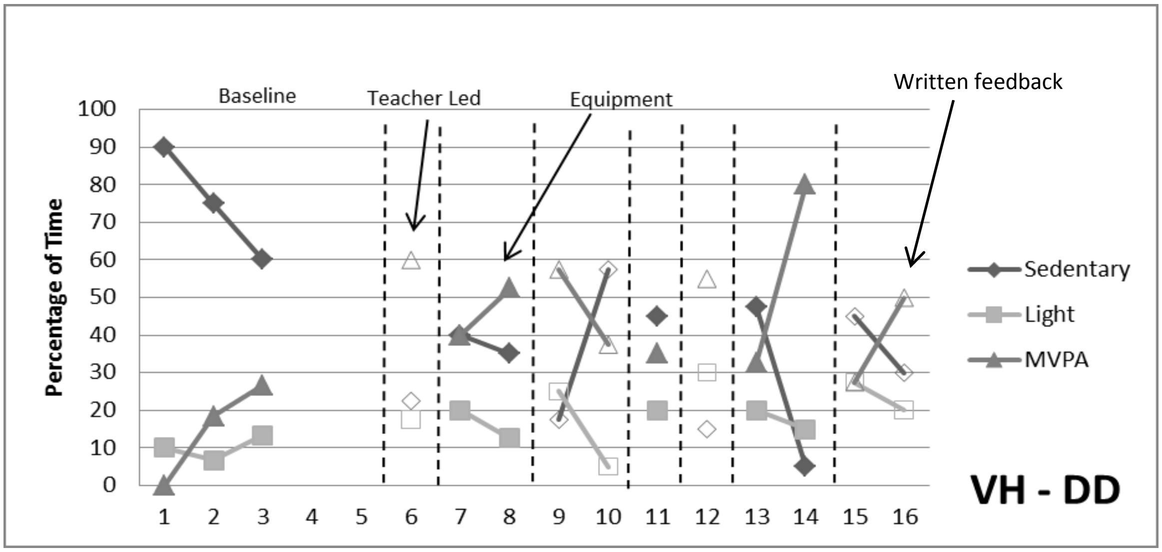


Figure 9. Time series and mean percentage of time engaged in sedentary, light, and moderate to vigorous physical activity by DV-DD



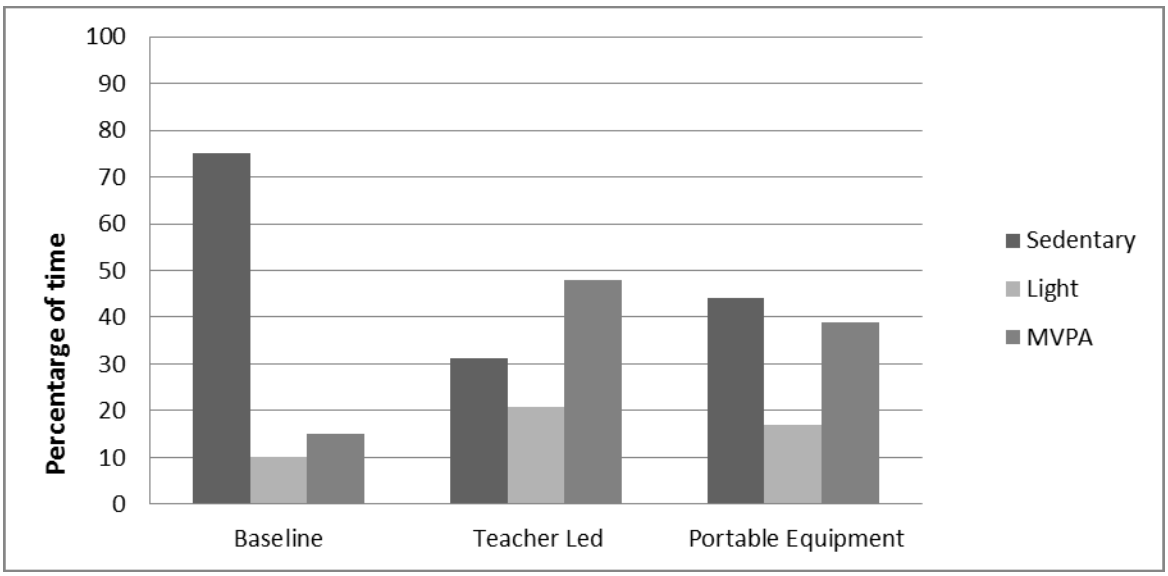
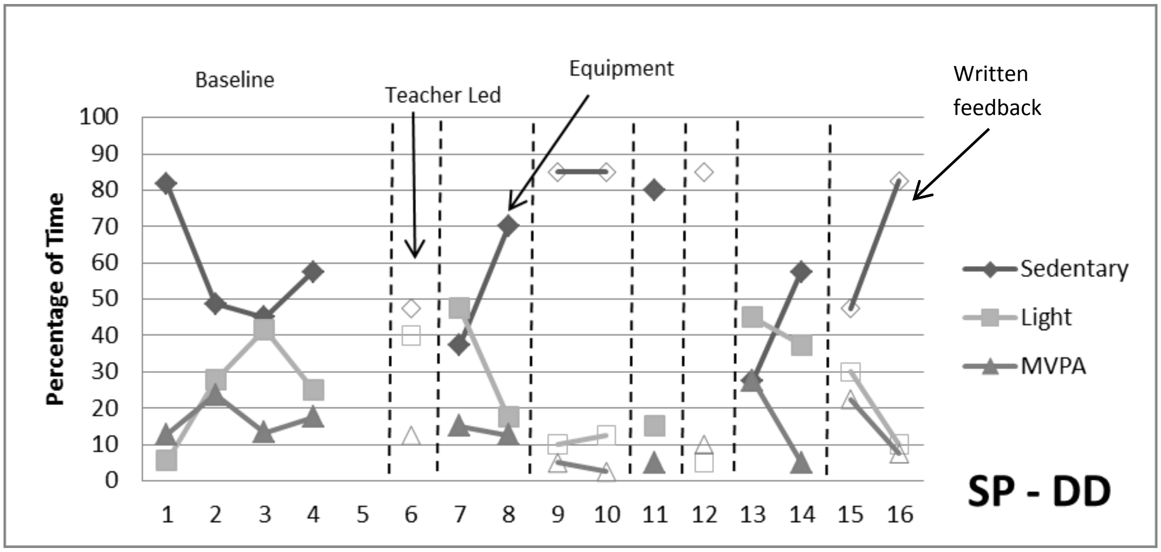


Figure 10. Time series and mean percentage of time engaged in sedentary, light, and moderate to vigorous physical activity by VH-DD



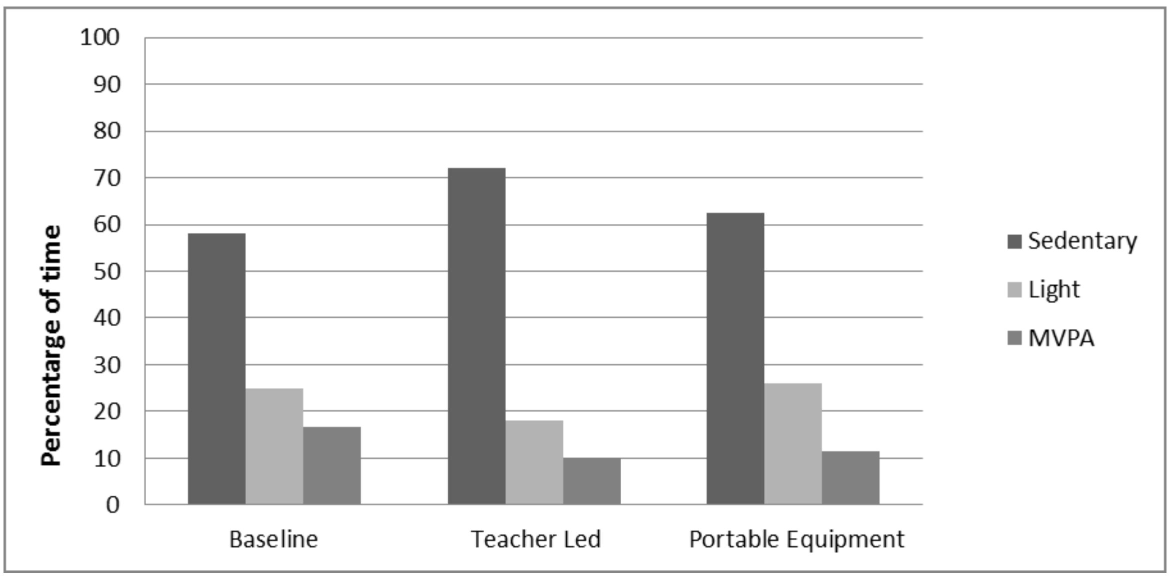
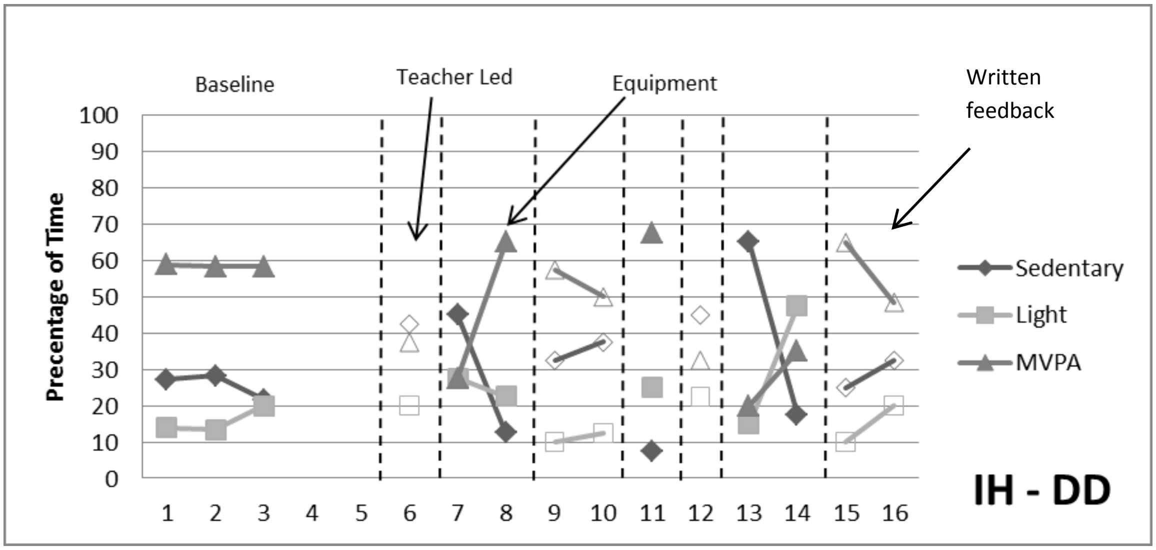


Figure 11. Time series and mean percentage of time engaged in sedentary, light, and moderate to vigorous physical activity by SP-DD



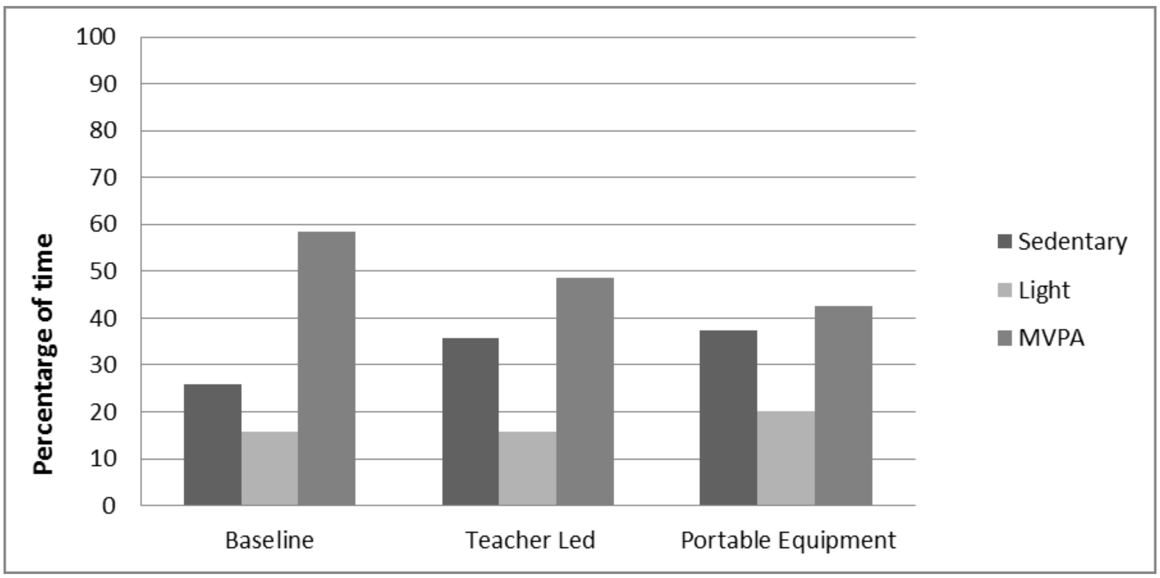
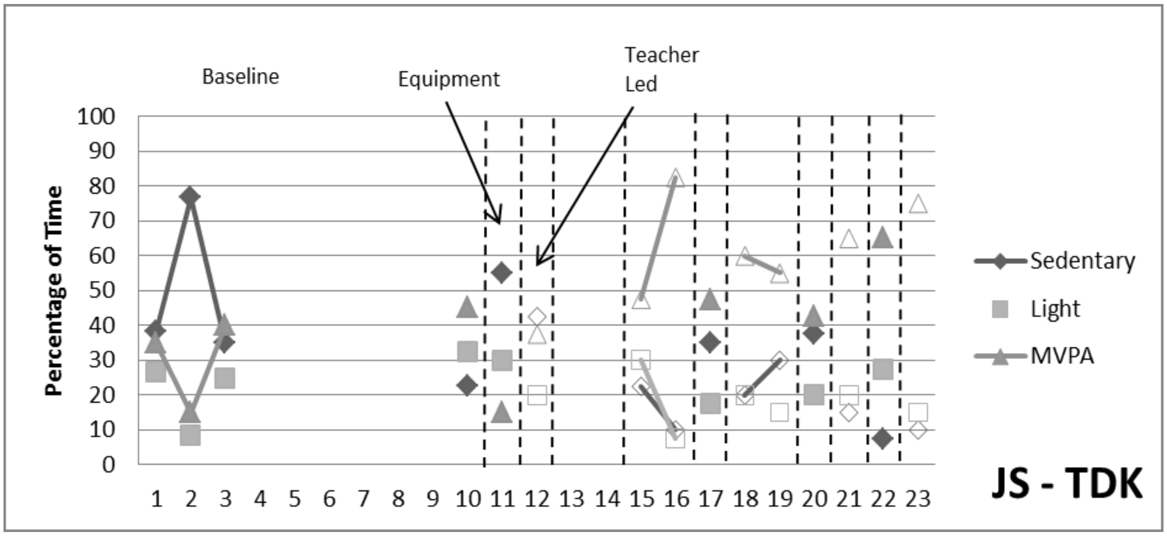


Figure 12. Time series and mean percentage of time engaged in sedentary, light, and moderate to vigorous physical activity by IH-DD



