Incorporating daily physical activity in kindergarten children with disabilities: Effect on classroom behavior and activity engagement

By

Natalyn Hibbs

Thesis Submitted in Partial Fulfillment Of the Requirements for the Degree of

Master of Health Sciences

Kinesiology

University of Ontario Institute of Technology

April 2016

Incorporating daily physical activity in kindergarten children with disabilities: effect on classroom behavior and activity engagement

Chairperson of the Supervisory Committee: Dr. Meghann Lloyd
Faculty of Health Sciences

Abstract

Children with disabilities often experience challenges staying on-task during instructional time in a classroom which is why this an important area of study for teachers and researchers. Physical activity has been shown to have a positive impact on classroom behavior. The purpose of this study was to determine the effectiveness of implementing 4 5-min breaks of daily physical activity (DPA) in a kindergarten classroom of children with disabilities at improving on-task behavior and reducing self-stimulatory behavior (n=14). A secondary purpose was to determine the level of engagement and feasibility of incorporating a DPA program in a classroom of children with disabilities. **Classroom Behavior:** Results indicated significant increases in on-task behavior from baseline measures to follow-up measures, immediately following 5-minutes of DPA, and from baseline to intervention phase. In addition, self-stimulatory behaviors also significantly reduced in participants who exhibited self-stimulatory behavior. **Engagement and Feasibility:** Results indicated significant improvements in engagement during DPA from week 1 to week 4. **Conclusion:** The results of this study indicate that incorporating 4 5-minute bouts of DPA in a classroom of children with disabilities is effective at increasing time on-task and reducing self-stimulatory behaviors. In addition, the DPA program was feasible and engagement level was achieved in students. These findings warrant future research with greater ranges of age groups and a longitudinal study design for children with disabilities.

Keywords: children, daily physical activity, disabilities, on-task behavior, physical activity, self-stimulatory behavior

Statement of Originality

I, Natalyn Hibbs, hereby declare that this thesis is, to the best of my knowledge, original, except as acknowledged in the text. I further declare that the material contained in this thesis has not be previously submitted, either in whole or in part, for a degree at this or any other university.

Acknowledgements

First I would like to thank my supervisor, Dr. Meghann Lloyd, for all your guidance, support, and encouragement over the last few years. You recognized potential in me early on and have guided my path to where I am today.

Thank you to my supervisory committee members, Dr. Nick Wattie and Dr. Rob Balogh for all your edits and feedback in helping develop my thesis.

Thank you to the volunteers who took time out of their busy schedules for helping with the intervention and coding: Leanne Elliott, thank you for all your help during the intervention and helping with creating the coding framework and getting the coding started. I could not have asked for a better volunteer and an even better friend to share laughs with last summer in the lab. Marie McTaggart and Michael Crozier, thank you for all your help with the coding. Also, thank you to all UOIT Graduate peers for being such a great support system and helping me keep my sanity during stressful times. Special thank you to Keri-Ellen Walcer for lending me your music to use for the intervention.

Thank you to the principal, Janet Harper, and the classroom teachers and educational assistants at Campbell Children's School for welcoming me to your school and into your classrooms. I could not have chosen a better school for my thesis research.

Thank you to the students for being such great active participants. This could not be possible without you. You also made the DPA sessions an enjoyable experience and helped further fuel my passion for working with children with disabilities.

Thank you to Zak Marchant for all of your excel expertise and assisting with my stats. I can't thank you enough for taking the time out of your busy day to come to my rescue and helping any way you could with all of my statistical and technical issues.

Finally, thank you to my family for all your encouragement along the way. To my dad, thank you for inspiring me to buckle down and work hard. To my mom, thank you for the unconditional love and always checking in on me. To my brother and sister, thank you for your patience. Lastly, thank you to Cody for always keeping me company during long days of writing.

List of Abbreviations Used

ADHD	Attention Deficit Hyperactivity Disorder
ADD	Attention Deficit Disorder
ASD	Autism Spectrum Disorder
AS! BC	Action Schools! BC
BOSS	Behavior Observation of Students in Schools
CHMS	Canadian Health Measures Survey
CP	Cerebral Palsy
CS4L	Canadian Sport For Life
DD	Developmental Disability
DPA	Daily Physical Activity
DS	Down Syndrome
ES	Effect Size
ID	Intellectual disability
IEP	Individual Education Plan
IQ	Intelligence Quotient
LTAD	Long-Term Athlete Development
MVPA	Moderate-to-Vigorous Physical Activity
OPHEA	Ontario Physical and Health Organization Association
PAAC	Physical Activity Across the Curriculum
PE	Physical Education
SPSS	Statistical Package for the Social Sciences

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Overview

This thesis is divided into six sections:

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2. Literature Review
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6. Appendices that include ethics approval, letter of invitation, consent forms, questionnaire, and sample of coding sheets.

Chapter 1: Introduction

Introduction to Thesis

Physical Activity among Children

Physical activity plays an important role in health, well-being, and overall quality of life (Janssen & LeBlanc, 2010). Studies have confirmed that a physically active lifestyle is associated with several health benefits in school-aged children and youth (Janssen & LeBlanc, 2010). In addtion to the several health benefits associated with physical activity, research has consistently shown that short bouts of physical activity can have a positive impact on students' on-task behavior and academic achievement (Ma, Mare, & Gurd, 2014). Studies have also shown that students who do regular physical activity demonstrate an increased willingness to learn and are able to stay on task for longer periods of time (Ontario Ministry of Education, 2006). There is also evidence that students show improved behavior following a physical activity break in the classroom (Chomitz et al., 2009; Davis et al., 2011); however, there is also growing evidence that there is considerable lack of physical activity in the Canadian population, especially among children (Colley et al., 2011). According to the Canadian Physical Activity Guidelines, for health benefits, children aged 5-11 years should accumulate at least 60 minutes of moderate-to-vigorous physical activity (MVPA) a day (Tremblay et al., 2011). However, according to the Canadian Health Measures Survey (CHMS) results from 2007-2009, few children accumulate even adequate amounts of physical activity a day (Colley et al., 2011).

Physical Activity in Schools

Schools are critically important to increasing physical activity among Canada's youth (Ontario Ministry of Education, 2006). Teachers play a vital role in implementing daily physical activity (DPA) in classrooms and ensuring several physical activity

opportunities are provided for each student (Ontario Ministry of Education, 2006). It is well established that physical activity provides several benefits among children of typical development, including the numerous health benefits and improvements in academic achievement (Cooper et al., 1999); however, few studies have investigated the effectiveness of physical activity on on-task behavior in a classroom of children with disabilities (Cooper et al., 1999). Yet, physical activity may be of even greater importance for children with disabilities because the presence of a disability generally leads to increased sedentary behavior (Sit, McManus, McKenzie, & Lian, 2007). Therefore, it is important to encourage participation in physical activity to provide important health benefits among people with disabilities.

DPA is an important component of a school's health and physical education (PE) program. DPA can be accomplished during PE but the Ontario Ministry of Education has mandated that it be included even on days that PE is not delivered. Incorporating a DPA program into the curriculum that is planned and adapted as approriate to ensure that students with disabilities can participate can help encourage youth to build physical activity into their daily routine but can also be beneficial academically. Existing research does not show that increasing school time on physical activity will cause a negative effect on educational outcomes, in fact, research has shown that students who are more physically active may learn better (Chomitz et al., 2009). Positive effects in cognitive function, concentration, on-task behaviour, and academic achievement have been shown following a physical activity break during instructional time (Chomitz et al., 2009; Davis et al., 2011). To date, few studies have examined the impact of physical activity on classroom behavior and academic achievement in children with disabilities (Ma et al.,

2014). Therefore, this represents an important area of study as classroom behavior is associated with academic achievement (Alexander, Entwisle, & Dauber, 1993; Ma et al., 2014; Mayes, Calhoun, & Crowell, 2000).

Physical Activity and Children with Disabilities

Children with disabilities are more sedentary and less likely to engage in physical activity and are less physically fit than their peers (Johnson, 2009; McDonald, 2002; Sit et al., 2007). There can be consequences of inactivity for individuals with disabilities because the presence of a disability often leads to drops in physical function and physical literacy, which can cause a further decline in physical activity and increased risk for sedentary behavior (Ford et al., 2011; Sit et al., 2007). In addition to increased sedentary behaviors among children with disabilities, research has also shown that children with disabilities are less likely to be on-task and more likely to be off-task compared to their peers without disabilities (Bender, 1986; Bender & Smith, 1990; McKinney & Feagans, 1984). This is important because off-task classroom behavior has been correlated with negative academic progress (McKinney & Feagans, 1983; McKinney, Mason, Perkerson, & Clifford, 1975). Several studies have shown improvements in classroom behavior following a physical activity break in children of typical development (Barros, Silver, & Stein, 2009; Gabbard & Barton, 1979; Jarrett et al., 1998; Ma et al., 2014; Mahar et al., 2006; McNaughten & Gabbard, 1993; Miller & Cox, 2001); however, to date few studies have examined the impact of physical activity on classroom behavior and academic achievement in children with disabilities (Ma et al., 2014). This is an important area of research as classroom behavior is associated with academic success and children with disabilities have increased off-task classroom behavior and lower educational outcomes

(Alexander et al., 1993; Bender, 1986; Bender & Smith, 1990; Ma et al., 2014; Mayes et al., 2000; McKinney & Feagans, 1984).

In addition to increased off-task behavior in children with disabilities, instances of self-stimulatory behavior are more likely to be observed in individuals with disabilities than people with typical development (Lovaas, Litrownik, & Mann, 1971; Watters & Watters, 1980). Self-stimulatory behaviors refer to repetitive body movements or can include repetitive movements with objects such as, rocking the body, moving fingers, nodding the head, staring at lights, and shaking or lining up objects (Kern, Koegel, Dyer, Blew, & Fenton, 1982; Lovaas, Newsom, & Hickman, 1987). While not all populations experience the same self-stimulatory behaviors, these types of behaviors are often shown to interfere with learning in many children with disabilities (Kern et al., 1982). Therefore, reducing self-stimulatory behavior is important for children with disabilities to facilitate learning in the classroom.

Summary

There is considerable lack of physical activity in the Canadian population, especially among children (Colley et al., 2011) and children with disabilities (Graham & Reid, 2000; Johnson, 2009; McDonald, 2002; Rimmer, 1999). Physical activity may be of even greater importance for children with disabilities because they are also at risk for secondary impairments due to the nature of their disability and sedentary lifestyles which may further compromise their health (Graham & Reid, 2000; Johnson, 2009; McDonald, 2002; Rimmer, 1999). In response to increasing children's physical activity, the Ontario Ministry of Education mandated that school boards provide "all elementary age students with a minimum of 20 minutes of sustained moderate to vigorous physical activity each

school day during instructional time" (p. 6) (Ontario Ministry of Education, 2006). Studies have shown that short bouts of DPA may be feasible for students and teachers (Ma et al., 2014; Oriel, George, Peckus, & Semon, 2011). Incorporating DPA breaks during instructional time may benefit children with disabilities. Research has shown that children with disabilities are less likely to be on-task and more likely to be off-task compared to their peers without disabilities (Bender, 1986; Bender & Smith, 1990; McKinney & Feagans, 1983). In addition to increased off-task behavior in children with disabilities, instances of self-stimulatory behavior are more likely to be observed in children with disabilities (Lovaas et al., 1971; Watters & Watters, 1980). Reducing self-stimulatory behavior is important among children with disabilities because it has been shown to interfere with learning and concentration in the classroom (Kern et al., 1982). It is important to investigate how to best incorporate physical activity into a school day for maximum effect on increasing children's DPA levels, increasing on-task classroom behavior, and reducing self-stimulatory behavior in children with disabilities

This study will investigate the feasibility and engaged level of incorporating daily physical activity 4x/day in a classroom of children with disabilities. The secondary purpose of this study was to determine if on-task behavior would improve and self-stimulatory behavior would decrease from baseline measures to follow-up measures, baseline to intervention, and immediately before DPA to immediately after. Results from this study will be divided into two main components: the on-task and self-stimulatory behavior outcomes (refer to Chapter 3), and the engagement outcomes during DPA intervention (refer to Chapter 4).

Proposed Research Framework: Play Deprivation Theory in Children with Disabilities

Play deprivation theory predicts that when children are engaged in cognitive tasks for a period of time, the longer the duration of instructional time will cause the children to engage in greater physically active and socialized tasks when given a break (Burghardt, 1984). Burghardt (1984) refers to this active break as a rebound because the duration of the sedentary period immediately before recess, for example, should result in increased levels of those behaviors of which children were deprived (Burghardt, 1984; Pellegrini, Huberty, & Jones, 1995; Smith & Hagan, 1980). The idea behind the play deprivation-rebound theory is that childhood is a period during which social and motor skills are developed and utilized and when given the opportunity children will engage in social and physical behaviors through active play (Burghardt, 1984; Smith & Hagan, 1980). If a child is deprived of opportunities to engage in social as well as physically vigorous behaviors (ie. during instructional time), they will later engage in increased levels of physical activity and social interaction when given the chance (ie. rebound) (Burghardt, 1984). Few studies of play deprivation have been conducted and focused on animals (Fagen, 1981) including deer (Müller-Schwarze & Müller-Schwarze, 1982), reptiles (Burghardt, 1988), goats (Chepko, 1971). However, there have been a few studies including samples of British preschool children (Smith & Hagan, 1980), and American primary school children (Pellegrini & Davis, 1993).

Pellegrini et al. (1995) proposed the idea of play deprivation theory and the effects of recess timing on children's playground and classroom behaviors. The hypothesis was that physical activity and social interaction at recess will provide positive academic and behavior outcomes on children's post recess work tasks (Pellegrini et al.,

1995). These recess behaviors also provide a break from academic tasks. Research suggests that providing children with active breaks from academic tasks can potentially improve or enable scholastic performance (Bjorklund & Harnishfeger, 1990; Pellegrini et al., 1995).

Building upon the play deprivation theory is the idea that, prior to a physical activity break, children have decreased attention, are more likely to be off-task, and are not cognitively present (Chomitz et al., 2009; Mahar et al., 2006). However, following a physical activity break children should be more alert, focused, and on-task because they have been given the opportunity to engage in physical activity and social interactions which gave them a break from cognitive tasks. It has been consistently shown that children become less attentive and distractible as a result of prolonged sedentary behavior in the classroom (Pellegrini & Davis, 1993; Ridgway, Northup, Pellegrin, LaRue, & Hightshoe, 2003). Research has also demonstrated that children focus more and fidget less after they have had an active break, compared with immediately before (Jarrett et al., 1998; Pellegrini et al., 1995; Ridgway et al., 2003). Interrupting prolonged periods of sedentary classroom behaviors with a physical activity break can be particularly important for children with attention deficit hyperactivity disorder (ADHD) (Ridgway et al., 2003). Previous studies have strongly suggested the importance of providing frequent breaks for active play (ie. recess) during the school day for these children (Jarrett et al., 1998; Pellegrini et al., 1995; Ridgway et al., 2003). Researchers have even proposed that an increase in the diagnosis of ADHD may be in fact due to schools cutting back on physical activity delivery in an effort to increase time spent on academics (Panksepp, 1998).

A study by Ridgway et al. (2003) aimed to determine the effects of recess on inappropriate behaviors among children with a diagnosis of ADHD. Results demonstrated that participants' off-task and distractible behaviors were significantly higher on days when they did not have recess, compared with days when they did. In addition, the children's level of off-task behaviors generally increased over time on days they did not have recess but this increase did not occur on days the students had recess. This study also replicates and extends the work of Pellegrini et al. (1995) with an evaluation of the effects of classroom confinement on classroom behavior for participants with ADHD and builds on previous research where all children with a diagnosis of ADHD benefited from recess (Jarrett et al., 1998; Pellegrini et al., 1995). Results from Ridgway et al. (2003) also suggest that recess may have a greater impact on levels of off-task behavior for children with ADHD, which may be due to higher levels of baseline off-task behaviors. Findings from this study agree with Pellegrini (1995) who found that children who demonstrate high energy during instructional time may have a greater need for recess than less active children. ADHD is an excellent example of a population that demonstrates the benefits of a physical activity break such as recess on classroom behavior. However, future research should extend that on other types of developmental disabilities (DD) and intellectual disabilities (ID) to determine if other methods of physical activity such as, DPA could potentially provide the same benefits. Ridgway et al. (2003) reported recess as being an effective intervention; however, the mechanism by which recess affected each participant's behavior is unknown. A physical activity break may have served as an escape from prolonged classroom sedentary behavior but the functions of this break may vary across individuals.

The current study will aim to build upon the play deprivation theory proposed by Burghardt (1984) and Pellegrini et al. (1995). Students can spend a large portion of their day sitting at their desks without receiving physical education (PE) or DPA. These prolonged periods of sedentary cognitively demanding tasks can decrease concentration, increase fidgeting, and decrease time on-task in a classroom of elementary school children, which in turn can lead to decreased academic achievement. Providing a physical activity break will hopefully increase concentration, reduce fidgeting, and increase time on-task by making the students more attentive and focused. According to the play deprivation theory, the duration of the classroom confinement period immediately before the short active break should result in increased levels of physically vigorous behaviors during the break. If deprived of the opportunity to engage in physical activity, when given the opportunity later, children will engage in increased levels of physical activity. In addition, it may be beneficial to provide multiple short active breaks throughout the school day to keep the instructional period short. This is in agreement with previous research suggesting that when instructional periods are kept relatively short, rather than long and intense, children's attention to class work is maximized (Pellegrini et al., 1995).

It is believed that by applying the play deprivation theory to this study, children should have increased concentration following each physical activity break. This is due to the children rebounding from their previous deprivation during instructional time. Therefore, the active break will provide the students with the opportunity to engage in structured and motivating forms of physical activity. In addition, this physical activity break will provide a change from cognitively demanding class tasks which research suggests may improve cognitive performance (Pellegrini et al., 1995). Also, the level of

engagement to which the children participate in the physical activity break should be directly related to the attention level on class work following the active break.

Significance of the Study: Addressing the Gaps in the Literature

Children with disabilities demonstrate poor health and are less physically active than their peers (Sit et al., 2007). Children with disabilities tend to engage in less daily physical activities, including at school (Sit et al., 2007). Campbell Children's School is the education partner of Grandview Children's Centre and is one of six schools in Ontario. Campbell's is a school for children with disabilities where teachers and therapists work collaboratively to create a program that supports each student and ensures a smooth transition to a home school. Campbell's is mandated under Section 68 of the Education Act to provide, in agreement with the Act and its regulations, the educational components of Grandview Children Centre's therapy program (Special Education Report, 2015). To the best of our knowledge, no published research has examined the effectiveness of physical activity on classroom behavior in children with disabilities. It is particularly important to incorporate physical activity in the classroom for children with disabilities because they tend to display poor behavior such as, inattentiveness, withdrawal, impulsivity, and hyperactivity (Stanford & Hynd, 1994) and are more distractible and off-task compared to their peers without disabilities (Bender, 1986; Bender & Smith, 1990; McKinney & Feagans, 1984). Therefore, this study will fill a gap in the literature by investigating the effect of four 5-minute bouts of physical activity on classroom behavior in kindergarten children with disabilities.

It is hypothesized that implementing a DPA program in Campbell Children's School can provide lasting benefits to the children academically by improving concentration, on-task behavior, and reduce self-stimulatory behavior but can also encourage the teachers to include active breaks throughout the school day (Chomitz et al., 2009; Davis et al., 2011). This study will help to fill the school's need of incorporating

PA in the school day for children with disabilities and address research gaps on whether PA in the curriculum improves behavior and overall academic achievement.

Purpose and Overall Contribution

The overall purpose of this study is to determine the feasibility of implementing a DPA program including four short bouts of 5 minutes (total 20 mins/day) of physical activity in a classroom of preschool age children with disabilities. A secondary outcome will be to measure the effectiveness of physical activity at decreasing off-task behavior and self-stimulatory behaviors. Expected results from this study are to improve concentration and on-task behavior in class following an active break. Teachers can also benefit from this by learning about the benefits of incorporating short active breaks in their curriculum.

There is no known research investigating the effectiveness of including multiple short bouts of physical activity in a classroom of children with developmental disabilities. The results from this study will fill a gap in the scientific literature, and may help to shape the curriculum for teachers and children in future schools with children with disabilities.

Hypothesis and Objectives

Objectives of Research

1. To determine the level of engagement and feasibility of implementing a DPA program including multiple short bouts of physical activity in a kindergarten classroom of children with disabilities.

2. To investigate the effectiveness of implementing a DPA program including multiple short bouts of physical activity in a kindergarten classroom of children

with disabilities at improving on-task behavior and reducing self-stimulatory behaviors.

Specific Hypothesis of the Research

1. The DPA program will be feasible in a kindergarten classroom of children with disabilities and engagement will be moderate.

2. The DPA program will result in improvements in on-task behavior and reduce self-stimulatory behaviors in a kindergarten classroom of children with disabilities.

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Chapter 2: Literature Review

Physical Activity and Children

Lack of physical activity and obesity represent two of the greatest burdens to public health in Canada (Katzmarzyk & Janssen, 2004). It is very well established that physical activity plays a critical role in health, well-being, and overall quality of life. Studies have confirmed that physical activity is associated with several health benefits in elementary school-aged children (Janssen & LeBlanc, 2010). In addition, interrupting classroom work tasks with physical activity breaks can improve behavior, reduce fidgeting, and increase time on-task by making students more attentive and focused (Chomitz et al., 2009; Davis et al., 2011), which in turn can improve academic success (Donnelly et al., 2009). Improved cognition can occur from increased blood flow to the brain and raises in levels of norepinephrine and endorphins after exercise, which may reduce stress and cause a more focused effect following a physical activity break (Fleshner, 2000; Morgan, 1994; Taras, 2005). There is also strong evidence that suggests higher levels of physical activity in individuals with and without disabilities are associated with greater health benefits and the more activity, the greater the benefit (Colley et al., 2011).

The Ontario government is committed to supporting a healthy school environment (Ontario Ministry of Education, 2005). The Ontario Ministry of Education has mandated that school boards must ensure that "all elementary students, including students with special needs, be provided with a minimum of twenty minutes of sustained moderate to vigorous physical activity each school day during instructional time" (p. 6) (Ontario Ministry of Education, 2005). Daily physical activity (DPA) is an important component of the school day because there is growing evidence that there is a considerable lack of physical activity in the Canadian population, especially among children (Colley et al.,

2011). Canadian children spend approximately 9 hours per day in sedentary activity (Colley et al., 2011). According to the Canadian Physical Activity Guidelines, for health benefits, children aged 5-11 years should accumulate at least 60 minutes of moderate-to-vigorous physical activity (MVPA) a day (Canada's Physical Activity Guidelines for Children, 2002). This should include vigorous-intensity activities and activities that strengthen muscle and bone at least 3 days per week. However, according to the Canadian Health Measures Survey (CHMS) results from 2007-2009 that included children and adolescents aged 6-19 years, few children accumulate even adequate daily amounts of physical activity (Colley et al., 2011). On at least 6 days a week, an estimated 9% of boys and 4% of girls achieved 60 minutes of moderate-to-vigorous physical activity (Colley et al., 2011). This data suggests that the importance of physical activity is not being taken seriously and schools and communities should provide greater opportunities for physical activity for youth, as well as improved understanding of strategies that can be effective in increasing children's daily physical activity (Batshaw, Roizen, & Lotrecchiano, 2007).

Physical Education and Daily Physical Activity in the Curriculum

It is well established that physical activity is a priority for children with and without disabilities, and a very important and suitable institution to address physical activity is in a school-setting. Children spend a large portion of their day in the education system, six or seven hours a day in which most of that time is spent sitting at their desks (Patton, 2012). Due to this significant amount of time spent in school, the education system has a responsibility to increase physical activity in school settings for all children. Physical education (PE) is considered the main domain for developing and shaping

children's physical activity behavior (Sit et al., 2007). PE is believed to provide opportunities for participating in physical activity on a regular basis and helps develop motor skills and knowledge that will promote an active lifestyle for children (Sit et al., 2007). Although PE is the most common form of physical activity delivery in schools, other physical activity initiatives are becoming more common, such as DPA. However, there is a common belief among teachers that increasing time spent on physical activity will cut into valuable time that should be spent on academics (Coe, Pivarnik, Womack, Reeves, & Malina, 2006; Sallis et al., 1999).

Many school districts have reduced PE requirements and have even eliminated physical activity programs altogether (Coe et al., 2006; Thomas, 2004). The percentage of schools requiring PE in each grade in the U.S decreased from approximately 50% in grades 1-5, to 25% in grade 8, to only 5% in grade 12 (Doak, Visscher, Renders, & Seidell, 2006). Data from Active Healthy Kids Canada report card indicate that the proportion of students who get the recommended 150 minutes of PE per week ranges from 15-65% across school grades (Active Healthy Kids Canada, 2012). In addition, only 31% of Canadian students receive regular PE (4-5 times per week) and the percentage of students taking at least 1 PE class per week drops significantly in higher grades (57% among grade 11-12 students) compared to other grades (98% in kindergarten, 99% in Grades 1-8, 84% in grades 9-10) (Active Healthy Kids Canada, 2012). PE classes are being replaced with other classes in an effort to increase the students' academic achievement (Coe et al., 2006); however, there is no evidence that academic achievement improves when PE classes are removed (Coe et al., 2006). In fact, there is evidence to the contrary. Numerous studies have demonstrated a positive relationship between academic

achievement and physical activity (Caterino & Polak, 1999; Coe et al., 2006; Keays & Allison, 1995; McNaughten & Gabbard, 1993; Pate, Heath, Dowda, & Trost, 1996; Raudsepp & Viira, 2000; Shephard, 1996, 1997; Shephard, Lavallee, Volle, LaBarre, & Beaucage, 1994; Sibley & Etnier, 2003; Tomporowski, 2003). This indicates that physical activity in schools should be prioritized.

The education system and teachers play a vital role in delivering physical activity for students and should not be cutting back on PE. The reality is that for many children if they don't get their physical activity in school, they won't get any at all (Sallis et al., 1999). School systems need to optimize what is already there, such as PE curriculums and in addition, look for other opportunities outside of PE in elementary schools that would include recess, classroom activity breaks, and before- and after- school programs. For this purpose the Ontario Ministry of Education announced a policy in 2005 requiring that "all elementary students Grades 1 to 8, including students with special needs, be provided with opportunities to participate in a minimum of twenty minutes of sustained moderate to vigorous physical activity each school day during instructional time" (p. 6) and could occur in a variety of locations (ie. classrooms, outdoors, and the gymnasium) (Ontario Ministry of Education, 2006). Full implementation of policy No. 138, "Daily Physical Activity in Elementary Schools, Grades 1-8", was to occur by the end of the 2005-06 school year (Ontario Ministry of Education, 2006). The goal of DPA is to enable all elementary students to improve or maintain their physical fitness and their overall health and wellness, and enhance their learning opportunities (Ontario Ministry of Education, 2006).

Daily Physical Activity in Canada

Ontario, Quebec, and Alberta have each mandated DPA within their school systems. However, in many schools the DPA program is not being run as mandated by the provincial government. Stone and colleagues conducted a study to evaluate whether the Ontario Ministry of Education's DPA policy was being effectively implemented in elementary schools. Of 856 participants, approximately half the students engaged in DPA every day of the school week, with a total of 16.6% engaging in DPA on 2 days, 17.9% on 3 days, and 16.1% on 4 days (Stone, Faulkner, Zeglen-Hunt, & Bonne, 2012). Just 165 participants (19.3%) accumulated at least 1 sustained (>5 min) bout of MVPA during scheduled DPA across the school week (Stone et al., 2012). The majority of bouts lasted between 5 and 10 minutes in duration and there were no differences according to gender (Stone et al., 2012). No children achieved a total of 20 minutes during a scheduled session of DPA, however, only 9 participants (1% of sample) were able to accumulate at least 15 minutes of MVPA through multiple shorter bouts on 1 day of scheduled DPA (Stone et al., 2012). The results indicate that incorporating multiple shorter bouts of physical activity into the classroom rather than one long bout of 20 minutes, may be more feasible and engaging for students and teachers.

A study conducted by Patton in 2012 selected a random sample of 37 schools across the Thames Valley District School Board in London, ON and provided questionnaires to each teacher addressing how the teachers conduct DPA in their classroom, any barriers to DPA delivery in the school setting, and the teacher's subjective attitudes towards the DPA program (Patton, 2012). One-hundred and forty-five questionnaires were returned of which 67 were from kindergarten – grade 3, 38 were

from grade 4 – grade 8, 22 were from grade 9 and up, and 18 were not categorized into grades (Patton, 2012). The most common frequency noted was 39% of respondents reported performing DPA sessions as 'sometimes'. An additional 16.3% reported 'never' or 'rarely' conducting DPA sessions, and only 45% of respondents claimed to be 'somewhat' knowledgeable about the Ministry of Education guidelines for DPA (Patton, 2012). This suggests that DPA is not being viewed as an important component to the curriculum and the program requirements are not being fully understood by the teachers (Patton, 2012). It is surprising because eighty-five percent of the teachers stated that they have sufficient knowledge of physical activity to conduct sessions of DPA and that if needed, there were enough educational resources at their disposal. In addition, 45% of respondents reported that time was the biggest barrier to planning DPA and conducting the DPA program in their classroom (Patton, 2012). Also, 39% of teachers stated that time devoted to DPA often or always took time away from other subjects (Patton, 2012). Therefore, although the provincial government has mandated an intervention to promote healthy living such as increasing physical activity among children, school-based interventions require the school boards, administrators, and teachers to all be on board in order to function efficiently (Patton, 2012).

The DPA program is a useful step towards encouraging healthier lifestyles among children and youth, however, there is a need to address the lack of DPA delivery among teachers through program follow-up (Patton, 2012). To date there has been no research supporting the effectiveness of including physical activity breaks in a classroom of children with disabilities. It is important for all children, including children with disabilities, to obtain the benefits of receiving quality physical activity from a teacher

who is passionate and knowledgeable for a healthier school community that embraces the importance of physical activity. It is clear that research should be done to fill a gap in the scientific literature that may help shape the curriculum for teachers and children with disabilities in future schools.