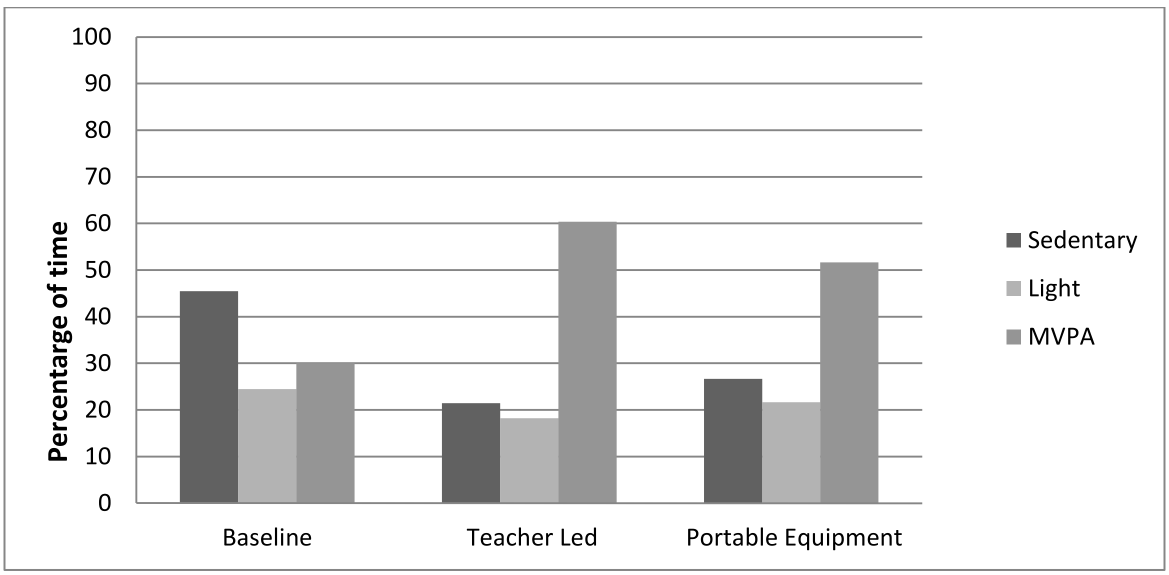
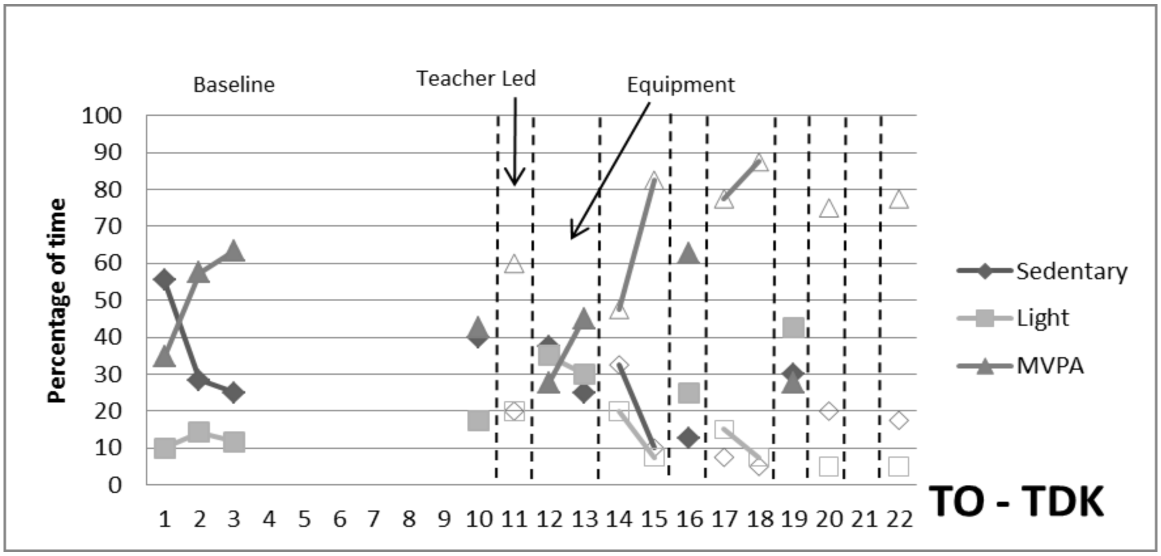


Figure 13. Time series and mean percentage of time engaged in sedentary, light, and moderate to vigorous physical activity by JS-TDK



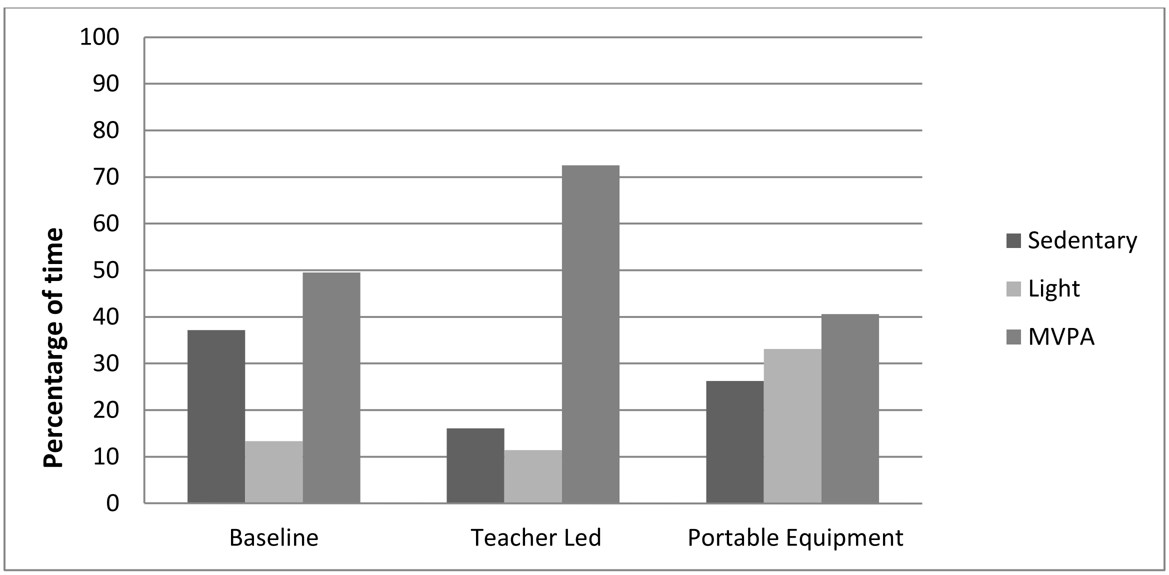
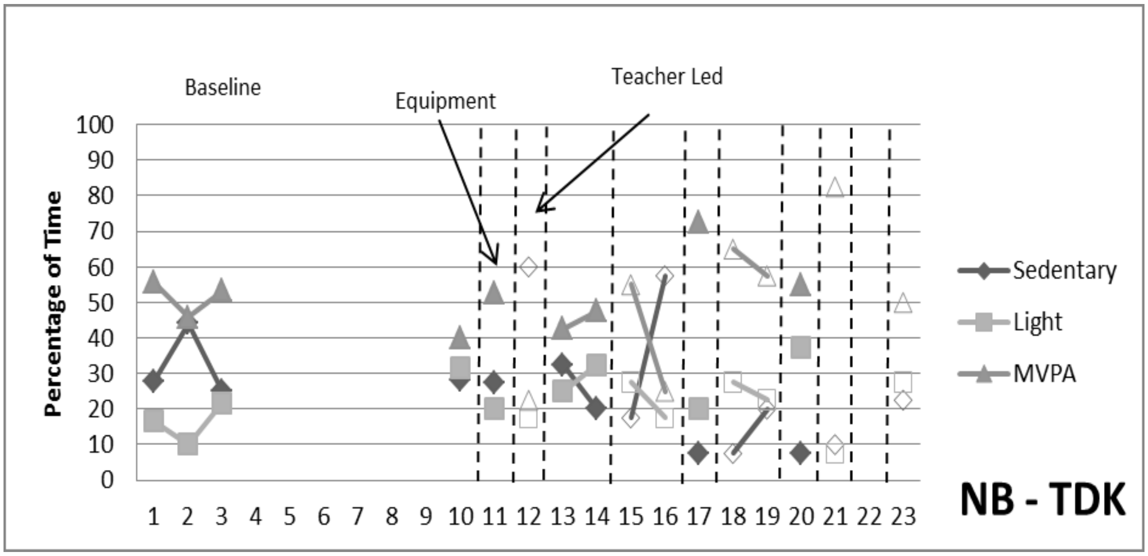


Figure 14. Time series and mean percentage of time engaged in sedentary, light, and moderate to vigorous physical activity by TFO-TDK



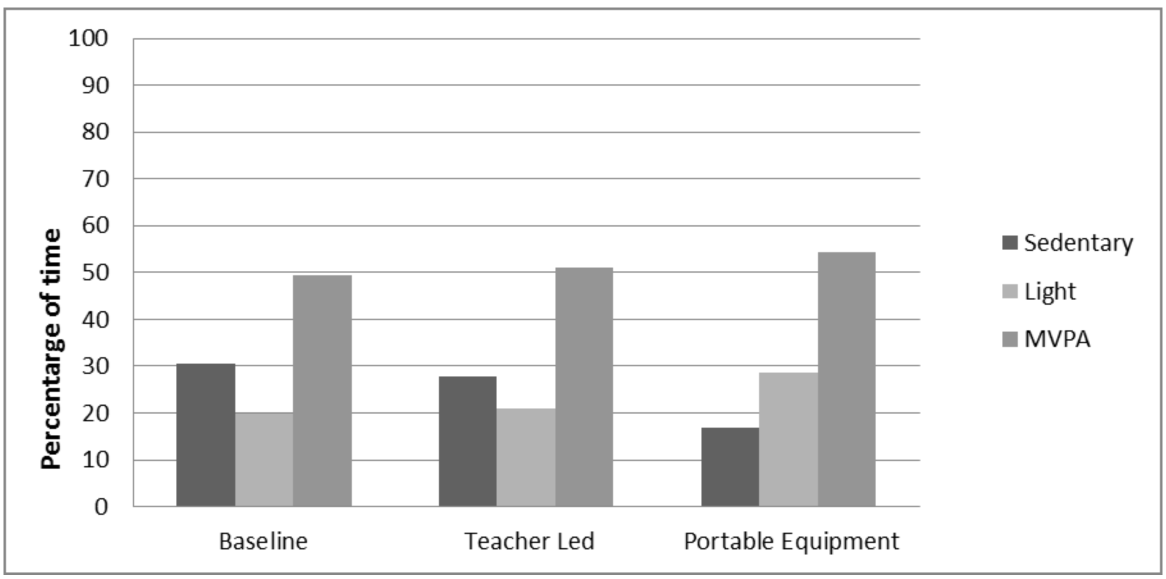
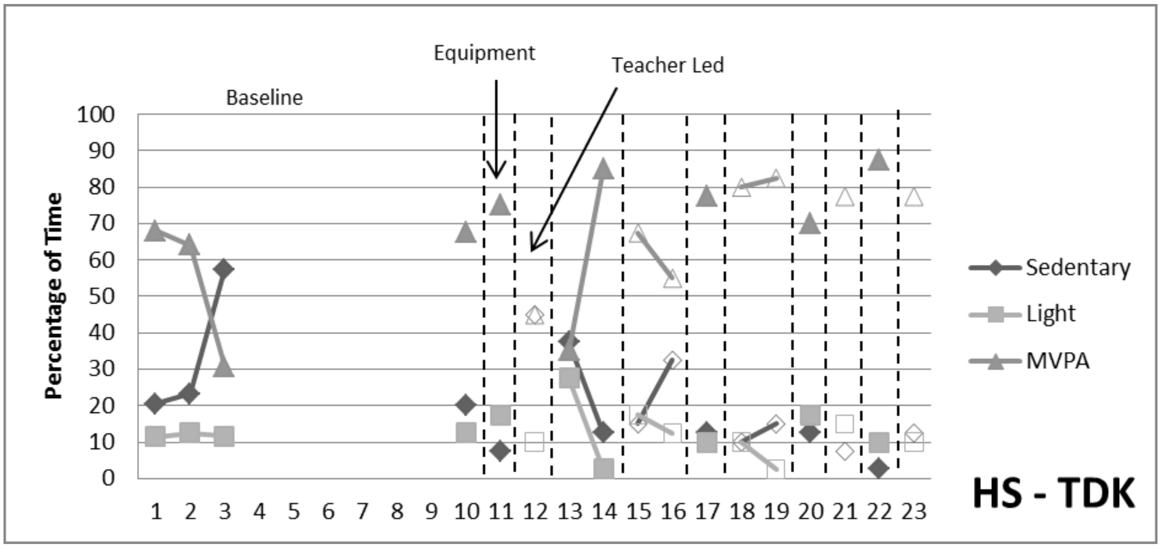


Figure 15. Time series and mean percentage of time engaged in sedentary, light, and moderate to vigorous physical activity by NB-TDK



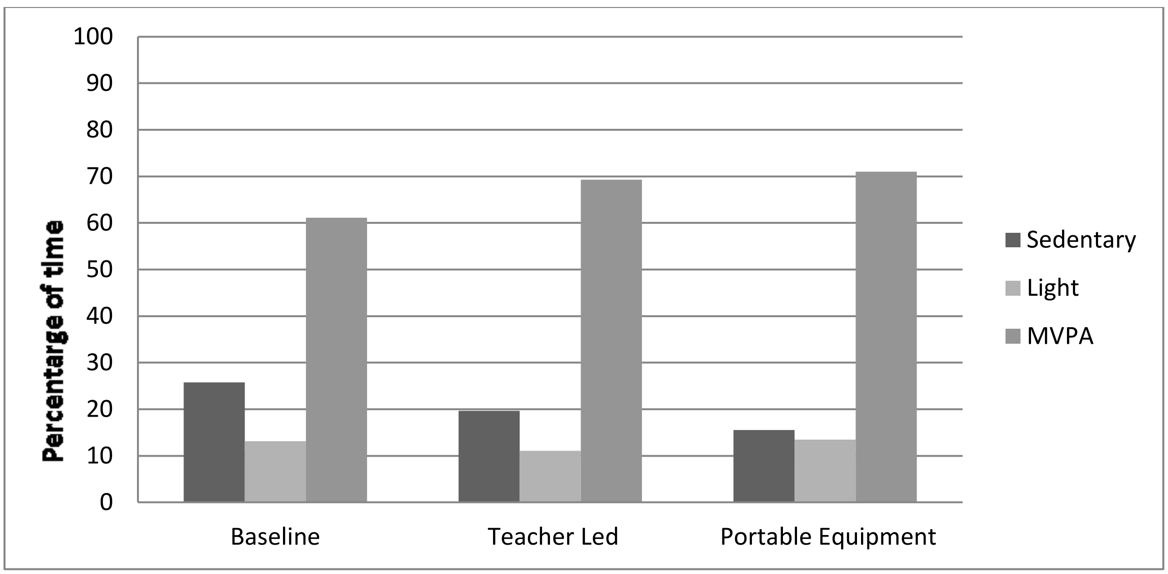


Figure 16. Time series and mean percentage of time engaged in sedentary, light, and moderate to vigorous physical activity by HS-TDK

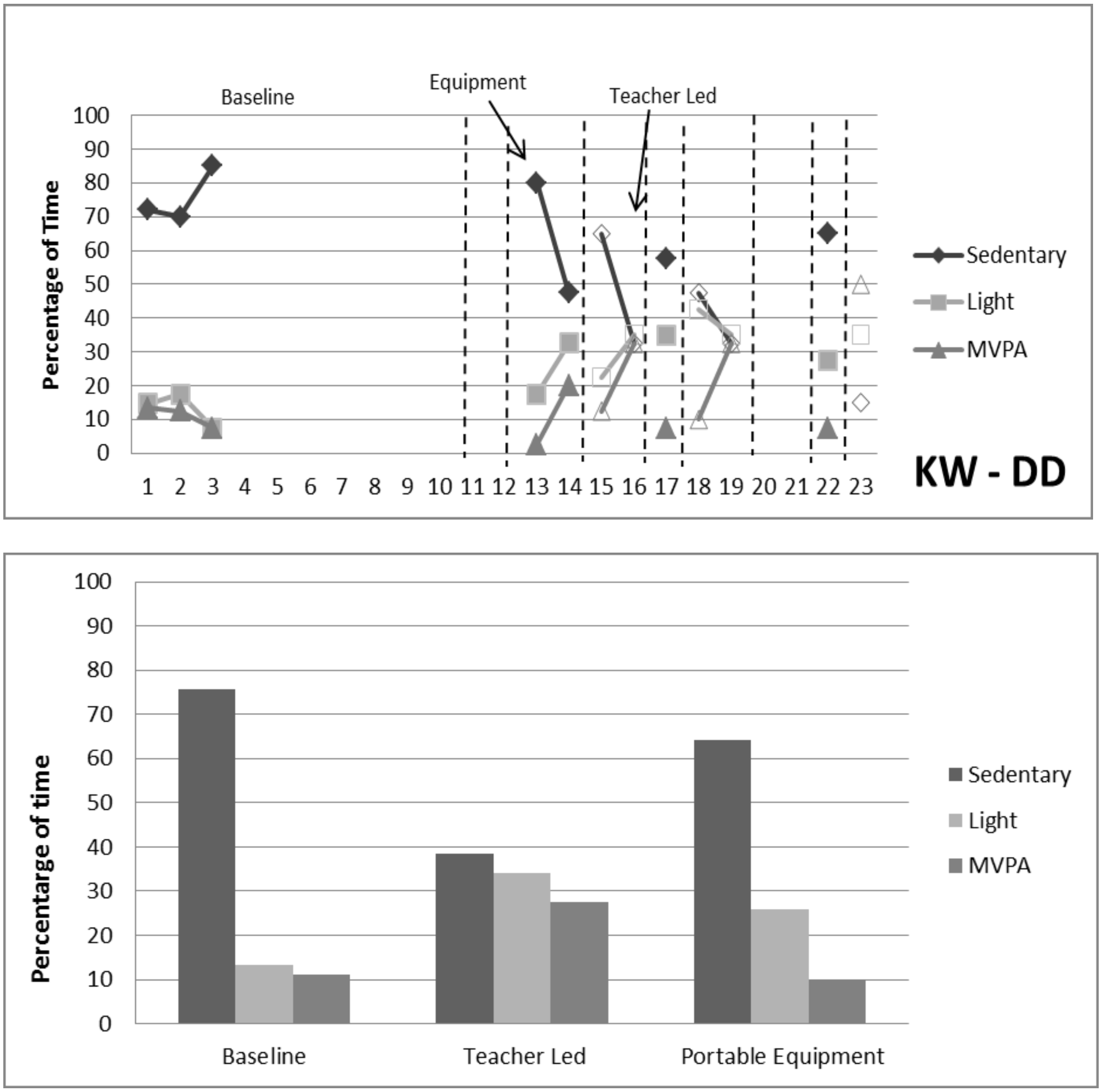
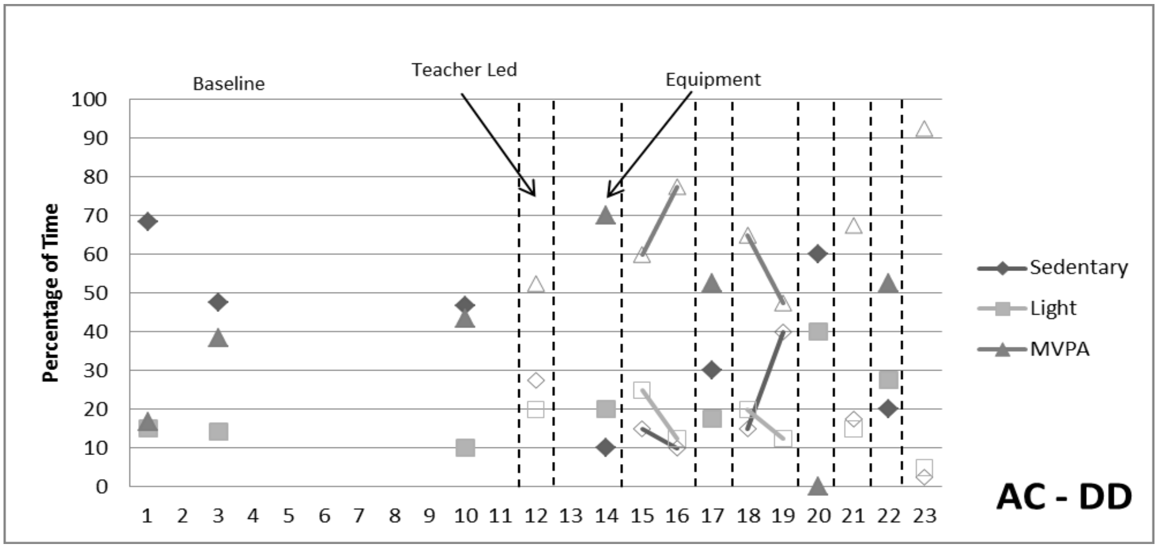


Figure 17. Time series and mean percentage of time engaged in sedentary, light, and moderate to vigorous physical activity by KW-DD



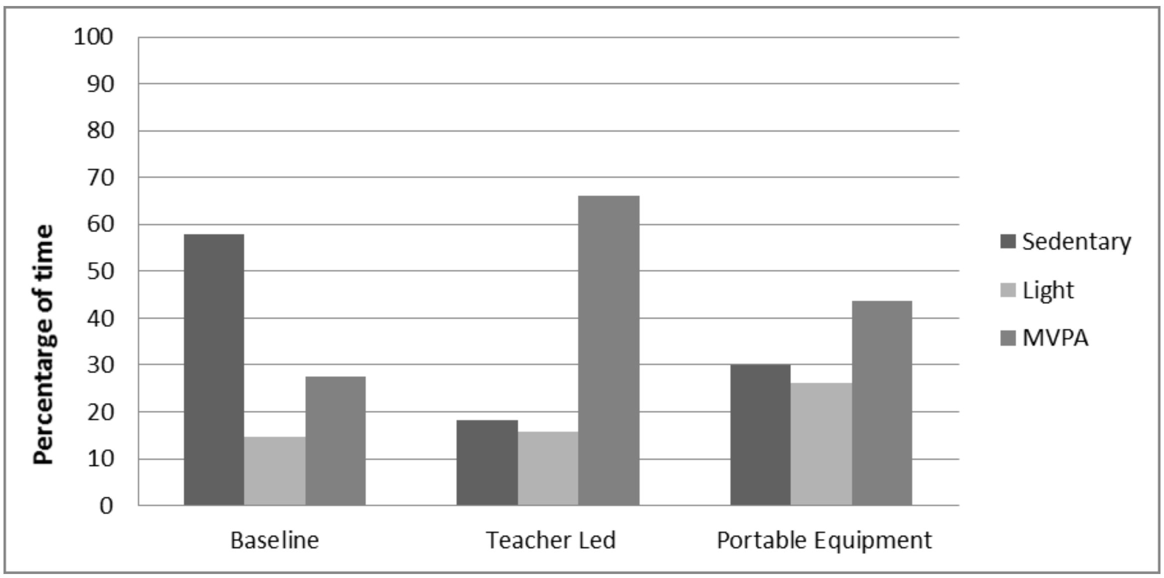
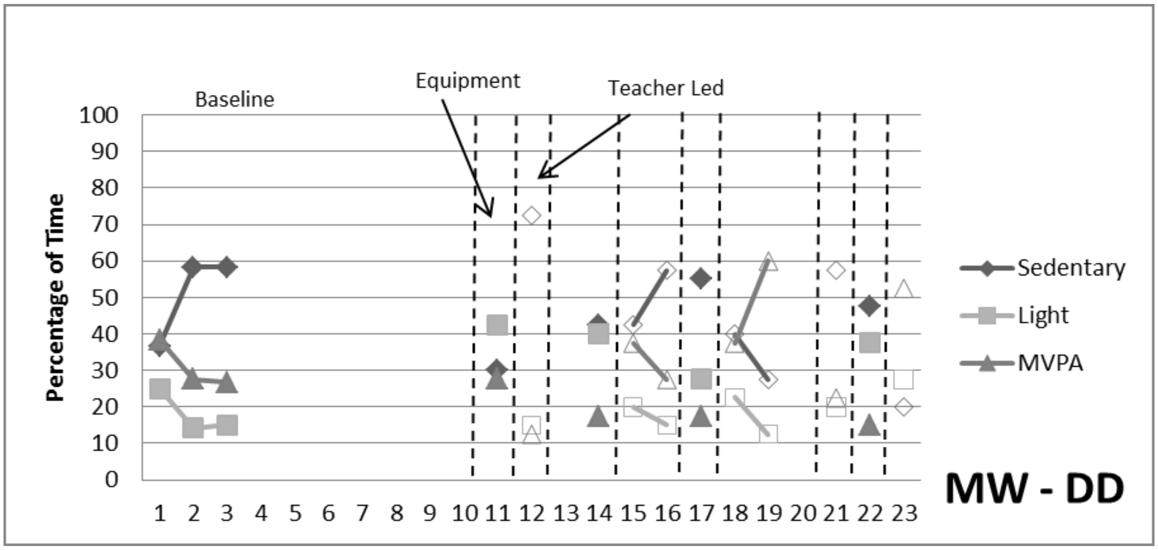


Figure 18. Time series and mean percentage of time engaged in sedentary, light, and moderate to vigorous physical activity by AC-DD



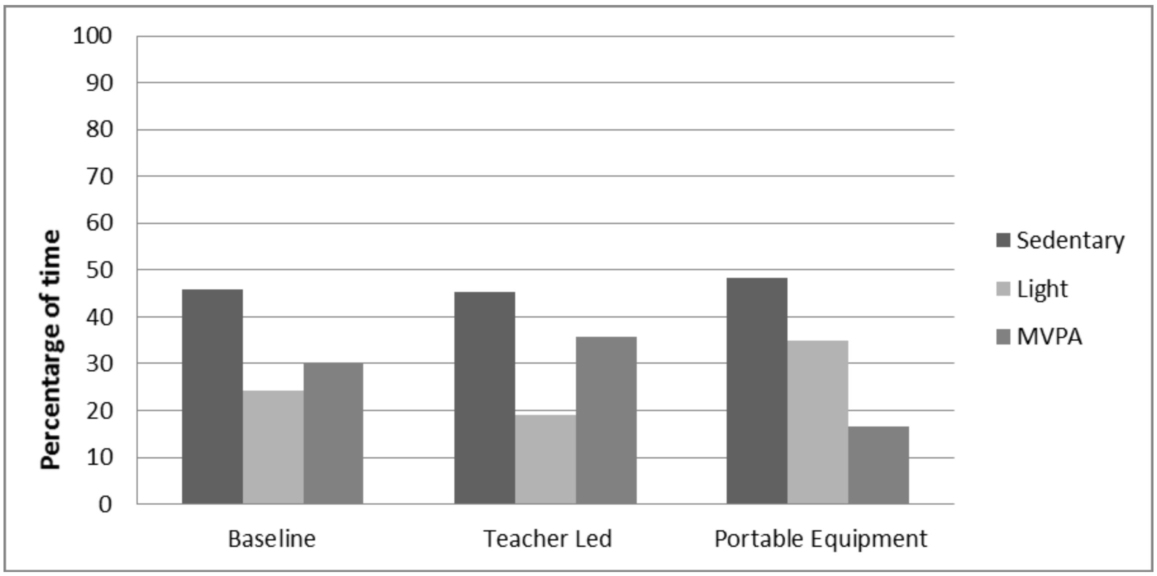


Figure 19. Time series and mean percentage of time engaged in sedentary, light, and moderate to vigorous physical activity by MW-DD

Overall both interventions – teacher led and increased presence of playground equipment – increased physical activity levels for children. Visual analysis shows that four children (AC, DV, ML, and VH) had zero or one overlapping MVPA data points between baseline and both interventions, a sign of an effective intervention when conducting single subject research. An additional four children (HM, HS, JS, and SE) had two to four data points overlap, showing some moderate effectiveness of the intervention. The interventions were also helpful in decreasing sedentary activity. For eight children (AC, AM, DV, KW, HS, ML, NB, and SE) the intervention was very effective in decreasing sedentary activity and moderately effective for one more (JS). The interventions were either not effective or negatively affected IH or SP, while MW increased light activity as a result of the interventions. While there did not seem to be a strong difference between the effects of either the teacher led and increased equipment interventions, some children (AC, KW, JS, and TO) appeared to increase their activity levels more during teacher led activities while HM and HS appeared to increase their activity levels during the presence of portable equipment.

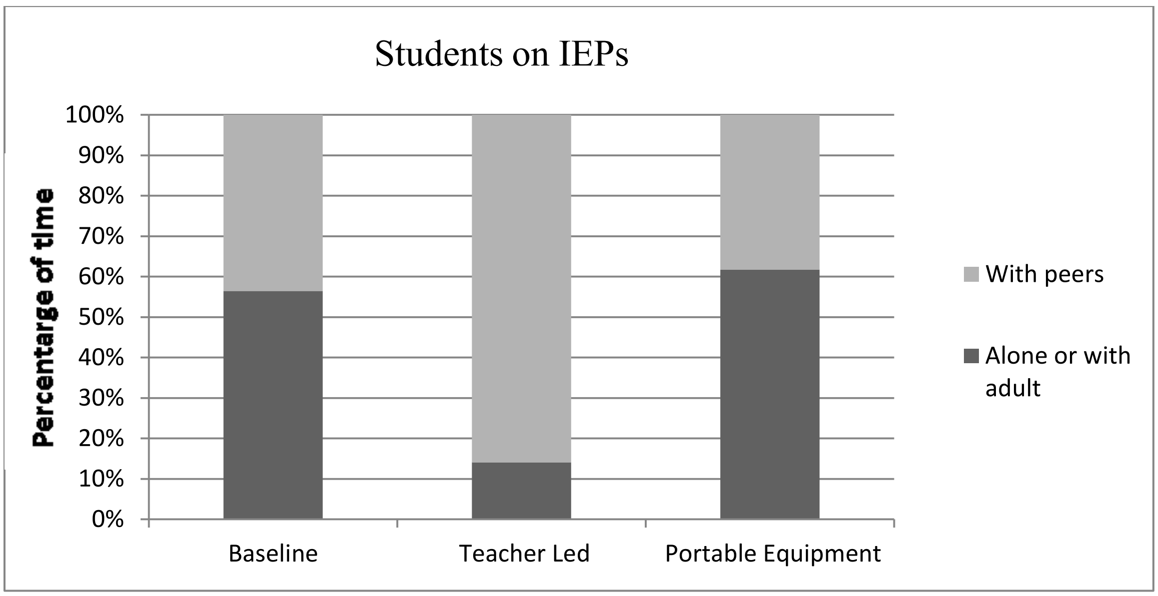
Some of the documented erratic activity trends of preschoolers occurred in this study, making it difficult to achieve a consistent and steady baseline or noticeable data trends for some of the participants during intervention. Thus, it is helpful to look at the means from each activity level during baseline, teacher led intervention, and the portable equipment intervention. The mean data for each participant shows that the intervention was effective in decreasing sedentary activity and/or increasing activity for all but two students (SP and VH). For 12 out of the 15 students, one or both interventions was effective at decreasing sedentary behavior and for 13 of 15 students, one or both interventions was effective at increasing MVPA. Eleven of the 15 participants (five typically developing and five on IEPs) saw both decreases in sedentary behavior and increases in MVPA when both interventions. The non-IEP participants whose sedentary behavior decreased during Intervention A (AM, ML, TO, NB, HS, and JS) did so an average of 17.9% (range 2.7-43.5). The students on IEPs (SE, DV, VH, KW, and AC), decreased sedentary behavior an average of 40.3% (range 35-49) during Intervention A. Intervention B decreased sedentary behavior for all non-IEP students an average of 16.6% (range 3-42) and decreased sedentary behavior for IEP participants an average of 30% (range 11-44).