Benefits of Physical Activity in the Curriculum

Research has consistently shown positive effects in cognitive function, concentration, on-task behavior, and academic achievement following a physical activity break during instructional time (Chomitz et al., 2009; Davis et al., 2011). Current research demonstrates that interrupting cognitively demanding tasks with bouts of physical activity will help prevent chronic diseases and promote well-being (Barr-Anderson, AuYoung, Whitt-Glover, Glenn, & Yancey, 2011). It is suggested that recommended DPA accumulated in short intervals may be more feasible and appealing to children and teachers than longer bouts (Barr-Anderson et al., 2011).

A study conducted by Gibson et al. (2008) implemented an intervention called Physical Activity Across the Curriculum (PAAC) consisting of 90 minutes of moderate intensity physical activity as part of academic instruction to improve educational outcomes in students over a 3-year period. A sample of 4906 children across 24 schools were included in this study. On a weekly basis, teachers reported which academic subjects they incorporated physical activity, the number of minutes per day they were using PAAC and the estimated level of intensity their students were engaged (i.e., light, moderate, or high intensity levels). Using a 5-point scale adapted from the Child and Adolescent Trial for Cardiovascular Health the teachers gathered information about their

self-confidence to delivering physical activity during instructional time and their opinion of the programs importance (Gibson et al., 2008). Results demonstrated that students in the intervention schools performed significantly greater levels of physical activity in the classroom than students in the control schools (Gibson et al., 2008). Over the course of six months, the number of minutes teachers incorporated PAAC into their lessons increased considerably, beginning with 47 minutes and ending with 65 minutes per week (Gibson et al., 2008).

The majority of teachers reported no barriers to incorporating physical activity into the classroom curriculum (Gibson et al., 2008). However, 26% reported time constrictions caused by field trips, standardized testing, and substitute teachers (Gibson et al., 2008). Finally, most teachers indicated high levels of confidence to deliver physical activity and incorporate it in the curriculum. The teachers also reported that although, at the onset, they had concerns about the possibility of worsening off-task and distractible behaviors at the beginning by adding physical activity to instructional time, the opposite occurred with PAAC. Teachers reported that it improved behavior and reduced fidgeting, as well as increased time on-task by making the students more alert and attentive (Gibson et al., 2008). In addition, PAAC helped the students retain concepts better and improve learning (Gibson et al., 2008). These findings demonstrate that physical activity in the curriculum was well accepted by the students and teachers following the 1 year evaluation. Although 90 minutes of PAAC lessons were not achieved per week, teachers valued the importance of physical activity in the curriculum and observed many benefits in the children academically and physically from incorporating physically active lessons within their classrooms (Gibson et al., 2008). At the end of the study 58% of teachers

reported that an intervention such as PAAC was able to improve behavior management and increase time on-task without taking time away from academic subjects in classrooms of typically developed children (Gibson et al., 2008). Compared to the control schools significant improvements were shown from baseline to 3 years for reading, math, and writing (Gibson et al., 2008) However, no child in this study was reported to have a disability. Further research should determine if behavior and academic improvements can be achieved in a population of children with disabilities.

A study by Stewart and colleagues (2004) confirmed that the recommended level of physical activity can be achieved in the classroom-setting if the active breaks are given in 10 minute bouts. They evaluated the effectiveness of an innovative, classroom-based physical activity program called TAKE 10! which was designed to integrate educational curriculum components along with a physical activity program in increasing DPA in children. Participants included students sampled across three classrooms of first, third, and fifth grade. The intervention occurred over a 5 day period including eight to nine activity sessions per class (Stewart, Dennison, Kohl, & Doyle, 2004). Teachers recorded how often they delivered each activity break as well as the number of step counts from the pedometers after each activity break (Stewart et al., 2004). Results demonstrated a similar number of sessions (8-9) were reported from the three grade levels and the exercise bouts ranged from approximately 10 to 11 minutes per session (Stewart et al., 2004). The total time spent in TAKE 10! activity sessions during the week of intervention for the three classrooms was 88.9 minutes for the first grade class, 91 minutes for the third grade classroom, and 86.1 minutes for the fifth grade class (Stewart et al., 2004). Participants in this study were able to achieve moderate-to-vigorous exercise intensities

and the intensity remained throughout the activity break (Stewart et al., 2004). Therefore, this study confirms that a classroom-based physical activity program integrated with academic curriculum can help students achieve increased physical activity even if the bouts of exercise are short (10 minutes). Future studies should investigate the effectiveness of implementing the recommended level of physical activity in shorter bouts at increasing time on-task in a classroom of children with disabilities.

Findings from Tsai and colleagues (2009) support the effectiveness of the TAKE 10! Program at helping students become more alert and focused following the physical activity break. Participants included elementary school Hispanic students in one lower socioeconomic public urban school (Tsai, Boonpleng, McElmurry, Park, & McCreary, 2009). Information questionnaires were obtained from 29 teachers who answered a written survey of their opinions about the TAKE 10! Program. The majority of the teachers thought the program had positive effects on the students. In general, teachers implemented the program 30-50 minutes per week, however, teachers reported that time and classroom interruptions were the main barriers to implementing the program (Tsai et al., 2009). Nevertheless, 24 teachers felt that students need more opportunities for physical activity during the school day. However, one teacher disagreed, and three were unsure, indicating that some teachers continue to not view physical activity as a priority. This is important because the DPA program cannot operate effectively without the full support of the school boards, administrators, and teachers and DPA is a useful step towards encouraging healthier lifestyles among children with and without disabilities. Both teachers and students reported that students were able to focus more on cognitive tasks following TAKE 10! (Tsai et al., 2009). The teachers changed their opinion and

became involved in including physical activity in the curriculum once they saw the program's effect on the students (Tsai et al., 2009). The findings of this study were consistent with previous reports that found the TAKE 10! Program can help students increase their physical activity levels (Barry, Mosca, Dennison, Kohl, & Hill, 2003; Mahar, Rowe, Kenny, & Fesperman, 2003; Tsai et al., 2009). However, TAKE 10! did not report any results for children with disabilities, future research should investigate whether this program could also improve concentration and on-task behaviors in students with disabilities.

A study conducted by Ahamed and colleagues (2007) evaluated the effectiveness of a school-based physical activity intervention, Action Schools! BC (AS! BC), for maintaining academic performance in a multiethnic group of elementary school children in British-Columbia, ON (Ahamed et al., 2007). A second purpose was to determine if gender had an influence on academic performance after participation in AS! BC (Ahamed et al., 2007). Teachers were asked to create a physical activity program that met the needs of each of their students and would provide classroom-based physical activity for 15 minutes each school day, five days a week for 16 weeks (Ahamed et al., 2007). Activities that were included in the program included hopping, seated aerobics, dancing, playground circuits, and strength exercises with exercise bands (Ahamed et al., 2007). Children continued to receive their regular program of PE, which included two 40-minute PE classes a week in addition to 75 minutes of classroom-based physical activity acquired each week (Ahamed et al., 2007). To assess student educational outcomes the Canadian Achievement Test was used. Results demonstrated that there was no difference in gender, and educational outcome scores were similar at baseline and changed similarly

during the intervention period. However, AS! BC effectively increased physical activity delivered to students in elementary schools. Although, the additional 10-15 minutes of school time devoted to physical activity did not improve educational achievement significantly, physical activity did not negatively affect student's educational outcomes (Ahamed et al., 2007). This suggests that a program like AS! BC effectively increased physical activity delivered to elementary school students and may be an attractive alternative for school administrators who aim to promote a school-based physical activity model, however, future research should look at shorter bouts of physical activity and the feasibility of such programs in classrooms of children with various disabilities.

Benefits of short bouts of Physical Activity in the curriculum

The Ontario Ministry of Education has mandated that "all students be provided with opportunities to participate in a minimum of 20 minutes of sustained moderate to vigorous physical activity each school day during instructional time" (p. 6) (Ontario Ministry of Education, 2006). However, many studies have demonstrated that students are not capable of sustaining MVPA for long durations (10-20 minutes) at a single time (Patton, 2012; Stone et al., 2012). Prior research has suggested that bouts of physical activity designed to be 10-20 minutes in duration begin to resemble exercise prescriptions and are less feasible to integrate into structured routine (Barr-Anderson et al., 2011). Therefore, the recommended DPA may be more feasible and appealing to teachers and students, especially students with developmental and intellectual disabilities, if accumulated in shorter intervals (5 mins or less) (Barr-Anderson et al., 2011)

A study conducted by Ma et al. (2014) examined the effects of a short bout of high-intensity interval exercise on off-task classroom behavior in primary school students. Participants were recruited from two south eastern Ontario elementary schools that were a part of either the active group or the inactive group (Ma et al., 2014). The study consisted of a single group, repeated cross-over design where each student's off-task behaviors on no-activity days were compared with their FUNterval days. FUNterval activities were delivered in 4-minute bouts, were always delivered in the classroom, were performed without equipment required, and occurred over a 3-week period. High-intensity movements incorporated into FUNterval activities included running in place, squats, jumping, and kicking. Interventions were conducted after at least 20 minutes of normal classroom instruction and following each active break the student's behavior was observed for 50 minutes during classroom instruction. Off-task behavior was measured using the Behavioral Observation of Students in Schools tool (BOSS) (Barr-Anderson et al., 2011; Hintze, Volpe, & Shapiro, 2002) with off-task behavior being recorded using the partial interval method (Barr-Anderson et al., 2011; Shapiro, 1996). Researchers recorded the occurrence and duration of motor (ie., fidgeting, restlessness, out-of-seat), verbal (ie., talking when prohibited), and passive (ie., looking out the window, watching other students) off-task behavior during each 30-s interval during each observation period (Ma et al., 2014; Shapiro, 1996). Duration of any off-task behavior was recorded as occurring for 1-4 seconds (ie. short period of time), 5-25 seconds (ie. some of the time), or for the entire duration of the observation interval (Ma et al., 2014). Results demonstrated that all off-task behaviors were significantly lower following the FUNterval intervention (passive 9%, verbal 3%, and motor 15% compared with the grade 2 control

classroom (Ma et al., 2014). Only the mean percentages of passive and motor off-task behavior were significantly decreased after the FUNterval activity break in the fourth grade classroom (Ma et al., 2014). This study demonstrates that 4-minute bouts of high-intensity physical activity, which is the shortest protocol to date, can decrease off-task classroom behavior in both grade 2 and grade 4 students (Ma et al., 2014). Students with the highest off-task behavior on days when FUNtervals was not delivered acquired the greatest benefit. This may provide additional motivation for teachers to include regular physical activity in their curriculum. These findings correlate with other evidence that is available suggesting that learning may actually be improved when it takes place following physical activity (Ma et al., 2014; Trudeau & Shephard, 2008). These results combined with other reports demonstrating the benefits of physical activity on classroom behavior (Grieco, Jowers, & Bartholomew, 2009; Jarrett et al., 1998; Ma et al., 2014; Mahar et al., 2006), suggest that improved on-task behavior may provide a link between physical activity and educational outcomes. The positive outcomes of this study highlight the importance of performing future research on larger, more diverse samples to examine the appropriateness of activity protocols for use with children with disabilities and its efficacy for decreasing off-task behavior in these populations.

Relationship between Physical Activity and Academic Achievement

In elementary schools PE is generally limited 30 minute sessions 2 or 3 days/week (Donnelly et al., 2009; Parsad, Lewis, & Greene, 2006) and students tend to only spend half of this time actually engaged in sustained MVPA (Donnelly et al., 2009; Levin, McKenzie, Hussey, Kelder, & Lytle, 2001). Therefore, if physical activity is to be increased in elementary schools, settings other than PE need be developed and assessed.

Students spend the majority of their time in a regular classroom, thus the classroom may be the ideal setting to combine physical activity with academic instruction. If regular classroom teachers provide physically active academic lessons it can help increase time on-task, reduce fidgeting, and increase concentration by making students more attentive and less distracted (Chomitz et al., 2009; Davis et al., 2011), which in turn can improve cognitive function and educational outcomes (Donnelly et al., 2009).

Two mechanisms have been proposed to explain the relationship between physical activity and cognition, which include, physiological mechanisms and learning/developmental mechanisms (Sibley & Etnier, 2003). Physiological mechanisms are based on physical changes in the body such as increased blood flow to the brain and raises in norepinephrine and endorphins, which occur from exercise (Sibley & Etnier, 2003). Movement and physical activity provide learning experiences that help, and may even be necessary for, proper cognitive development (Sibley & Etnier, 2003). Research has shown that in very young children movement stimulates brain development because skills and relationships learned during exercise transfer to the learning of other concepts and relationships in academics (Leppo, Davis, & Crim, 2000; Piaget, 1968; Pica, 1997; Sibley & Etnier, 2003). This would suggest that to acquire cognitive benefits the actual physical exertion during exercise is not what is important, in fact, it is the movement involved in the activity that is important (Sibley & Etnier, 2003). The importance of physical activity for overall health and well-being is well known, however the positive impacts of physical activity on increasing attentiveness, learning, and educational outcomes on reducing off-task and self-stimulatory behaviors are not well understood (Mahar et al., 2006). Children often are more focused and learn concepts better after

participating in physical activity through recess or PE (Bachman & Fuqua, 1983; Jarrett et al., 1998; Mahar et al., 2006; Rosenthal-Malek & Mitchell, 1997; Sallis et al., 1999; Shephard, 1996, 1997). Elementary school children who are in engaged in sedentary cognitively demanding tasks for long durations often become distractible and restless and are unable to concentrate (Mahar et al., 2006; Pellegrini & Davis, 1993). This may be of even greater importance among children with developmental and learning disabilities who may already have difficulties staying on task due to the nature of their disability (Sibley & Etnier, 2003). Therefore, allowing for an active break during instructional time may help students focus more, behave better, and stay on task which can all improve academics.

A meta-analysis on the relationship between physical activity and cognition in children conducted in 2003 suggested that physical activity may be related to cognitive function during development (Sibley & Etnier, 2003). Results of this study also indicated that physical activity may be an important component to children with disabilities education program because physical activity is just as beneficial for children with learning disabilities as it is with children without (Sibley & Etnier, 2003). An important finding was that improvements in cognitive function did not depend on the type of activity, suggesting that any type of physical activity can benefit cognition. Elementary school students appeared to receive greater benefit in cognitive performance after participating in physical activity (Sibley & Etnier, 2003). This is not surprising because young children tend to engage in more active play and research suggests that movement may be especially important to the cognitive development of very young children (Leppo et al., 2000; Piaget, 1968; Pica, 1997; Sibley & Etnier, 2003).

The most interesting finding from Sibley & Etnier (2003) was that academic grades produced significant improvement, which is the area that teachers are most concerned about improving, and interestingly this is also the area considered when PE programs are reduced in an effort to increase time spent on academic subjects (Sibley & Etnier, 2003). This finding demonstrates that PE programs may actually result in improved education outcomes (Sibley & Etnier, 2003). Therefore, the results from this analysis support previous findings suggesting that physical activity may actually be related to improved cognitive performance and academic achievement and provides evidence for the argument that physical activity should be a part of the school day for both its physical health and cognitive benefits (Shephard, 1997; Sibley & Etnier, 2003). Future research should focus on classrooms with children with developmental and intellectual disabilities to determine if incorporating physical activity in the classroom-setting will provide the same positive outcome on on-task behavior and academic achievement.

Coe et al. (2006) conducted a study to determine the effect of PE classroom enrollment and activity levels on academic achievement in 214 sixth-grade students from a single public school in western Michigan. The students were randomly assigned to one of two groups; one group was enrolled in PE for the first semester and during the second semester the students were enrolled in an art or computer class (Coe et al., 2006). Academic achievement was assessed from 4 core academic courses (math, science, English, and world studies) (Coe et al., 2006). Results demonstrated that when the students performed physical activity at any intensity during the first semester, they had better educational outcomes compared with students who did not participate in any

activity (Coe et al., 2006). Although, the majority of this activity was achieved through participation in sports outside of school and not significantly related to PE enrollment, higher grades were associated with vigorous physical activity, suggesting that PE cannot be the only location where children engage in moderate to vigorous physical activity, other venues should be utilized, such as the classroom.

Cognitive benefits

A study conducted by Davis et al. (2007) evaluated the effect of an aerobic exercise program on children's cognitive performance. Ninety-four children ranging from 7 to 11 years of age with obesity were separated into three groups which include: a low-dose (20 minute/day exercise), high-dose (40 minute/day exercise), or control condition 5 days/week for 15 weeks (Davis et al., 2011). The exercise conditions occurred in the gymnasium and differed in intensity but not duration (volume) of DPA. The physical activity bouts occurred at the end of the school day rather than preferably being delivered during prolonged periods of cognitively demanding tasks. Cognitive Assessment System (CAS), which is a standardized test of cognitive processes, was administered individually before and following the intervention. Results demonstrated that students in the control group did not perform as well academically than the students in the high dose exercise group (Davis et al., 2007) These results provide evidence for a relationship between a high-intensity physical activity and improvement in children's cognitive functioning (Davis et al., 2011). The children who received physical activity at high-intensity significantly increased their standardized test scores for Planning compared to the control group (Davis et al., 2011). Executive function, particularly the element of self-monitoring, plays a pivotal role in planning, organizing, and controlling goal-directed actions which are crucial to the development during the school-age years (Davis et al.,

2011; Eslinger, 1996). The Planning scale of the CAS is linked to achievement, indicating that these findings may have important implications for children's educational outcomes (Davis et al., 2007). Increased sedentary behavior among children may negatively impact their cognitive health (Booth, Gordon, Carlson, & Hamilton, 2000; Davis et al., 2011). Future studies should address the minimum duration needed for a program of regular exercise to achieve an effect on cognition. These findings are consistent with the literature suggesting that perhaps if children routinely had opportunities for supervised physical activity during the school day, they would be better able to learn information presented in their academic classes (Davis et al., 2011).

In addition, Hillman and colleagues (2009) found students performed better on the academic achievement test following aerobic exercise. Changes in performance following exercise during a modified flanker test were assessed on 20 participants. The physical activity session consisted of 20 minutes of walking on a treadmill at 60% of estimated maximum heart rate. Once the heart rate restored to within 10% of pre-exercise levels the participant was cognitively tested (Hillman, Erickson, & Kramer, 2008). Findings from this study indicate that single, short bouts of moderately-intense aerobic exercise (i.e. walking) may improve the attention in youth, and further support the use of short physical activity bouts as a contributing factor for making students more alert and focused and improving educational outcomes (Hillman et al., 2008). Therefore, implementing school-based interventions should be a priority of all schools to improve academic performance. It is important that future research includes students with developmental and intellectual disabilities, to determine the feasibility of incorporating a physical activity program in a classroom based setting of children with different abilities.

Classroom behavior

Jarret and colleagues (1998) looked at the effect of a recess break on classroom behavior, specifically attention, fidgeting, and performance in a large southern urban school that did not offer recess because they had a policy on 'uninterrupted instructional time'. The observed classes participated in structured PE classes in the early morning, three days a week. On the other 2 days, they normally had no physical activity. During the observation period the students were observed in the classroom for 25 minutes following a 15-20 minute recess once a week. Findings from this study have indicated that children were more off-task and restless when engaged in prolonged uninterrupted instructional time (Jarrett et al., 1998). Sixty percent of the children (boys and girls), including all 5 of the students with attention deficit disorder (ADD) demonstrated considerable benefits (Jarrett et al., 1998). They performed better, were more attentive and fidgeted less on recess days. This suggests that interrupting instructional time with a physical activity break is beneficial on on-task behavior. However, this study could not control for the students who socialized during the recess break rather than engaging in MVPA. It may also be more feasible and efficient for teachers and students to have structured DPA in the classroom rather than having multiple recess breaks. Therefore, having a structured physical activity break in the classroom supervised by the teachers could provide even greater long-lasting benefits on classroom performance, behavior, and attention among children with disabilities.

Time on-task behavior

A study by Mahar et al. (2006) evaluated the effects of a physical activity program in the classroom on student's on-task behavior during instructional time at a public school in eastern North Carolina. During the intervention period the physical

activity program (ie. Energizers) was teacher-led and consisted of short whole body exercises lasting approximately 10 minutes in the classroom (Mahar et al., 2006). Student on-task behavior during classroom academic instruction was assessed immediately before the active break and immediately after the active break for a period of 30 minutes (Mahar et al., 2006). Results demonstrated that student's on-task behavior improved following Energizers. These findings support previous research where instances of off-task, distractible behaviors were reduced following a physical activity break interrupting prolonged periods of instructional time each school day (Bachman & Fuqua, 1983; T. Dwyer, Coonan, Worsley, & Leitch, 1979). However, 10 minutes does not meet the minimum requirement of DPA required by the Ontario Ministry of Education. Additional research should evaluate the effectiveness of a classroom-based physical activity program on on-task behavior and academic performance that meets the minimum requirement of 20 minutes of sustained physical activity each school day in a classroom of children with disabilities.

Physical activity and children with disabilities

Developmental disabilities (DD) is an umbrella term that describes a person having "prescribed significant limitations in cognitive functioning and adaptive functioning that becomes apparent before the age of 18, are likely to be life-long in nature, and affect areas of major life activity, such as personal care, language skills or learning abilities, the capacity to live independently as an adult or any other prescribed activity" (Klein-Geltink, Lunsky, & Yates, 2014). This umbrella term includes Intellectual disability (ID), autism spectrum disorders (ASD), Down syndrome (DS), Cerebral Palsy (CP) (Klein-Geltink et al., 2014). In some cases the cause of DD's is

unknown. However, DD's can be genetic in origin or caused by illness or injury either before birth or in early childhood (Klein-Geltink et al., 2014). In most cases, individuals with DD's are diagnosed early on in elementary school. Most students with a diagnosis of DD will have difficulty learning in the classroom compared to their peers of typical development and will require additional support for daily living (Klein-Geltink et al., 2014). Children with disabilities tend to engage in less daily physical activities, including at school. This results in children with disabilities being at a greater risk of being less active than their peers (Sit et al., 2007). Therefore, increasing physical activity programs for this population is extremely beneficial because physical activity has a positive correlation with well-being in adulthood, in part because of the development and maintenance of good habits.

The benefits of physical activity are universal for all children, including those with disabilities. It is well established that regular physical activity offers numerous health benefits for the general population (Cooper et al., 1999). There is also significant knowledge about the detrimental physiological effects of physical inactivity on both physical functioning and health (Cooper et al., 1999). Children with developmental disabilities typically have low muscle strength, decreased flexibility, and poor joint structure and function, indicating that physical activity may be of even greater importance for children with disabilities because it may help prevent the functional deterioration often associated with the disability (Murphy & Carbone, 2008). In addition, physical activity can offer several psychosocial benefits which include improved self-esteem, increased social interactions, and ultimately greater independence among persons with disabilities (Murphy & Carbone, 2008). Structuring physical activity in a school

classroom can also provide social benefits that could result in academic outcomes (Taras, 2005). Learning to collaborate, share, and follow rules of group physical activities helps students challenge themselves and feel that they can contribute to their school and community (Taras, 2005).

Sedentary behavior in individuals with disabilities can provide physical consequences because the presence of a disability generally leads to a decline in physical functioning, which can cause a further increase in inactivity (Sit et al., 2007). Due to the nature of the disability and sedentary lifestyles, people with disabilities are at risk of secondary impairments that may further compromise their health, including osteoporosis, decreased balance, strength, endurance, fitness, flexibility, obesity, and depression (Batshaw et al., 2007). These secondary impairments may have even more negative effects than the disability themselves. Declines in strength, balance, and fine motor control may also be experienced with increased age in this population (Batshaw et al., 2007). Educational problems, poor cognitive performance, and academic under achievement are common among children with disabilities compared to their peers (Loe & Feldman, 2007). These types of educational difficulties are particularly shown in children with ADHD, who show significant decreases in IQ testing and score lower on standardized tests than children without ADHD (Loe & Feldman, 2007).

It is important to encourage physical activity participation in children with ADHD because restlessness and off-task behaviors are common in this population. A study conducted by Loe & Feldman (2007) on the effects of a recess on classroom behavior showed that off-task behavior were significantly reduced following recess in children with ADHD. This finding contributes to other literature indicating recess being

beneficial for both children with and without disabilities (Loe & Feldman, 2007; Ridgway et al., 2003). However, future research should extend on the effects of on-task behavior following a physical activity break in other DD's. To determine if physical activity opportunities for children with other disabilities at school can potentially promote academic achievement by increasing on-task behavior or academic engaged time.

Self-stimulatory behaviors are stereotyped and repetitive and can take the form of prolonged body-rocking, head-nodding, flapping the hands at the wrist, tapping or shaking objects, gazing at lights, jumping up and down, etc. (Lovaas et al., 1987). It is common for the behavior to be visual stimulation as when the individual squints or rolls the eyes, stares at lights or rotating fans, repeatedly assembles the same puzzle, or "compulsively" lines up objects on the floor (Lovaas et al., 1987). At times the self-stimulatory behavior may be primarily vestibular, as when the person engages in body-rocking, head-nodding, or spinning while standing up. Some behaviors may generate tactile input such as, stroking, poking, or pinching oneself, or rubbing interesting surfaces or textured sweaters. The primary source of feedback may also be auditory stimulation in some cases this may include tapping an object on a table, repeating the same pattern of three notes, or repeatedly echoing a string of words (Lovaas et al., 1987). These behaviors may involve the use of objects (ie. tapping, shaking, or twirling) or involve the body (ie. rocking and hand-flapping). In addition, the stereotyped behaviors may reflect various degrees of interaction with the environment such as, simple gazing at lights or body-rocking to elaborate lining up of objects or repetitive assembly and reassembly of puzzles (Lovaas et al., 1987).

Self-stimulatory behaviors refer to repetitive body movements or can include repetitive movements with objects and are most commonly observed in children with autism (Watters & Watters, 1980). A study conducted by Watters and colleagues was done to assess the effects of physical activity on the self-stimulatory behavior of boys with ASD. Following either a regular classroom seat task, TV watching, or a physical activity break, educational outcomes and self-stimulatory behaviors were assessed in boys with ASD (Watters & Watters, 1980). The physical activity break consisted of 8-10 minutes of jogging. Results demonstrated that there was a decrease in self-stimulatory behavior following the physical activity break compared to the level of self-stimulatory behavior following the regular classroom seat work tasks (Watters & Watters, 1980). This indicates that physical activity may also have a positive impact on self-stimulatory behaviors.

Long-term Athlete Development and Children with Disabilities

In 2002, the Canadian governmental agency responsible for sport invested in Canadian Sport for Life (CS4L) and its core Long-Term Athlete Development (LTAD) framework (Balyi, Hamilton, Robertson, & Canadian Sport, 2005). A framework that commits to increase participation in Canadian sport that allows all Canadians to engage and enjoy involvement in sport to the extent of their abilities and interests (Balyi et al., 2005; Houlihan, 2002). The CS4L focuses on increasing physical activity and participation in sport in Canada from policy to program delivery. One of the planned outcomes of CS4L includes physical literacy which is the confidence and competence of an individual to be active in a variety of activities and environments that benefit healthy development (Ford et al., 2011). Individuals who are physically literate are able to

demonstrate a variety of fundamental movement skills (eg., walk, run, jump, throw) and sport skills (eg., catch, hop, gallop) across a wide range of different activity settings (Ford et al., 2011). Research has shown that children with disabilities demonstrate less physical literacy, are more sedentary, and are more disruptive in physical education classes compared to their peers without disabilities (Bouffard, Watkinson, Thompson, Causgrove Dunn, & Romanow, 1996; Ford et al., 2011). There are several stages to the LTAD framework which are based on the physical, emotional, and cognitive development of children. The first stage of the LTAD, known as "Active Start" encourages physical literacy and sport for all children. The active start phase helps children 0-6 learn fundamental motor skills paired with active play. The healthy development of children with disabilities requires participation in structured physical activity and active play (Balyi et al., 2005). Daily physical activity in schools is a common approach to help children with disabilities in becoming physically literate (Balyi et al., 2005; Ford et al., 2011).

Conclusion

Children with developmental disabilities are less physically active than their peers (Cooper et al., 1999). It is well established that physical activity provides benefits for all children, it may be of even greater importance for children with developmental disabilities because having a disability can generally lead to a decline in physical functioning, which can further lead increased risk for sedentary behavior and inactivity (Sit et al., 2007).

Children spend a large portion of their day in the education system. Due to this significant time allotment spent in school, it would seem reasonable to suggest that the education system should provide opportunities for children to be physically active outside of PE. In addition to the significant health benefits associated with physical activity, research has consistently shown that interrupting prolonged periods of instruction with an active break provides positive effects in cognitive performance, concentration, on-task behavior and educational outcomes following the physical activity break (Chomitz et al., 2009; Davis et al., 2011). This may be particularly important because children with disabilities tend to show inattentive, impulsive, and hyperactive behaviors that may be distractible (Stanford & Hynd, 1994).

Although no published research has examined the effectiveness of physical activity on classroom behavior in children with disabilities, this study will fill a void gap in the literature by investigating the effect of four short bouts of physical activity on classroom off-task behavior in preschool age children with developmental disabilities. This study may also help to shape the curriculum for teachers and children with disabilities in future schools.

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Chapter 3: Manuscript 1

Effect of multiple short bouts of physical activity on classroom behavior in children with disabilities

Abstract

Evidence indicates that children with disabilities are less likely to be on-task and more likely to be off-task and instances of self-stimulatory behavior are more likely to be observed compared to their peers without learning disabilities. Off-task classroom behaviors and instances of self-stimulatory behaviors have been shown to have negative correlations with academic progress and learning. Improvements in classroom behavior have been seen in children of typical development following a classroom-based physical activity break. The purpose of this study was to examine the impact of including a 5-minute daily physical activity (DPA) break in a kindergarten classroom of 14 children with a wide range of disabilities at improving on-task behavior and reducing self-stimulatory behaviors. Direct observation of classroom behavior was used to assess student's classroom behaviors during baseline and follow-up, and immediately before and immediately after the DPA for each participant. Results indicated that students on-task behavior significantly increased from baseline to follow-up measures ($p = 0.003$) and self-stimulatory behaviors significantly reduced ($p = <0.01$). Results also indicated that students on-task behavior significantly increased immediately after DPA from immediately before ($p = <0.01$) and self-stimulatory behavior also significantly reduced ($p = <0.01$). The results of this study indicate that incorporating 5-minute bouts of DPA 4x/day in a classroom of kindergarten children with disabilities is effective at improving on-task behavior and reducing self-stimulatory behavior. However, future research with a greater age range and larger sample sizes is necessary.