	Sedentary	Light	MVPA
Intervention A – Teacher Led			
DD	40.3	10.1	30.2
TDK	17.9	-1.2	24.8
Intervention B – Equipment			
DD	30.1	11.3	18.8
TDK	16.6	3.5	11.1

Table 3. Mean change in percentage of time engaged in sedentary, light, and moderate to vigorous physical activity per group.

Individual data was also collected using the OSRAC-P. Data was collected at least one time (range 1-4 times) per phase of the intervention and the averages for each phase. The analysis of data will focus on the latter two components (type and context). During baseline, children engaged in an average of 6.7 different activities (range from 4 to 9) including sitting, standing, running, climbing and jumping. Children, as a whole, spent over 65% of the time engaged in 3 major activities: standing (25.1%), walking (21.7%), or running (19.7%). The largest range was seen from running with one child spending 1% of observations engaged in running and one child spending 50% of observations running. During the teacher led intervention, children participated in an average of 5.9 (range 3-9) different activities. Children were observed participating in higher rates of standing (32.2% of all observations), but also higher rates of walking (31.1%). During increased portable equipment phases, children engaged in an average of 6.7 activities (range 3-11).

Perhaps the most noteworthy data collected from the OSRAC-P is who children were spending time with. During baseline phases, all children spent almost half (46.3%) of their time alone or with only an adult. Children with disabilities spent 54% of the time alone or with an adult only while typically developing children spent 37.6% of their time alone or with an adult, leaving more time for interactions with other peers. During the teacher led activities (in which a teacher was gathering students and actively participating in an activity), all children were around peers – either with adult support or in a group of just preschoolers – 89.5% of the time. During intervention B (portable equipment), study participants were around peers 55.3% of the time. Children with disabilities however, were around peers significantly less (30% of observations) than children without disabilities (75.1% of observations). Though there was quite a range for individual children, children with disabilities were observed alone or with an adult only 70% of intervention B observations.



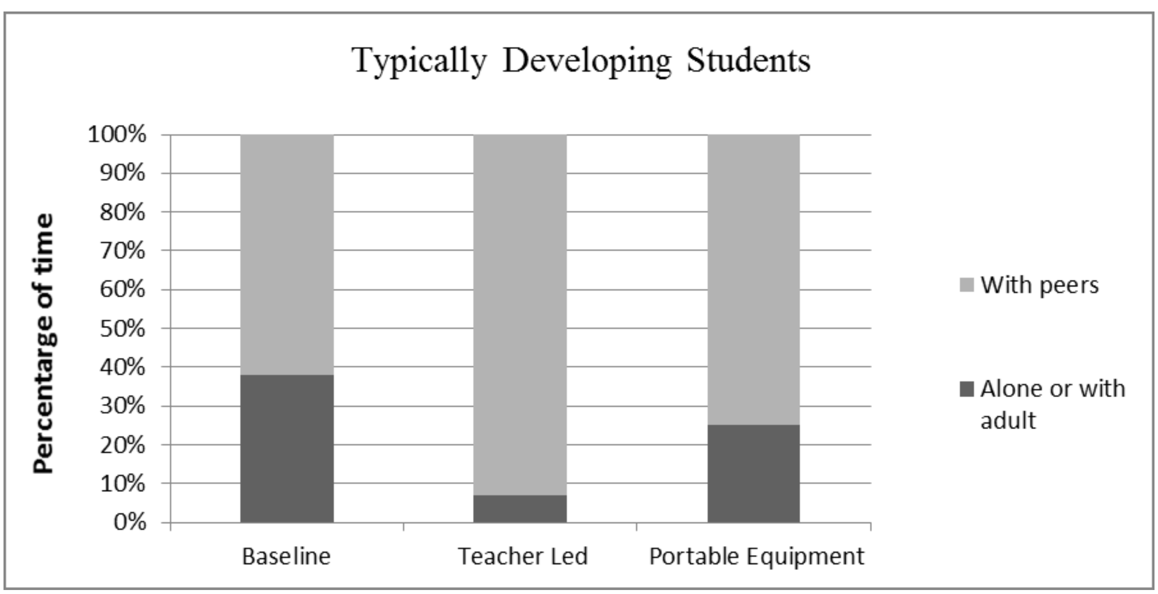


Figure 20. Percentage of time spent alone or with an adult only compared to time with peers for each phase of intervention per group

Participant's pre and post BMI measurements are shown below. One student (ML) saw a 1.1 decrease in BMI. While his weight remained similar at pre and post measurements, he grew 1.5 inches which resulted in the large decrease. Both children who were above the 85th percentile (overweight according to the CDC), reduced their BMI; one participant's BMI (AC) was reduced by .9, moving him to the healthy weight category. There were no other notable differences between the two measurements. This is most likely due to the short amount of time of the intervention.

Group	Child	Gender	Age	Pre-test BMI	Post-test BMI	Change
1	ML	Male	5.3	16.1	15	-1.1
1	HM	Female	4.8	16.3	16.2	-0.1
1	AM	Male	3.9	15.5	16	0.5
1	SE	Male	4.3	15.3	15.3	0
1	DV	Male	3.8	***	15.1	***
1	VH	Female	4.9	16.3	16.3	0
1	SP	Male	5.7	14.9	14.9	0
1	IH	Female	4.9	16	15.8	-0.2
2	JS	Male	4.7	17.5*	17.4*	-0.1
2	TFO	Male	5.1	16.8	17	0.2
2	NB	Female	3.7	13.4	13.2	-0.2
2	HS	Male	4.6	16	16.3	0.3
2	KW	Male	4.4	16.3**	16.7**	0.4
2	AC	Male	4.1	17.6*	16.7	-0.9
2	MW	Female	5.1	16.2	16.5	0.3
* above the 95th percentile, considered overweight by the CDC						
**calculated differently than others, due to behavior						
***data not available						

Table 4. Pre and Post BMI measurements

Social validity results. Social validity surveys were given to the head teacher, the assistant teacher, and the Occupational Therapist/Physical Therapist who provided services in each classroom (*n=13*). Eleven surveys were returned. Using a five point Likert scale – with 1 being 'very easy' and 5 being 'difficult', staff members scored the intervention as a whole a 2.9 to implement, with teacher-led activities scored separately as a 3.5 and increased presence of portable equipment scored a 1.4. Teachers felt that there was an increase in physical activity for the target students with an average score of 1.9 where 1 was a 'large increase' and 5 was a 'large decrease'. Teachers felt that study participants were slightly more engaged (1.3) during teacher-led activities that during increased playground equipment (1.9). On a similar scale (1 being very engaged and 5 being disengaged), teachers reported students as engaged (2.3) during intervention time. Teachers reported slightly more engagement during teacher directed activity (2.1) than playground equipment (2.6).

All survey respondents reported they would implement the activities again, though some stated changes they would make such as modeling appropriate use of toys, limiting the days toys were available to make them seem "special", and changing the format of the teacher-led activities. A majority of the written feedback was that 10 minutes was too long to engage preschool children in a specific activity and suggestions for a warm-up and cool down time as well as just shortening the intervention were given. One occupational therapist stated that the intervention got in the way of her being able to do her job. Anecdotally teachers saw some improvements in not just physical activity but communication and social interactions as well.

Preschool participants were also asked to provide information about what activity was their favorite during recess. Pictures of each activity were put on a piece of paper and children were verbally asked "what was your favorite thing to do on play court – play with toys, dance, follow the leader/go on a mission, or rolling the activity dice?" A point (for non-verbal children) or a verbal response were both accepted and recorded. While the author does acknowledge that this self-report is not a highly accurate representation, it is interesting to see the results and think of ways to make this measure more reliable in the future.

Type of activity	Number of preschoolers
Play with Toys	8
Dance Party	3
Follow the Leader	3
Roll the Activity Dice	0

Table 5. Preschool participant's social validity results

CHAPTER 5

Discussion

Overall both the teacher led activities and increasing portable equipment interventions were effective in increasing the levels of moderate to vigorous physical activity and decreasing the levels of sedentary activity for preschool children with and without disabilities when compared to the baseline condition. Teacher led activities, such as obstacle course/follow the leader and dance party, resulted in slightly higher levels of MVPA than increased equipment however, both interventions did increase the percentage of time that most participants spent in MVPA. Although the two interventions were equally effective for increasing activity levels for typically developing children, the teacher led activities were more successful than the equipment interventions in increasing activity levels for children with disabilities.

Children with disabilities were less active that children without disabilities and those with ASD were less active than the children with DD. While findings from this study – for children with and without disabilities – support work done by Brown and colleagues (2009) on typically developing children, it is especially interesting to note the context for when the children with disabilities were engaged in the most and least physical activity. Moderate to vigorous activity increased almost 20% for children with disabilities during the teacher led activities and less than

10% during the increased equipment phase while their typically developing counterparts increased MVPA by steadier percentages (13% for teacher led and 10% for increased equipment). Students with ASD had the highest levels of sedentary activity and the lowest levels of MVPA. When teacher led interventions were introduced, children with ASD reduced sedentary behavior by 21% and increased MVPA by nearly 15%. This is twice the increase seen when more equipment was introduced (7%). This seems to show that teacher support is a critical component for increased physical activity, especially among those students with disabilities. One reason for this is that children with disabilities, especially those with ASD may lack the motivation or skill to interact with peers or materials. When a teacher or adult helps guide the process, children with disabilities have clear expectations and demands and thus are better able to engage in an activity. Additionally, with the absence of concrete play materials, children with disabilities may have a harder time initiating play on the playground. The presence of novel materials did encourage those children with disabilities become slightly more active.

The individual time series data for each child supports other research that has documented the variable nature of preschooler's physical activity. Due to both constraints of the design and issues around measurement of activity level, steady baselines were difficult to achieve for many participants. For example, several children who exhibited low levels of MVPA one day, increased activity by 30%, 40% and in one case 70%, the next data collection session. Moderate to vigorous activity levels also dropped quickly from day to day. Because the intervention was implemented for all the children in the class, the start of intervention could not be delayed until all children demonstrated stable baseline. During intervention, only two participants (DV and IH) had consistently higher levels of MVPA (meaning no overlapping data points) during both interventions, while one additional child (AC) engaged in consistently higher levels of MVPA during teacher led activities. This individual data is helpful for specific programming and planning. Looking at the mean percentages for each participant shows that the intervention was moderately or very effective in increasing physical activity levels and/or decreasing sedentary behavior for all but two students (SP and VH). Both methods of analysis (time series and comparison of means) are helpful when determining the effectiveness of an intervention.

The observational data collected from the OSRAC-P shows no notable differences between the types of activities that the children engaged in during baseline as compared to activities during either intervention. Most children continued to exhibit higher levels of standing, walking, or running throughout each phase of the study. The most interesting and potentially important that that emerged from the OSRAC-P observations was the amount of time spent with peers across the different conditions. Children on IEPs spent more time alone or with an adult only during what would be considered unstructured playground time (baseline and equipment phases) that during adult directed activities. One child on the autism spectrum – a neurological disorder characterized by a deficit in social skills – spent 100% of baseline and 90% of equipment phases either alone or with an adult but was around peers with adult support 100% of the time during teacher led physical activities. This suggests that teachers play an important role in the socialization process for children with more significant delays who may require direction instruction around social skills. As noted, one of the defining characteristics for children on the autism spectrum is a deficit in social skills. Planned opportunities and explicit instruction on how to appropriately engage with peers is needed for many children with ASD, including how to enter play, how to engage in play itself, how to follow the changing flow of play, and conflict resolution during play. Anecdotally, it was surprising how willing students with disabilities, especially those with ASD, were to engage in the adult led physical activities. Very little support was needed to keep students with the group (though more support was needed to perform the actions of the activity). Thus, a novel and engaging activity seems to be the first component needed for facilitating social interactions amongst children with and without disabilities.

When planning activities, it is important for teachers to think about all of the skills necessary for participation and learning in a group setting. First, a child must be able to physically remain with a group, attend to the activity at hand and/or the person leading the group, follow the verbal and non-verbal cues/directions present during the activity, and interact or engage with others when appropriate. These are four larger skills that may need to be broken down further when teaching children with disabilities, especially those with ASD. To expect a child on the spectrum, or any children for that matter, to be successful at all of the skills without pre-teaching is risky. Instead a child may require instruction for each skill separately and time for the skills to build on one another. Anecdotally, this was evident in two different scenarios during this study. For SP, who exhibited no to low levels of peer proximity in unstructured settings, entering and remaining a part of the group during structured activities might have been the first step in group activities on the playground. Conversely, another student (KW) with ASD who also exhibited low levels of peer proximity and interaction during unstructured phases (less than 30% of observed sessions), saw a smaller increase – to 50% - during teacher led activities. This was because his gross motor skills were significantly delayed and he was learning to move faster and for more sustained periods of time. Though he was participating in the actions of the group, his speed was such that he was not always part of the group and needed adult support to maintain proximity to his peers.

These two cases lead into a discussion around what the intent of recess is and what a teacher's role during that time should be. Despite the evidence citing the multiple health benefits of physical activity (Janz et al., 2001; NCCDPHP, 1999), the rise of obesity in early childhood (Ogden et al., 2008), the high rates of sedentary behavior amongst children (Brown et al., 2009b; Pate et al., 2004; Tucker, 2008), and the need for social skills support for many children with disabilities, recess is rarely considered instructional time. In elementary school, a few teacher's aides (usually not as trained as head teachers) supervise numerous students while teachers take a much needed break or prepare for the next activity. Additionally, for children who have been challenged cognitively in class, recess is a time to relax and be free of demands or to spend time socializing with friends. The social validity results of this study (discussed below) show that teachers did feel that the teacher led activities were too long and that implementation was difficult, decreasing the likelihood that the lessons would be implemented after completion of the intervention.

In this study, despite the strong evidence for both interventions, one was much better received than the other by teachers and other staff members. Teachers found that implementing the playground equipment phase was much easier and all reported they would continue to use this intervention. Besides putting out and cleaning up the equipment, there was very little demand on a teacher's time and little effort needed to be put forth. In contrast, staff overwhelmingly reported that the teacher led activities were difficult to maintain for 10 minutes. The preschool day is a little over two hours long and children (and adults) are not used to participating in a single, highly structured activity throughout the day for more than 10 minutes. Teachers did come up with creative ways to maintain engagement throughout the full ten minutes, such as switching the teacher leading the activity halfway through or using a whole class token system to mark the minutes passed, but most reported that they would not implement the teacher led activities without some modifications.

Implications

There are both long term and short term implications of this study. Short term, this study adds to the literature showing adult planning and instruction, at the preschool level, can lead to increased physical activity (Wadsworth et al., 2011; Brown et al., 2009). Perhaps more important is that children with disabilities increased PA at similar or higher levels than their typically developing counterparts. As show in other studies, PA increases can increase attention (Greico et al., 2009) and decrease inappropriate behavior. Although data was not collected for subsequent classroom behavior for this study, implications are that increases in activity levels found as a result of the interventions could also affect classroom behavior as well.

A second short term implication is that carefully constructed physical activity activities can bring groups of peers together in a way that other classroom activities might not. This creates fun and engaging opportunities to teach not just physical activity and health related concepts but perhaps social and cognitive skills as well. The physically active academic lesson plans taught in the elementary schools (Kibbe et al., 2012, CDC, 2010) may be adapted to teach age appropriate concepts to preschool-aged students.

Increased physical activity has lifelong health benefits. Long term, a more active lifestyle can not only increase quality of life for many individuals, but it can impact our nation's infrastructure as well. Current healthcare costs for people with disabilities is burdensome for both families and society. The estimated "expense burden" to the healthcare system for autism related expenditures rose 142% between 2000 and 2004 and the estimated lifetime healthcare costs for a person with ASD is now more than 1.6 million (Kogan, et. al, 2009). The lifetime per capita cost (including adult care and lost productivity) is 3.2 million (Dawson, Rogers, Munson, Smith, et al., 2009). In addition, it is estimated that individuals with mental retardation (MR) have an average lifetime economic cost of just over 1 million dollars per person (CDC, 2004). Due to these numbers as well as the fact that people with developmental disabilities routinely have more health concerns than those without disabilities (Sigofoos, Arthur, & O'Rielly, 2003), it has been suggested that by increasing physical activity in individuals with developmental disabilities, secondary health conditions can be lowered thereby reducing overall health care costs and improving quality of life (Traci et al., 2002). While a divide exists between the levels of physical activity between adults with MR and adults without MR, there is little information if this disparity is present in preschool and elementary aged children (Foley, Bryan, & McCubbin, 2008). The long implication is that if young children with disabilities learn the skills necessary to become more active and have the support to maintain that active lifestyle, some of these healthcare costs may decrease over time.

Limitations

There are several limitations of this study. First, the context of the intervention may not be generalizable to other settings. The intervention took place at a school on a university campus where children and staff may not be similar to that of the general preschool population. Only 13% of this sample population for this study was classified as overweight by the CDC guidelines. This is significantly under the 31% of overview children nationwide (Ogden et al., 2008). Thus these children may have already been more active and/or more willing to participate in physical activities than another population. In addition, the trained staff provided many "invisible supports" – such as proximal and behavior specific praised – to keep kids engaged and interacting with each other and materials. This high quality environment has already been shown be correlated with higher levels of physical activity (Dowda et al., 2004) and, again, may not be replicated at other preschool cites. A second limitation to the study is the sample size. One goal of the intervention was to learn more about the PA trends of both children with and without disabilities, which the study was able to do. However, results from the small number in each group again may not be generalizable. In addition, extensive cost would be involved in purchasing more accelerometers for a large n study. A final limitation of the study was that procedural fidelity was not always high. Although most days that fidelity data was collected were above 80%, two classes each had one day and one class had two days where protocol was only followed 60% of the time. The class with two days of low protocol was due to late arrival (because of bus pick-up) onto the playground. During one particular observation in another classroom, teachers had a difficult time keeping the target children engaged in the activity for more than 6 minutes.

Future Research

There are several areas of future research to consider as a result of this study's findings. First is that more physical activity research involving young children with special needs needs to be conducted. While there is a great deal of descriptive data on preschoolers without special needs and their activity levels, there is very little known about the trends of children with disabilities, especially those with intellectual disabilities within a school setting. It would also be helpful to find a way of comparing data across studies. Given that preschool aged children spend their time away from home in many different settings (home-based child care, center-based child care, public school, Montessori school) for a varied amount of time (full day, half day, different days of the week), methods are needed to make results interpretable in the same way. Perhaps minutes every hour spent in a certain intensity level would help. Another measurement concern is the reliability of different methods used. Research in this area is becoming increasingly stronger and more reliable, but reliability between different tools continues to be looked at.

One question that commonly arose during data collection and analysis was "is there a threshold for moderate to vigorous physical activity amongst preschool students?" Previous research has shown a great range of percentage of time engaged in MVPA, so it still appears this question has not been answered. The data from this study shows that, in general, the interventions were less effective in increasing MVPA with the children who were more active as these children were already engaged in moderate levels of activity. We know that the guidelines set forth by the NASPE state at least 60 minutes of structured activity and 60 minutes or more of unstructured physical activity a day, but how does that translate into a day potentially broken down into time in multiple environments or contexts (i.e. time in preschool, time in daycare, time at home with a babysitter, time at home with parents)? In addition, because preschoolers' activity is defined by multiple bouts of short, sometimes intense energy bursts, it is often difficult to tell the true amount of time spent in MVPA.

A third area of research that would be of interest involves other interventions that could take place as a result of the OSRAC-P data. The observational data showed that during teacher directed activities children with disabilities were more likely to be in the vicinity of peers, making this an appropriate time to work on social interventions as well. Continued research around the benefits of physical activity for preschoolers is also a key area for future research. Studies that have looked at increased responding and time on task in older students (CDC, 2010) should be replicated at the preschool age.

Another potential study would look at the effects of teacher-mediated play during preschool hours to increase PA. As mentioned earlier, several teachers would have liked to model appropriate use of the playground materials prior to the children interacting with them. Changing protocol slightly such that physical activity with materials was modeling and encouraging would be an interesting modification to the present study. This enhances the intervention phase which teacher reportedly preferred (playground equipment) by using some aspects of the intervention that was statistically more effective (teacher-directed).

Finally, as with any small study, replication of the current study would always be helpful. As noted in the limitations, this population may not have represented a normal sample as no children were obese and the high quality school setting is not always typical. Using a great number of participants from a wider variety of race, weight, and socio-economic status would be encouraged.

In conclusion, research shows that physical activity can enhance multiple aspects of a child's life, including physically (NCCDPHP), behaviorally (Baumeister & MacLean, 1984; Celiberti, Bobo, Kelly, Harris, & Handleman, 1997; Elliott et al., 1997; Kern et al., 1982; Kern et al., 1984; Rosenthal-Malek & Mitchell, 1997; Watters & Watters, 1980), and academically (Kern et al., 1982; Rosenthal-Malek & Mitchell, 1997). The available research tells us a great deal about the physically activity habits of young children – specifically preschoolers, but very little about interventions to increase physical activity. Descriptive studies as well as interventions specific to preschoolers with disabilities are also much needed. This study sought to find a simple, physical activity intervention that could be implemented by preschool teachers during recess. The research was successful in finding two interventions – teacher led activities and increased presence of portable equipment – that decreased sedentary behavior and increased MVPA in preschoolers with and without disabilities. More importantly, teachers valued the interventions and, with some modifications, will likely implement one if not both interventions in the future.

References

Ainsworth, B.E., Haskell, W.L., Leon, A.S., Jacobs Jr., D.R., Montoye, H.J., Sallis, J.F., Paffenbarger Jr., R.S. (1993). Compendium of physical activities: classification of energy costs of human physical activities. *Medicine and Science in Sports and Exercise, 25,* 1, 71-80.

Al-Nakeeb, Y., Duncan, M. J., Lyons, M., & Woodfield, L. (2007). Body fatness and physical activity levels of young children. *Annals of Human Biology, 34,* 1, 1-12.

Baranowski, T., Dworkin, R., Henske, J.C., Clearman, D.R., Dunn, J.K., Nader, P.R., Hooks, P.C. (1986). The accuracy of children's self-reports of diets: family health project. *Journal of the American Dietetic Association, 86*, 10, 1381-1385.

Baumeister A. A., & MacLean W. E. (1984). Deceleration of self-injurious and stereotypic responding by exercise. *Applied Research in Mental Retardation. 5,* 3, 385-93.

Bagby, K., & Adams, S. (2007). Evidence-based practice guideline: increasing physical activity in schools--kindergarten through 8th grade. *The Journal of School Nursing, 23,* 3, 137-143. DOI: 10.1177/10598405070230030301

Bender, J.M., Brownson, R.C., & Elliott, M.B. (2005). Children's Physical Activity: Using Accelerometers to Validate a Parent Proxy Record. Medicine and Science in Sports and Exercise, 37, 8, 1409-13.

Beighle, A., Morgan, C.F., Le, M.G., & Pangrazi, R. P. (2006). Children's Physical Activity During Recess and Outside of School. *The Journal of School Health, 76,* 10, 516-520.

Boldemann, C., Blennow, M., Dal, H., Martensson, F., Raustorp, A., Yuen, K., Wester, U., (2006). Impact of preschool environment upon children's physical activity and sun exposure. *Preventive Medicine, 42*, 4, 301-308.

Bower, J. K., Hales, D. P., Tate, D. F., Rubin, D. A., Benjamin, S. E., & Ward, D. S. (2008). The childcare environment and children's physical activity. American Journal of Preventive Medicine, 34, 1, 23-29.

Brown, W. H., Googe, H. S., McIver, K. L., & Rathel, J. M. (2009). Effects of teacher-encouraged physical activity on preschool playgrounds. *Journal of Early Intervention, 31,* 126-145. DOI: 10.1177/1053815109331858

Brown, W. H., Pfeiffer, K. A., McIver, K., Dowda, M., Addy, C., & Pate, R. R. (2009). Social and environmental factors associated with preschoolers' nonsedentary physical activity. *Child Development, 80*, 1, 45-58.

Brownson, R. C., Baker, E. A., & Housemann, R. A. (2001). Environmental and policy determinants of physical activity in the United States. *American Journal of Public Health, 91,* 12, 1995-2003.

Bundred, P., Kitchiner, D., & Buchana, I. (2001) Prevalence of overweight and obese children between 1989 and 1998: population based series of cross sectional studies. *British Medical Journal (BMJ), 322*, 326-328.

Burdette, H. L., & Whitaker, R. C. (2005). Resurrecting free play in young children: looking beyond fitness and fatness to attention, affiliation, and affect. *Archives of Pediatrics & Adolescent Medicine, 159,* 1, 46-50.

Cardon, G.M., Van Cauwenberghe, E., Labarque, V., Haerens, L., De Bourdeaudhuij, I., (2008). The contribution of preschool playground factors in explaining children's physical activity during recess. *International Journal of Behavioral Nutrition and Physical Activity 5,* 11 DOI:10.1186/1479-5868-5-11.

Caspersen, C. J., Powell, K. E., Christenson, G. M., (1985). Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. Public Health Reports. 100, 2, 126-131.

Centers for Disease Control and Prevention, (2010). The association between school based physical activity, including physical education, and academic performance.

Celiberti D.A., Bobo H.E., Kelly K.S., Harris S.L., & Handleman J.S. (1997). The differential and temporal effects of antecedent exercise on the self-stimulatory behavior of a child with autism. *Research in Developmental Disabilities.* 18 (2).

Davison K.K., Werder J.L., & Lawson C.T. (2008). Children's active commuting to school: current knowledge and future directions. *Preventing Chronic Disease,* 5. 3. DOI:10.1186/1479-5868-3-19

Dawson, G., Rogers, S., Munson, J., Smith, M., Winter, J., Greenson, J.,… Varley, J. (2009). Randomized, controlled trial of an intervention for toddlers with autism: The Early Start Denver model. Published online on November 30, 2009. Accessed from www.pediatrics.org.

Dawson, G. & Watling, R. (2000). Interventions to facilitate auditory, visual, and motor integration: A review of the evidence. Journal of Autism and Developmental Disorders, 30, 415-421.

De, S., Small, J. & Baur, L.A. (2008). Overweight and obesity among children with developmental disabilities. Journal of Intellectual and Developmental Disability, 33, 1, 43-47.

De Bock, F., Menze, J., Becker, S., Litaker, D., Fischer, J., Seidel, I. (2010). Combining accelerometry and HR for assessing physical activity. *Medicine & Science in Sports and Exercise, 42,* 12, 2237-2243. DOI: l0.1249/MSS.0b013e3181e27b5d

Deforche, B., De, Bourdeaudhuji. I., D'hondt, E., & Cardon, G. (2009). Objectively measured physical activity, physical activity related personality and body mass index in 6- to 10-yr-old children: a cross-sectional study. *The International Journal of Behavioral Nutrition and Physical Activity, 6.*

Dennison, B. A., Erb, T. A., & Jenkins, P. L. (2002). Television viewing and television in bedroom associated with overweight risk among low-income preschool children. *Pediatrics, 109,* 6. DOI: 10.1542/peds.109.6.1028

DeVries, S. I. D., Hirtum, H. W. J. E. M. V., & Bakker, I. (2009). Validity and Reproducibility of Motion Sensors in Youth: A Systematic Update. *Medicine and Science in Sports and Exercise, 41,* 4, 818-27.

Donnelly, J.E. Lambourne, K., (2011) Classroom-based physical activity, cognition, and academic achievement. *Preventive Medicine, 52,* SUPPL., S36-S42.

Dowda, M., Brown, W. H., Addy, C., Pfeiffer, K. A., McIver, K. L., & Pate, R. R. (2009). Policies and characteristics of the preschool environment and physical activity of young children. *Pediatrics, 123*, 2 DOI: 10.1542/peds.2008-2498

Dowda, M., Pate, R. R., Trost, S. G., Almeida, M., & Sirard, J. (2004). Influences of preschool policies and practices on children's physical activity. *Journal of Community Health, 66*, 4, 145-150.

Duncan, J. S., Hopkins, W. G., & Schofield, G. (2008). Effects of weather on pedometer-determined physical activity in children. *Medicine and Science in Sports and Exercise, 40,* 8, 1432-8.

Elliott, R. O., Dobbin, A. R., Rose, G. D., & Soper, H. V. (1994). Vigorous, Aerobic Exercise versus General Motor Training Activities: Effects on Maladaptive and Stereotypic Behaviors of Adults with Both Autism and Mental Retardation. *Journal of Autism and Developmental Disorders.* 24 (5), 565.

Epstein, L. H., Paluch, R. A., Gordy, C. C., & Dorn, J. (2000). Decreasing sedentary behaviors in treating pediatric obesity. *Archives of Pediatrics & Adolescent Medicine, 154,* 3, 220-6.

Finn, K., Johannsen, N., & Specker, B. (2002). Factors associated with physical activity in preschool children. *Journal of Pediatrics, 140*, 1, 81-85.

Fitzgibbon M.L., Stolley, M.R., Schiffer, L., Van Horn, L., KauferChristoffel, K. & Dyer, A. (2006). Hip-Hop to Health Jr. for Latino preschool children. *Obesity,* 14, 9, 1616-25.

Fitzgibbon, M.L., Stolley, M.R., Schiffer, L., Van Horn, L., KauferChristoffel, K., & Dyer, A. (2005). Two-year follow-up results for Hip-Hop to Health Jr.: a randomized controlled trial for overweight prevention in preschool minority children. *The Journal of Pediatrics, 146,* 5, 618-25.