Introduction

Student Classroom Behavior

Keeping students focused and attentive in the classroom is considered an important aspect for successful learning. A common problem teachers face in the classroom is loss of instructional time due to off-task behavior (Godwin, Almeda, Petroccia, Baker, & Fisher, 2013). Loss of instructional time in the classroom can be caused by several reasons which include, sudden classroom interruptions (ie. fire drills, announcements over the loud speakers), weather (ie. snow days), and special events (ie., field trips, BBQ's, bake sales) (Godwin et al., 2013; Karweit & Slavin, 1981). However, research has shown that student off-task behavior such as, student inattentiveness is the biggest factor that contributes to loss of instructional time (Godwin et al., 2013; Lee, Kelly, & Nyre, 1999). Research has demonstrated that children can spend between 10% and 50% of their time off-task in the classroom (Godwin et al., 2013; Karweit & Slavin, 1981; Lee et al., 1999). This indicates that classroom off-task behavior should be examined further to promote academic outcomes.

Elementary school age children spend a large portion of their day at school, six or seven hours, in which most of that time is spent sitting at their desks (Patton, 2012). Students who engage in sedentary cognitively demanding tasks for long durations can become more fidgety, restless, distractible, and experience reduced concentration (Chomitz et al., 2009; Davis et al., 2011; Godwin et al., 2013; Mahar et al., 2006; Pellegrini & Davis, 1993). Asking for quiet and concentration for prolonged periods may be very challenging for children because they are highly energetic by nature (Leppo, Davis, & Crim, 2000; Ridgway, Northup, Pellegrin, LaRue, & Hightshoe, 2003). Godwin

et al. (2013) suggested that if classroom instruction was broken up into small blacks with the incorporation of active breaks in the curriculum, students may be able to concentrate better and refocus during a lesson (Fleshner, 2000; Mahoney & Fagerstrom, 2006; Morgan, 1994).

It is important to provide opportunities for children to engage in active breaks because research suggests that movement may be especially important to the cognitive development of young children (Leppo et al., 2000; Piaget, 1968; Pica, 1997; Sibley & Etnier, 2003). By giving children the opportunity to engage in movement periodically, teachers can create a balance between teaching the curriculum and helping students in their need for movement. Elementary age students need time to release their built up energy (Pica, 2006), and recess may not be enough time do so, especially with the long time period between recess breaks and children may not always be physically active during recess (Mahoney & Fagerstrom, 2006). In response to the need for increasing daily physical activity (DPA) for all children, the Ontario Ministry of Education mandated that "all elementary school students, including students with special needs, be provided with opportunities to participate in a minimum of 20 minutes of sustained moderate-to-vigorous physical activity (MVPA) each school day during instructional time" (p. 6) (Ontario Ministry of Education, 2006). Ministry documents have suggested that students who do regular physical activity are more willing to learn and are able to stay on task for longer periods of time (Ontario Ministry of Education, 2006).

There is no evidence that increasing physical activity at school will have a negative effect on educational outcomes; in fact, research has indicated that learning may be enhanced in students after they have had an active break (Chomitz et al., 2009).

Research has consistently shown that incorporating short bouts of physical activity in the classroom can have a positive impact on student's on-task behavior and academic achievement (Chomitz et al., 2009; Ma, Mare, & Gurd, 2014; Mahar et al., 2006). A study conducted by Gibson et al. (2008) found that incorporating physical activity during instructional time helped the students focus and retain concepts better. There is also evidence that students show improved behavior following a physical activity break in the classroom (Barros, Silver, & Stein, 2009; Mahar et al., 2006). Jarrett et al. (1998) also reported increased on-task behavior following a recess break in a school that normally did not have recess. In addition, increasing physical activity time at school through increased physical education (PE) time, encouraging active recess time, and providing active breaks in the classroom demonstrate a positive relationship to in cognitive function (Chomitz et al., 2009; Kramer et al., 2002; Studenski et al., 2006).

A 12-week study conducted in eastern North Carolina in 2006 evaluated the effectiveness of providing kindergarten through fourth grade students with a DPA 10-minute break. Mahar et al. (2006) found on-task behavior increased significantly (average of 8%) among 243 students following a DPA break. In addition, activity breaks improved on-task behavior by 20% among students who were the least on-task (Mahar et al., 2006). The challenge teacher's face is how to incorporate the mandated 20 minutes/day of DPA into their curriculum (Patton, 2012). Results from a survey indicate that teachers in Ontario realize DPA is required in the curriculum but view time constraints to be the biggest barrier (Patton, 2012). Therefore, multiple short bouts of DPA might be more feasible and easier to incorporate in the curriculum than trying to find space in a day to

include blocks of 10 or 20 minutes of DPA. However, there is very little research on short bouts of DPA for students with and without disabilities (Mahar et al., 2006).

Classroom Physical Activity and Children with Disabilities

Incorporating breaks during instructional time may also benefit children with disabilities. Over the last several years researchers have found that children with learning disabilities are less likely to be on-task and more likely to be off-task and distractible compared to their peers without learning disabilities (Bender, 1986; Bender & Smith, 1990; McKinney & Feagans, 1984). This is important because off-task classroom behavior has been demonstrated to have negative correlations with academic progress (McKinney & Feagans, 1983; McKinney, Mason, Perkerson, & Clifford, 1975). Several studies have demonstrated improvements in classroom behavior following a physical activity break in children of typical development (Barros et al., 2009; Jarrett et al., 1998; Ma et al., 2014; Mahar et al., 2006; McNaughten & Gabbard, 1993; Miller & Cox, 2001); however, to date, few studies have examined the impact of physical activity on classroom behavior and academic achievement in children with disabilities (Ma et al., 2014). Ma and colleagues (2014) were able to demonstrate that 4-minutes of high-intensity physical activity (the shortest protocol studied to date) was effective at decreasing off-task behaviors such as, fidgeting and restlessness, and to a lesser extent, looking around in children with typical development. This represents an important area of study as classroom behavior is associated with academic achievement and children with disabilities have increased off-task classroom behavior and lower academic outcomes (Alexander, Entwisle, & Dauber, 1993; Bender, 1986; Bender & Smith, 1990; Ma et al., 2014; Mayes, Calhoun, & Crowell, 2000; McKinney & Feagans, 1984).

Self-Stimulatory Behavior

In addition to increased off-task behavior in children with disabilities, instances of self-stimulatory behavior are more likely to be observed in individuals with developmental delay than children with typical development (Lovaas, Litrownik, & Mann, 1971; Watters & Watters, 1980). Individuals with typical development may still exhibit self-stimulatory behaviors when under stress or not able to engage in other behaviors (Lovaas, Newsom, & Hickman, 1987). However, reducing self-stimulatory behavior is important among children with disabilities, particularly children with autism, because it has been shown to interfere with learning and appropriate play (Kern, Koegel, Dyer, Blew, & Fenton, 1982).

Self-stimulatory behaviors have been widely studied in various populations and are also referred to as stereotypic behaviors, repetitive behaviors, or autistic mannerisms (Kern et al., 1982). Self-stimulatory behaviors refer to repetitive body movements or repetitive movements with objects and can include but are not limited to: rocking the body, moving fingers, nodding the head, staring at lights, jumping up and down, and shaking or lining up objects (Lovaas et al., 1987). While not all populations experience the same self-stimulatory behaviors, these types of behaviors have often been shown to interfere with learning in many children with disabilities (Kern et al., 1982). Most of the research on self-stimulatory behavior has been conducted on children with autism spectrum disorder (ASD). Research has indicated that some children with ASD have difficulty learning and engaging in appropriate play when engaged in self-stimulatory behaviors (Epstein, Doke, Sajwaj, Sorrell, & Rimmer, 1974; Koegel & Covert, 1972). However, research has shown that when self-stimulatory behaviors are suppressed, appropriate play behaviors typically increase (Epstein et al., 1974). It is important to note

that some children without ASD also exhibit self-stimulatory behavior (Kern et al., 1982). A study conducted by Watters and colleagues (1980) found that 8-10 minute bouts of physical activity was effective at decreasing self-stimulatory behaviors which may suggest physical activity may be effective at positively influencing the symptoms of a variety of neurological disabilities (Watters & Watters, 1980). Although, research has found physical activity to be effective at reducing self-stimulatory behaviors in children with disabilities, it is important to investigate how to best incorporate physical activity into a school day for maximum effect on children with disabilities.

The purpose of this study was to determine if there was a long-term effect in improved on-task behavior in follow-up phase compared to baseline after the intervention (4-min bouts of DPA, 4x/day, for four weeks). In addition, the purpose was to also measure an immediate effect of incorporating 5-min breaks of physical activity 4x/day, for decreasing off-task behavior and self-stimulatory behaviors and increasing on-task behavior immediately after the activity break. We hypothesize that on-task behavior will increase and self-stimulatory behaviors will decrease immediately following the DPA break and also during follow-up when the DPA break is no longer being delivered.

Methods

Ethics

Ethics approval was obtained from the University of Ontario Institute of Technology's Research Ethics Board (Appendix 1), from Grandview Children's Centre (Appendix 2), and from Campbell Children's School (Appendix 3). Participants were recruited from Campbell Children's School through the school principal via a letter of invitation (Appendix 4) sent home to the parents. All parents signed written informed consent before the study started (Appendix 5).

School

Campbell Children's School is the education partner to Grandview Children's Centre in Oshawa, ON. Campbell's is mandated under Section 68 of the *Education Act* to provide, in accordance with the Act and its regulations, the educational component of Grandview Children's Centre's therapy program. It is the board's goal to provide appropriate therapy and educational programs to children enrolled at Campbell's and to assist the transition of these children into community school programs. Campbell Children's School has its own trustees appointed by the Ministry of Education and as such is not under the jurisdiction of any of the local district school boards. Campbell's has four classrooms consisting of mixed groupings of children with multiple exceptionalities (Special Education Report, 2015). The students enrolled each year usually range from Junior Kindergarten to Grade One. Each student at Campbell's has an Individual Education Plan (IEP) that includes academic goals based on the Ontario curriculum as well as therapy goals. In order to be considered for admission at Campbell's, each child must be at least 4 years of age, must have the ability to participate and benefit from the treatment program provided by therapeutic services, and must require development of strategies and/or adaptive equipment to be able to function in a classroom setting (Special Education Report, 2015).

Participants

Campbell Children's school consisted of 32 students separated into 4 classrooms when this study occurred in Spring 2015. Two classrooms were selected by the Principal for this study. Due to certain sensitivities to music, individual behaviors of the children, and challenges with disruption and transitions, the room selection could not be randomized for these reasons. Classroom A consisted of 10 students with a teacher and

two educational assistants. Classroom B consisted of 7 students with a teacher and two educational assistants. All parents/guardians provided written informed consent for their child to participate and be videotaped for this study. Two students from Class A and one student from Class B were absent for all of baseline measures and therefore were not included in the study. A total of 14 students (class A= 8, class B=6) were included in this study. Of the 14 participants in this research study there was a wide range of developmental and sensory disabilities. Some of these disabilities include cerebral palsy (CP), Spina Bifida, hydrocephalus, global development delay, fine and gross motor delay, speech sound disorder, speech delay, and sensorineural hearing loss. Participant characteristics are presented in the results section.

Study Design

This research study followed a pre-post test design using a physical activity program including 4 bouts of 5-min DPA/day as the intervention

Baseline Phase

Baseline observations occurred for 5 days (1 school week) during school hours from Monday April 27, 2015 to Friday May 1, 2015. A video camera was set up in both classrooms recording the students during regular classroom activities for 20 minutes 4 times/day mirroring the planned time of day for videotaped observations during the intervention phase of this study for consistency. The off-task behaviors and self-stimulatory behaviors observed during the 1-week of baseline were used to identify individual behaviors and off-task behaviors specific to the children in this study, because different children exhibit different behaviors. Teachers were also asked to provide a list of common off-task behaviors and individual behaviors that are specific to each student in their classroom to assist with the identification of student behaviors.

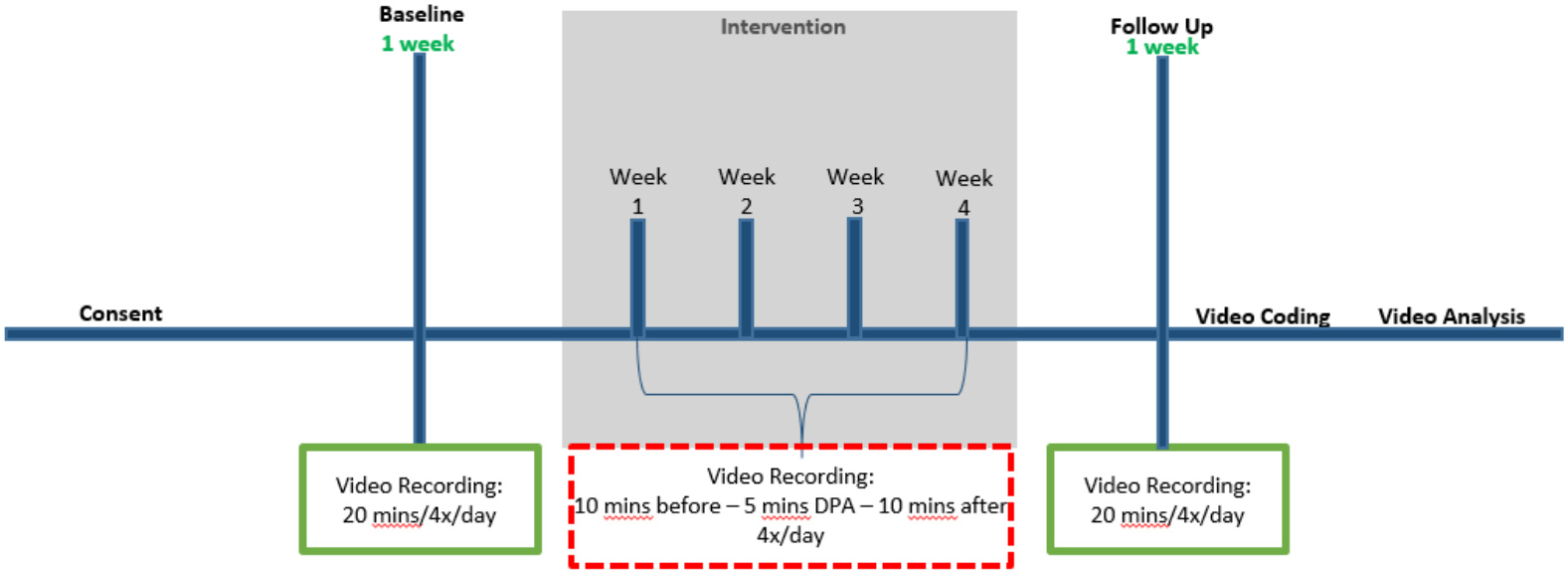
Intervention Phase

The intervention took place 5 days/week, for 4 weeks, from Monday May 4, 2015 to Friday May 29, 2015 during school hours. A video camera was set up in both classrooms and recorded the students during classroom activities for 10 minutes prior to the initiation of the intervention. After 10 minutes, the primary investigator delivered a 5 minute physical activity break in the classroom. The video camera also videotaped the students during the 5 minute activity break to allow for the primary investigator to investigate the engagement level of the targeted students during the DPA (see Chapter 4). The video camera also recorded the students during regular classroom activities for 10 minutes immediately after the 5-minute DPA.

Follow-up Phase

Follow-up observations occurred for 1 school week for 5 days, Monday June 1, 2015 to Friday June 5, 2015. Similar to baseline a camera was set up in both classrooms recording the students during regular classroom activities for 20 mins/day 4 times per day without the addition of the DPA break at the same times of day as the baseline observations. The procedures for follow-up recordings were identical to the baseline recordings (Figure 1).

Figure 1 Overview of Study Design



The expectation was to deliver a total of 80 sessions of DPA, (4x/day, 5 days/week, for 4 weeks); however, due to the timing of the study (ie. the end of the year school year) multiple end of the year school field trips were scheduled and classrooms often had families and students visiting to facilitate transitioning new students for the next school year. This resulted in the researchers not being able to videotape the classroom activities at all planned times. Of a possible 80 planned DPA sessions, 45 sessions were delivered.

The intervention consisted of a song(s) to facilitate movement selected from the MusiGo Kids: Going Places Elementary Teacher Resource (Walcer, 2008). This resource was created to give teachers the opportunity to include movement activities to songs that are ideal for use in the classroom. Other songs were selected from outside teacher resources such as, GoNoodle, The Learning Station, and Youtube videos which include grade level appropriate songs to whole body movements. Some songs were only played on the radio and others were shown through video using the smartboard. Each song was age appropriate and accommodated the needs and abilities of each student. The students were free to participate at their own intensity and ability. For example, some of the movements to the song "Jump Up" from the MusiGo Kids CD involve the students doing a two leg jump. For the student who use a wheelchair they would push their arms straight up. Similarly, if a child had difficulty jumping with two due to orthotics they could hop or skip to the best of their ability. Two activity breaks of 5 minutes each were dispersed in the morning and two sessions in the afternoon Monday through Friday for 4 weeks. Student classroom behavior was videotaped/observed for 10 minutes before and 10

minutes after each DPA break to determine the immediate effects of the PA break (Table 1).

Table 1 Video/DPA Intervention Schedule

Day Schedule		
Time	Class A	Class B
9:15-9:30	Video-Observe	
9:30-9:35	DPA[1] break	
9:35-9:45	Video-Observe	
10:00-10:10		Video-Observe
10:10-10:15		DPA break
10:15-10:25	Video-Observe	Video-Observe
10:25-10:30	DPA break	
10:30-10:40	Video-Observe	
10:50-11:00		Video-Observe
11:00-11:05		DPA break
11:05-11:15		Video-Observe
11:30 – 12:00	LUNCH	
12:10-12:20	Video-Observe	
12:20-12:25	DPA break	
12:25-12:35	Video-Observe	
12:45-12:55		Video – Observe
12:55-1:00		DPA break
1:00-1:10		Video Observe
1:20-1:30	Video – Observe	
1:30-1:35	DPA break	
1:35-1:45	Video – Observe	
2:00 – 2:10		Video – Observe
2:10-2:15		DPA break
2:15-2:25		Video - Observe

[1]DPA- Daily Physical Activity

Measures

Once parental consent (see Appendix 5) was received by the parents a supplemental information form (see Appendix 6) was completed to provide demographic information about the child. The information from this form helped provide more detail about the child (e.g., age, details of diagnosis, identifying any self-stimulatory behaviors) to help account for the child's behavior in the classroom (see results section).

Direct observation of classroom behavior is one of the most widely used assessment procedures by schools (Hintze, Volpe, & Shapiro, 2002). Systematic direct observation refers to the observation of behavior in the classroom environment and it is distinguished by five characteristics (Hintze & Matthews, 2004). First, the goal of observation is to measure specific behaviors. Second, the behaviors being observed have been selected and defined in a precise manner. Third, observations are conducted under standardized procedures and are highly objective in nature. Fourth, the times and places for observation are carefully selected and specified. Finally, scoring and summarizing of data are standardized and do not vary from one observer to another (Hintze & Matthews, 2004). Therefore, direct observation can be easily used to assess student behavior in the classroom and is used in the scientific literature.

A well-known tool was used for direct observation to assess child classroom behavior is the Behavioral Observation of Students in Schools (BOSS) (Volpe, DiPerna, Hintze, & Shapiro, 2005). The BOSS demonstrates the levels of academic engagement and non-engagement for the targeted student (Shapiro, 1996). The BOSS assesses levels of "on-task" and "off-task" behavior. On-task engagement was defined as those times when a student was either attending to the assigned instructional material(s). Examples include writing or answering a question, looking at a worksheet or listening to the teachers instructions (Shapiro, 1996). Furthermore, off-task behaviors included getting out-of-seat, fidgeting, playing with a pencil, calling out and/or talking to a peer, looking around the room or looking out the window. The BOSS was also used in previous studies investigating the effects of on-task and off-task behavior following a physical activity break in elementary-school children (Mahar et al., 2006; Nicholson, Kehle, Bray, &

Heest, 2011), however it was modified for this study to include a self-stimulation code. Each child's individual self-stimulating behaviors had been previously noted and recorded.

The BOSS traditionally is administered in 15-second intervals for a period of at least 15 minutes (Hintze & Matthews, 2004). For the purpose of this study 30-second intervals were deemed most accurate in this context, with these children. The targeted student was coded as either on-task or off-task during a 30-second interval as long as they were in view on screen. If the targeted student was out of screen for a portion of that interval (eg. 10-seconds) they were considered off-screen for that entire interval (eg. 30-seconds). Therefore, of the viewable time (child is in view of camera) on-task and off-task behaviors summed always equal the total amount of time the child is in view.

Using the BOSS, off-task behaviors were coded by using partial-interval scoring, meaning that an occurrence of the behavior is scored if it occurs during any part of the interval (Hintze & Matthews, 2004). Therefore, if a behavior begins before the interval begins and ends within the interval, then an occurrence is scored. Similarly, if the behavior starts after the beginning of the interval, then an occurrence is scored. Finally, if multiple occurrences of the behavior are observed within the same interval, then the interval is simply scored as if the behavior occurred only once. It has been suggested that partial-interval recording is a good choice for behaviors that occur at a relatively low rate or behaviors that of somewhat inconsistent duration (Hintze & Matthews, 2004). Partial-interval recording is also well suited for behaviors targeted for decrease through intervention efforts because if a target student is observed to be off-task for only 2 seconds of the 30-second interval, then the interval would be scored for the presence of

the behavior as if it occurred for the entire 30-second interval (Hintze & Matthews, 2004).

For the purpose of this study self-stimulation was also recorded as either present or absent for the targeted student for every 30-second interval. Similar to the method of coding on-task and off-task behavior, if the targeted student demonstrated any self-stimulatory behavior during the 30-second interval that was previously identified as that student's stereotypical self-stimulatory behavior it was recorded as present where appropriate (ie. not all children demonstrated self-stimulatory behaviors).

Video Recordings

The camera used for this study was a CANON VIXIA HF R50 8GB Flash HD Camcorder. Videos were downloaded onto a secure server by the primary investigator. A trained research assistant coded 14% of the videos. To establish interrater reliability, the primary investigator and the research assistant coded one session. The percentage of interrater reliability was 91%. Two other research assistants coded 7% of the videos each. The primary investigator and second research assistant achieved a percentage of 87% interrater reliability. The primary investigator and third research assistant achieved a 85% interrater reliability.

Video Coding

Baseline and Follow-up Phase

On-task and off-task behaviors were recorded in 30-second intervals for 20 minutes, 4x/day during the baseline and follow-up phases of this study. The maximum number of on-task and off-task behaviors that could be recorded was 40 (ie. 40, 30-second intervals in 20 minutes). A student could only be coded as either on-task or off-task per 30 second interval. To transform the data in a usable format for analysis, the sum

of all on-task and off-task behaviors were calculated separately and were entered into the Statistical Package for the Social Sciences (SPSS). The sum of on-task and off-task behaviors add up to 40 (40 possible occasions) if the student was in camera view for the full 20 minutes. If the student‘s sum of on-screen time is the number of intervals the student was on-task and off-task in 20 minutes. The remainder of intervals in 20 minutes would be the student’s sum of off-screen time. For example, a target student may be on-task 23/40, off-task 15/40, and off-screen 2/40 possible occasions in 20 minutes (see Appendix 8 for a sample of coding template).

A student could be on-task and/or off-task while engaging in self-stimulatory behavior, therefore, self-stimulatory behaviors were coded, summed, and entered into the Statistical Package for the Social Sciences (SPSS) software separately. For each 30-second interval in 20 minutes a student’s self-stimulatory behavior was coded as either present or absent. The maximum number of self-stimulatory occasions that could occur in 20 minutes was 40. If a self-stimulatory behavior occurred at any point during the 30-second interval is coded as occurring one time. For example, a student could exhibit self-stimulatory behaviors for 32/40 possible occasions in 20-minutes where 8/40 intervals the student did not exhibit self-stimulatory behaviors. This method is similar to Mahar et al. (2006) study where the student’s score for a particular off-task and on-task behavior was calculated by summing the number of intervals in which each behavior occurred during the total observation period.

Intervention Phase

On-task and off-task behaviors were recorded in 30-second intervals for 10 minutes before the DPA and 10 minutes after the DPA 4x/day during the intervention

phase. The maximum number of on-task and off-task behaviors that could be recorded in 10 minutes was 20 (ie. 20, 30-second intervals in 10 minutes). A student could only be coded as either on-task or off-task per 30-second interval. To transform the data in a usable format for analysis, the sum of all on-task and off-task behaviors were calculated separately and were entered into SPSS similar to baseline and follow-up. For the intervention the sum of on-task and off-task behaviors should add up to 20 (it. 20 possible occasions) if the student was in camera view for the full 10 minutes. If the student was not in camera view for the full 10 minutes, the missing data after summing on-task and off-task behavior would be the student's sum off off-screen time. For example, a target student may be on-task 11/20 and off-task 9/20 possible occasions in 10 minutes (see Appendix 9 for a sample of coding template).

Similar to the baseline and follow-up phase, a student could be on-task and/or off-task while engaging in self-stimulatory behavior during the intervention phase. For each 30-second interval in 10 minutes a student's self-stimulatory behavior was coded as either present or absent. The maximum number of self-stimulatory occasions that could occur in 10 minutes was 20.

Analysis

Descriptive statistics were conducted to evaluate changes between baseline and follow-up and immediate changes between before DPA and immediately after DPA. A paired sample t-test was used to evaluate changes in on-task behavior and self-stimulatory behavior between baseline measures and follow-up measures. Similarly, to evaluate changes in on-task behavior immediately before DPA and immediately after. When significant, post-hoc analysis with a Bonferonni correction was used to detect

where the differences were. Effect size (ES) was also calculated for each test. These analyses were used to explore the effectiveness of incorporating multiple short bouts of DPA at improving on-task behavior and reducing self-stimulatory behavior in the classroom.

A repeated measures ANOVA was conducted to compare differences in on-task behavior and self-stimulatory behavior between weeks. When significant, post-hoc analysis with Bonferonni correction was used to detect between which weeks the difference occurred. Effect size were also calculated for each test. The power to detect statistical difference was set an alpha level of 0.05.

Below are examples of the equations that were used to determine the percent of time a targeted student (eg. Participant 1) was on-task during baseline:

Participant 1 data: sum of recorded intervals during baseline off-task (116), follow-up off-task (40), baseline on-task (481), and follow-up on-task (298). Participant 1 total sessions during baseline (16)

$$Participant\ 1\ \text{On Task Baseline}\% = \frac{\sum "On\ Task\ Baseline"}{Max.Intervals\ per\ session(40) * ParticipantActualSessions} \times 100$$

$$Participant\ 1\ On\ task\ baseline\% = \frac{481}{40 * 16} = \frac{481}{640} = 75.16\%$$

$$Participant\ 1\ \text{Off Task Baseline}\% = \frac{\sum "Off\ Task\ Baseline"}{Max.Intervals\ per\ session(40) * ParticipantActualSessions} \times 100$$

$$Participant\ 1\ Off\ task\ Baseline\% = \frac{116}{40 * 16} = \frac{116}{640} = 18.1\%$$

Due to on-task behavior and off-task behavior not adding up to 100%. Each student's percent of on-task time and off-task time may be different, therefore we could not

compare baseline to follow-up using this equation. This equation was used to calculate percent of in view (Table 3 and table 4) and was repeated for follow-up on-task, follow-up off-task, immediately before DPA on-task, immediately before DPA off-task, immediately after DPA on-task, immediately after DPA off-task, self-stimulatory baseline, self-stimulatory follow-up, self-stimulatory immediately before DPA, and self-stimulatory immediately after DPA for each participant. It is important to note that the "max interval per session" was 40 for baseline and follow-up (ie. 40 intervals in 20 minutes). However, for "before" and "after" recordings the "max interval per session" was 20 (ie. 20 intervals in 10 minutes).

This equation was used to calculate the % of individual on-task and off-task behavior baseline and follow up and "before" and "after" the DPA during the intervention. Due to the students being in camera view more during baseline than follow-up, the data had to be converted into percent of participant in camera view. Therefore, all calculations from this point on will include in camera view only and were repeated for all time periods. Below is an example of the equation for participant 1:

$$Participant\ 1\ On\ Task\ Baseline\% = \frac{\sum "On\ Task\ Baseline"}{On\ Task\ Baseline + Off\ Task\ Baseline} \times 100$$

$$Participant\ 1\ On\ Task\ Baseline\% = \frac{481}{481*116} = \frac{481}{597} = 80.5\%$$

$$Participant\ 1\ Off\ Task\ Baseline\% = \frac{\sum "Off\ Task\ Baseline"}{Off\ Task\ Baseline + On\ Task\ Baseline} \times 100$$

$$Participant\ 1\ Off\ Task\ Baseline\% = \frac{116}{116*481} = \frac{116}{597} = 19.4\%$$

Results

There were 14 participants in this study (7 boys, 7 girls). The age range was between 4-6 years old. Refer to table 2 for additional participant characteristics including diagnosis and additional difficulties.

Table 2 Participant Characteristics

Participant	Age (years)	Gender	Diagnosis	Additional diagnosis and difficulties	Self-stimulatory behavior	Therapy received through Grandview	Additional information
1	6	Female	Speech and language delay	N/A[2]	N/A	Speech therapy	
2	5	Male	Speech sound disorder	N/A	N/A	Speech therapy	Use of wheelchair
3	6	Female	Spastic dystonic quad cerebral palsy	N/A	N/A	Speech	Use of wheelchair
4	5	Female	Speech and language delay	N/A	N/A	Speech therapy	
5	5	Male	Speech sound disorder, hyperactivity, impulsivity	N/A	Sudden run	Speech therapy	
6	5	Male	Speech sound disorder	Suspected ADHD[1]	Body rocking	Speech therapy	
7	5	Male	Moderate bilateral sensorineural hearing loss	Visual problems (Amblyopia)	Repetitive hand and leg movements, noises with mouth	Speech therapy	
8	5	Female	Gross and fine motor delay, speech delay, learning disability	Learning disability, speech delay	N/A	Occupational therapy, physiotherapy, speech therapy	
9	5	Female	Speech	N/A	Sucking thumb	Speech therapy	

Continued Table 2. Participant Characteristics

10	5	Female	Spina Bifida, Hydrocephalus	N/A	N/A	Physiotherapy	Use of wheelchair
11	5	Male	Speech	N/A	N/A	Occupational therapy, physiotherapy, speech therapy	
12	6	Male	Fine motor delay, speech delay	N/A	Sucking/chewing sleeves	Occupational therapy, physiotherapy, speech therapy	
13	4	Male	Global Developmental Delay, Duplicate chromosome 2, Apraxia	N/A	N/A	Physiotherapy, occupational therapy, speech therapy	
14	4	Female	Cerebral Palsy	Developmental Delay, Learning Disability, Visual problems	N/A	Occupational therapy, physiotherapy, botox, orthotics	

[1]ADHD – Attention Deficit Hyperactivity Disorder, [2] N/A - Not applicable

In camera view during Baseline and Follow-up

During baseline there were a total of 19 possible video recordings in the week. During follow-up there were a total of 12 possible video recordings in the week. The amount of time each participant was in view of camera during baseline and follow-up is presented in Table 3. This table indicates that participants were in view of the camera on average more during baseline (90%) than during follow-up (85%). An explanation for this is that while the camera was set up to obtain the best field of view of the classroom not all participants were in view, students may also have been absent due to illness or receiving therapy or were simply engaged in tasks outside of camera view while the camera was recording.