Foley, J., Bryan, R., & McCubbin, J. (January 01, 2008). Daily Physical Activity Levels of Elementary School-Aged Children With and Without Mental Retardation. *Journal of Developmental and Physical Disabilities, 20,* 4, 365-378.

Gabbard, C. (1983). Muscular endurance and experience with playground apparatus. *Pecept Motor Skills*, 56, 538.

Grieco, L. A., Jowers, E. M., & Bartholomew, J. B. (2009). Physically Active Academic Lessons and Time on Task: The Moderating Effect of Body Mass Index. *Medicine and Science in Sports and Exercise, 41,* 10, 1921-6.

Guinhouya, C.B., Hubert, H., Soubrier, S., Vilhelm, C., Lemdani, M., & Durocher, A. (2006). Moderate-to-vigorous physical activity among children: discrepancies in accelerometry-based cut-off points. *Obesity, 14,* 5, 774-7.

Gubbels, J.S., Kremers, S.P.J., van Kann, D.H.H., de Vries, N.K., Stafleu, A., Candel, M.J.J.M.,…Thijs, C. (2011). Interaction between physical environment, social environment, and child characteristics in determining physical activity at child care. *Health Psychology, 30*, 1, 84-90.

Guo, S. S., Wu, W., Chumlea, W. C., & Roche, A. F. (2002). Predicting overweight and obesity in adulthood from body mass index values in childhood and adolescence. *The American Journal of Clinical Nutrition, 76,* 3, 653-8.

Hands, B., Parker, H., & Larkin, D. (2006). Physical activity measurement methods for young children: A comparative study. *Measurement in Physical Education and Exercise Science, 10*, 3, 203-214.

Hannon, J. C., & Brown, B. B. (2008). Increasing preschoolers' physical activity intensities: An activity-friendly preschool playground intervention. *Preventive Medicine, 46,* 532-536.

Harrington, J. W., Nguyen, V. Q., Paulson, J. F., Garland, R., Pasquinelli, L., & Lewis, D. (2010). Identifying the "tipping point" age for overweight pediatric patients. *Clinical Pediatrics, 49,* 7, 638-43. DOI: 10.1177/0009922809359418

Hinkley, T., Crawford, D., Salmon, J., Okely, A. D., & Hesketh, K. (2008). Preschool Children and Physical Activity: A Review of Correlates. *American Journal of Preventive Medicine, 34,* 5.

Hughes, C. C., & Gooze, R. A. (2010). Barriers to obesity prevention In Head Start. *Health Affairs, 29,* 3, 454-462.

Janz, K.F., Burns, T.L., Torner, J.C., Levy, S.M., Paulos, R., Willing, M.C., & Warren, J.J. (2001). Physical activity and bone measures in young children: the Iowa Bone Development Study. *Pediatrics*, 107, 1387-1393.

Jarrett, O.S., Maxwell, D.M., Dickerson, C., Hoge, P., Davies, G., & Yetley, A. (1998). Impact of Recess on Classroom Behavior: Group Effects and Individual Differences. *The Journal of Educational Research.* 92 (2), 121.

Kern L., Koegel R.L., & Dunlap G.. (1984). The influence of vigorous versus mild exercise on autistic stereotyped behaviors. *Journal of Autism and Developmental Disorders.* 14 (1), 57-67.

Kern L., Koegel R.L., Dyer K., Blew P.A., & Fenton L.R. (1982). The effects of physical exercise on self-stimulation and appropriate responding in autistic children. *Journal of Autism and Developmental Disorders.* 12 (4), 399-419.

Kibbe, D.L., Harris, S., Hackett, J., Hurley, M., McFarland, A., Schubert, K.G., Schultz, A., (2011). Ten Years of TAKE 10!: Integrating physical activity with academic concepts in elementary school classrooms. *Preventive Medicine, 52,* SUPPL., S43-S50.

Kleinert, K.L, Miracle, S., Sheppard-Jones, K. (2007). Including students with moderate and severe intellectual disabilities in school extracurricular and community recreation activities. *Intellectual and developmental disabilities, 45*, 1, 46-55.

Kogan M., Blumberg, S., Schieve, L., Boyle, C., and Perrin, J. (2009). Prevalence of parent-reported diagnosis of autism spectrum disorder among children in the US, 2007. Published online on October 5, 2009. Accessed from www.pediatrics.org.

Lee, S., Burgeson, C., Fulton, J, & Spain, C. (2007). Physical education and physical activity: results from the school health policies and programs study 2006. *Journal of School Health, 77,* 8, 435-463.

Levinson, L.J., & Reid, G. (1993). The effects of exercise intensity on the stereotypic behaviors of individuals with autism. *Adapted Physical Activity Quarterly*. 10 (3), 255.

Loprinzi, P.D., & Cardinal, B.J. (2011). Measuring children's physical activity and sedentary behaviors. *Journal of Exercise Science & Fitness, 9,* 1, 15-23.

Mahar, M. T., Murphy, S. K., Rowe, D. A., Golden, J., Shields, A. T., & Raedeke, T. D. (2006). Effects of a Classroom-Based Program on Physical Activity and On-Task Behavior. *Medicine and Science in Sports and Exercise.* 38 (12), 2086- 2094.

McIver, K. L., Brown, W. H., Dowda, M., Pate, R. R., & Pfeiffer, K. A. (2009). Assessing children's physical activity in their homes: The Observational System for Recording Physical Activity in Children-Home Environments (OSRAC-H). *Journal of Applied Behavior Analysis, 42*, 1, 1-17.

McKenzie, T. L., Sallis, J. F., Elder, J. P., Berry, C. C., Hoy, P. L., Nader, P. R.,...Broyles, S.L. (1997). Physical activity levels and prompts in young children at recess: A two-year study of a bi-ethnic sample. *Research Quarterly for Exercise and Sport, 68,* 195-202

McWilliams, C., Ball, S. C., Hales, D., Vaughn, A., Ward, D. S., & Benjamin, S. E. (2009). Best-practice guidelines for physical activity at child care. *Pediatrics, 124,* 6, 1650-1659.

Medcalf, R., Marshall, J., Rhoden, C., (2006). Physical education and behavior: Exploring the relationship between physical education and enhancing behaviour in pupils with emotional behavioural difficulties. *Support for Learning, 21,* 4, 169-174.

Mei, Z., Grummer-Strawn, L.M., Pietrobelli, A., Goulding A., Goran, M.I., & Dietz, W.H. (2002). Validity of body mass index compared with other body-composition screening indexes for the assessment of body fatness in children and adolescents. The American Journal of Clinical Nutrition, 75, 6, 978-985.

Murphy, N., & Carbone, P. (2008). Promoting the participation of children with disabilities in sports, recreation, and physical activities. *American Academy of Pediatrics, 121(5),* 1057-1061.

Nader, P. R., O'Brien, M., Houts, R., Bradley, R., Belsky, J., Crosnoe, R., Friedman, S., Mei, Z., & Susman, E.J. (2006). Identifying risk for obesity in early childhood. Pediatrics, 118, 3, 594-601.

Nardella, M. T., Sulzbacher, S. I., & Worthington-Roberts, B. S. (January 01, 1983). Activity levels of persons with Prader-Willi syndrome. *American Journal of Mental Deficiency, 87,* 5, 498-505.

National Association for Sport and Physical Education (2002). Active Start: A Statement of Physical Activity Guidelines for Children Birth to Five Years Reston, VA: NASPE Publications.

National Center for Chronic Disease Prevention and Health Promotion (1999). *A report of the Surgeon General on adolescents and young adults*. Retrieved from: http://www.cdc.gov/nccdphp/sgr/pdf/adoles.pdf

National Research Council and Institute of Medicine. Making friends and getting along with peers. In: Shonkoff JP, Phillips DA, eds. From Neurons to Neighborhoods: The Science of Early Childhood Development. Washington, DC: National Academy Press; 2000:165-169.

Neter, J.E., Schokker, D.F., de Jong, E., Renders, C.M., Seidell, J.C. & Visscher, T.L.S, (2011). The prevalence of overweight and obesity and its determinants in children with and without disabilities. *The Journal of Pediatrics*, 158, 5, 735-739.

Ogden, C.L., Carroll, M.D., & Flegal, K.M. (2008). High body mass index for age among US children and adolescents, 2003-2006. *Jama: Journal of the American Medical Association, 299,* 20, 2401

Oliver, M., Schofield, G.M., & Kolt, G.S. (2007). Physical activity in preschoolers: Understanding prevalence and measurement issues. *Sports Medicine, 37,* 1045-1070.

Orsmond, G., Krauss, M., & Seltzer, M. (2004). Peer relationships and social and recreational activities among adolescents and adults with autism. *Journal of Autism and Developmental Disorders, 34*(3), 245-56.

Pan, C. Y. (2008). School time physical activity of students with and without Autism Spectrum Disorders during PE and Recess. *Adapted Physical Activity Quarterly, 25,* 308-321.

Pan, C.Y., & Frey, G. (2006). Physical Activity Patterns in Youth with Autism Spectrum Disorders. *Journal of Autism and Developmental Disorders.* 36, 5, 597-606.

Parrish, A.M, Yeatman, H., Iverson, D., Russell, K. (2012). Using interviews and peer pairs to better understand how school environments affect young children's playground physical activity levels: a qualitative study. *Health Education Research, 27*, 2, 269-280.

Pate, R.R., O'Neill, J.R., & Mitchell, J. (2010). Measurement of Physical Activity in Preschool Children. *Medicine & Science in Sports & Exercise, 42,* 3.

Pate, R.R., McIver, K., Dowda, M., Brown, W.H., & Addy, C. (2008). Directly observed physical activity levels in preschool children. *Journal of School Health, 78,* 438-444.

Pate, R.R., Almeida, M.J., McIver, K., Pfeiffer, K.A., & Dowda, M. (2006). Validation and Calibration of an accelerometer in preschool children. Obesity, 14, 11, 2000-2006.

Pate, R.R., Pfeiffer, K.A., Trost, S.G., Ziegler, P., & Dowda, M. (2004). Physical activity among children attending preschools. *Pediatrics, 114,* 1258-1263.

Pellegrini, A.D., Huberty, P.D., & Jones, I. (1995). The Effects of Recess Timing on Children's Playground and Classroom Behaviors. *American Educational Research Journal, 32,* 4, 845-864.

Phillips, A. C., & Holland, A. J. (January 01, 2011). Assessment of objectively measured physical activity levels in individuals with intellectual disabilities with and without Down's syndrome. *Plos One, 6,* 12.

Pitetti, K.H., Beets, M.W., & Combs C. (2009) Physical activity levels of children with intellectual disabilities during school. Medicine and Science in Sports and Exercise, 41, 8, 1580-1586.

Purslow, L.R., Hill. J., Saxton, J., Corder, K. and Wardle, J. (2008). Differences in physical activity and sedentary time in relation to weight in 8–9 year old children.

Ridgers, N. D., Saintâ Maurice, P. F., Welk, G. J., Siahpush, M., & Huberty, J. (2011). Differences in Physical Activity During School Recess. Journal of School Health, 81, 9. 545-551.

Ridgers, N. D., Fairclough, S. J., & Stratton, G. (2010). Variables associated with children's physical activity levels during recess: the A-CLASS project. The International Journal of Behavioral Nutrition and Physical Activity, 7.

Ridgers, N. D., Stratton, G., Fairclough, S. J., & Twisk, J. W. (2007). Children's physical activity levels during school recess: a quasi-experimental intervention study. *The International Journal of Behavioral Nutrition and Physical Activity,* 4.

Ridgers, N. D., Stratton, G., Fairclough, S. J., & Twisk, J. W. R. (2007). Long-term effects of a playground markings and physical structures on children's recess physical activity levels. *Preventative Medicine, 44,* 393-397.

Reilly, J.J., Jackson, D.M., Montgomery, C., Kelly, L.A., Slater, C., Grant, S., Payton, J.Y. (2004). Total energy expenditure and physical activity in young Scottish children: mixed longitudinal study. Lancet, 363, 211-12.

Roberts C, Tynjala J, Komkov A. Physical activity. In: Currie C, Roberts C, Morgan A, et al., editors. Young people's health in context. Health Behaviour in School-aged Children (HBSC) study. International report from 2001/2002 survey. Copenhagen: World Health Organization, 2004:90–7.

Rogers, S., Hayden, D., Hepburn, S., Charlifue-Smith, R., Hall, T., & Hayes, A. (2006). Teaching Young Nonverbal Children with Autism Useful Speech: A Pilot Study of the Denver Model and PROMPT Interventions. Journal of Autism and Developmental *Disorders.* 36 (8), 1007-1024.

Rosenthal-Malek, A., & Mitchell, S. (1997). Brief Report: The Effects of Exercise on the Self-Stimulatory Behaviors and Positive Responding of Adolescents with Autism. *Journal of Autism and Developmental Disorders.* 27 (2), 193-202.

Rowlands, A.V., Eston, R.G., & Ingledew, D.K. (1997). Measurement of physical activity in children with particular reference to the use of heart rate and pedometry. *Sports Medicine, 24,* 4, 258-272.

Sallis J.F., McKenzie T.L., Kolody B., Lewis M., Marshall S., & Rosengard P. (1997). Effects of health-related physical education on academic achievement: project SPARK. *Research Quarterly for Exercise and Sport.* 70 (2), 127-34.

Seo, D. C., & Sa, J. (2010). A meta-analysis of obesity interventions among U.S. minority children. *Journal of Adolescent Health, 46,* 4, 309-323.

Sothern, M.S., Loftin, M., Suskind, R.M., Udall, J.N., & Blecker, U. (1999). The health benefits of physical activity in children and adolescents: implications for chronic disease prevention. *European Journal of Pediatrics.* 158, 4, 271-4.

Sharma, S., Chuang, R.J., & Hedberg, A.M. (2011). Pilot-Testing CATCH Early Childhood: a preschool-based healthy nutrition and physical activity program. *American Journal of Health Education, 42,* 1, 12-23.

Sharav, & T. Bowman, T., (1992). Dietary practices, physical activity, and body-mass index in a selected population of Down syndrome children and their siblings. *Clinical pediatrics, 31*, 6, 341-4.

Special Olympics. *Changing Lives through Sport—A Report Card on the Impact of Special Olympics* Retrieved from: http://info.specialolympics.org/NR/rdonlyres/ejnoru3sfcigj2s3356q5k7yvsn33v4yo63iib73ol3ysnzstk66a2jnx4njojrssfrfwvhnxe5lhsfcfrsv5naua2g/CACW_Sports.pdf

Stratton, G. & Mullan, E. (2005). The effect of multicolor playground markings on children's physical activity level during recess. *Preventive Medicine,* 41, 5-6, 828-833.

Stellino, M.B., Sinclair, C.D., Partridge, J.A., & King, K.M.C. (2010). Differences in Children's Recess Physical Activity: Recess Activity of the Week Intervention. *Journal of School Health, 80,* 9, 436-444.

Strong, W.B., Malina, R.M., Blimkie, C.J.R., Daniels, S.R., Dishman, R.K., Gutin, B., Hergenroeder A.C., Must A., Nixon P.A.,...Pivarnik J.M. (2005). Evidence Based Physical Activity for School-age Youth. *The Journal of Pediatrics*, 146, 732-737.

Trost, S.G., Fees, B., & Dzewaltowski, D. (2008). Feasibility and efficacy of a "move and learn" physical activity curriculum in preschool children. *Journal of Physical Activity and Health, 5,* 1, 88-103

Trost, S.G., Pate, R.R., Sallis, J.F., Freedson, P.S., Taylor, W.C., Dowda, M., & Sirard, J. (2002). Age and gender differences in objectively measured physical activity in youth. *Medicine and Science in Sports and Exercise, 34,* 2, 350-5.

Trost, S.G., Kerr, L.M., Ward, D.S., & Pate, R.R. (2001). Physical activity and determinants of physical activity in obese and non-obese children. *International Journal of Obesity, 25,* 6, 822-829.

Tucker, P. (2008). The physical activity levels of preschool-aged children: A systematic review. *Early Childhood Research Quarterly, 23,* 4, 547-558.

Verstraete, S.J.M., Cardon, G.M., De Clercq, D.L.R., & De Bourdeaudhuji, I.M.M, (2006). Increasing children's physical activity levels during recess periods in elementary schools: the effects of providing game equipment. *European Journal of Public Health,* 16, 4, 415-419.

Wadsworth, D.D., Robinson, L.E., Beckham, K, & Webster, K. (2012). Break for physical activity: incorporating classroom-based physical activity breaks into preschools. *Early Childhood Education Journal*, 39, 391-395,

Wagner, M., Cadwallader, T., & Marder, C. (with Cameto, R., Cardoso, D., Garza, N., Levine, P., & Newman, L.). (2003). *Life Outside the Classroom for Youth with Disabilities. A Report from the National Longitudinal Transition Study-2 (NLTS2).* Menlo Park, CA: SRI International. Available at www.nlts2.org/reports/2003_04-2/nlts2_report_2003_04-2_complete.pdf.

Ward, D. S., Vaughn, A., McWilliams, C., & Hales, D. (2010). Interventions for increasing physical activity at child care. *Medicine and Science in Sports and Exercise, 42,* 526-534.

Ward, D. S., Benjamin, S. E., Ammerman, A. S., Ball, S. C., Neelson, B. H., & Bangdiwala, S. I. (2008). Nutrition and physical activity in child care: Results from an environmental intervention. *American Journal of Preventive Medicine, 35,* 352-356.

Watters, R. G., & Watters, W. E. (1980). Decreasing Self-Stimulatory Behavior with Physical Exercise in a Group of Autistic Boys. *Journal of Autism and Developmental Disorders.* 10 (4), 379-87.

White House Task Force on Childhood Obesity (2010). Solving the Problem of Childhood Obesity Within a Generation

Willenberg, L.J., Ashbolt, R., Holland, D., Gibbs, L., MacDougall, C., Garrard, J.,…Waters, E., (2010). Increasing school playground physical activity: A mixed methods study combining environmental measures and children's perspectives. *Journal of Science and Medicine in Sport, 13,* 210–216.

World Health Organization (WHO) (2000). Obesity: preventing and managing the global epidemic. Report of a WHO Consultation, WHO Technical Report Series 894. Geneva

Zask, A., van Beurden, E., Barnett, L., Brooks, L.O., & Dietrich, U.C., (2001). Active School Playgrounds—Myth or Reality? Results of the "Move It Groove It" Project. Preventive Medicine, 33, 402-408.

APPENDIX A: CHILD CONSENT FORM

UNIVERSITY OF WASHINGTON - PARENTAL CONSENT FORM

Increasing physical activity in young children with and without disabilities; interventions and implications for a more active generation.

Principal Investigator: Shane Herriott, Doctoral Candidate, Special Education
Phone #: 206-930-7116
*E-mail address: skh20@uw.edu
Co-Investigator: Ilene Schwartz, Chair, Special Education
Phone #: 206-543-4011
*E-mail address: ilene@uw.edu

*Please note that the confidentiality of email cannot be guaranteed.

Researcher's Statement

My name is Shane Herriott and I am a doctoral candidate at the University of Washington. Together with Ilene Schwartz, we are asking your permission to include your child in a research project. The purpose of this consent form is to give you information you will need to help you decide whether or not to allow your child to be in the project. Please read the form carefully. You may contact the researchers listed above to ask questions about the purpose of this research, what we would ask your child to do, the possible risks and benefits, your child's rights as a volunteer, and anything else about the research or this form that is not clear. When we have answered any questions you have, you can decide if you want to be in the study or not. This process is called "informed consent." You can keep a copy of this form for your records.

PURPOSE

The purpose of this study is to determine what types of intervention strategies (increased presence of playground equipment versus teacher directed play activities) lead to increases in physical activity during recess for preschool children with and without disabilities. There is limited research done in this area and studies that have been conducted have shown mixed results. No study of this type has included children with disabilities.
Additionally, this study will investigate what motivates and/or deters teachers from implementing activities that could increase physical activity and movement in their classrooms. Physical activity is an important part of a young child's day with impending physical, social, behavioral, and academic benefits, yet research shows that most preschoolers do not get the recommended amounts of physical activity. This study hopes to learn more from teachers themselves on what physical activity strategies they would most likely implement.

PROCEDURE

Participants in the study will be asked to participate in a variety of adult led physical activities (running, dance party) during recess throughout a two month period. Before and after the intervention, students' height and weight will be measured. During the intervention, your child will wear an accelerometer, a small device which measures the energy output of your child. This device has resembles a small pager and has been used in other research with young children. The accelerometer will be worn on the right hip during recess time (two to three times a week) and will be put on and taken off by the researcher or your child's teacher. If your child does not want to wear the accelerometer, a classroom teacher will try verbal encouragement. If your child continues to refuse to wear it, one more attempt will be made the following day by your child's teacher. In addition, a researcher will be on the playground two to three times a week collecting data through directly observing your child playing.

Prior to the start of the intervention, your child will wear the accelerometer for three to five days while researchers gather baseline data. This means that we want to get an accurate representation of your child's normal physical activity during recess. During each intervention day, one of two intervention procedures will be used (either increased presence of play equipment or a 7-10 minute teacher led activity). During the days where more equipment is on the playground, your child will be given the normal amount of supervision and staff interaction, but will not be prompted towards any of the new equipment. On the days where teachers direct a short physical activity, you child will be directed to participate for the duration of the activity. Prompts and reinforcement will be used if necessary.

Because the intervention is occurring for all students during their designated recess times, the only loss of instructional time will occur twice for the height and weight measurements. This will happen once for 15 minutes prior to the start of the intervention as well as one 15 minute session at the end of the intervention, for a total of 30 minutes across the two month period.

We will videotape 25% of the recess sessions so that we can review them in greater depth at a later time. We also may use some of these videos to train some of the study staff who will analyze the data. We will keep some of the videos to for educational purposes such as to teach new teachers.

We are also asking your permission to access your child's school record to collect the following information: confirmation of special education services received (if applicable), age, and AEPS (Assessment Evaluation and Programming System) scores.

RISK, STRESS, OR DISCOMFORT

Increasing physical activity may cause sweating and/or increased heart rate. If your child displays significant challenging behaviors during recess that are considered dangerous to him/her or the staff, the physical activity will be discontinued.

ALTERNATIVES TO TAKING PART IN THIS STUDY

Taking part in this study is voluntary and will not affect your child's current educational services. If you choose for your child not to be in this study, your child will continue to receive the educational practices that your child's teacher currently uses. You can choose for your child to stop participating in the study at any time by contacting the principal investigator listed at the beginning of this form.

BENEFITS

While this study involves standard educational techniques that have been shown to be effective, we cannot guarantee that your child will directly benefit from taking part in this study. We hope the results of this study will tell us whether teachers can increase physical activity in their classrooms by small curricular and environmental changes.

OTHER INFORMATION

All of your child's information will be kept in strict confidentiality. Any information we collect will be labeled with a code number rather than your child's name. All information, including the videotapes, will be kept in a locked file cabinet or on a password protected computer. We will keep a link between your child's name and the code in a separate and secure location until September 1, 2012, and then we will destroy the link. We will not destroy the videotapes. The recordings may be used outside of this research project in college level education classes, professional development for teachers, and other educational purposes. While names will not be used, a viewer could recognize a child in the recording. If the results of this project are published or presented in any format, we will not use your or your child's name.

If you have any questions about this project, you can contact Shane Herriott at the telephone number or e-mail listed above.

____

SIGNATURE OF INVESTIGATOR PRINTED NAME DATE

PARENT OR GUARDIAN STATEMENT:

This research study has been explained to me. I have had a chance to ask questions. If I have questions later about the study, I can contact the investigators listed above. If I have questions about my child's right as a research participant, I can call the University of Washington Human Subjects Division at 206-543-0098. I can keep a copy of this consent form.

I give my permission for my child to participate in this study and for the researchers to collect information from my child's school record as described above.

_________________________ __________________

NAME OF CHILD PHONE NUMBER

____

PRINTED NAME OF PARENT/GUARDIAN SIGNATURE DATE

Copies to: Shane Herriott, Ilene Schwartz, Parents/Guardian

APPENDIX B: TEACHER CONSENT FORM

UNIVERSITY OF WASHINGTON - TEACHER CONSENT FORM

Increasing physical activity in young children with and without disabilities; interventions and implications for a more active generation.

Principal Investigator: Shane Herriott, Doctoral Candidate, Special Education
phone #: 206-930-7116
*e-mail address: skh20@uw.edu
Co-Investigator: Ilene Schwartz, Chair, Special Education
phone #: 206-543-4011
*e-mail address: ilene@uw.edu

*Please note that the confidentiality of email cannot be guaranteed.

Researcher's Statement

My name is Shane Herriott and I am a doctoral candidate at the University of Washington. Together with Ilene Schwartz, we are asking you to participate in a research study in your classroom. The purpose of this consent form is to give you information you will need to help you decide whether or not to allow your child to be in the project. Please read the form carefully. You may contact the researchers listed above to ask questions about the purpose of this research, what we would ask you to do, the possible risks and benefits, your right as a volunteer, and anything else about the research or this form that is not clear. When we have answered any questions you have, you can decide if you want to be in the study or not. This process is called "informed consent." You can keep a copy of this form for your records.

PURPOSE OF THE STUDY

The purpose of this study is to determine what types of intervention strategies (increased presence of playground equipment versus teacher directed play activities) lead to increases in physical activity during recess for preschool children with and without disabilities. There is limited research done in this area and studies that have been conducted have shown mixed results. No study of this type has included children with disabilities.
Additionally, this study will investigate what motivates and/or deters teachers from implementing activities that could increase physical activity and movement in their classrooms. Physical activity is an important part of a young child's day with impending physical, social, behavioral, and academic benefits, yet research shows that most preschoolers do not get the recommended amounts of physical activity. We hope to learn more about what types of activities are more likely to be implemented in a preschool classroom by staff.

PROCEDURE

This study is designed as an alternative treatment design study, meaning that one of two different physical activity interventions will be randomly selected each data collection session to be implemented during recess. It will be the responsibility of the classroom staff, with support from the researchers, to ensure that each intervention is implemented correctly on the given day. The first intervention involves classroom staff members leading and supporting 7-10 minute physical activity interventions during a two month data collection period. Lesson plans for these adult directed physical activities will be written by the researcher and staff will be trained by the researcher in how to lead and support the activities. The second intervention is an increase in playground equipment during recess. Staff will be provided with a large bag of additional playground equipment that they will need to set up before recess and clean up after recess. On these days, staff will be asked to provide support and/or prompting as they typically would, with no additional prompting to engage with the new materials. The two interventions will change each day based on random assignment and will take place two to three times a week. In addition, each student participant will wear an accelerometer each data collection session. Classroom staff are responsible for putting on and taking off the accelerometer before and after recess. Accelerometers will then be given to the researcher at the end of each day so that data can be uploaded to the computer. The classroom staff member's final responsibility will be an interview with the researcher upon completion of the intervention. Each staff member will be asked to spend approximately 30 minutes answering questions about their experience during the intervention and their opinions on physical activity implementation within a preschool classroom setting.

We will video-record 25% of the play court sessions so that we can review them in greater depth at a later time. We also may use some of these videos to train some of the study staff who will analyze the data. We will keep some of the videos to for educational purposes such as to teach new teachers.

RISK, STRESS, OR DISCOMFORT

Increasing physical activity may cause sweating and/or increased heart rate. If your students display significant challenging behaviors that are considered dangerous to him/her or the staff, you may discontinue the physical activity. Answering questions about your personal experience and opinions may be uncomfortable.

ALTERNATIVES TO TAKING PART IN THIS STUDY

Taking part in this study is voluntary and will not affect your job placement. If you choose not to be in this study, other classroom roles (setting up the classroom or supervising children not participating in the study) will be assigned to you. You can choose to stop participating in the study at any time by contacting the principal investigator listed at the beginning of this form.

BENEFITS

While this study involves standard educational techniques that have been shown to be effective, we cannot guarantee that your instruction will directly benefit from taking part in this study. We hope the results of this study will tell us whether teachers can increase physical activity in their classrooms by small curricular and environmental changes.

OTHER INFORMATION

Any information collected about you or your instructional practices will be labeled with a code number and not your name. Your name will not appear on any of the information we collect. All information, including the videotapes, will be kept in a locked file cabinet or on a password protected computer. We will keep a link between your name and the code in a separate and secure location until September 1, 2012, and then we will destroy the link. We will not destroy the videotapes. The recordings may be used outside of this research project in college level education classes, professional development for teachers, and other educational purposes. While names will not be used, a viewer could recognize you in the recording. If the results of this project are published or presented in any format, we will not use your name.

If you have any questions about this project, you can contact Shane Herriott at the telephone number or e-mail listed above.

____

SIGNATURE OF INVESTIGATOR PRINTED NAME DATE

PARENT OR GUARDIAN STATEMENT:

This research study has been explained to me. I have had a chance to ask questions. If I have questions later about the study, I can contact the investigators listed above. If I have questions about my rights as a research participant, I can call the University of Washington Human Subjects Division at 206-543-0098. I can keep a copy of this consent form.

I agree to participate in this study and for the researchers to collect information described above.