Table 3 Percent of participants in view of camera during baseline and follow-up measurements

Participant Number	% In view during Baseline	% In View during Follow-up	% Change in view
1	93.28%	80.48%	-12.81%
2	94.85%	79.17%	-15.69%
3	86.47%	81.19%	-5.28%
4	92.12%	74.52%	-17.60%
5	90.88%	87.22%	-3.66%
6	96.82%	82.50%	-14.32%
7	92.00%	75.42%	-16.58%
8	83.48%	85.71%	2.23%
9	89.57%	95.00%	5.43%
10	91.88%	91.82%	-0.14%
11	85.71%	91.25%	5.54%

Table 3 continued percent of participants in view of camera during baseline and follow-up measurements

12	81.77%	100.00%	18.23%
13	89.31%	87.27%	-2.04%
14	91.96%	91.82%	-0.14%
		Mean	
	90%	85%	-4.63%

In camera view during Intervention

There were 45 DPA sessions delivered from week 1 to week 4 (ie. the camera recorded classroom behavior and DPA sessions 45 times in 4 weeks). The DPA/video recordings include 16 in week 1, 8 in week 2, 8 in week 3, and 13 in week 4 of the intervention. The amount of time each participant was in view of camera for the intervention phase are presented in Table 4. This table indicates that on average participants were in view of camera more before the 5 minute DPA (88%) than they were after the 5 minute DPA (80%). It is possible that students were engaged in tasks out of camera view while the video camera was recording.

Table 4 Percent of participants in view of camera before and after 5-min DPA

Participant Number	% In view 10-mins before	% In View 10-mins after	% Change in view
1	87.83%	85.33%	-2.50%
2	85.67%	76.07%	-9.60%
3	89.50%	81.77%	-7.73%
4	86.08%	82.03%	-4.05%
5	96.25%	80.78%	-15.47%
6	79.25%	76.28%	-2.97%

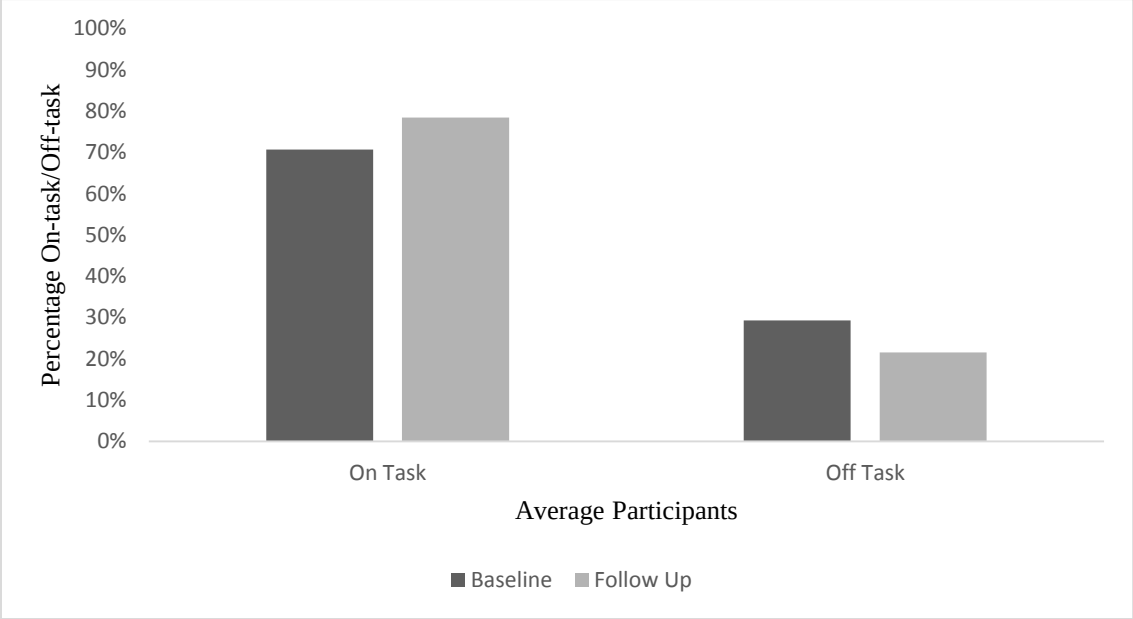
Table 4 continued percent of participants in view of camera before and after 5-min DPA

7	92.00%	75.39%	-16.61%
8	90.53%	86.11%	-4.42%
9	85.00%	81.75%	-3.25%
10	80.77%	66.62%	-14.15%
11	92.30%	83.57%	-8.73%
12	91.62%	87.81%	-3.81%
13	91.57%	76.21%	-15.36%
14	86.03%	82.30%	-3.73%
		Mean	
	88%	80%	-8%

Baseline-Follow-up Impact

Results from Figure 2 demonstrate that the group average on-task behavior increased by 7% in follow-up compared to baseline. Off-task behavior decreased also decreased by 7%. The results from the paired sample t-test on variables baseline from follow-up overall were statistically significant [$F_{13} = -3.667$, p=.003, ES = 0.34], indicating there more time was spent on-task in follow-up compared to baseline measures.

Figure 2 Group Average On-task and Off-task Behavior in Baseline vs. Follow-up for the whole group



Results from individual participant's on-task behavior from baseline to follow-up are shown in Figure 3. Results from individual participant's off-task behavior from baseline to follow-up are showing in Figure 4.

Figure 3 Average Participant On-task Behavior in Baseline vs. Follow-up

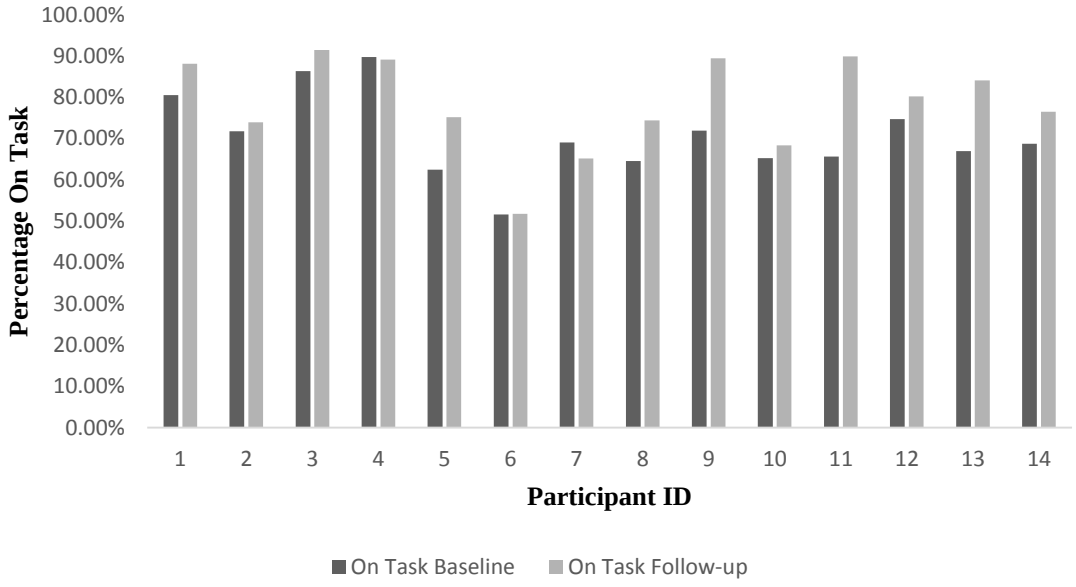
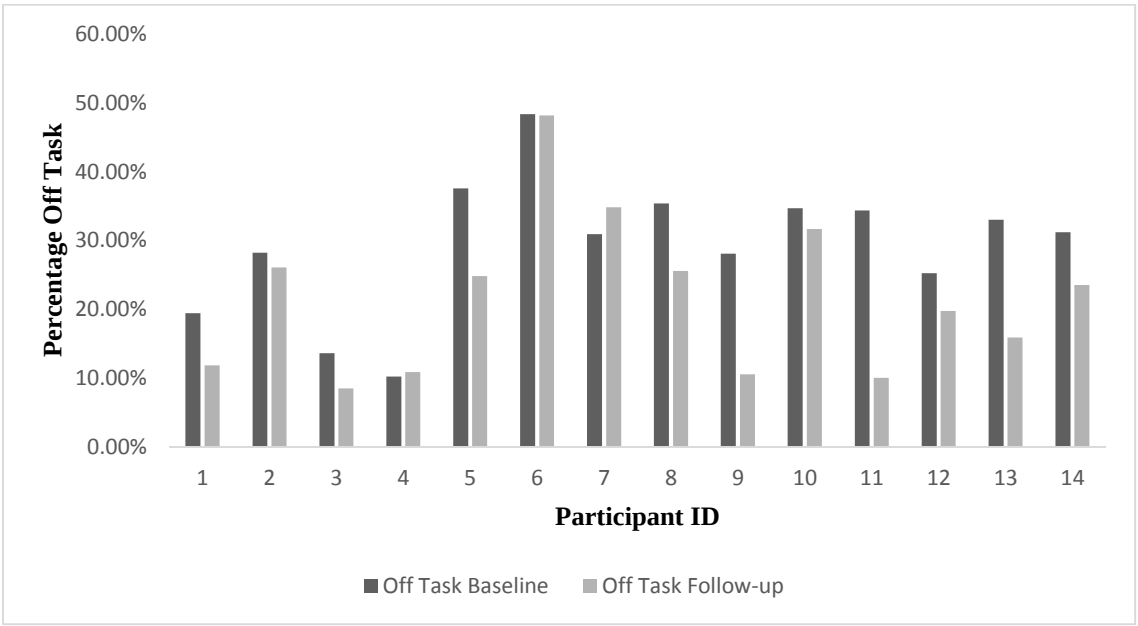
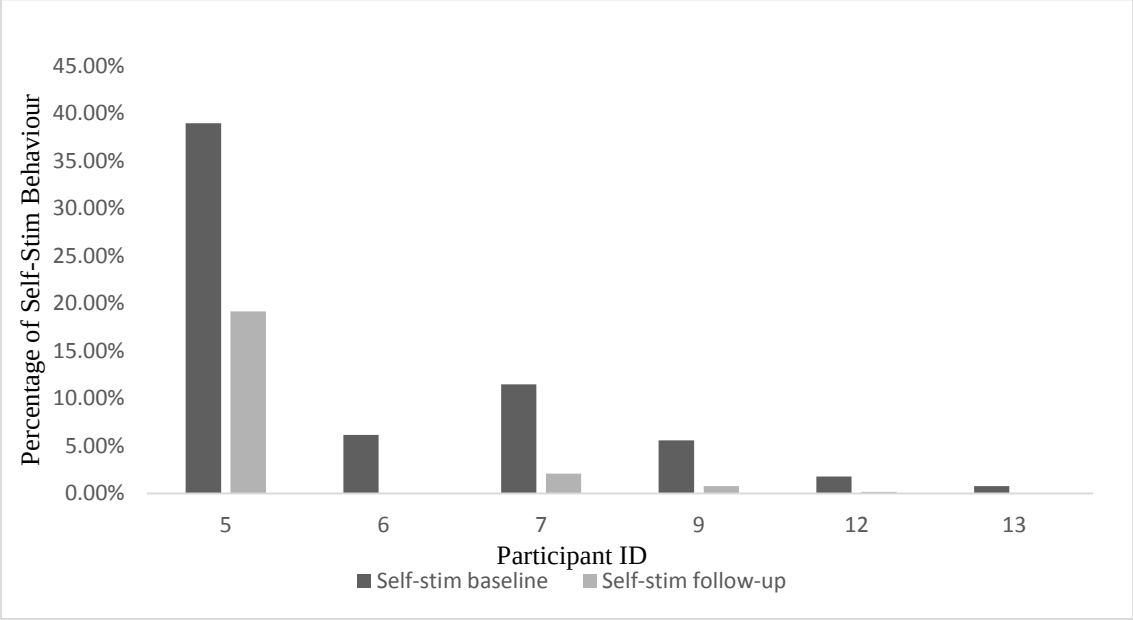


Figure 4 Average Participant Off-task Behavior in Baseline vs. Follow-up



Results for participant self-stimulatory behavior also decreased during follow-up observations compared to baseline observations in the six participants who exhibited self-stimulatory behaviors (Figure 5). Participant 5 decreased by 20%, participant 6 decreased by 6%, participant 7 decreased by 9%, participant 9 decreased by 5 %, participant 12 decreased by 2%, and participant 13 decreased by 1%. Results for the paired sample t-test of self-stimulatory behavior from baseline to follow-up were statistically significant overall [$F_5 = 2.491$, $p = <.01$, ES = 0.295], indicating that self-stimulatory behavior did reduce during follow-up compared to baseline measures.

Figure 5 Average Participant Percentage of Self-stimulatory Behavior Baseline vs. Follow-up

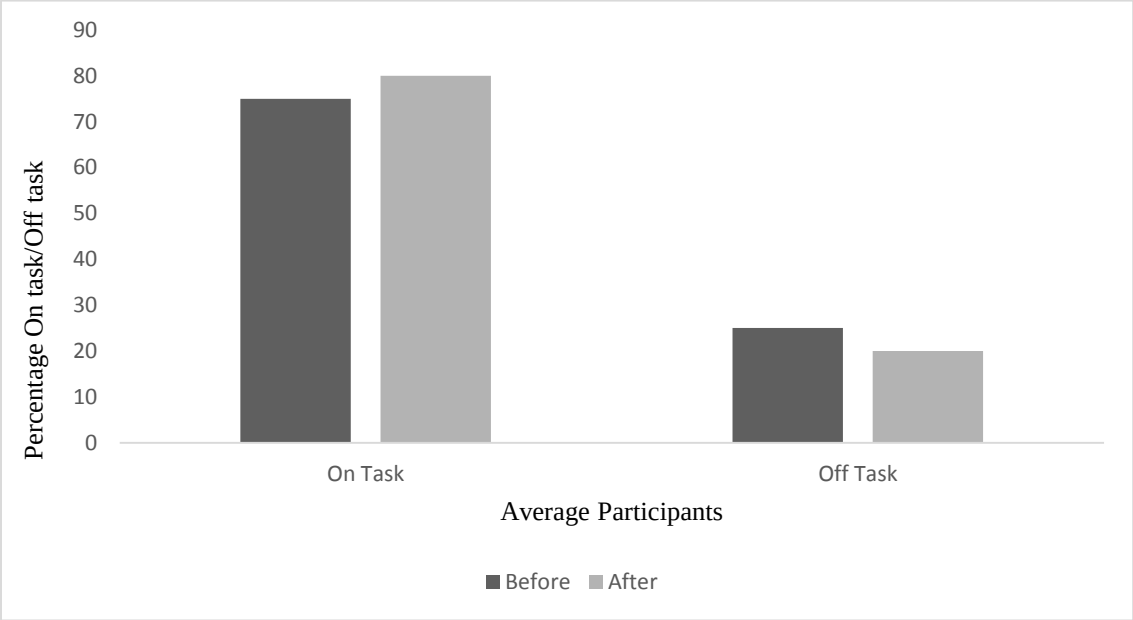


4-Week Intervention Impact

Average group on task behavior at baseline was 71%, this increased to 80% during the intervention after the DPA. Group average time spent on-task increased by 9% from baseline to intervention.

Figure 6 shows the average of all before-intervention period compared to after-intervention time period for on-task and off-task behaviors for all participants. Results from the average on-task/off-task behavior before and after DPA demonstrate a 5% increase in on-task behavior and 5% decrease in off-task behavior immediately following the 5 minute physical activity breaks. Results from the paired sample t-test from before DPA on-task measures to after DPA on-task measures were statistically significant overall [$F_{13} = 2.026$, $p = <.01$, ES = 0.152], indicating that students were more on-task immediately after the DPA compared to immediately before.

Figure 6 Group Average On-task/Off-task Behavior Before vs. After DPA



Average of all 45 sessions during the intervention were calculated for the large individual participant analyses. Results from the 4 week intervention also show an average individual participant increase in on-task behavior after the 5-min bout of DPA compared to before the DPA in each participant.

Figure 7 Average Participant On-task Behavior Before vs. After DPA

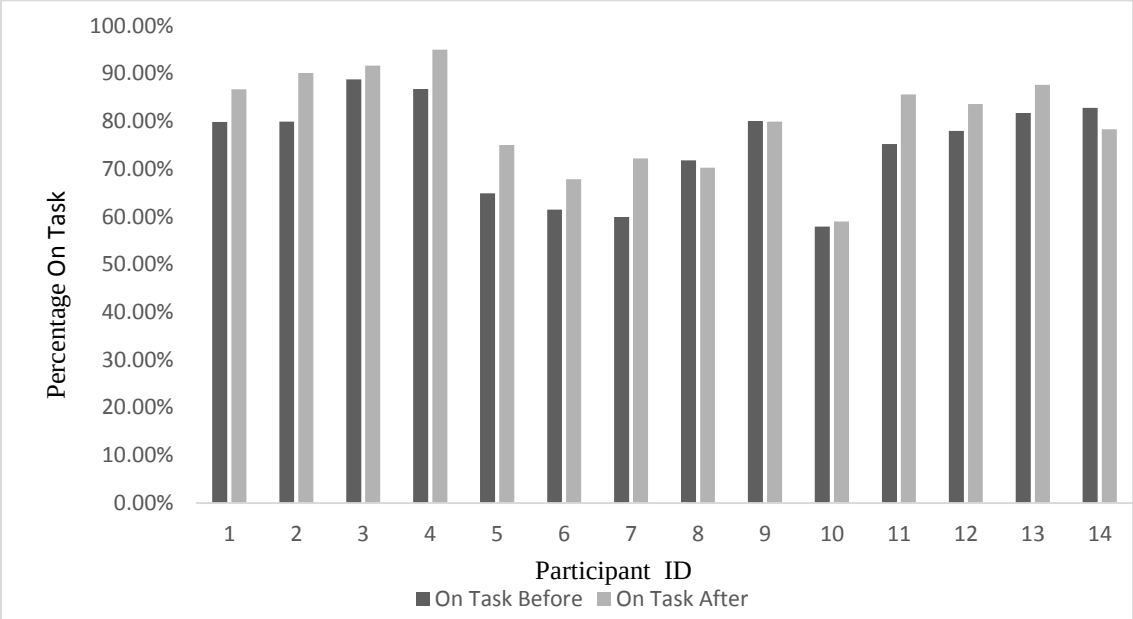


Figure 8 Average Participant Off-task Behavior Before vs. After DPA

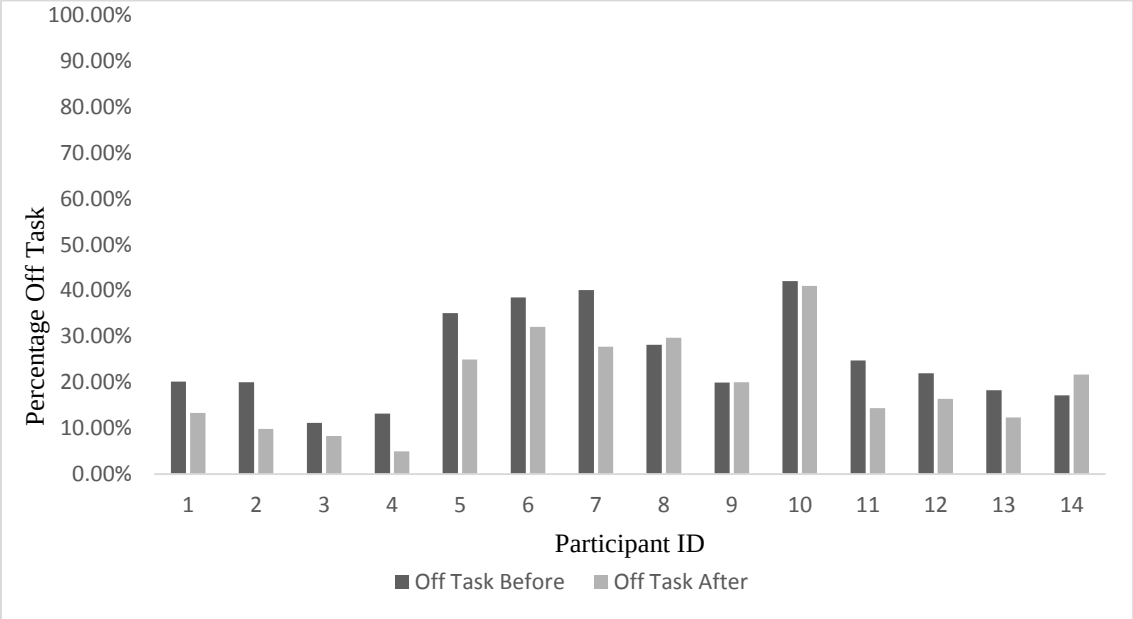
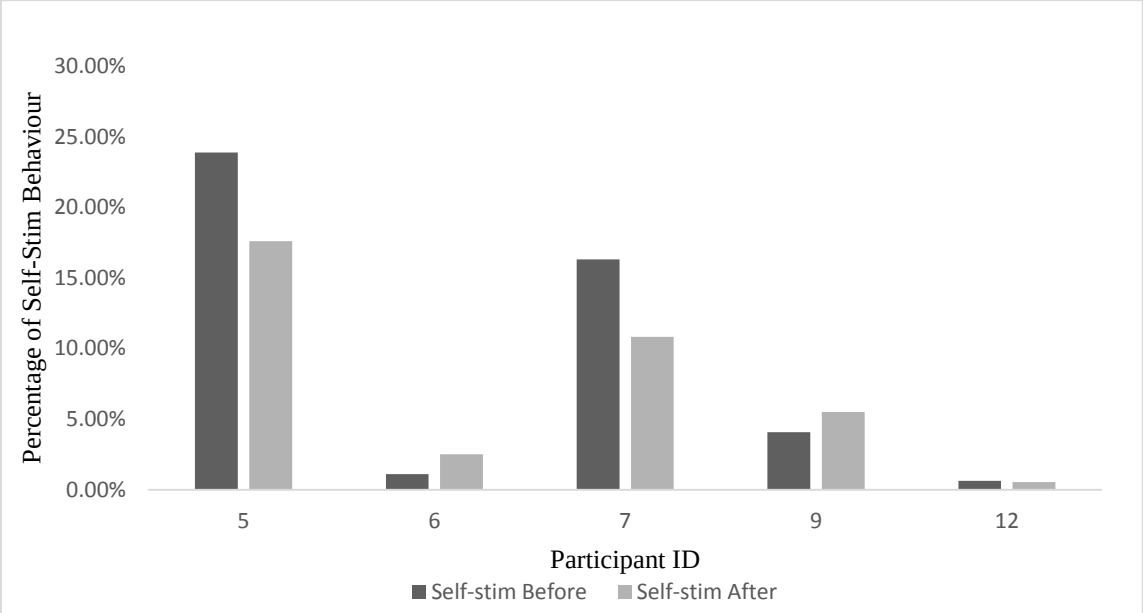


Figure 9 demonstrates that of the participants who exhibited self-stimulatory behaviors, 3 of the 5 participants decreased self-stimulatory behaviors immediately after DPA compared to before the DPA. It is also important to note that participant 13 did not show any self-stimulatory behavior during the intervention weeks 1-4 but did show 1% of self-stimulatory behaviors during baseline observations. Results from a paired sample t-test for self-stimulatory behaviors before the DPA to self-stimulatory behaviors after the DPA were statistically significant overall [$F_{1,3} = 1.174$, $p = <.01$], indicating that self-stimulatory behaviors did reduce immediately after DPA compared to immediately before.

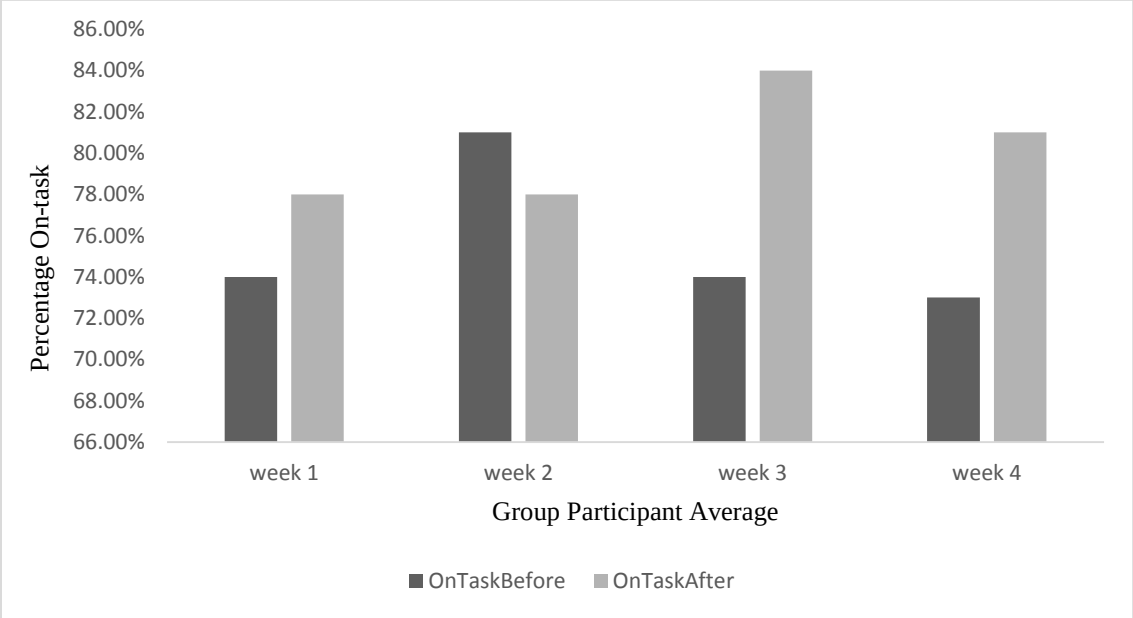
Figure 9 Participant Self-stimulatory Behavior Before vs. After DPA



Week by week Intervention Impact

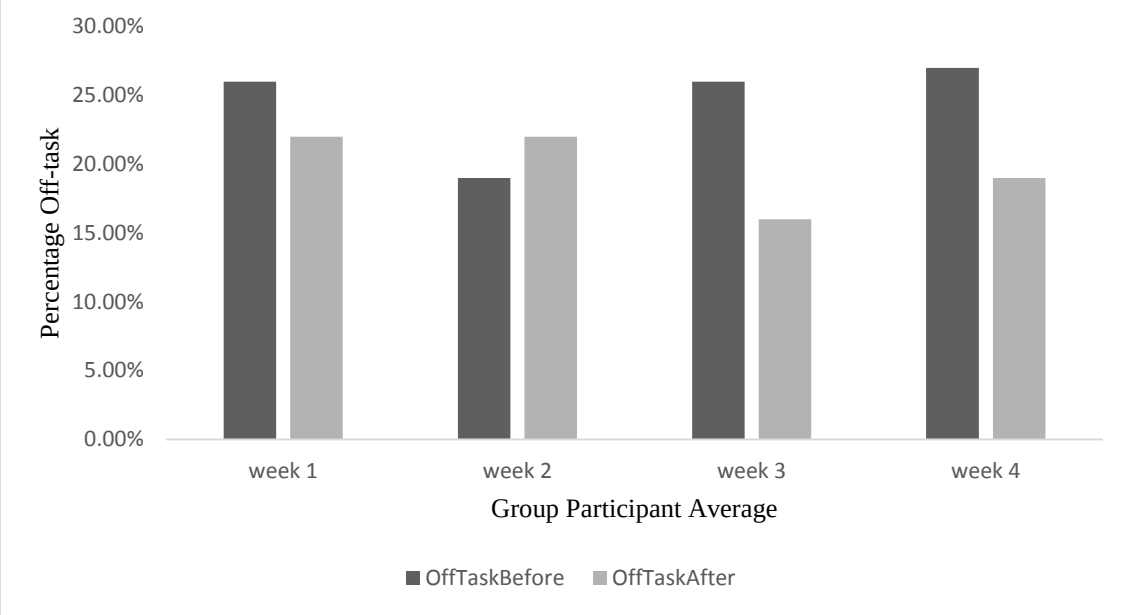
On-task and off-task behaviors were also compared by week (1 – 4). When looking at Figure 10 comparing average on-task behavior before and after the DPA in all weeks, results show that on-task behavior after the DPA increased in week 1 (4%), week 3 (10%), and week 4 (8%). Results from a repeated measures ANOVA looking at differences in on-task behavior after the 5-minute DPA between weeks 1, 2, 3, 4 were overall statistically significant [$F_{1.13}$ = 146.677, p = <.01, ES = .983], indicating that there were differences in on-task behaviors immediately after DPA compared to immediately before between weeks. However, Bonferroni comparisons were not significant between each of the weeks.