________________________ ______________________________

NAME E-MAIL/PHONE NUMBER

____

SIGNATURE DATE

Copies to: Shane Herriott, Ilene Schwartz

APPENDIX C: OSRAC-P CODING SYSTEM

Observational Codes for Observational System for Recording Physical Activity in Children-Preschool (OSRAC-P) – modified for this study

Physical Activity Level Codes	**Brief Descriptions**
1 – Stationary or motionless	Stationary or motionless with no major limb movement or major joint movements (e.g., sleeping, standing, riding passively in a wagon)
2 – Stationary with limb or trunk movements	Stationary with easy movement of limb(s) or trunk without translocation (e.g., standing up, holding a moderately heavy object, hanging off of bars)
3 – Slow-easy movements	Translocation at a slow and easy pace (e.g., walking with translocation of both feet, slow ad easy cycling, winging without assistance and without leg kicks
4 – Moderate movements	Translocation at a moderate pace (e.g., walking uphill, two repetitions of skipping or jumping, climbing on monkey bars, hanging from bar with legs swinging)
5 – Fast movements	Translocation at a fast or very fast pace (e.g., running, walking upstairs, three repetitions of skipping or jumping, translocation across monkey bars with hands while hanging)

Physical Activity Type Codes	**Description**
Climb	Climbing, hanging
Crawl	Crawling
Dance	Dancing, expressive movements
Jump/skip	Jumping, skipping, hopping, galloping
Lie down	Lying down
Pull/push	Pulling or pushing an object or child
Rough and tumble	Rough and tumble play such as wrestling and play fighting
Ride	Cycling, skateboarding, roller skating, scooter
Rock	Rocking on a teeter totter or on a horse
Roll	Rolling
Run	Running
Sit/Squat	Sitting, squatting, kneeling
Stand	Standing
Swim	Swimming or playing in a pool
Swing	Swinging on a swing
Throw	Throwing, kicking, catching
Walk	Walking, marching
Other	Physical activity type other than the options listed above

Outdoor Activity Context	**Description**

Codes	
Ball and object play	Activity with objects used for gross motor activities (e.g., balls, throwing objects)
Fixed equipment	Activity on or engagement with fixed playground equipment
Games	Participating in preschool games such as Duck-Duck-Goose, Red Rover, or Freeze Tag
Open space	Being in an open outdoor area that is not one of the other outdoor activity contexts
Pool activities	Being in a pool or playing with toys in water
Portable equipment	Activity with equipment brought to the playground other than balls or wheel toys
Sandbox	Engaging with sandbox materials or being in a sandbox
Snacks	Preparing, eating, or cleaning up food or being in an outside eating area
Sociodramatic props	Using sociodramatic play props or similar materials outdoors
Teacher arranged	Engaging in teacher planned, arranged, and led gross motor activities with or without equipment
Time out	Child is placed in time-out for disciplinary reasons
Wheel	Touching, riding, or pushing wheel toys that are not fixed equipment (e.g., tricycles, scooters, wagons)
Other	Outdoor activity other than the options listed above

Group Composition Codes	**Description**
Solitary	Solitary/alone
1-1 Adult	One-to-one interaction with adult
1-1 Peer	One-to-one interaction with peer without adult support
Group Adult	Group of peers with an adult present (at least 3 people including target child)

Group	Group of peers without adult support (at least 3 people including target child)
Prompt for Physical Activity	**Description**
None	No teacher prompts
TP-I	Teacher prompt to target child to increase or maintain physical activity
TP-D	Teacher prompt to target child to stop or decrease physical activity
PP-I	Peer prompt to target child to increase or maintain physical activity
PP-D	Peer prompt to target child to stop or decrease physical activity

APPENDIX D: DATA COLLECTION SYSTEM

Child ___________________ Date _____________ Coder _______________

Intensity										
Activity										
Where										
With Who?										
Prompt										

Intensity										
Activity										
Where										
With Who?										
Prompt										

Child ___________________ Date _____________ Coder _______________

Intensity										
Activity										
Where										
With Who?										
Prompt										

Intensity										
Activity										
Where										
With Who?										
Prompt										

APPENDIX E: LESSON PLANS

Intervention Plan – Dance Party

Current Objective: Target Children will engage in a teacher-led dance party for at least 10 minutes of playcourt, maintaining a high level of physical activity

Materials: portable stereo, CD of songs, token chart, treasure box

Introduction of activity: Staff will start by giving a one minute warning to all children, with individual warnings to the target children.

Staff will then bring the bring target children (while encouraging others) to come participate in the activity. Once everyone is gathered, staff will introduce activity by saying something like:

> "Okay everyone, today we are going to have a dance party on playcourt. I'm going to start the music and when you hear the music, you can start dancing. It's important that we all stay together and we all keep dancing."

Activity: Staff turns on stereo and instructs students to start dancing. Gauge the level of engagement and make adjustments accordingly to keep students involved. Variations to dance party include:

- Having kids make up their own moves and have friends copy them
- Dance when the music is on and freeze when it's off
- Dance with partners
- A conga-type line

****If a target child becomes disengaged for more than 5 seconds, redirect him/her to engage in the activity. It is also okay to provide reinforcement for maintaining engagement in the activities.****

Ending the activity: Staff running the activity gives a one minute warning that the will be ending. After the one minute, stop the activity and reinforce those who have played the entire time (or a majority of the time) with a sticker or stamp.

**If target children are having difficulty maintaining engagement, the use of a token system is encouraged with a trip to the treasure box as the reward for filling up the tokens (if you want to do this for the whole group, that is okay too. Researcher will provide treasure box and "treasures"

Intervention Plan – Races/Obstacle Course

Current Objective: Target Children will engage in a teacher-led obstacle course/race for at least 10 minutes of playcourt, maintaining a high level of physical activity.

Materials: token chart, treasure box

Introduction of activity: Staff will start by giving a one minute warning to all children, with individual warnings to the target children.
Staff will then bring the bring target children (while encouraging others) to come participate in the activity. Once everyone is gathered, staff will introduce activity by saying something like:

> "Okay everyone, today we are going to do an obstacle course around playcourt. We might also do some racing. I'm going to show you what the obstacle course looks like and I want everyone to watch and follow me! It's like follow the leader out on playcourt! It's important that we all stay together and we all keep moving."

Activity: Staff has children get in a single file line and starts the obstacle course up, down, around the playcourt. Gauge the level of engagement and make adjustments accordingly to keep students involved. Variations to the obstacle course can include:

- Having a student be the leader
- Conducting a "race" around playcourt every few minutes of the obstacle course
- Varying the speed (fast/slow) or the method (jump, crawl, skip) for which you are completing the course

****If a target child becomes disengaged for more than 5 seconds, redirect him/her to engage in the activity. It is also okay to provide reinforcement for maintaining engagement in the activities.****

Ending the activity: Staff running the activity gives a one minute warning that the will be ending. After the one minute, stop the activity and reinforce those who have played the entire time (or a majority of the time) with a sticker or stamp.
**If target children are having difficulty maintaining engagement, the use of a token system is encouraged with a trip to the treasure box as the reward for filling up the tokens (if you want to do this for the whole group, that is okay too. Researcher will provide treasure box and "treasures"

Intervention Plan – Activity Dice

Current Objective: Target Children will engage in a teacher-led activity using two blue activity dice for at least 10 minutes of playcourt, maintaining a high level of physical activity.

Materials: activity dice, token chart, treasure box

Introduction of activity: Staff will start by giving a one minute warning to all children, with individual warnings to the target children.
Staff will then bring the bring target children (while encouraging others) to come participate in the activity. Once everyone is gathered, staff will introduce the activity saying something like:

> "Okay everyone, today we are going to do some fun things on playcourt. These two dice right here are going to tell us what activity we are going to do. I'm going to roll them (model) and look….they say I have to do 8 PUSH UPS (point to number and activity while talking). Let's do it (have students complete the activity with you) Okay, let's roll again and see what activity we will have to do."

Activity: Staff rolls the dice and helps/encourages students to participate in the activity. You can also pass the dice around so that each student gets an opportunity to roll the dice. Gauge the level of engagement and make adjustments accordingly to keep students involved. Variations to this activity include:

- Have two different children roll one dice each
- Roll the number dice and have kids pick different activities

****If a target child becomes disengaged for more than 5 seconds, redirect him/her to engage in the activity. It is also okay to provide reinforcement for maintaining engagement in the activities.****

Ending the activity: Staff running the activity gives a one minute warning that the will be ending. After the one minute, stop the activity and reinforce those who have played the entire time (or a majority of the time) with a sticker or stamp.
**If target children are having difficulty maintaining engagement, the use of a token system is encouraged with a trip to the treasure box as the reward for filling up the tokens (if you want to do this for the whole group, that is okay too. Researcher will provide treasure box and "treasures"

APPENDIX F: FIDELITY CHECKLISTS

Fidelity Checklist for **Teacher Led Activities**

Date: ___________________________

Classroom/Teacher: _____________________________ AM PM (circle one)

Did the teacher(s)……	Circle
Have equipment and visuals in designated area on play court?	Yes No N/A
Announce the activity prior to starting (we are going to do an obstacle course)?	Yes No N/A
Gather the four target children?	Yes No N/A
Explain the rules/expectations verbally?	Yes No N/A
Model the expected behavior after or during a verbal description of the rules/expectations	Yes No N/A
Give a clear verbal direction to start the activity?	Yes No N/A
Prompt an target child if they have been off task/disengaged for 5 seconds?	Yes No N/A
Led the activity for at least 10 minutes?	Yes No N/A
Provide verbal and tangible (token system) reinforcement to participants?	Yes No N/A
After 10 minutes, give a clear ending to the activity by summarizing and praising (okay, we are all done with our dance party. You guys did a great job staying together and dancing!)?	Yes No N/A
Provide access to the "treasure box" for those who filled up the token chart?	Yes No N/A

Total steps completed: ________ out of 11

Percentage (divide # completed by 11): _________________

Fidelity Checklist for **Extra Playground Equipment**

Date: ___________________________

Classroom/Teacher: _____________________________ AM PM (circle one)

Did the teacher(s)…….	Circle
Set out all of the equipment (spaced out around free areas of play court) within the first 5 minutes of play court?	Yes No N/A
Not provide any additional prompting or support to initiate or maintain engagement with the extra materials?**	Yes No N/A
Have the equipment out for at least 10 minutes of play court?	Yes No N/A
Clean up all equipment before the class leaves the play court area?	Yes No N/A

Total steps completed: ________ out of 4

Percentage (divide # completed by 11): ________________

**Teachers should not encourage a student to interact with any of the equipment if they are not already with it, nor should they provide prompting to maintain engagement if a student becomes disengaged. Teachers can respond to students' requests for assistance and/or make general statements regarding play (it looks like you are having fun)

APPENDIX G: SOCIAL VALIDITY QUESTIONAIRRE

Social Validity Questionnaire

Increasing Physical Activity in Young Children with and without Disabilities

Thank you so much for allowing me to conduct my research in your classroom. Please fill out the following questionnaire to the best of your ability. Your feedback is important as we continue to find the most effective and efficient ways to increase physical activity in young children.

Circle the answer that best describes your opinion.

❖ Intervention Implementation

How easy was the intervention, as a whole, to implement?	1 Very Easy	2 Easy	3 Average	4 Slightly Difficult	5 Difficult
How easy was the Teacher Led Activity portion of the intervention to implement?	1	2	3	4	5
How easy was the Increased Presence of Portable Equipment portion of the intervention to implement?	1	2	3	4	5

❖ Please describe your thoughts about the implementation of this intervention:

___

___

___

❖ Student Engagement

Overall, how engaged were the target students during the intervention time?	1 Very Engaged	2 Engaged	3 Average	4 Slightly Disengaged	5 Disengaged
How engaged were the target students during the Teacher Led Activity portion of the intervention?	1	2	3	4	5
How engaged were the target students during the Increased Presence of Portable Equipment portion of the intervention?	1	2	3	4	5

❖ Increased Physical Activity

Overall, how much do you feel the intervention increased the physical activity of the target students?	1 Large Increase	2 Small Increase	3 No Change	4 Small Decrease	5 Large Decrease

Specifically, how much do you feel the teacher led activities increased the physical activity of the target students?	1	2	3	4	5
Specifically how do you feel the increased presence of playground equipment increased the levels of physical activity of the target students?	1	2	3	4	5

- Please list all other effects you noticed as a result of children participating in this research study? *(i.e. increased communication with peers or adults, increased engagement in playground activities, better focus after play court, etc.)*

- What Teacher Led Activity did students seem to prefer? *circle one* **Dance Party** **Obstacle Course**

- What portable equipment did students seem to prefer? *circle all that apply* **Balls** **Hula Hoops**

Hurdles **Jump Ropes** **Stomp Rocket** **Target Games** **Tunnel**

- Would you continue these activities now that the study has ended? *circle one* **Yes** **No**

Why or Why not?
____

- What do you see as potential barriers to implementing physical activities throughout your preschool day?

- What suggestions for improvement do you have for the researcher?

Thank you for your time!

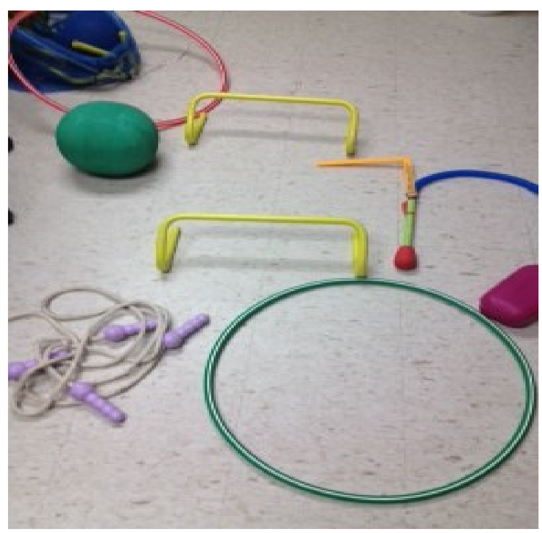
APPENDIX H: CHILD SOCIAL VALIDITY VISUAL

What 

did you like  best?

Dance Party

Activity Dice



Follow the Leader

Playing with toys

VITA

Shane Herriott was born in Bremerton, Washington. She earned a dual Bachelor of Arts degree in Communication and Foreign Language/International Affairs from the University of Puget Sound and a Master of Education in Early Childhood Special Education from the University of Washington. Shane is also a Board Certified Behavior Analyst (BCBA). In 2012, she earned her Doctor of Philosophy in Special Education from the University of Washington

.

RESEARCH PROJECTS

2011 – 2012 Research Assistant: *National Center for Quality Teaching and Learning*
Dr. Susan Sandall and Dr. Gail Joseph (PIs), University of Washington

2009 - 2010 Research Assistant: *Peer-Networks Autism Project*,
Dr. Ilene Schwartz (PI), University of Washington
Dr. Deborah Kamps (PI), University of Kansas

PRESENTATIONS

Herriott, S. *The Effects of Physical Activity on On-task Behavior in Young Children with Autism.* Applied Behavior Analysis International (ABAI), Seattle, WA

Harbin, S. & Herriott, S. (May 2012). *Hip Hop…You don't stop.* Infant and Early Childhood Conference (IECC), Tacoma, WA

Brown, W., Cronin Favazza, P., Schwartz, I. & Herriott, S. (February 2012). *Let's Get Physical: What do We Know About Physical Activity and Preschoolers.* Conference on Research and Innovation in Early Children (CRIEI), San Diego, CA

Schwartz, I., Ashmun, J., Herriott, S., & Gauvreau, A. (October, 2009). *Project DATA Blending Approaches to Meet Individual Needs of Children with Autism Spectrum Disorders.* Presentation at Division of Early Childhood Conference (DEC), Albuquerque, NM

Herriott, S. & Gauvreau, A. (August, 2009). *Successful Teaching Strategies to use with students with ASD.* Summer Institute Training at the Haring Center, University of Washington

Leon-Guerrero, R.M. & Herriott, S. (August, 2009). *Social Skills for Students with ASD and Related Disorders.* Summer Institute Training at the Haring Center, University of Washington

Ashmun, J. & Herriott, S. (April, 2009). *Good Assessment, Good Goals, Good Practice.* Presentation at the Council for Exceptional Children Conference, Seattle, WA

Schwartz, I., Herriott, S., & Pamparo, V. (January, 2009). *Implementing Effective Intervention Programs for Young Children with ASD.* Presentation at the Office for the Superintendent of Public Instruction Conference, Seattle, WA

Ashmun, J. & Herriott, S. (May, 2008). *Good Assessment, Good Goals, Good Practice.* Presentation at the Infant and Early Childhood Conference, Bellevue, WA