Figure 10 Comparing Average On-task Behavior Before vs. After DPA in all Weeks



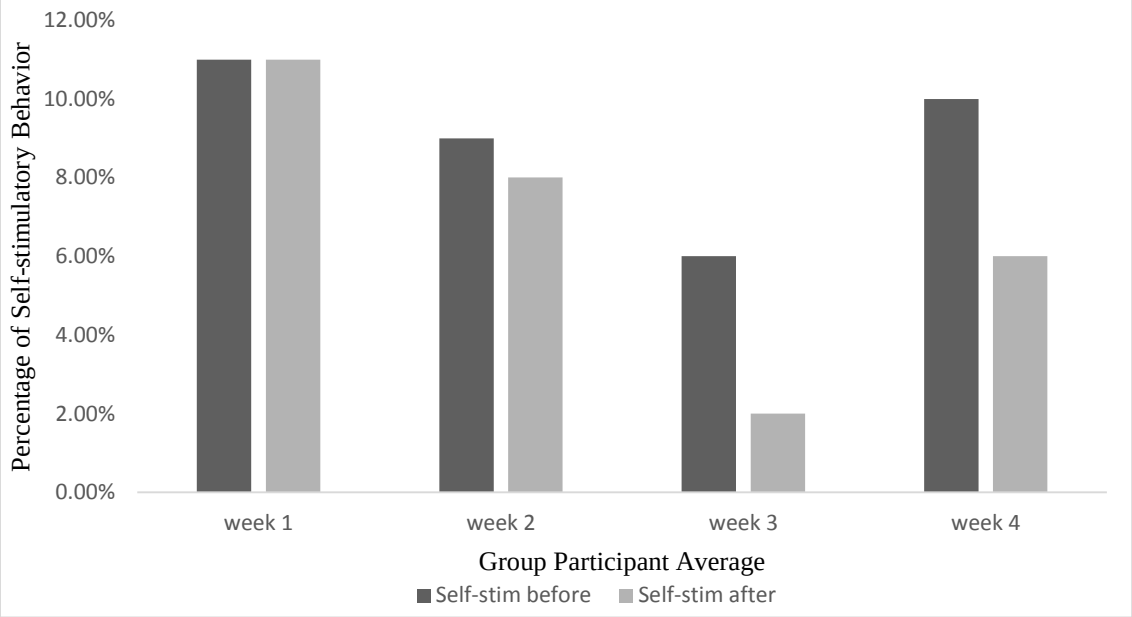
Similarly, when looking at off-task behavior in figure 11, off-task behavior in week 1, week 3, and week 4 all decreased by 4%, 10%, and 8%. Average results for self-stimulatory behavior in figure 12 show that self-stimulatory behavior decreased by 1% in week 2, 4% in week 3, and 4% in week 4.

Figure 11 Comparing Average Off-task Behavior Before vs. After DPA in all Weeks



Of the 6 participants who exhibited self-stimulatory behavior at the time of study, there were no changes in average behaviors in the first week, however, week 2, week 3, and week 4 demonstrated decreases in behavior following DPA compared to immediately before DPA. This suggests that self-stimulatory behavior may have taken a little longer to have an impact.

Figure 12 Comparing Average Self-stimulatory Behavior Before vs. After DPA in all Weeks



Discussion

The purpose of this study was to measure the effectiveness of 5-minute physical activity bouts, 4x/day at decreasing off-task and increasing on-task behavior and decreasing self-stimulatory behavior from baseline to follow-up (long-term effect). Also, to determine if there is a positive impact on on-task, off-task, and self-stimulatory behavior from baseline to intervention. Additionally, this study examined if there are decreases in off-task behavior, increases in on-task behavior, and decreases in self-

stimulatory behavior directly after the 5-minute DPA (immediate effect). Student off-task behavior is one of the biggest factors that contributes to loss of instructional time in the classroom and is negatively correlated with academic progress (Godwin et al., 2013; Lee et al., 1999; McKinney & Feagans, 1983; McKinney et al., 1975). Decreasing off-task behavior in children with disabilities is imperative because they are less likely to be on-task and more likely to be off-task and distractible compared to their peers without disabilities (Bender, 1986; Bender & Smith, 1990; McKinney & Feagans, 1984). Reducing self-stimulatory behavior is also important among children with disabilities because it has been shown to interfere with learning and appropriate play (Kern et al., 1982; Lovaas et al., 1987; Watters & Watters, 1980). Decreasing off-task behavior and self-stimulatory behavior by incorporating physically active breaks may increase time on-task, reduce fidgeting, and increase concentration by making students more attentive and less distracted (Chomitz et al., 2009; Davis et al., 2011; Jarrett et al., 1998; Mahar et al., 2006). Findings from other studies have suggested incorporating multiple short physically active breaks into the school day can decrease off-task behavior when students return to cognitive tasks (Chomitz et al., 2009; Donnelly et al., 2009; Gibson et al., 2008; Ma et al., 2014; Mahar et al., 2006). However, this is the first study to incorporate multiple short bouts of physical activity in a classroom of children with a wide range of various disabilities.

There were a total of 19 possible video recordings during the week of baseline observation and 12 during the week of follow-up. Gibson et al. (2008) also found it challenging to incorporate DPA at various times during the school day reporting similar barriers from teachers incorporating a classroom-based physical activity program.

Twenty-six percent of teachers reported time constraints caused by field trips, standardized testing, and substitute teachers (Gibson et al., 2008). During the intervention weeks (1-4) there were 16 video recordings during week 1, 8 in week 2, 8 in week 3, and 13 in week 4. For similar reasons to baseline and follow-up, several days throughout the intervention field trips and events were scheduled which resulted in the students not being able to be recorded in the classroom. Also, if there were visitors in the classrooms the camera could not record classroom activities without consent. Scheduling several field trips and events is reality for this school at this time of year and the researcher aimed to be the least disruptive as possible to the teacher's plans. Future research should address this challenge by studying classroom behavior over a longer period of time to allow for more observations.

In addition to sessions of DPA being missed entirely, table 2 and table 3 indicate that students were in camera view more during baseline (90%) and immediately before DPA (88%) compared to follow-up (85%) and immediately after DPA (80%). While the observable time was consistently high, we are not completely certain as to why the students were more in view during camera recordings during baseline and immediately before DPA compared to follow-up measures and immediately after DPA. It is possible that due to the field of view the camera was not able to capture every student during classroom activities. Although we had one camera set up high in each of the classrooms to capture the best field of view, it was not feasible to capture every corner of the classroom for this study with multiple cameras. Therefore, if the child is not in camera view during recordings it is unknown if the child is on-task or off-task. Also, some students may have been removed from classroom for therapy or other matters. However,

the researcher also did not restrict the movements of the students and therefore if the students happened to be out of camera view while doing seat work, they were not disrupted to return back to the camera's field of view.

Baseline and Follow-up Findings

Our results indicate that there were long-term improvements in on-task behavior from baseline to follow-up even after the intervention phase (DPA) was removed. On-task behavior showed a statistically significant increase on average by 7% in follow-up observations compared to baseline observations (Figure 2). This finding is consistent with a previous study indicating that following a physical activity break, on-task behavior increased by 2.18% (Nicholson et al., 2011). Nicholson and colleagues (2011) found an increase from baseline on-task behavior (71.45%) to follow-up on-task behavior (73.63%). However, in our study although DPA was not delivered during follow-up phase, on-task behavior increased by 7% from baseline after 4 weeks of DPA intervention, which was a greater increase than what was shown by Nicholson et al. (2011). This demonstrates that even though follow-up occurred during the end of the school year (Spring), during the hectic and exciting time of planning for graduation, practicing for the end of the year school play, and the DPA has been discontinued, the students continued to show increased on-task behavior after the intervention without receiving a physical activity break during follow-up week. Therefore, by providing an intervention such as including active breaks after prolonged periods of instruction during the school day can provide long-term positive outcomes on children's on-task behavior. Increasing time on-task is important for teachers because off-task behavior can contribute to loss of instructional time in the classroom.

In addition to increases in students overall on-task behavior, figure 3 also shows increases in individual participant's on-task behavior from baseline to follow-up. Even during follow-up when DPA was no longer being delivered, 11/14 participants on-task behavior increased in follow-up compared to baseline, 2/14 participants on-task behavior stayed the same, and 1/14 participants on-task behavior slight decreased (3.91%). This indicates that although the DPA during the intervention may have had a long-term effect for most students, it was possibly not beneficial for 3 of the 14 participants. It is possible that the three participants require DPA every day in order to see improvements in on-task behavior.

In addition to improvements in on-task behavior from baseline to follow-up, figure 5 shows the percentage of individual self-stimulatory behaviors decreasing in follow-up compared to baseline for the participants who exhibited self-stimulatory behavior (n=6). All participant's self-stimulatory behaviors significantly decreased from baseline to follow-up. In fact, in 2/6 participants who exhibited a small percentage of self-stimulatory behaviors during baseline measures (6%), their self-stimulatory behaviors completely decreased during follow-up. Our findings are supported with previous research suggesting that physical activity is an effective intervention at reducing self-stimulatory behaviors in children with ASD (Kern et al., 1982; Watters & Watters, 1980). Future research should investigate whether intensity and type of physical activity have an effect on reductions in self-stimulatory behavior (Levinson, 1991; Oriel, George, Peckus, & Semon, 2011). However, the participants in the current study did not have a diagnosis of ASD. This suggests that future research should investigate the type of

physical activity delivered on decreasing self-stimulatory behavior in children with other varied and emerging disabilities.

Findings from baseline and follow-up observations demonstrate a promising trend for future research. Our findings indicate that it is possible to increase on-task behavior in children with a wide range of disabilities after the intervention has been implemented, which means once DPA is no longer being delivered, students were more on-task than they were in baseline observations. In addition, all 6 participants who exhibited self-stimulatory behaviors at baseline decreased in follow-up. Future research is needed on incorporating DPA in the classroom to improve on-task behavior and reduce self-stimulatory behavior in children with disabilities.

Intervention Findings

In addition to increases in on-task behavior from baseline to follow-up. Our findings also show statistically significant increases in average group on-task behavior from baseline (71%) to during the intervention (80%). Indicating that group average time spent on-task increased by 9% from baseline to intervention. This percent change was similar to findings from Nicholson et al. (2011) where group average on-task behavior was 71.45% at baseline and increased to 78.99% during the intervention which was an 8% increase. These results suggest that incorporating DPA or a similar physical activity intervention may have tremendous benefit for children with disabilities.

Our results also show improvements in on-task behavior immediately following the DPA sessions compared to the 10-minutes immediately before DPA. On-task behavior increased on average by 5% immediately after the DPA compared to immediately before the DPA was delivered (figure 7). Mahar and colleagues (2006)

evaluated the effect of incorporating a 10-min bout of physical activity on on-task behavior in third-grade and fourth-grade students. Results indicated that average on-task behavior increased by 8.3% immediately after a physical activity break (Mahar et al., 2006). On-task behavior after a 12 minute activity break was assessed in four participants with ASD in a study by Nicholson et al. (2011). Results for individual participants in this study suggested that total observed on-task behavior increased consistently over the course of the intervention phase (Nicholson et al., 2011). Although Nicholson and colleagues (2011) study did not observe on-task behavior immediately before the physical activity and could only compare behaviors from baseline to after DPA, the results indicate that the physical activity break was beneficial at increasing on-task behavior compared to baseline. In addition, Oriel and colleagues (2011) reported improvements in on-task behavior and academic responding for 30 minutes following aerobic exercise. This has implications for classroom instructional time because research has found off-task behavior to be the biggest factor that contributes to loss of instructional time (Godwin et al., 2013; Lee et al., 1999).

Potential mechanisms to explain the beneficial effects of physical activity include physiological changes; it might be that physical activity results in increased transmission of monoamines, specifically norepinephrine, dopamine, and serotonin, in the brain which affect arousal and attention and may facilitate an increase in on-task behavior (academic engagement) (Dunn & Dishman, 1991; Ransford, 1981). We hypothesize that the increase in on-task behavior following a DPA break was due to providing the students with an energy release outlet. Providing an active break after prolonged periods of instruction will provide positive behavior outcomes on children's post break work tasks

(Pellegrini, Huberty, & Jones, 1995). This is based on the play deprivation theory suggesting that prior to a break children are deprived of physically active opportunities and engaged in cognitively demanding tasks (Pellegrini et al., 1995). When children are given the opportunity to release built up energy they will engage in increased levels of physical activity and will be more on-task and cognitively present when returning to classroom activities (Burghardt, 1984; Pellegrini et al., 1995). Future research should investigate how physical activity may affect other children with a wide range of disabilities.

Our findings for self-stimulatory behaviors in Figure 9 show that self-stimulatory behaviors significantly decreased in 4/6 participants immediately after DPA compared to immediately before. In one participant self-stimulatory behaviors increased by 1.43%. It is possible that for this participant the incorporation of physical activity enhanced self-stimulatory behaviors by creating an unstructured environment, using music, and generally a more stimulating environment for this participant. Decreases in self-stimulatory behaviors were also found in participants with ASD following vigorous physical activity (Kern, Koegel, & Dunlap, 1984). However, Kern et al. (1984) also found no reduction in self-stimulatory behavior following mild exercise; indicating that for some participants the intensity of the physical activity may have an impact on decreasing self-stimulatory behavior. Studies have demonstrated that structured aerobic exercise has been shown to increase attention, work performance, and on-task behavior in children with self-stimulatory behaviors (Kern et al., 1984; Rosenthal-Malek & Mitchell, 1997). Watters and Watters (1980), Kern et al. (1984), and Rosenthal-Malek et al. (1997), all used moderate aerobic exercise for a period ranging from 8-20 minutes and found

significant reductions in self-stimulatory behaviors following the activity. In addition, self-stimulatory behaviors decreased following exercise and did not return to baseline until 90 minutes later (Kern et al., 1982). This suggests that for some children, 5 minute bouts of physical activity may not be a long enough bout for self-stimulatory behaviors specifically to decrease. However, for other students, incorporating a short bout of DPA can have significant improvements on self-stimulatory behavior. In addition, 1 participant exhibited no self-stimulatory behaviors during the intervention compared to 8% during baseline indicating an elimination of this particular child's self-stimulatory behavior. Based on our findings from this study, physical activity breaks are still recommended for children who exhibit self-stimulatory behavior. For the 3 participants in our study who did not show any decreases in self-stimulatory behavior following DPA, it may be due to the intensity and duration of the DPA not being vigorous or long enough (Kern et al., 1984; Oriel et al., 2011). Therefore, future studies should investigate the desired length and intensity of physical activity breaks for populations with different disabilities.

Small decreases in self-stimulatory behavior, of those who had observed behaviors also occurred each week; however, it did take a little longer to have an impact (Figure 12). The students who did show self-stimulatory behaviors appeared to engage in such behaviors more prior to DPA in the fourth week. This could be due to certain classroom activities, for example, preparing for the end of the year play, and graduation. This may have excited the students and caused an increase in self-stimulatory behavior. Findings of self-stimulatory behavior were limited by small sample of children who did demonstrate self-stimulatory behaviors. Future research should investigate the effects of

physical activity on a larger sample size of children who exhibit self-stimulatory behavior.

Week by Week Findings

The present study also compared on-task and off-task behavior before and after DPA by week. Results for week 1, week 3, and week 4 show that on-task behavior increased after the DPA compared to before. Group average on-task behavior increased by 4% in week 1, 10% in week 3, and 8% in week 4. However, during week 2, there was a decrease in on-task behavior immediately after the DPA compared to immediately before (10% decrease). This result could be due to only 8 DPA sessions having occurred that week out of a possible 20 during week 2. That week also had many interruptions each day consisting of families and children visiting for the next academic year and field trips. It is also possible the students were engaging in less academic tasks and more unstructured activities (free time) during week 2 which may have increased off-task behavior. Results from Mahar and colleagues (2006) indicate that improvements in on-task behavior were generally seen from incorporating an activity break at week 5 of the intervention compared to the first week the intervention. These findings suggest that on-task behavior following DPA generally increases as time goes on (Nicholson et al., 2011). Future research should examine whether on-task behavior continues to increase with longer interventions.

Summary of findings

Campbell Children's School does not have a gymnasium to offer physical education; outside of therapeutic services (occupational and physiotherapy) and swimming for therapeutic purposes, teachers did not deliver classroom DPA in an attempt to achieve 20 minutes of DPA per day prior to this study. We were able to deliver

classroom-based 5-min bouts of DPA with no extra equipment required. Findings from this study suggest that after delivering DPA student on-task behavior increases in regular classroom activities. Not only did on-task behavior increase immediately following DPA but it also increased from baseline to follow-up and from baseline to intervention. Additionally, similar results were seen with self-stimulatory behavior. Reducing self-stimulatory behavior is important among children with disabilities because it has been shown to interfere with learning (Kern et al., 1982). Findings from our study indicate that incorporating DPA in the curriculum can decrease self-stimulatory behavior among those who exhibit them. These results are promising for teachers because research has shown that student off-task behavior is the biggest factor that contributes to disrupted instructional time (Godwin et al., 2013; Lee et al., 1999) and children with disabilities are more likely to be off-task than students without disabilities (Bender, 1986; Bender & Smith, 1990; McKinney & Feagans, 1984). Teachers report improvements in classroom behavior when a physical activity break is provided to students during the school day (T. Dwyer, Coonan, Worsley, & Leitch, 1979). On-task behavior has significant implications for teachers because they are overloaded with overwhelming curriculum expectations as well as pressure to focus on academic subjects (J. Dwyer et al., 2003). If students can spend more time on-task teachers may be able to cover more content in a day and enhance learning (Chomitz et al., 2009). Teachers are driven people in a stressful profession and can tend to be hard on themselves. Increasing student time on-task can also increase overall teacher well-being by enhancing their job performance including greater ability to prioritize, greater self-confidence, and less distressed.

Strengths and Limitations

As with all studies, there are strengths and limitations to this study. The first strength is that, to the best of our knowledge, no other DPA intervention has been conducted in a classroom-based setting of children with a wide range of disabilities. Therefore this study fills a gap in the literature and provides a platform for future research in this area. A short classroom-based physical activity program was relatively easy to implement and was encouraged and accepted from the teachers. The in class DPA was also convenient for the teachers because the students did not have to leave the classroom to receive physical activity. The curriculum designed for this study is relatively easy to implement and only involved the use of music. This program could easily be implemented by teachers and educational assistants with minimal training. Another strength to this study was the use of video cameras to record behaviors. One of the best assessment procedures for direct observation of classroom behavior in schools is systematic direct observation (Hintze et al., 2002). This study also recorded classroom behaviors immediately before the DPA breaks to compare on-task behavior immediately after to immediately before DPA. This study also occurred over the period of 6 weeks (1 week of baseline observations, 4 week intervention, and 1 week of follow-up observations).

There are also a number of limitations to this study that need to be addressed. The first limitation is the lack of control group. A control group would give us a better understanding of the effectiveness of the 5-min bouts of DPA on on-task behavior, off-task behavior, and self-stimulatory behavior and increase the confidence that changes were in fact due to the intervention. However, due to the participants of this study having a wide range of various disabilities it was more feasible to have them act as their own

control. Also, the participants disabilities are still emerging, they are in kindergarten are still developing as well as having a disability, their disability has not stabilized yet and it is difficult to predict how it will manifest at the end of the day. Larger sample sizes would be ideal; however, this study was done in a school with small classroom sizes (class A=10, class B= 7) and would require more than one researcher and the involvement of teachers and education assistants if this study consisted of more than two classrooms, which was not feasible for this study.

Another limitation is that the researcher was not blind to the study intervention, but because the researcher led the DPA and videotaped the student's behavior it was objective as it could be. However, two of the three research assistants were blind to the study and only received training on the coding protocol. It is important to note that our inter-rater reliability scores (~85% agreement) provides confidence in the precision of observations, which is similar to other studies (Ma et al., 2014; Mahar et al., 2006). Although, inter-rater reliability does not eliminate the possibility of bias, it does support the accuracy of our measure of on-task, off-task, and self-stimulatory behavior (Mahar et al., 2006).

Another limitation to this study would be the duration of observation immediately following DPA. This study observed students classroom behavior for 10 minutes immediately following DPA. Future research should investigate the duration of effects on on-task behavior longer than 10 minutes. However, it was not feasible for this study to observe classroom behavior longer than 10 minutes. Future research should investigate whether student on-task behavior continues to increase in longer durations immediately following DPA in children with disabilities.

A final limitation to this study would be the time of year the study took place. Of a planned 80 DPA sessions for the intervention, only 45 were delivered, however, it was reality for this school at that time. Unfortunately, due to this study finishing up in the spring the students spent several afternoons outside. In addition, several field trips, BBQ's, bake sales were scheduled during regular classroom hours and prevented us from being able to deliver all DPA sessions and having the student's classroom behavior be videotaped. It would be ideal to deliver this study over the course a full school year to have more data if students missed school certain days.

Future Research

On-task, off-task, and self-stimulatory behavior were assessed following incorporation of a 5-min DPA break, 4x/day, in a classroom of children with various disabilities. Additional research is needed to evaluate the effectiveness of classroom-based physical activity programs on on-task behavior and academic performance. This study did not test whether or not improving on-task behavior had a direct relationship with improved academics (e.g. learning outcomes). Due to on-task behavior having a direct link to physical activity that is delivered immediately after an active break, it may be an important finding to evaluate a relationship between physical activity and on-task behavior in relation to educational outcomes (Mahar et al., 2006). We hypothesize that increased on-task behavior would have a positive influence on academic performance. Additional research on the effectiveness of classroom-based DPA on educational outcomes (ie. grades) can provide greater support for why school boards and teachers should implement changes to the curriculum to include more physical activity during the school day. To evaluate physical activity effects over a longer period of time, larger samples of students should be tracked over a full school year to determine the effects of

classroom-based DPA on on-task behavior and academic performance in children with and without disabilities. Future studies should have a control group to give us a better understanding of the effects of a 5-minute physical activity break on improving on-task behavior and reducing off-task and self-stimulatory behaviors. Due to the participants of this study being a mixed group of children with various disabilities, future research should investigate who specifically benefits the most from physical activity interventions in a classroom-setting (ie. what characteristics predict the best outcomes). Future research should also investigate the duration of effects on on-task behavior longer than 10 minutes. In this study, improvements in on-task behavior were seen during the 10 minute observation period immediately following DPA, however, our findings do not indicate how long on-task effects may last following DPA.

Conclusions

We were able to incorporate 5-minute bouts of DPA, 4x/day in a classroom of children with a wide range of disabilities. In addition, we were able to increase on-task behavior, decrease off-task behavior, and decrease self-stimulatory behavior following a DPA break for most participants. Results from this study suggest that incorporating short classroom-based activity breaks without the use of equipment may be beneficial to students with disabilities. Opportunities to be physically active are limited at this school and teachers are often pressured to improve classroom behavior and educational outcomes (Mahar et al., 2006). However, incorporating DPA during instructional time is a promising way to increase children's activity levels as well as increase time on-task without sacrificing scholastic performance (Mahar et al., 2006). Research has shown that students spend between 10% and 50% of their time off-task in the classroom (Godwin et al., 2013; Karweit & Slavin, 1981; Lee et al., 1999). This suggests that any improvement

in on-task behavior may benefit children and educational outcomes. Incorporating multiple short DPA breaks with appropriate grade level music to movement is recommended for teachers who may want to increase physical activity and/or on-task behavior in their students with a wide range of disabilities.

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Chapter 4: Manuscript 2

Effect of DPA on level of engagement in a classroom of children with developmental disabilities

Abstract

Children with disabilities are less likely to engage in physical activity and are more sedentary than their peers without disabilities. Children spend a large portion of their day in the classroom. The Ontario Ministry of Education has mandated that school boards must ensure that all elementary students, including students with special needs, be provided with a minimum of 20 minutes of physical activity each school day during instructional time. The purpose of this study was to determine the feasibility of implementing daily physical activity (DPA) including four bouts of 5 minutes each, 20 minutes/day in a classroom of kindergarten children with a wide range of disabilities (n=14). A secondary purpose was to determine the student's engagement levels during DPA sessions over time. Direct observation of classroom behavior was used to assess the engagement level of students during each 5-minute DPA session. Engagement: Results indicated that student engagement was moderate throughout the DPA sessions during the intervention. Significant increases in engagement were seen from week 1 to week 4 (p = <0.01). Results between weeks indicated that there was a significant increase in engagement from week 1 to week 4 (p = 0.01). The results of this study indicate that incorporating four 5-minute bouts of DPA a day in a classroom of children with a wide range of disabilities is feasible. In addition, engagement level was moderate throughout the 4 week intervention. However, future research consisting of teacher-led DPA, greater student age range of children with disabilities, and different DPA protocols is necessary.

Introduction

Physical Activity among Children

According to the Canadian Physical Activity Guidelines, for health benefits, children aged 5-11 years should accumulate at least 60 minutes of moderate-to-vigorous physical activity (MVPA) a day (Tremblay, LeBlanc, et al., 2011). However, according to the Canadian Health Measures Survey (CHMS) results from 2007-2009, few children accumulate even adequate amounts of physical activity a day (Colley et al., 2011). It is well established that physical activity provides several physical benefits among children of typical development (Janssen & LeBlanc, 2010); however, physical activity may be of even greater importance for children with disabilities because the presence of a disability generally leads to increased sedentary behavior (Cooper et al., 1999; Sit et al., 2007).

People with disabilities are less likely to engage in physical activity and are also at risk of secondary impairments due to the nature of their disability and sedentary lifestyles which may further compromise their health (Graham & Reid, 2000; Johnson, 2009; McDonald, 2002; Rimmer, 1999). These secondary impairments may include osteoporosis, osteoarthritis, certain infections, decreased strength and flexibility, obesity, and depression (Chanias, Reid, & Hoover, 2010; Damiano, 2006; Johnson, 2009; Sit et al., 2007; Wind, Schwend, & Larson, 2004). Therefore, it is important to encourage participation in physical activity to provide important health benefits among people with disabilities, particularly children. Greater opportunities to increase physical activity should be provided to for children and youth. There is a need for evidence based strategies to increase physical activity for all children.

Physical Activity in Schools

Children spend a large portion of their day in sedentary activity, sitting at their desks in classroom confinement (Patton, 2012). Due to this significant time allotment spent in school, the education system has a responsibility to increase physical activity in school settings for all children. Physical Education (PE) has historically been considered the main domain for developing and shaping children's physical activity behavior (Sit et al., 2007). However, many school districts have reduced PE requirements and have even eliminated physical activity programs altogether (Coe et al., 2006; Thomas, 2004). The percentage of schools requiring PE in each grade in the United States decreased from approximately 50% in grades 1-5, to 25% in grade 8, to only 5% in grade 12 (Doak et al., 2006). A study in Ontario reported only 7% of instructional time in the school day was devoted to physical education in English schools and 8% in French schools (Active Healthy Kids Canada, 2012). Although PE is the most common form of physical activity delivery in schools, other physical activity initiatives are becoming more common, such as daily physical activity (DPA).

The Ontario government is committed to supporting a healthy school environment (Ontario Ministry of Education, 2005). In response to concerns of inactivity among youth, the Ontario Ministry of Education has mandated that school boards must ensure that "all elementary students, including students with special needs, be provided with a minimum of twenty minutes of sustained moderate to vigorous physical activity each school day during instructional time" (p. 6) (Ontario Ministry of Education, 2006). Schools are critically important to increasing physical activity among Canada's youth and DPA is an important component to school's health programs (Active Healthy Kids Canada, 2012; Ontario Ministry of Education, 2006). Although DPA can be

accomplished during PE, the Ministry of Education has mandated that DPA be included during instructional time even on days when PE is not offered. Teachers can help encourage youth to build physical activity into their daily routine by incorporating DPA into their curriculum that is appropriately adapted for all students, including students with special needs. To the best of our knowledge, there is no known studies conducting DPA in classrooms of children with a wide range of disabilities.

Daily Physical Activity in Canada

Ontario, Alberta, and British-Columbia have each mandated DPA within their school systems (Active Healthy Kids Canada, 2012; Alberta Education, 2008; British Columbia Ministry of Education, 2011; Ontario Ministry of Education, 2006). However, in many schools DPA is not being run as mandated by the provincial government. A study conducted by Patton in 2012 provided questionnaires to teachers across 37 schools in the Thames Valley District School Board in London, ON. Thirty-nine percent of teachers reported that they delivered DPA sessions only some of the time (Patton, 2012). An additional 16.3% reported that they never or rarely conducted DPA, and only 45% of teachers indicated to somewhat know about the Ministry of Education guidelines for DPA (Patton, 2012). This suggests that DPA is not being viewed as a priority in the curriculum. Forty-five percent of teachers also noted that time was the biggest barrier to delivering DPA. Therefore, although the provincial government has mandated an intervention to increase DPA in children, school boards and teachers need to support school-based interventions in order to effectively promote healthy living (Patton, 2012).

Stone and colleagues (2012) used accelerometers to evaluate whether the Ontario Ministry of Education's DPA policy was being effectively incorporated in elementary

classrooms. Results demonstrated that of 856 participants, just under half (49%) engaged in DPA every day of the school week (Stone et al., 2012). A total of 16.1% engaged in DPA on 4 days, 17.9% on 3 days, and 16.6% on 2 days. In addition, only 165 of participants accumulated at least 1 sustained (greater than 5-min) bout of MVPA during schedule DPA across the school week (Stone et al., 2012). These findings suggest that the majority of schools are not meeting the DPA policy requiring a minimum of 20 minutes of MVPA each school day. Research has also shown that children typically accumulate physical activity in short sporadic bursts and may not be able to sustain bouts of physical activity for more than 10 minutes (Bailey et al., 1995; Stone et al., 2012). Findings from Stone et al. (2012) demonstrated that the majority (90%) of participants accumulated MVPA under 10 minutes, on average bouts lasted 6-7 minutes (Stone et al., 2012). This suggests that incorporating multiple short bouts of physical activity into the classroom rather than one long bout of 20 minutes, may be more feasible and engaging for the children to accumulate required DPA.

A study conducted by Gibson et al. (2008) implemented an intervention called Physical Activity Across the Curriculum (PAAC) consisting of 90 minutes per week of moderate intensity physical activity as part of academic instruction. Results demonstrated that over the course of six months, although teachers were not able to deliver 90 minutes of physical activity per week, the number of minutes teachers incorporated PAAC into their lessons increased considerably, beginning with 47 minutes and ending with 65 minutes per week (Gibson et al., 2008). At the end of the study 58% of teachers reported that an intervention such as PAAC was able to provide additional minutes of physical activity to students in the classroom. However, no child in this study reported to have a

disability. Nevertheless, findings from this study demonstrate that incorporating physical activity in the curriculum can be delivered by teachers in classroom-based settings. Further research should determine if DPA delivered in multiple short bouts per day is feasible in a classroom of children with disabilities.

Short bouts of DPA

A systematic review of literature on the integration of short bouts of physical activity in schools suggested that bouts of physical activity designed to be 10-20 minutes in duration begin to resemble exercise prescriptions and are less feasible to integrate into organizational routines such as the classroom (Barr-Anderson et al., 2011). Stone et al. (2012) also found that students were not able to achieve MVPA during bouts of 20 minutes in duration, however, the majority of participants could achieve bouts lasting between 5-10 minutes in duration. A TAKE 10! Program which was designed to integrate education curriculum components along with a physical activity program in providing DPA was successful at increasing daily physical activity levels (Stewart et al., 2004). The total time spent in TAKE 10! Activity sessions during the week of intervention for three classrooms was 88.9 minutes for the first grade class, 91 minutes for the third grade class, and 86.1 minutes for the fifth grade class (Stewart et al., 2004). These results suggest that participants in this study were able to achieve exercise intensities in the moderate to vigorous range and were able to main these intensities throughout the 10 minute activity session however, the minimum requirement of 20 minutes of additional classroom-based physical activity was not achieved (Stewart et al., 2004). These results indicate that although participants from this study were able to increase their physical activity levels in short 10 minute bouts, providing even shorter bouts (<10 minutes) for children in kindergarten with developmental disabilities may be more feasible at achieving the

recommended DPA requirement (Barr-Anderson et al., 2011). Future studies should investigate the feasibility of attaining DPA in classroom-based settings for children with a wide range of various disabilities.

Ma and colleagues (2014) investigated the effects of incorporating multiple short bouts (4-minutes) of physical activity in classroom-based settings, which was the shortest protocol studied to date. Although Ma et al's. (2014) results were on different outcomes, they were able to deliver physical activity breaks in shorter bouts in a grade 2 and a grade 4 classroom. However, the number of bouts delivered per day in the intervention classroom was not stated. It is not known if this study was able to deliver the minimum requirement of 20 minutes of DPA with 4-min bouts in a classroom of elementary school children. Future research should investigate whether short DPA breaks (4-5 mins) is feasible in kindergarten children with disabilities at delivering the minimum requirement of DPA (20 minutes) mandated by the Ministry of Education.

Benefits of DPA for children with disabilities

The majority of research on the benefits of incorporating physical activity in the curriculum is among children of typical development (Barr-Anderson et al., 2011; Donnelly et al., 2009; Stewart et al., 2004; Stone et al., 2012). Few studies have investigated the effectiveness and feasibility of incorporating DPA in a classroom of children with disabilities (Cooper et al., 1999). Children with disabilities are more sedentary, less likely to engage in physical activity, and are less likely to be physically fit than their peers (Johnson, 2009; McDonald, 2002; Sit et al., 2007). There can be physical consequences of inactivity for individuals with disabilities because the presence of a disability often leads to a deterioration of physical functioning, which in turn results in a

further reduction in physical activity and increased risk for sedentary behavior (Sit et al., 2007). Therefore, finding avenues to promote physical activity among children and youth with disabilities may be of even greater importance. Due to the significant amount of time children spend in school, teachers and education systems need to look for opportunities outside of PE such as, the classroom to provide DPA for children with disabilities.

The purpose of this study was to determine the feasibility of implementing a DPA program including four short bouts 5 minutes each, 20 minutes/day, of physical activity in a classroom of junior kindergarten students with disabilities because to the best our knowledge no known studies have explored feasibility of this type of program. A second purpose of this study was to determine the student's engagement level in the DPA sessions over time. Also, we wanted to obtain the teachers perspectives on the DPA sessions and if they feel they can benefit from incorporating DPA into their curriculum to hopefully provide useful recommendations for future teachers.

Methods

Ethics

Ethics approval was obtained from the University of Ontario Institute of Technology's Research Ethics Board (Appendix 1), from Grandview Children's Centre (Appendix 2), and from Campbell Children's School (Appendix 3). Participants were recruited from Campbell Children's School through the school principal via an Invitation letter (Appendix 4) sent home to the parents. Parents provided consent for their children to participate in the study (see Appendix 5).

School

Campbell Children's School is the education partner to Grandview Children's Centre in Oshawa, ON. Campbell's is mandated under Section 68 of the *Education Act* to provide, in accordance with the Act and its regulations, the educational component of Grandview Children's Centre's therapy program. Campbell's has its own trustees appointed by the Ministry of Education and is not under the jurisdiction of any of the local district school boards. Campbell Children's School has four classrooms of students ranging from Junior Kindergarten to Grade one with multiple exceptionalities and/or severe speech impairments (Special Education Report, 2015). The students with severe speech impairments frequently require occupational therapy for fine motor and visual motor difficulties that become apparent during the year. Each student at Campbell's has an Individual Education Plan (IEP) that includes academic goals based on the Ontario curriculum as well as therapy goals and it is the board's goal to assist the transition of these children into community school programs. Each child must be at least 4 years of age, must have the ability to participate and benefit from the treatment program provided by therapeutic services, and must require development of strategies and/or adaptive equipment to be able to function in a classroom-setting in order to be considered for admission at Campbell's (Special Education Report, 2015). It is important to note that Campbell Children's school is a school that does not have a gymnasium to offer physical education and although the students at Campbell's receive occupational and physiotherapy in addition to weekly therapeutic swimming, there is no systematic attempt to achieve 20 minutes of daily physical activity/day.

Participants

Two classrooms were selected by the Principal for this study. Due to certain sensitivities to music, individual behaviors of the children, and challenges with disruptions and transitions of the students, the room selection could not be randomized. When this study occurred, Campbell's consisted of 32 students separated into 4 classrooms. Each classroom in this study had one teacher and two educational assistants. Classroom A consisted of 10 students and classroom B consisted of 7 students. All parents/guardians provided written informed consent for their child to participate and be videotaped for this study. Two students from Class A and one student from Class B were absent for all of baseline measures and therefore were not included in the study. A total of 14 students (class A= 8, class B=6) were included in this study. Of the 14 participants in this research study there was a wide range of developmental and sensory disabilities. Some of these disabilities include cerebral palsy (CP), Spina Bifida, hydrocephalus, global development delay, fine and gross motor delay, speech sound disorder, speech delay, and sensorineural hearing loss. Participant characteristics are presented in the results section.

Study Design

This study is a part of a larger study addressing on-task and off-task behavior following a DPA break. The current paper considers the students engagement level during a DPA intervention. The intervention took place 5 days/week, for 4 weeks, from Monday May 4, 2015 – Friday May 29, 2015 during school hours. A video camera was set up in both classrooms and recorded the students doing regular classroom activities for 10 minutes before the DPA break and 10 minutes after. After the first 10 minutes the primary investigator delivered a 5 minute classroom-based physical activity break

consisting of songs to facilitate movement and a cool-down selected from the MusiGo Kids: Going Places Elementary Teacher Resource (Walcer, 2008). This resource was created to give teachers the opportunity to include movement activities to songs that are ideal for use in the classroom. Other songs were selected from outside teacher resources such as, GoNoodle, The Learning Station, and Youtube videos which include grade level appropriate songs to whole body movements. Some songs were played through CDs on the radio and others were delivered using the smartboard. Each song was appropriate and accommodated the needs and abilities of each student and the students were free to participate at their own intensity and ability. For example, some of the movements to the song " Jump Up" the MusiGo Kids CD involve the students doing a two leg jump. For the students who use a wheelchair they would push their arms straight up. Similarly, if a child had difficulty jumping with two due to orthotics they could hop or skip to the best of their ability. The video camera recorded the students during regular classroom activities 10 minutes before the DPA break (see Chapter 3). The students were also video recorded during the 5-minute activity break to allow for the primary investigator to examine each student's level of engagement during the DPA. After the 5-minute break another 10 minutes of regular classroom activities were recorded (see Chapter 3). Two activity breaks of 5 minutes each were distributed in the morning and two sessions in the afternoon Monday through Friday for 4 weeks (Table 5).

Table 5 Video/DPA Intervention Schedule

	Day Schedule	
Time	Class A	Class B
9:15-9:30	Video-Observe*	
9:30-9:35	DPA[1] break	
9:35-9:45	Video-Observe	
10:00-10:10		Video-Observe

Continued Table 5. Video/DPA Intervention

10:10-10:15			DPA break
10:15-10:25	Video-Observe		Video-Observe
10:25-10:30	DPA break		
10:30-10:40	Video-Observe		
10:50-11:00			Video-Observe
11:00-11:05			DPA break
11:05-11:15			Video-Observe
11:30 – 12:00		LUNCH	
12:10-12:20	Video-Observe		
12:20-12:25	DPA break		
12:25-12:35	Video-Observe		
12:45-12:55			Video – Observe
12:55-1:00			DPA break
1:00-1:10			Video Observe
1:20-1:30	Video – Observe		
1:30-1:35	DPA break		
1:35-1:45	Video – Observe		
2:00 – 2:10			Video – Observe
2:10-2:15			DPA break
2:15-2:25			Video - Observe

*Video Observations see Chapter 3 ¹ DPA – Daily Physical Activity

The expectation was to deliver 80 sessions of DPA (4x/day, Monday – Friday, 5 days/week) over 4 weeks. However, due to the time of year being the end of the school year, multiple end of the year school field trips were scheduled and classrooms often had families and students visiting for the following year resulting to the camera not being able to record. Of a possible 80 planned DPA sessions, 45 sessions were delivered. The 45 DPA sessions include 16 in week 1, 8 in week 2, 8 in week 3, and 13 in week 4 of the intervention.

Measures

Once parental consent (see Appendix 5) was received by the parents a supplemental information form (see Appendix 6) was also completed to provide demographic information about the child. The information from this form helped provide

more detail about the child (e.g., details of diagnosis, identifying any self-stimulatory behaviors) which may have helped predict or account for the child's behaviors in the classroom) (see results section). A 4-point Teacher Questionnaire consisting of open-ended questions was also provided to both classroom teachers to gain feedback on their thoughts of the DPA intervention and if they plan to incorporate DPA in their curriculum in the future (Table 6).

Table 6 4-Point Teacher Questionnaire

Question #	Question
1	Will you continue to include multiple short bouts of physical activity throughout the day in your curriculum?
2	Did you notice a difference in your student's behaviors? (e.g. improved concentration, on-task behavior, academic achievement, reduced stereotypic behaviors)
3	Did you notice anything else change within the student's demeanor after including short active breaks in the curriculum? (e.g. Improved social interactions with peers)
4	Do you have any comments on the program itself? Feedback on certain aspects you thought were helpful or challenging or parts you may change in the future.

Direct observation of classroom behavior is one of the most widely used assessment procedures by schools (Hintze et al., 2002). Systematic direct observation refers to the observation of behavior in the classroom environment. The Behavior Observation of Students in Schools (BOSS) is a well-known measure for assessing child academic behavior in the classroom (see Chapter 3). For the purpose of this study, student engagement during DPA sessions was observed. Participant's behavior was coded as either "engaged", "observing", "not engaged", or "off-screen" in 30-second intervals during the 5-minute DPA sessions from the video recordings. Engaged was coded when a student was actively engaged in the DPA session (ie. trying their best to

mimic the primary investigator or the video, moving to the best of their ability), observing was coded when the target student was watching the other students engage in DPA or watching the primary investigator. Not engaged was coded when the student demonstrated no interest in participating in the DPA sessions but was in view of the camera, off-screen was coded when the student was present in the room but not present on video camera (see Appendix 9 for sample of coding template).

Video Recording

The camera used for this study was a CANON VIXIA HF R50 8GB Flash HD Camcorder. Videos were downloaded onto a secure server in the lab by the primary investigator. A trained research assistant coded 14% of the videos. To establish interrater reliability, the primary investigator and the research assistant coded one session. The percentage of interrater reliability was 100%. Two other research assistants coded 7% of the videos each. The primary investigator and second research assistant achieved a percentage of 80% interrater reliability. The primary investigator and third research assistant achieved an 80% interrater reliability.

Video Coding

Video coding for the DPA was separated into 30-second intervals for the 5 minute bout. For each 30-second interval the target student was coded as either engaged, observing, not engaged, or off screen. The number of observed intervals of each of engaged, observing, not engaged, and off-screen separately for each participant were summed. During one session of DPA (5-minutes), there are 10 – 30-second intervals (a possible of 10 occasions) for a variable (engaged, observing, not engaged, or off-screen) to be coded. This suggests that for each sum of engaged, observing, not engaged, and off-screen the maximum number that the target student could obtain was 10. For example,

during one session of DPA (5-minutes) a target student may be engaged 5/10 times, 2/10 times was observing, 2/10 times was not engaged, and 1/10 times was off-screen. To the best of our knowledge level of engagement during DPA sessions has not been observed and coded in previous studies in this way.

Analysis

Descriptive statistics were conducted to evaluate changes between baseline and follow-up and immediate changes between before DPA and immediately after DPA. A repeated measures ANOVA was conducted to compare differences in level of engagement, observing, and non-engagement between weeks. When significant, a post-hoc analysis with a Bonferonni correction was used to detect where the differences were. Effect sizes (ES) were also calculated for each test. The power to detect statistical difference was set an alpha level of 0.05.

Results

There were 14 participants in this study (7 boys, 7 girls). The age range was between 4 – 6 years old. Refer to Table 7 for additional participant characteristics including diagnosis and additional difficulties

Table 7 Participant Characteristics

Participant	Age (years)	Gender	Diagnosis	Additional diagnosis and difficulties	Self-stimulatory behavior	Therapy received through Grandview	Additional information
1	6	Female	Speech and language delay	[2]N/A	N/A	Speech therapy	
2	5	Male	Speech sound disorder	N/A	N/A	Speech therapy	Use of wheelchair
3	6	Female	Spastic dystonic quad cerebral palsy	N/A	N/A	Speech	Use of wheelchair
4	5	Female	Speech and language delay	N/A	N/A	Speech therapy	
5	5	Male	Speech sound disorder, hyperactivity, impulsivity	N/A	Sudden run	Speech therapy	
6	5	Male	Speech sound disorder	Suspected [1]ADHD	Body rocking	Speech therapy	
7	5	Male	Moderate bilateral sensorineural hearing loss	Visual problems (Amblyopia)	Repetitive hand and leg movements, noises with mouth	Speech therapy	
8	5	Female	Gross and fine motor delay, speech delay, learning disability	Learning disability, speech delay	N/A	Occupational therapy, physiotherapy, speech therapy	
9	5	Female	Speech	N/A	Sucking thumb	Speech therapy	
10	5	Female	Spina Bifida, Hydrocephalus	N/A	N/A	Physiotherapy	Use of wheelchair

Continued Table 7. Participant Characteristics

11	5	Male	Speech	N/A	N/A	Occupational therapy, physiotherapy, speech therapy
12	6	Male	Fine motor delay, speech delay	N/A	Sucking/chewing sleeves	Occupational therapy, physiotherapy, speech therapy
13	4	Male	Global Developmental Delay, Duplicate chromosome 2, Apraxia	N/A	N/A	Physiotherapy, occupational therapy, speech therapy
14	4	Female	Cerebral Palsy	Developmental Delay, Learning Disability, Visual problems	N/A	Occupational therapy, physiotherapy, botox, orthotics

[1]ADHD – Attention Deficit Hyperactivity Disorder, [2] N/A - Not applicable.

In View during DPA

Table 8 represents the percent of time the participants were in view of camera during the DPA. Of a total of 80 possible DPA sessions only 45 were delivered. Several DPA sessions were missed due to the time of year being the end of the school year. The school had several field trips scheduled, bake sales, events etc. and spent several afternoons outside in the playground. The students were in view of camera for 70% of the DPA and not in view of camera for 30% of the DPA. If a student was absent for the entire DPA (e.g. absent from school or out of the classroom receiving therapy) it was not coded as in view or out of view of camera it was missing data for that child. One camera was set up in each of the two classrooms to record the students engaged level during DPA.

Table 8 Percent of participants in view of camera during DPA

Participant Number	% In view during DPA	% Not in view during DPA
1	80.67%	19.33%
2	77.81%	22.19%
3	77.32%	22.68%
4	72.89%	27.11%
5	71.60%	28.40%
6	74.69%	25.31%
7	77.81%	22.19%
8	66.30%	33.70%
9	64.19%	35.81%
10	64.02%	35.98%
11	64.53%	35.47%
12	65.94%	34.06%
13	63.85%	36.15%
14	64.02%	35.98%
	Mean	
	70%	30%

Total Observations during DPA

Figure 13 demonstrates the average percentage of time students were engaged, observing, and not engaged during 'in view of camera' DPA over the 4 weeks. Students were engaged 72% of the time they were in view of camera, 16% of the time they were observing, and 13% of the time they were not engaged.

Figure 13 Average Total Time Engaged, Observing, and Not Engaged During DPA

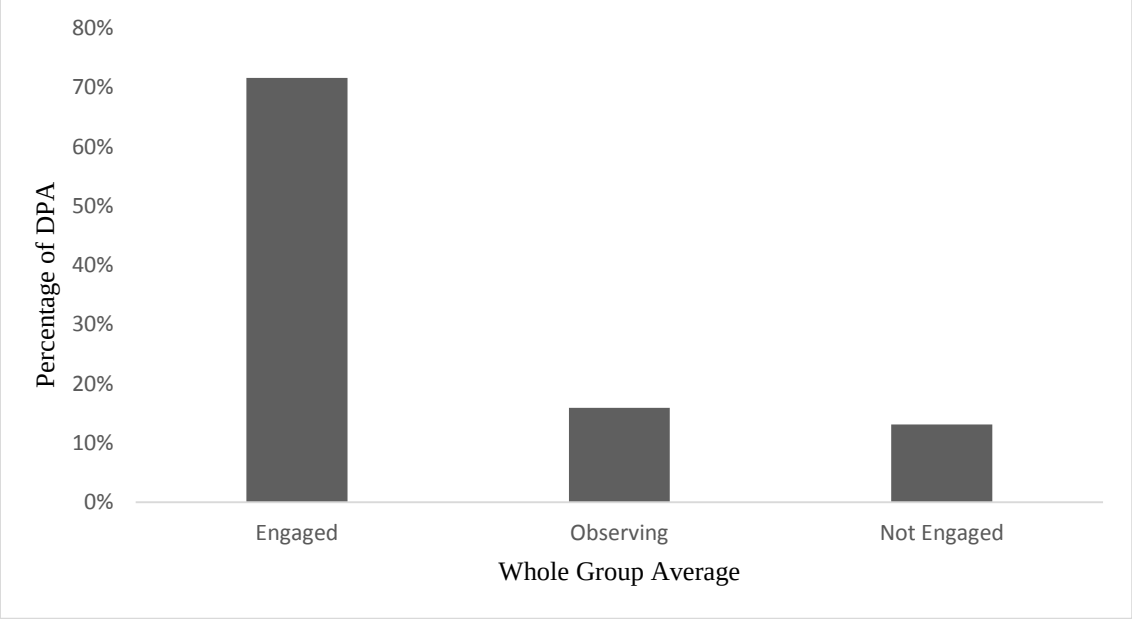
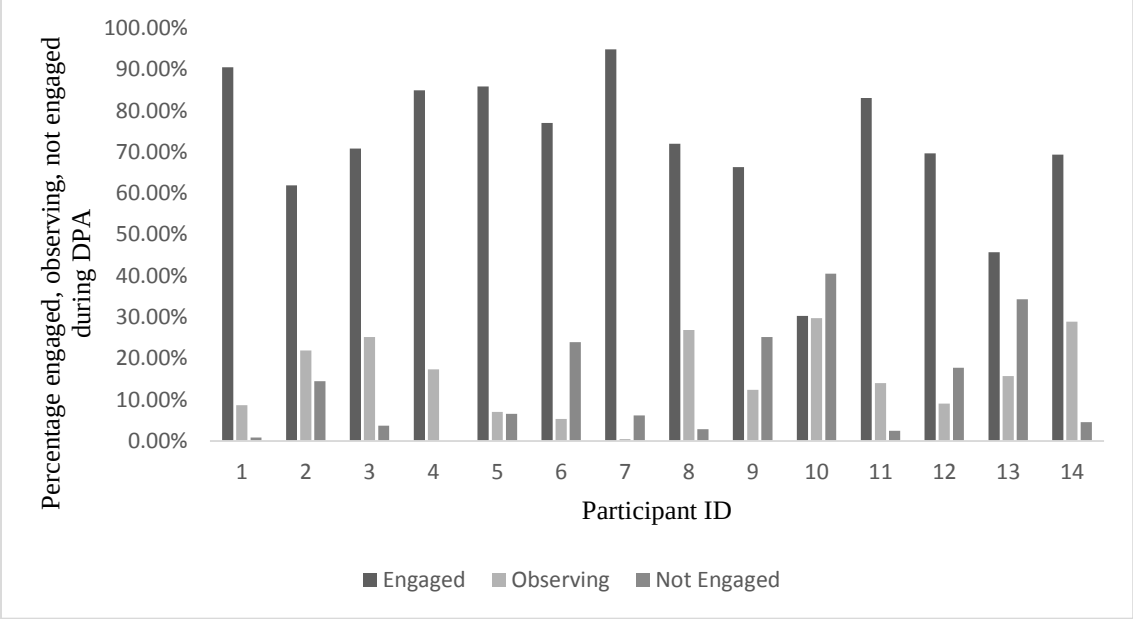


Figure 14 represents the individual participant's percentage of time they were engaged, observing, and not-engaged during 'in camera view' DPA.

Figure 14 Average Individual Participant Engaged, Observing, and Not Engaged during DPA



Week by Week DPA Impact

A comparison of group average by week was calculated to understand if the level of percent enjoyment differed over 4 weeks. Figure 15 represents the group average percent of engaged time during DPA for week 1, week 2, week 3, week 4. In week 1 the students on average were engaged 71% of the time, week 2 they were engaged on average 72%, there was a slight decrease to 66% of the time in week 3, and week 4 it returned to 73% of the time. Results from a repeated measures ANOVA looking at differences in engagement from week 1 to week 4 overall was statistically significant [$F_{1,3} = 146.677$, $p = <.01$, ES = .919]. Results from a post-hoc Bonferroni correction used to detect where the differences occurred indicate that there was a statistical significance

between week 1 and week 2 (p = .003), week 1 and week 3 (p = .002), week 2 and week 4 (p = <.01), and week 3 and week 4 (p = <.01).

Figure 15 Average Engaged time during DPA from Week 1 - Week 4

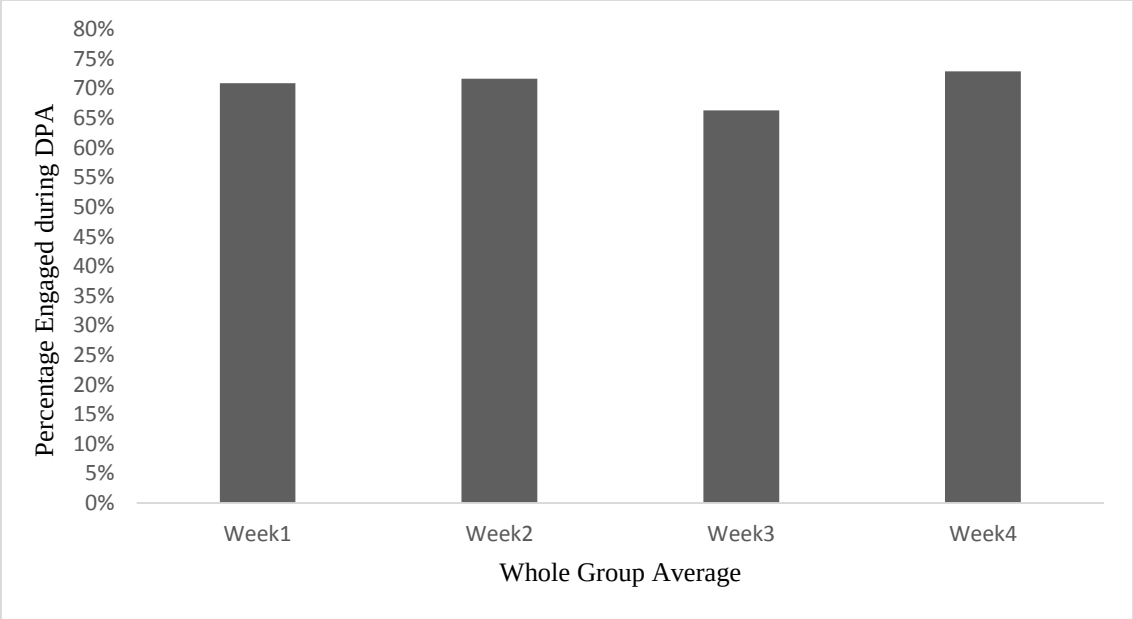


Figure 16 represents the group average percent of observing time during DPA for week 1, week 2, week 3, and week 4. In week 1 the students were on average observing 14% of the time, week 2 they were observing 16% of the time, week 3 they were observing 22% of the time, and week 4 15% of the time. Results from a repeated measures ANOVA showed an overall statistical significance between week 1 and week 4 observing behavior [$F_{1,13} = 40.052$, $p =<.01$, ES = .755]. A post-hoc Bonferroni was used to detect where differences occurred between weeks and was not statistically significant.

Figure 16 Average Observing time during DPA from Week 1 - Week 4

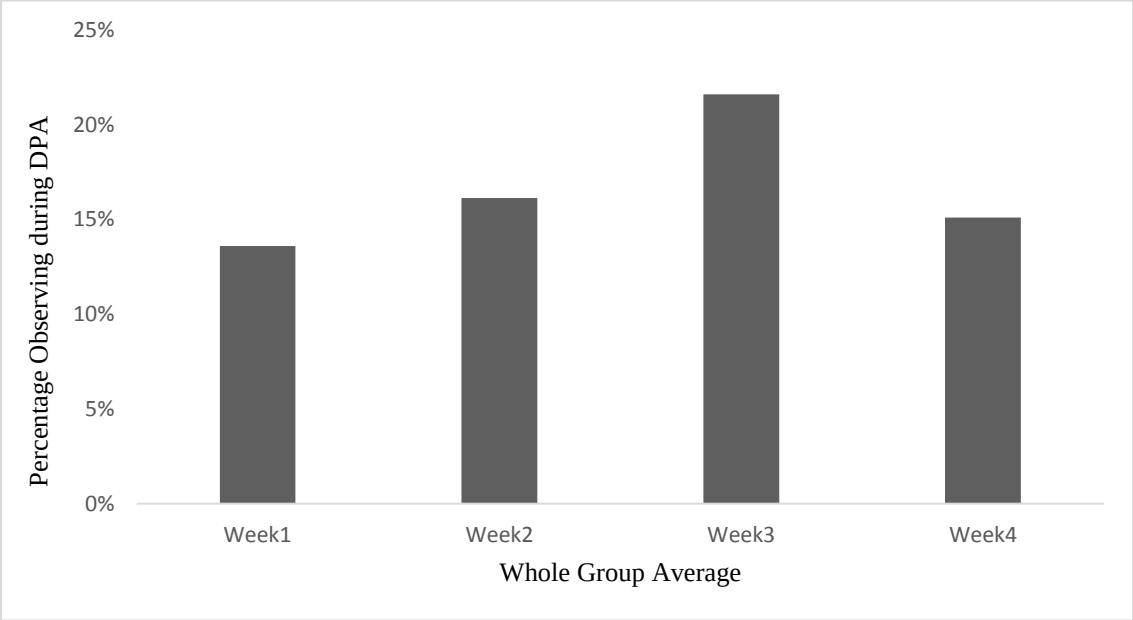


Figure 17 represents the group average percent not engaged time during DPA for week 1, week 2, week 3, and week 4. In week 1 the students were on average not engaged 16% of the time, in week 2 they were on average not engaged 17% of the time and week 3 and 4 their non-engagement level decreased from 13% of the time to 9% of the time. Results from a repeated measures ANOVA looking at differences in non-engagement from week 1 to week 4 was overall statistically significant [$F_{1,13} = 13.719$, $p = .003$, ES = .513]. Between weeks were only statistically significant from week 1 to week 3 ($p = .027$).

Figure 17 Average Non Engaged time during DPA from Week 1 - Week 4

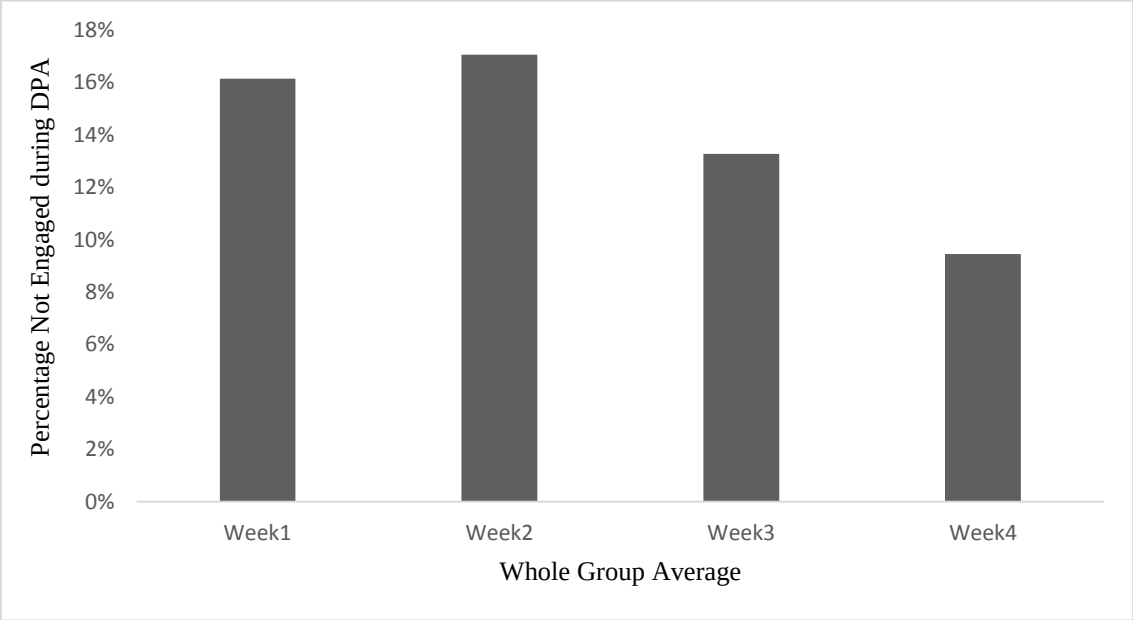


Figure 18 shows the percent of all students engaged during DPA in week 1. It is important to note that 11 of 14 participants were engaged 50% of the time during week 1 of DPA. In addition, 10 of 14 students were engaged 70% of the time in week 1 of DPA.

Figure 18 Percent of all Participants Engaged during Week 1 of DPA

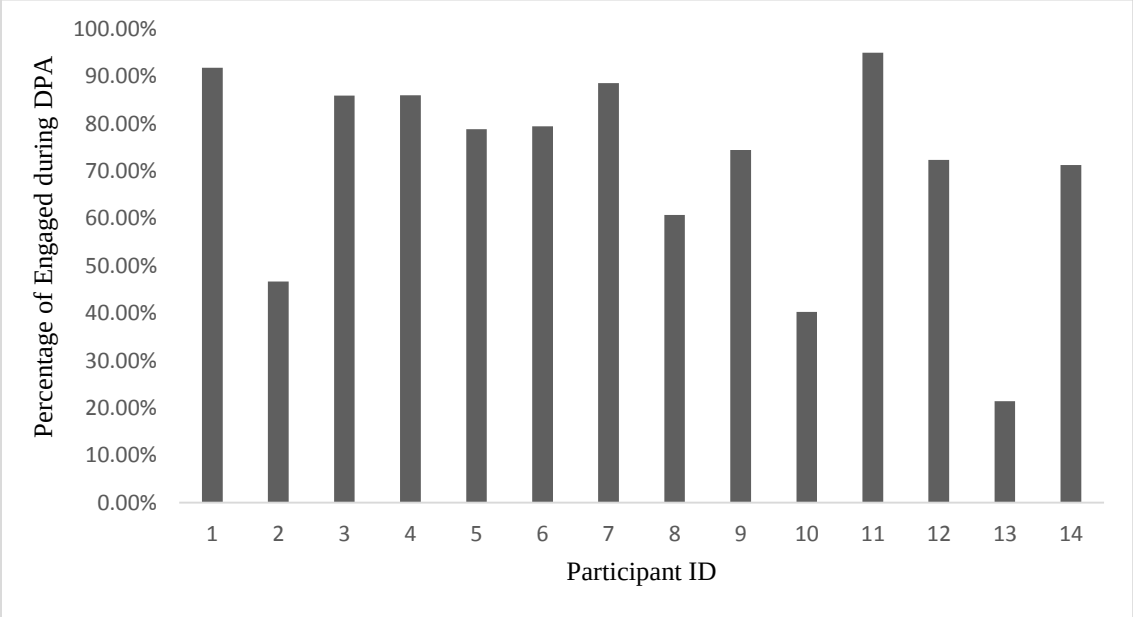
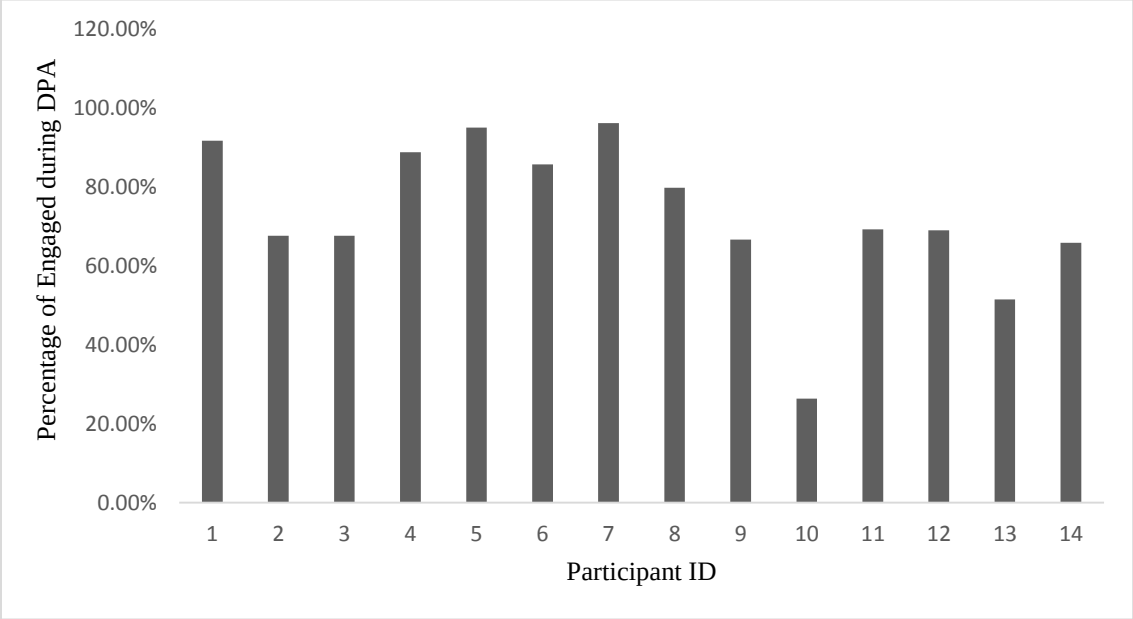


Figure 19 represents the percent of all participants engaged during DPA in week 4. In week 4, although only 6 of 14 participants were engaged 70% of the time. 13 of 14 participants were engaged 50% of the time during DPA.

Figure 19 Percent of all Participants Engaged during Week 4 of DPA

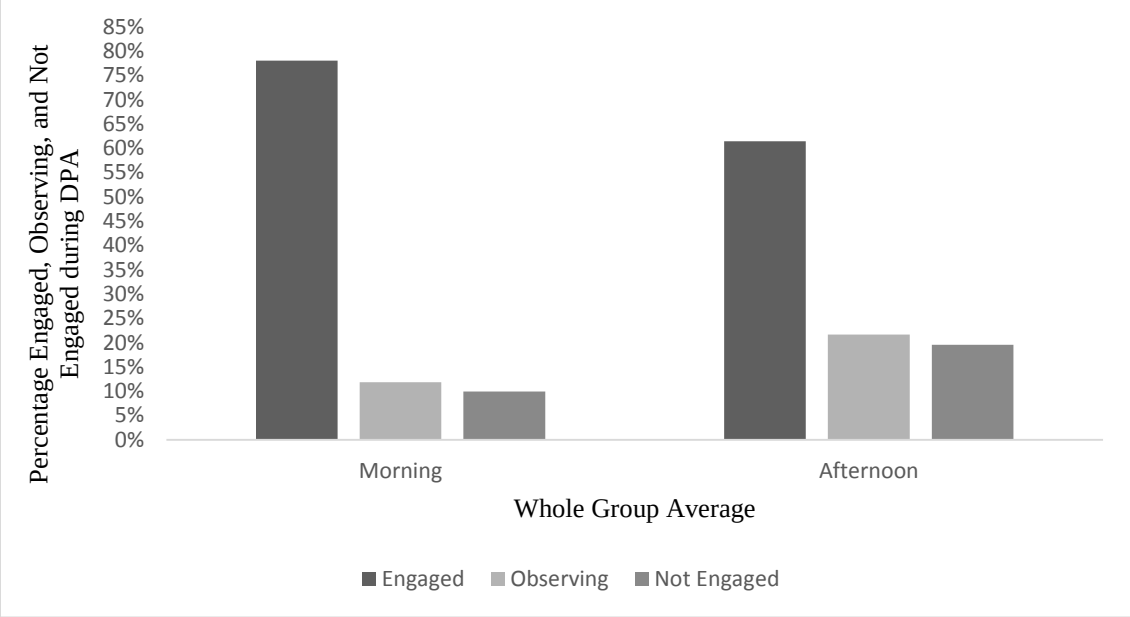


Morning vs. Afternoon DPA Impact

The intervention for this study consisted of 5-min bouts of physical activity 4x/day for 4 weeks. The 4 activity sessions were dispersed to allow for two sessions to be delivered in the morning (before the students had lunch and recess) and two DPA sessions delivered in the afternoon. Figure 20 represents the group average engaged, observing, and non-engaged time comparing the two morning sessions to the two afternoon sessions. Results from this figure show that the students were engaged in the morning 78% of the time and in the afternoon they were engaged 61% of the time. This indicates that the group average was engaged 17% more in the morning than they were in the afternoon. In addition, students were observing on average 12% of the time in the

morning and 22% of the time in the afternoon. This indicates that the group average observed 10% more during DPA in the afternoon compared to the morning. Also, the students were not engaged 10% of the time in the morning and on average 20% of the time in the afternoon. These results indicate that the students were not engaged 10% more in the afternoon compared to the morning sessions.

Figure 20 Average Engaged, Observing, and Non Engaged time during DPA Mornings vs. Afternoons



The 4-point teacher questionnaire consisted of questions to both classroom teachers to gain feedback on their thoughts of the DPA intervention and if they plan to incorporate DPA in their curriculum in the future. Results from this questionnaire are presented in table 9.

Table 9 4-Point Teacher Questionnaire Answers (Verbatim)

1. Will you continue to include multiple short bouts of physical activity throughout the day in your curriculum?
Yes!
Yes but less times. Maybe not set times but more on the spur of the moment

Continued Table 9. 4-Point Teacher Questionnaire

2. Did you notice a difference in your student's behaviors? (e.g. improved concentration, on-task behavior, academic achievement, reduced stereotypic behaviors)
Depending on task improved concentration and less fidgeting (table work). But sometimes more off-task if followed by free time/less structured activity. Depending on the day. Some kids got ramped up.
3. Did you notice anything else change within the student's demeanor after including short active breaks in the curriculum? (e.g. improved social interactions with peers)
Greater willingness to join in on physical activities in some students. This group didn't seem to enjoy the 4th time per day
4. Do you have any comments on the program itself? Feedback on certain aspects you thought were helpful or challenging or parts you may change in the future.
Overall it was excellent, the amount of time was perfect and the kids were interacted. Transitions may be easier if it was built into the lesson. It was difficult to break into the middle of an activity.

Discussion

Growing evidence has indicated that physical activity levels in children and youth has declined (Colley et al., 2011; Tremblay et al., 2010). Physical activity plays an important role in health because it is associated with several health benefits in children and youth, and the more activity the greater the benefit (Colley et al., 2011; Janssen & LeBlanc, 2010). Physical activity may be of even greater importance for children with disabilities because the presence of a disability generally leads to increased sedentary behavior (Cooper et al., 1999; Sit et al., 2007). Due to the significant time allotment spent in school and the concerns of inactivity among youth, the Ontario Ministry of Education has mandated that school boards must ensure that "all elementary students, including students with special needs, be provided with a minimum of twenty minutes of sustained moderate to vigorous physical activity each school day during instructional time" (p. 6)

(Ontario Ministry of Education, 2006). Greater opportunities to increase physical activity should be provided to children with and without disabilities.

Teachers are already mandated by the Ministry of Education to incorporate 20 minutes of sustained MVPA during instructional time each school day (Ontario Ministry of Education, 2006). We were able to deliver the minimum requirement of DPA in 5-minute bouts four times per day in a classroom of children with disabilities. The program was used in the classrooms with minimal interruptions in daily classroom academics and classroom behavior. Our findings demonstrating that DPA was achieved in multiple short bouts of physical activity which is consistent with the literature indicating that short activity bursts in the classroom-based settings would add at least 20 minutes of DPA each school day (Katz et al., 2010). In addition, elementary age children were able to engage in short bouts of physical activity (Ma et al., 2014; Mahar et al., 2006). Therefore, DPA can be implemented in a classroom of children and our results indicate that it is also feasible in a classroom of children with disabilities. Future studies should investigate whether teachers are able to implement DPA in a classroom of children with disabilities without having to change the curriculum or remove students from the classroom.

Our results also show that of planned 80 DPA sessions only 45 were delivered. Table 6 shows the percent of participants in view/not in view during DPA. Participants on average were not in view of camera during DPA for 30% of the time. One camera was set up high in a corner in each of the two classrooms to capture the best field of view of the classroom. This was the best way to capture the greatest space in the classroom because it was not feasible to have a camera set up in every corner of the classroom. Even though 30% of the time students were not in view of camera it is possible the students

could have been engaged or observing off camera. The researcher did not restrict the movement of the students during DPA, students were free to use the entire classroom space, as long as it was safe, to engage in the DPA. Some students may have ran or walked out of camera view due to camera placement. In addition, the researcher wanted to be the least disruptive as possible. There were several occasions the researcher could not record students in the classroom because they were not present. It is reality for Campbell Children's School to spend school hours, typically allocated for classroom activities, participating in events such as BBQ's, bake sales, field trips etc. However, the researcher did not have an impact on the number of DPA sessions that were delivered.

Group and Individual Observations during DPA

A primary research question was whether the students in these classrooms would positively respond to the DPA program. The results of this study show students were engaged on average 72% of the time, observing 16% of the time, and not-engaged 13% percent of the time. Of a possible 225 minutes of DPA (5 minutes of DPA x 45 sessions), the students were in view on average 127 minutes and were engaged for a total of 92 minutes. Figure 14 shows 12/14 participants were engaged during DPA 50% of the time. In addition, 9/14 participants were engaged 70% of the time. Other studies have also attempted short bouts of DPA but their outcomes were different (Ma et al., 2014; Mahar et al., 2006). Ma et al. (2014) were able to achieve sustained engagement with 4-minute bouts of DPA. However, to the best of our knowledge no research has investigated participant engagement with short bouts of DPA. Student average engagement of 72% is a worthy finding that warrants future research. To the best of our knowledge, no other studies have investigated engagement level in DPA. We might not expect 100% engagement at any given time in this population, therefore 72% engagement is very

promising for students. We hypothesize that the high engagement level in DPA was due to the music being developmentally appropriate for children and the skills and movements during with the music were also age and ability level appropriate. It is unclear whether the same engagement level would be achieved from students without music. Although delivering DPA with music was beneficial with this population, teachers are encouraged to try different methods of DPA delivery and infuse choice among their students to obtain high engagement in DPA. In addition, an interesting finding is that the students were observing more (16%) than they were not-engaged (13%). The importance of observing in children with disabilities should be highlighted. These classrooms consisted of kindergarten students with a wide range of various disabilities. The study began towards the end of the year which would have disrupted the student's daily routine. Incorporating something new such as, DPA in a classroom of children with disabilities may result in high observing behavior which is not necessarily a negative finding. When combining results of students average engaged time and observing time during DPA is 86%. This indicates that students with disabilities may take longer to become engaged. They may need more time to completely process what is being asked of them and how to respond appropriately. Future research should investigate percent of time students are observing and how to encourage students who are more likely to observe to be more engaged during DPA.

Week 1 – Week 4 Observations during DPA

Another research question of this study was whether DPA engagement increased over time. Figure 15 shows that average participant engaged time during DPA was highest in week 4 (73%). Engagement also significantly increased from week 1 to week 4 (p = <.01). In addition, significant increases were seen between weeks 1 and 2 and 1 and

3, week 2 and 4, and week 3 and 4. Week 1 and week 2 showed similar engagement (71% in week 1, 72% in week 2). However, average participant engaged time slightly decreased in week 3 (66%). Decreases in engagement level during week 3 could be due to the primary investigator introducing new songs and videos to try and keep the engagement level of participants high, but it may have resulted in some students observing more than engaging in the DPA. Increases in student observation may be due to the students trying to learn the new songs and movements that are paired with the songs. These classrooms consist of children with disabilities therefore, it may take longer for these students to learn the new DPA program if it was changed. This is supported by our findings in figure 18 demonstrating that in week 3 students were observing 22% of the time and not-engaged 33% of the time.

Statistically significant differences between observing as well as non-engagement time was also seen. However, there were no statistically significant differences between weeks for both observing and non-engagement. The primary investigator was trying to decrease boredom among students and keep engagement level high however, children with disabilities may not need as much variety. In fact, children with disabilities often prefer activity-focused interventions that are familiar, structured, and repetitive (Valvano, 2004). Future research should investigate the balance between keeping DPA programs familiar and repetitive vs. switching up the program to decrease boredom and increase engagement in children with various disabilities. Another explanation could be due to this study being conducted in a kindergarten classroom with several blocks in the schedule consisting of free play. At times it was difficult to obtain engagement in DPA when

students were more interested in playing. Future studies should investigate the effects of DPA incorporated during cognitive tasks vs. free play time.

The average percent of all participants' engagement during DPA in week 1 is shown in figure 18. More than half of participants (11/14) were engaged 50% of the time (ie. 79% of participants were engaged at least 50% of the time). Only 3 participants were engaged less than 50% of the time. This could be due to some students not yet familiar to the DPA sessions and were observing or not yet engaged. In addition, 5/14 students were engaged 80% of the time (ie. 36% of participants were engaged 80% of the time). When looking at Figure 19 average percent of all participants engaged time during DPA in week 4, 13/14 participants were engaged 50% of the time (ie. 93% of participants were engaged at least 50% of the time). That is a 14% increase of participants engaged in week 4. In week 4 only 1 participant was engaged less than 50% of the time. In addition, 6/14 participants were engaged 80% of the time (ie. 43% of participants were engaged at least 80% of the time) in week 4. These results are consistent with findings from Goh et al. (2014) suggesting that following a 10-minute classroom-based activity break, students average time spent being physically active during the break increased from week 1 to the last week of intervention. Indicating that students may observe and not be as engaged when DPA first starts but over time students may become more engaged. A reason for this may be that in the beginning students were not yet familiar with DPA and the movements with music. It may have taken a little longer for students to engage in DPA. The researcher also infused choice whenever possible and once she learnt the different personalities of the students she gave the students the opportunity to choose which songs they would prefer for DPA. It is important for children with disabilities to make choices

and be provided the opportunity for self-determination. Choosing or conveying preferences may be difficult for children with disabilities to communicate and such preferences are often ignored in the classroom (Brotherson, Cunconan-Lahr, Cook, & Wehmeyer, 1995; Houghton, Bronicki, & Guess, 1987). Yet, the ability to exercise choice and self-determination plays a central role in defining quality of life for all persons with disabilities (Brotherson et al., 1995; Guess, Benson, Siegel-Causey, & Agran, 2008). Teachers should structure their DPA programs to ensure opportunities for choice and decision-making because it gives students with disabilities the opportunity to demonstrate their abilities in a particular environment.

Morning vs. Afternoon Observations during DPA

Our study also differentiated daily time periods (ie. morning vs. afternoon) of DPA. Our results showed that on average students were more engaged in the morning (78%) than in the afternoon (61%). Similar findings have been reported in other studies suggesting that the most active time periods for students were those ranging from 9:00 to 11:59 am (Durant et al., 1992; Janz, Golden, Hansen, & Mahoney, 1992). However, in contrast to our study Durant et al. (1992) also found increased moderate-to-vigorous physical activity in the early afternoon (12:00-14:59 pm). These findings suggest that students with typical development can benefit from physical activity at the beginning of the day and these activity breaks can be teacher- or video- led (Erwin, Beighle, Morgan, & Noland, 2011). However, our findings suggest that for children with disabilities morning DPA sessions may be more beneficial than afternoon DPA sessions. Some explanations for this may include the age of the students (younger children may need an activity break early in the day after sitting on the school bus for a long time). Travel time on the school bus can be extremely long for some of these students (Special Education

Report, 2015). Also, a 6-7 hour school day can be extremely long for some students who might get tired towards the end of the school day and lack motivation and energy for DPA given their disabilities and age. It may be more beneficial for teachers to provide DPA in the morning once the students arrive to school before transitioning into academics or provide 3 DPA sessions in the morning and 1 in the afternoon. Another explanation for increased engagement in the mornings compared to the afternoons might be that the researcher repeated the same songs every first DPA session of the day and provided more variety in the second, third, and fourth sessions. Indicating that too much variety for this population may have resulted in decreased engagement. Children with disabilities often prefer repetition and familiarity with physical activity interventions (Valvano, 2004). Also, the researcher always used music with the two morning sessions and alternated music and videos with the afternoon sessions, suggesting that this type of population may have been more engaged when they did not have a video to watch, which may have been a distraction. Depending on the age of the population, showing a DPA video through the smartboard may result in increased observing behavior rather than engagement. Once teachers learn the personalities of their students they should organize the DPA sessions during the day that result in the highest engagement and enjoyment level from the students. In addition, teachers should consider the ages of their students when choosing the delivery method of DPA. Having the students engage in DPA through a video may actually be more distracting for younger students.

4-Point Teacher Questionnaire Results

Results from the 4-teacher questionnaire from both classroom teachers are listed in Table 7. Overall the consensus from both teachers was that they plan to incorporate DPA into their schedules at random times throughout the day rather than set times and

they thought the morning DPA sessions were more beneficial for their students than the afternoon sessions, which was consistent with our findings on engagement. It is recommended that teachers incorporate DPA at times that will provide both them and students the most benefit. It is suggested that DPA be fused into the educational rhythm of the classroom and based on lesson content. One of the classroom teachers indicated that she found it difficult to take an activity break in the middle of an academic task. Although incorporating DPA in the classroom improved on-task behaviors in most students, for some students it may have caused them to be more distracted. Both classrooms consisted of students with a wide range of disabilities and additional difficulties. Future research should investigate the type and duration of activity that would be most beneficial for students with specific disabilities. However, one teacher did indicate that overall they thought the DPA was beneficial and found the duration of the DPA (5-minutes) to be feasible for his classroom. He also noted that incorporating DPA built into the lesson may be more beneficial for his class (ie. if a lesson was on frogs he would have the students get up and hop like frogs around the classroom for 5 minutes), which is extremely informative for teachers and pedagogy.

We were able to deliver 5-min bouts of DPA in two classrooms of children with disabilities in a school that does not have a gymnasium to offer physical education and with no extra equipment. Indicating that for children who are not regularly exposed to 20 minutes of school based physical activity outside of therapeutic services 72% engagement is very promising for future teachers. Results from this study show that children were on average more engaged than they were observing or not engaged during the DPA sessions. In addition, our results demonstrate that on average students were

more engaged in the two morning sessions than they were in the two afternoon sessions. This provides great insight for teachers to possibly deliver DPA sessions before lunch to gain greater engagement from the students.

Strengths and Limitations

As with all studies, there are strengths and limitations to this study. The first strength is that, to the best of our knowledge, no other DPA intervention has been conducted in a classroom of children with a wide range of disabilities. In addition, to the best of our knowledge, level of engagement during DPA sessions has not been directly observed in a systematic way in previous studies. Therefore this study fills a gap in the literature and provides a platform for future research in this area. A short classroom-based physical activity program consisting of 5-min bouts 4x/day was relatively easy to implement and deliver and was encouraged and accepted by the teachers. The teachers and education assistants were able to supervise and help out if necessary. This was also convenient for the teachers because the students did not have to leave the classroom to receive physical activity because all DPA sessions were delivered in the classroom. The curriculum designed for this study is relatively easy to implement and only involved the use of music or Smartboard that was age and developmentally appropriate with no additional equipment. Movements paired with music and/or videos were easy to follow along with for the population. Another strength to this study was the use of video cameras for direct observation. Systematic direct observation was used for this study which is one of the best assessment procedures used for direct observation of classroom behavior in schools (Hintze et al., 2002). This study also occurred over the period of 6 weeks (1 week of baseline observations, 4 week intervention, and 1 week of follow-up observations). Contrary to the study by Ma et al. (2014) which consisted of a 3 week intervention with

alternating days of physical activity. Future studies should investigate engagement in DPA over a longer intervention for children with disabilities.

There are also a number of limitations to this study that need to be addressed. The first limitation would be the sample size. This study consisted of a sample size of n=14 participants. A larger sample size would be ideal but may require more than one researcher and the involvement of teachers and education assistants, which was not feasible for this study. However, a sample of 14 participants is a suitable sample size considering these participants all had a wide range of disabilities and served as their own control and we found statistical significance in results.

Another limitation might include that the researcher was not blind to the study. However, two of the three research assistants were blind to the study and only received training on the coding protocol. It is important to note that our inter-rater reliability scores (~85% agreement) provides confidence in the precision of observations, which is similar to other studies (Ma et al., 2014). Although, inter-rater reliability does not eliminate the possibility of bias, it does support the accuracy of our measure of engaged, observing, and not engaged during DPA (Mahar et al., 2006).

The time of year this study took place may also be a limitation. Unfortunately, due to it being the end of the school year, several field trips prevented us from being able to deliver all DPA sessions and having the student's classroom behavior be recorded. Of a planned 80 DPA sessions for the intervention, only 45 were delivered, however, it was reality for this school at that time. Due to this study finishing up in the Spring the students also spent several of their afternoons outside. It would be ideal to deliver this study over the course of a full school year to have more data if students missed school on

certain days. Future studies should investigate the effectiveness and feasibility of incorporating 5-minute bouts of physical activity in the curriculum in the Fall (October-November).

Another limitation might be the DPA curriculum for this study. Due to the students being in junior kindergarten, the primary investigator selected music and Smartboard videos that were age appropriate and simple for students to follow along with the movements. However, some students may have preferred not using any music and performing selected activities in the classroom. However, to facilitate transitioning between DPA and academics the primary investigator chose music and accompanying actions which did work for the majority of students. But for some students the DPA curriculum may not have been advanced enough for them. Also, this study did not investigate participant intensity during DPA breaks. However, little is known regarding intensity in children with a wide range of disabilities therefore accelerometers were not used and, engagement level was more feasible.

Despite the limitations of this study in a school of children with a wide variety of disabilities who were not achieving the minimum requirement of 20 minutes of DPA per day mandated by the Ministry of Education (Ontario Ministry of Education, 2006), we were able to deliver 5-minute bouts of DPA 4x/day to 14 participants. In addition, we were able to obtain statistically significant high engagement through week 1 to week 4 and in addition can recommend to teachers that delivering DPA in the morning may be more feasible and appealing to students and teachers.

Future Research

The feasibility and participant engagement level was assessed during a 5-min bout of DPA, 4x/day, in a classroom of children with various disabilities. The majority of students were engaged during DPA sessions. Additional research is needed to evaluate participant intensity during DPA breaks. This study did not test whether or not students engaged in moderate or vigorous levels of physical activity during the DPA break. Future research on the effectiveness of incorporating multiple (5-min) bouts of DPA 4x/day can provide greater support for why school boards and teachers should implement changes to the curriculum to include more physical activity during the school day. This study occurred in the Spring but it is recommended that future studies track students over a year to evaluate the long-term effects of classroom-based DPA on physical activity levels and engagement. Schools and teachers should provide a variety of physical activity opportunities that appeal to students with different interests and ability levels, since this DPA program has been shown to be successful in engaging students. Future studies should investigate the effectiveness of implementing different types of physical activity delivery such as, instant activity breaks that are offered within the first 2 minutes of a lesson, morning physical activity breaks that are offered as soon as the students arrive to class, and physical activity incentives when a student achieves a specific goal (Castelli & Ward, 2012). In addition, the DPA sessions were led by the primary investigator. Future studies should investigate the effectiveness of teacher-led DPA sessions to determine if teachers similar positive outcomes in increased engagement level and whether or not teachers are adequately delivering DPA sessions in the curriculum.

Conclusions

We were able to incorporate 5-minute bouts of DPA, 4x/day in a classroom of children with a wide range of disabilities. In addition, we were able to obtain an average of 72% engagement in DPA. Results from this study suggest that incorporating short bouts of classroom-based physical activity breaks without the use of equipment is feasible for students with disabilities. The ministry of Education has mandated that "all students, including students with special needs be provided with a minimum of 20 minutes of daily physical activity during instructional time" (p. 6) (Ontario Ministry of Education, 2006). Prior to this study teachers were not incorporating DPA in the curriculum that was providing the students with the minimum requirement of 20 minutes of DPA per day. Due to limited opportunities to be physically active at Campbell Children's School, it is imperative for teachers to incorporate DPA in their curriculum. Teachers should arrange their classroom to offer physical activity space and regularly incorporate DPA into their lessons. It is important to ensure that students are not sitting for long periods of time without a chance to be active (Castelli & Ward, 2012). Incorporating DPA in a classroom of children with disabilities is a useful step towards encouraging healthier lifestyles among youth.

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Chapter 5: Thesis Conclusions

Summary

Physical activity is important for health, well-being, and overall quality of life (Janssen & LeBlanc, 2010). It is well established that physical activity is associated with several health benefits in school-aged children and youth (Janssen & LeBlanc, 2010). In addition to the several health benefits associated with physical activity, research has consistently shown that bouts of physical activity can have a positive impact on student's on-task behavior in school (Ma, Mare, & Gurd, 2014; Mahar et al., 2006; Nicholson, Kehle, Bray, & Heest, 2011). Studies have also shown that students who do regular physical activity are more attentive, more focused, and more alert for longer periods of time (Chomitz et al., 2009; Davis et al., 2011). There is growing evidence that there is considerable lack of physical activity in the Canadian population, especially among children (Colley et al., 2011) and children with disabilities (Graham & Reid, 2000; Johnson, 2009; McDonald, 2002; Rimmer, 1999). Physical activity may be of even greater importance for children with disabilities because they are also at risk of secondary impairments due to the nature of their disability and sedentary lifestyles which may further compromise their health (Graham & Reid, 2000; Johnson, 2009; McDonald, 2002; Rimmer, 1999). Therefore, it is imperative that evidence-based physical activity interventions are developed and evaluated.

The Ontario Ministry of Education has mandated that school boards must ensure that "all elementary students, including students with special needs, be provided with a minimum of twenty minutes of sustained moderate to vigorous physical activity each school day during instructional time" (p. 6) (Ontario Ministry of Education, 2006). Several studies have investigated the effects of daily physical activity (DPA) in 10-20

minute bouts in classroom-based settings on on-task behavior (Barros, Silver, & Stein, 2009; Jarrett et al., 1998; Mahar et al., 2006; Oriel, George, Peckus, & Semon, 2011). Studies have suggested that shorter bouts of DPA may in fact be more feasible for students and teachers (Ma et al., 2014; Oriel et al., 2011). Ma et al. (2014).

The majority of research on the benefits of incorporating physical activity in the curriculum is on children of typical development (Barr-Anderson, AuYoung, Whitt-Glover, Glenn, & Yancey, 2011; Donnelly et al., 2009; Stewart, Dennison, Kohl, & Doyle, 2004; Stone, Faulkner, Zeglen-Hunt, & Bonne, 2012). One study investigated the effects of incorporating short bouts (4-minutes) of physical activity in classroom-based settings with children of typical development, which was the shortest protocol studied to date (Ma et al., 2014). Few studies have investigated the effectiveness and feasibility of incorporating DPA in a classroom of children with disabilities (Cooper et al., 1999). Research is needed to determine whether short DPA breaks (4-5 mins) is feasible in kindergarten children with disabilities at delivering the minimum requirement of DPA (20 minutes) mandated by the Ministry of Education.

Incorporating breaks during instructional time may also benefit classroom behaviors in children with disabilities. Research has shown that children with learning disabilities are less likely to be on-task and more likely to be off-task and distractible compared to their peers without learning disabilities (Bender, 1986; Bender & Smith, 1990; McKinney & Feagans, 1983). In addition to increased off-task behavior in children with disabilities, instances of self-stimulatory behavior are more likely to be observed in individuals with developmental delay than children with typical development (Lovaas, Litrownik, & Mann, 1971; Watters & Watters, 1980). Reducing self-stimulatory behavior

is important among children with disabilities because it has been shown to interfere with learning (Kern, Koegel, Dyer, Blew, & Fenton, 1982). It is important to investigate how to best incorporate physical activity into a school day for maximum effect on increasing on-task behavior and reducing self-stimulatory behavior in children with disabilities.

The results of this study indicate that incorporating 5-minute bouts of DPA 4x/day in a classroom of children with a wide range of various disabilities is feasible. In addition, students were engaged in the activities, on average, 72% of the time during DPA sessions. Results from individual participants showed 12/14 participants were engaged during DPA 50% of the time, and 9/14 participants were engaged 70% of the time. Indicating that the DPA sessions were well liked by the students. Average engagement also increased over four weeks beginning with 71% engaged in week 1 to 73% engaged in week 4 which was statistically significant. Results also showed, on average, students were more engaged in the morning (78%) than in the afternoon (61%). Findings from this study indicate that we were able to incorporate 5-minute bouts of DPA, 4x/day in a classroom of children with a wide range of disabilities. In addition, we were able to obtain high engagement in DPA. To the best of our knowledge, no other studies have investigated engagement level in DPA. We might not expect 100% engagement at any given time in this population, therefore 72% engagement is a very promising result. We hypothesize that the high engagement level in DPA was due to the music being developmentally appropriate for the children and the skills and movements during the music were also age and ability level appropriate The researcher also learned which songs over time obtained the highest level of engagement from the students (i.e. they were motivated to participate and move). It is unclear whether the same engagement

level would be achieved from students without music to facilitate the 5-minute DPA break. Although, delivering DPA with music was beneficial for this population, teachers are encouraged to try different methods of DPA delivery and infuse choice among their students to obtain high engagement in DPA.

Our results also indicate that there were long-term improvements in on-task behavior from baseline to follow-up even after DPA was removed. On-task behavior increased on average by 7% in follow-up observations compared to baseline observations. This is an important finding because even without DPA being delivered during follow-up phase students classroom behaviors did not return to baseline, in fact, they actually increased by 7%. In addition, self-stimulatory behaviors decreased in follow-up phase compared to baseline for the participants who exhibited self-stimulatory behavior. Our findings also show increases in average group on-task behavior from baseline (71%) to during the intervention (80%) in addition to improvements in on-task behavior immediately following the DPA sessions compared to immediately before DPA. On-task behavior increased on average by 5% 10 minutes immediately after DPA compared to 10 minutes immediately before. Similarly, our results for self-stimulatory behaviors decreased on average 3% immediately after DPA compared to immediately before in the students who exhibited self-stimulatory behavior. We hypothesize that the increase in on-task behavior following a DPA break was due to providing them with an energy release outlet. By providing an active break after prolonged periods of instruction will provide positive behavior outcomes when children return to an academic lesson (Pellegrini, Huberty, & Jones, 1995). These results are promising for students and teachers because off-task behavior can contribute to loss of instructional time in the

classroom. Most teachers view time as the number one barrier to implementing DPA in the school day (Dwyer et al., 2003; Patton, 2012). Many believe that reducing physical activity opportunities in the classroom in an effort to increase time spent on academic subjects will improve educational outcomes (Sibley & Etnier, 2003). However, our results indicate that by incorporating DPA in the classroom students will increase time on-task. Although time is of essence teachers should place value on increased time on-task. Therefore, teachers should be more inclined to spend some time planning and delivering DPA if it results in greater time on-task, which can maximize classroom learning time.

Play Deprivation Theory in Children with Disabilities

The main intention of implementing 5-minute bouts of DPA 4x/day was to obtain activity engagement and ensure that it was feasible in a kindergarten classroom of children with disabilities and to increase on-task behavior. These outcomes can be explained by the play deprivation theory. The play deprivation theory predicts that when children are engaged in cognitive tasks for a period of time, the longer the duration of instructional time will cause the children to engage in greater physically active tasks when given a break. If a child is deprived of opportunities to engage in social as well as physically vigorous behaviors (eg. during instructional time), they will later engage in increased levels of physical activity and social interaction when given the chance (ie. rebound) (Burghardt, 1984). Pellegrini et al. (1995) extended on this research and proposed the idea of play deprivation theory and the effects of recess timing on children's playground and classroom behaviors. The hypothesis was that physical activity and social interaction at recess will provide positive academic and behavior outcomes when children return to instructional time (Pellegrini et al., 1995). These recess behaviors also provide a

break from academic tasks. Research suggests that providing children with active breaks from such tasks can potentially improve or facilitate classroom performance (Bjorklund & Harnishfeger, 1990; Pellegrini et al., 1995).

Building upon the play deprivation theory is the idea that, prior to a break, children have decreased attention, are more likely to be off-task, and are not cognitively present (Chomitz et al., 2009; Mahar et al., 2006). However, following a physical activity break students should be more alert, focused, and on-task because they have been given the opportunity to engage in physical activity and social interactions which gave them a break from cognitive tasks (Jarrett et al., 1998; Pellegrini et al., 1995; Ridgway, Northup, Pellegrin, LaRue, & Hightshoe, 2003). Our study has aimed to build upon the play deprivation theory proposed by Burghardt (1984) and Pellegrini et al. (1995). Students at Campbell's can spend a large portion of their day in sedentary behaviors. Prolonged periods of sedentary, cognitively demanding tasks can decrease concentration, increase fidgeting, and decrease time on-task in the classroom. By incorporating short 5-minute bouts of physical activity 4x/day we were able to increase time on-task from baseline to follow-up, from baseline to intervention, and immediately after DPA compare to immediately before. In addition, our study demonstrates by the high engagement level achieved during DPA that by interrupting prolonged periods of instruction with a DPA break, children were engaged in increased levels of physical activity when given the opportunity. Therefore, the findings of this study support the ideas in play deprivation theory. The children in this study demonstrated increased on-task behavior following each physical activity break (immediate effect) in addition to after the intervention was no longer implemented in follow-up (long-term effect).

Future Recommendations

Our findings warrant further investigation regarding the effectiveness of incorporating multiple short bouts of DPA during instructional time at improving on-task behavior. It is recommended that future studies implement a control group, greater sample size, greater ranges of age groups, and a longitudinal study design for children with disabilities. Future studies should investigate teacher-led DPA sessions to obtain teachers thoughts on delivering DPA during the school day. It is recommended that teachers use resources provided by organizations such as the Ontario Physical and Health Organization Association (OPHEA) to include children with disabilities in DPA. The use of music with DPA breaks was successful at obtaining engagement in kindergarten children with disabilities but may be different for older children. Teacher training is recommended to obtain knowledge on different methods to deliver DPA effectively. It is important for teachers to get to know their students and their personalities to achieve the greatest level of achievement and enjoyment in their students from DPA. The reality is that today students enter classrooms with different abilities and learning styles. Every teacher who has entered a classroom has differentiated instruction in one way or another to meet a child's needs (Levy, 2008). Therefore, just as a teacher would differentiate their lessons to meet the needs and abilities of their students they may also need to adapt their DPA sessions for inclusion. It is important for teachers to be on board with delivering DPA because if teachers are passionate about planning and delivering DPA it may increase the enjoyment and engagement in students. School administrators should place value in DPA because our study shows that incorporating DPA increases time on-task during academic tasks which is what teachers strive for on a daily basis.

Future research should also investigate whether improving on-task behavior has a direct relationship with learning outcomes. There is no evidence indicating that increasing school time physical activity will have a negative effect on academic performance; in fact, research has indicated that learning may be enhanced in students after they have had an active break (Chomitz et al., 2009). Research shows that not only can physical activity increase classroom on-task behavior but it may also influence academic achievement (Chomitz et al., 2009; Ma et al., 2014; Mahar et al., 2006). Our study shows a direct link to incorporating physical activity and increased on-task behavior therefore, future research is needed to investigate the relationship between physical activity and on-task behavior relative to educational outcomes (Mahar et al., 2006). If incorporating DPA breaks throughout the day can increase on-task behavior and academics in students this is should be a major incentive for teachers to take the time to plan and deliver DPA.

Future research should also investigate the duration of effects on on-task and self-stimulatory behavior beyond 10 minutes. In this study, improvements in on-task behavior and decreases in self-stimulatory behaviors were seen during the 10 minute observation period immediately following DPA. Research has shown that on-task behavior may last up to 60 minutes following a 5-10 minute active break (Castelli & Ward, 2012). This warrants future research on investigating the duration of on-task behavior effects in children with disabilities. If the effects of physical activity engagement during a short 5 minute DPA break can offer increased on-task behavior from 40-60 minutes this has significant implications for teachers and students.

Schools should strive to meet the minimum requirement of 20 minutes of physical activity per day and offer students a balanced academic program that includes opportunities for physical activity. Although our study incorporated DPA at set times in the school day schedule, teachers should fuse it into the educational rhythm of the classroom. Incorporate DPA based on lesson content to assist the transition from cognitive tasks to a physical activity break and in addition, obtain a classroom environment with less distraction, fidgeting, and off-task behavior. Teachers are also encouraging participation in physical activity among children with disabilities when incorporating DPA into the school day, which can offer several health benefits. Teachers can encourage children and youth to build physical activity into their daily routine by incorporating DPA in their curriculum which can hopefully transfer to more physically active lifestyles in the future.

Recommendations for Teachers

1. Daily physical activity can be delivered in bouts of 5 minutes spread out across the day. Keeping in mind student age, ability, and classroom rhythm (i.e. more sessions in the morning).
2. Use a timer and music to facilitate the transition between instructional time and DPA in young children.
3. Fuse DPA into the lesson that day to assist transition from cognitive tasks to DPA (e.g. learning about frogs – have students jump around like frogs).
4. Incorporating a calm cool-down at the end of the DPA break before returning students to cognitive tasks (e.g. a couple deep breaths).

Conclusion

In conclusion, results from this study indicate that incorporating 5-minute bouts of DPA 4x/day is feasible in a kindergarten classroom of children with various disabilities to obtain the minimum requirement of 20 minutes/ day mandated by the Ministry of Education. In addition, results from this study showed increased on-task behavior immediately following DPA sessions and in follow-up compared to baseline. These improvements may lead to an overall improvement in learning and academic achievement. To the best of our knowledge, this is the first study to examine the effectiveness of incorporating 5 minute bouts of DPA on on-task behavior in a classroom of children with a wide range of disabilities. Therefore, these results make a significant contribution to the DPA literature of children and classroom behavior. It is recommended that teachers incorporate DPA in the curriculum and continuous interventions involve the impact on classroom behavior of children with disabilities.

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Chapter 6: Appendices

Appendix 1: Certificate of Approval from the University of Ontario Institute of Technology Research Ethics Board

UNIVERSITY OF ONTARIO INSTITUTE OF TECHNOLOGY

RESEARCH ETHICS BOARD
OFFICE OF RESEARCH SERVICES

Date: April 13th, 2015

To: Natalyn Hibbs (Student PI) and Meghann Lloyd (Supervisor)

From: Bill Goodman, REB Chair

REB File #: 14-105

Project Title: Effect of multiple short bouts of physical activity on classroom behavior in preschool age children with physical and developmental disabilities

DECISION: APPROVED
CURRENT EXPIRY: April 1st, 2016

NOTE: Notwithstanding this approval, you are required to obtain/submit, to UOIT's Research Ethics Board, any relevant approvals/permissions required, prior to commencement of this project.

The University of Ontario, Institute of Technology Research Ethics Board (REB) has reviewed and approved the above research proposal. This application has been reviewed to ensure compliance with the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS2 (2014)) and the UOIT Research Ethics Policy and Procedures.

Please note that the (REB) requires that you adhere to the protocol as last reviewed and approved by the REB. Always quote your REB file number on all future correspondence.

CONTINUING REVIEW REQUIREMENTS:

- **Renewal Request Form:** All approved projects are subject to an **annual** renewal process. Projects must be renewed or closed by the expiry date indicated above ("Current Expiry"). **Projects that are not renewed within 30 days of the expiry date will be automatically suspended by the REB; and projects that are not renewed within 60 days of the expiry date will be automatically closed by the REB.** Once your file has been formally closed, a new submission will be required to open a new file.
- **Change Request Form:** any changes or modifications (i.e. adding a Co-PI or a change in methodology) must be approved by the REB through the completion of a change request form before implemented.
- **Adverse or unexpected Events Form:** events must be reported to the REB within 72 hours after the event occurred with an indication of how these events affect (in the view of the Principal Investigator) the safety of the participants and the continuation of the protocol. (I.e. un-anticipated or un-mitigated physical, social or psychological harm to a participant).
- **Research Project Completion Form:** must be completed when the research study has completed.

All Forms can be found at http://research.uoit.ca/faculty/policies-procedures-forms.php.

REB Chair Dr. Bill Goodman, FBIT bill.goodman@uoit.ca	Ethics and Compliance Officer compliance@uoit.ca

University of Ontario, Institute of Technology
2000 Simcoe Street North, Oshawa ON, L1H 7K4
PHONE: (905) 721-8668, ext. 3693
Version: Jan. 2015

Appendix 2: Letter of Support from Grandview Children's Centre

Tuesday March 3, 2015

UOIT Research Ethics Board
2000 Simcoe Street North
Oshawa, Ontario
L1H 7K4

Dear UOIT Research Ethics Board,

It is my pleasure to write a letter in support of the proposed "Effect of multiple short bouts of physical activity on classroom behaviour in preschool age children with physical and developmental disabilities" being submitted to the University of Ontario Institute of Technology Research Ethics Board by Natalyn Hibbs who is a Graduate Student of Dr. Meghann Lloyd's. Dr. Lloyd is an assistant professor at the University of Ontario Institute of Technology (UOIT) and research associate at Grandview Children's Centre. This is Natalyn's thesis project for her Master's.

This study is being implemented to provide the students with a little active break incorporating whole body movements to music to increase their concentration and improve on-task behaviour which can potentially improve educational outcomes. This study will be facilitated by Campbell Children's School within Grandview Children's Centre. When approved by UOIT's REB a letter of invitation will be delivered to all families of the students participating in the study.

I fully support this endeavour and the efforts of Dr. Meghann Lloyd and Natalyn Hibbs as they seek ethics approval for this study and we look forward to working with UOIT. Any programs that can help children get active and improve classroom behavior can potentially help improve educational outcomes.

Sincerely,

Lorraine Sunstrum-Mann ECEDH, RN, BA, MBA
Executive Director
600 Townline Road South
Oshawa , Ontario
L1H 7K6
905 728 1673 ext 2258
toll free 1-800-304 6180
lorraine.sunstrum-mann@grtc.ca

Grandview Children's Centre
600 Townline Road South
Oshawa, Ontario L1H 7K6

Tel 905.728.1673
Toll Free 1.800.304.6180
Fax 905.728.2961
Website grandviewkids.ca

Registered Charitable Organization

Inspiring possibilities for children and youth with special needs.

Appendix 3: Letter of Support from Campbell Children's School

Campbell Children's School Authority

Located at Grandview Children's Centre
600 Townline Road South
Oshawa, Ontario L1H 7K6
Phone 905-576-8403
Fax 905-576-4414
email ccs@grtc.ca

March 3, 2015
UOIT Research Ethics Board
2000 Simcoe Street North
Oshawa, Ontario
L1H 7K4

Dear UOIT Research Ethics Board,

It is my pleasure as the Principal of Campbell's Children School to write a letter in support of the proposed "Effect of multiple short bouts of physical activity on classroom behaviour in preschool age children with physical and developmental disabilities" being submitted to the University of Ontario Institute of Technology Research Ethics Board by Natalyn Hibbs who is a Graduate Student of Dr. Meghann Lloyd's. Dr. Lloyd is an assistant professor at the University of Ontario Institute of Technology (UOIT) and research associate at Grandview Children's Centre. This is Natalyn's thesis project for her Master's.

This study is being implemented to provide the students with a little active break incorporating whole body movements to music to increase their concentration and improve on-task behaviour which can potentially improve educational outcomes. This study will be facilitated by Campbell Children's School, the Education partner of Grandview Children's Centre. When approved by UOIT's REB a letter of invitation will be delivered to all families of the students participating in the study.

I fully support this endeavour and the efforts of Dr. Meghann Lloyd and Natalyn Hibbs as they seek ethics approval for this study and we look forward to working with UOIT. Any programs that can help children get active and improve classroom behavior can potentially help improve educational outcomes.

Sincerely,

J. Harper

Janet Harper, BAAECE, BSC, M. Ed
Principal
600 Townline Road South
Oshawa , Ontario
L1H 7K6
905-576-8403
Fax: 905-576-4414
Janet.harper@grandviewkids.ca

Campbell Children's School
Challenge, Celebrate, Strengthen

Appendix 4: Letter of Invitation

Effect of multiple short bouts of physical activity on classroom behavior in preschool age children with physical and developmental disabilities.

April 16, 2015

Dear Parents,

My name is Natalyn Hibbs and I am a Master's student from the Faculty of Health Sciences at the University of Ontario Institute of Technology (UOIT). I am also a certified teacher and have completed a placement this past year at Campbell's Children School. My supervisor is Dr. Meghann Lloyd who is a research associate at Grandview Children's Centre. We would like to invite your child to participate in a research project titled: *Effect of multiple short bouts of physical activity on classroom behavior in preschool age children with physical and developmental disabilities.*

Including bouts of physical activity during the school day can help with behavior management, reduce fidgeting, and increase time on-task by making students more alert and focused.

These active breaks will be put in place to provide the students with a little "brain break" and incorporate small whole body movements to music to increase their concentration and improve off-task behavior when they return to regular instruction time. The active break will take place in the classroom four times per day for 5 minutes. The activities will resemble movement exercises like the song "Head and Shoulders". The students will be able to move at their own pace and intensity. We believe that by incorporating small activity breaks in between instructional time we can improve concentration and reduce off-task behavior which may improve overall educational outcomes. We will not be measuring physical activity improvements and our goal is not to teach the students a new skill.

All exercise will be modified to include all children with different abilities and all teachers and education assistants will be present at all times.

Participation in this study is completely voluntary. You may withdraw your child from the study at any time by telling the researchers, and you are not required to provide a reason for doing so. Not participating in this study or withdrawing your child partway will in no way affect their schooling from Campbell Children's School or services from Grandview Children's Centre.

If you have any questions or concerns about the study or for your child, please don't hesitate to contact myself, or Meghann Lloyd.

If you have any questions about this study, please contact Natalyn Hibbs at 905-721-8668, ext. 2953, or Dr. Meghann Lloyd at 905-721-8668, ext. 5308. This study has been approved on April 13, 2015 by the University of Ontario Institute of Technology Research Ethics Board (REB #14-105), which is a committee of the university whose goal is to ensure the protection of the rights and welfare of people participating in research. The Board's work is not intended to replace a parent/guardian or child's judgment about what decisions and choices are best for you. If you have any questions about your child's rights as a research participant you may contact the University of Ontario Institute of Technology Research Ethics Board at 2000 Simcoe St. N., Oshawa, On, L1H 7K4, 905-721-8668, ext. 3693 or compliance@uoit.ca

Thank You,

Natalyn Hibbs
Graduate Student
University of Ontario Institute of Technology
905-721-8668, ext.2953
natalyn.hibbs@uoit.ca

Dr. Meghann Lloyd
Assistant Professor
University of Ontario Institute of Technology
Research Associate at Grandview Children's Centre
905-721-8668, ext. 5308
meghann.lloyd@uoit.ca

Appendix 5: Informed Consent

Effect of multiple short bouts of physical activity on classroom behavior in preschool age children with physical and developmental disabilities.

Date: April, 2015

Investigators:

Natalyn Hibbs	Faculty of Health Sciences University of Ontario Institute of Technology 905-721-8668, ext. 2953 natalyn.hibbs@uoit.ca
Dr. Meghann Lloyd	Faculty of Health Sciences University of Ontario Institute of Technology 905-721-8668, ext. 5308 meghann.lloyd@uoit.ca

Dear Parents,

I am currently a Master's student in Health Sciences at the University of Ontario Institute of Technology (UOIT), and inviting your child to participate in a voluntary research study. The purpose of this study is to determine the feasibility of implementing a daily active break including multiple short bouts of physical activity in your child's classroom.

Including bouts of physical activity during the school day can help with behavior management, reduce fidgeting, and increase time on-task by making students more alert and focused.

I am requesting your permission for your child to participate in a 4 week physical activity program during the school day hours between May 4, 2015 – May 29, 2015. The program will take place at Campbell Children's School, but instructed by myself, along with the support of the teachers and Education Assistants. Each active break will take place in the classroom. There will be one week of pre-test prior to beginning the study where I will be observing baseline behaviors of the students in the classroom during their regular activities. See the Frequently Asked Questions Form for additional details on the layout of the activity breaks. Following the exercise intervention I will be observing the behaviors to see if off-task behaviors have decreased (ie. Fidgeting, looking around, playing with a pencil). The focus of including four short active breaks throughout the school day is to see if interrupting prolonged periods of sitting during instructional time with bouts of physical activity will help improve concentration and on-task behavior following an active break, which may improve overall academics.

Background and Rationale:

The purpose of this study is to determine if it's possible to include a daily physical activity program including four short active breaks throughout the day in a classroom of children with developmental and intellectual disabilities. A second purpose is to determine how effective it would be to incorporate an active break in between instructional learning time on improving off-task behavior and reduce self-stimulatory behaviors.

Why is this important?

Physical activity (PA) plays a critical role in health, well-being, and overall quality of life. PA is of particular importance for children with intellectual and developmental disabilities. Children with disabilities tend to engage in less daily physical activities, including at school, therefore, they are at greater risk of being less active than their peers.

The most important and suitable institution to address PA is in a school-setting because children spend a large portion of their day at school. Due to this significant time allotment spent in school, the Ontario Ministry of Education announced a policy in 2005 requiring that all elementary students be provided opportunities to participate in a minimum of twenty minutes of physical activity each school day during instructional time. Although the children at Campbell Children's School take part in swimming once a week, have access to a beautiful playground, and receive consistent therapy sessions through Grandview Children's Centre, there is no gymnasium and limited opportunities for the children to engage in sustained physical activity.

Many schools have applied physical activity programs lasting 10-15 minutes in duration in classroom based settings. However, recommended daily physical activity (DPA) may be accumulated in shorter intervals (<5 mins) and may be more practical and appealing to the children and the teachers. Due to the fact that it may be difficult to engage children with disabilities in PA there is a critical need to develop evidence based strategies for the teachers to implement in the school system. Benefits of PA include improvements in off-task behavior and academic achievement in addition to multiple physical benefits. In addition, well-taught school-based PA can provide opportunities for children to participate in PA on a regular basis and enable children to have an active lifestyle.

Study Procedures:

This study will last 8 weeks and consist of three phases. After you have provided consent for your child to participate in this study a Supplemental Information Form will be sent home to be completed and returned to the researchers. This will provide demographic and developmental information about your child and will be kept confidential. The data will be entered into a confidential database where your child will be given a unique number and their name will not be linked to their data (including data from the Supplemental Information Form). The first phase will be an observational period during which a video-camera will be set up in the corner of the classroom to record the student's everyday

behaviors in the classroom setting. I will observe the students in the classrooms for the purpose of establishing baseline behaviors. The second part of the study will consist of delivering the physical activity breaks to the students. Finally, the third phase will be another observational period, identical to the first. A video camera will be set up in the corner of the classroom to record the children's behavior. The camera will record the students in their environment for 10 minutes prior to the activity, the 5 minute activity break, and 10 minutes following the activity, four times/day. For a total of 1 hour and 40 minutes/day. The camera will remain in the corner of the classroom and should not disrupt the class, the idea is to record the children in the most "natural" way possible.

The following table provides an overview of the study timeline:

April 2015	Week 1	Baseline Observation [1 hour/day]
May 2015	Week 2	Active break Intervention [4 x 5min Intervention & Video/day]
	Week 3	Active break Intervention [4 x 5 min Intervention & Video/day]
	Week 4	Active break Intervention [4 x 5 min Intervention & Video/day]
	Week 5	Active break Intervention [4 x 5 min Intervention & Video/day]
June 2015	Week 7	Follow-up Observation [1 hour/day]

Risks and Benefits:

Your child's participation in this study does not pose any risk that differs from what they would normally encounter in daily life. All physical activities will be simple whole body movements that the child can achieve on their own, for example, singing the song head and shoulders and doing the body actions. As with any physical activity, there is a risk of falling; however, no additional equipment will be used and safety is our first priority. The teacher and education assistants as well with any additional personnel your child may have will be present at all times, the school's standard emergency procedures will be followed. In the event that your child suffers an injury as a direct result of participating in this study, normal legal rules for compensation will apply.

Your child is free to stop participating in the activity bout at any time and rejoin for next active break if they choose. If your child is simply having a bad day and not willing to participate in one of the active breaks, they are able to sit out for that active break.

Your child will potentially benefit from this study by receiving valuable activity instruction, which may help to improve their concentration and behavior during instructional time. In addition to significant health benefits that are associated with physical activity, your child can potentially gain positive effects in concentration, off-task behavior, and academic achievement. In addition, they may improve their social skills, which may ultimately encourage them to participate in more physical activity in school or in the community. The research findings will also help to motivate future teachers and

shape other schools with children with disabilities in including activity breaks in their curriculum.

Are There Any Consequences for Not Participating?

No, this research study is completely voluntary. You may withdraw your child from the study at any time by telling the researchers, and you are not required to provide a reason for doing so. Because this is facilitated by Campbell Children's School, not participating in this study, or withdrawing your child partway, will in no way affect their schooling from Campbell Children's School or services from Grandview Children's Centre. Withdrawing from the study prior to the end of the intervention will mean that you and your child will not receive information regarding their final results. If you would not like your child to participate in the study or be videotaped, we can arrange for your child to take part in the active break without actually being a part of the study.

Confidentiality:

The data collected in this study is used for current and potentially future research and will be secured safely. All information that you and your child provide will be numbered and will not contain names. Overall results may be published for scientific purposes, but participant's identity will remain confidential. Limits of this confidentiality include situations of suspected child abuse, concerns of harm to self or others, or any request for information by court order.

Right to Withdraw:

You are free to withdraw your child at any time without penalty; your child may continue to participate in the activity breaks with the other children in the study without having their data included in the study. If you do not consent for your child to be video-taped, measures will be taken to ensure the camera is set up in the classroom that does not allow your child to be filmed. Your child will continue to participate in regular educational activities during this time out of camera view. If you do not consent for your child to participate in the active break and video tape, it is a regular practice at Campbell's school to have the child taken to a space within the classroom that is not within the view of the camera. If you choose to withdraw, any data that has been collected from your child (including data from the Supplemental Information Form) will be destroyed and will not be used in any analyses, publications or further research. If you wish to withdraw your child from the study you can do so by contacting one of the investigators by telephone or email (see contact information above).

Dissemination:

At your request, you can receive a copy of the results from this study following its completion. You can request a summary of your child's personal results once they have completed their final assessment session.

Questions about the study:

If you have any questions about this study, please contact Natalyn Hibbs at 905-721-8668, ext. 2953, or Dr. Meghann Lloyd at 905-721-8668, ext. 5308. This study has been approved on April 13, 2015 by the University of Ontario Institute of Technology Research Ethics Board (REB #14-105), which is a committee of the university whose goal is to ensure the protection of the rights and welfare of people participating in research. The Board's work is not intended to replace a parent/guardian or child's judgment about what decisions and choices are best for you. If you have any questions about your child's rights as a research participant you may contact the University of Ontario Institute of Technology Research Ethics Board at 2000 Simcoe St. N., Oshawa, On, L1H 7K4, 905-721-8668, ext. 3693 or compliance@uoit.ca

Informed Consent to Participate: Effects of multiple short bout of physical activity in a classroom-based setting in 4 year old children with physical and developmental disabilities.

I, _____,
(Your Name)

the parent/guardian of _____ :
(Your Child's Name)

☐ **Give consent** to my child's participation in the above study.

☐ **Give consent** for my child to be video recorded during the activity break and classroom instructional time.

OR

☐ **Do not** give consent for my child to be video recorded during the active break and instructional time, however **I do** give consent for my child to participate in the activity break.

OR

☐ **Do not** give consent for my child to be video recorded and **do not** give consent for my child's participation in the above study.

I have read an understood the attached information sheet or had the attached information sheet verbally explained to me, and have received a copy of this consent form. I have been fully informed of the details of the study and have had the opportunity to discuss my concerns. I understand that I am free to withdraw my child at any time or not answer questions. I understand that by consenting, I do not waive any legal rights or recourse.

☐ I am willing to receive further information regarding future research studies that my child may be eligible for.

Email: _____

_____
Name of Child

_____ _____
Name of Parent/Guardian Contact Phone Number

_____ _____
Signature of Parent/Guardian Date

Appendix 6: Supplemental Information Form

Participant #_____

Supplemental Information Form

This form includes questions about your child that will help to determine the appropriate type of activity to accommodate in the active break that best fits your child and identify factors that may relate to children's rate of progress and development. Please feel free to ask questions if you would like further clarification.

1. Child's name: _____

2. Birth date: _____ (day, month, and year)

3. What is your child's diagnosis (es)?

_____
_____
_____
_____

4. Has a doctor/physician or other health care provider told you that there are specific types of physical activities your child should not participate in? If yes, please specify.

☐ Yes
☐ No

_____
_____
_____

5. Has your child also been diagnosed with any of the following?

☐ Anxiety
☐ Attention Deficit Disorder
☐ Attention Deficit Hyperactivity Disorder
☐ Development Delay
☐ Epilepsy
☐ Intellectual Disability
☐ Learning Disability
☐ Operational Defiant Disorder
☐ Seizures
☐ Sensory Integration Disorder
☐ Visual Problems
☐ Other:_____

6. What type of motor interventions does your child receive through therapy at Grandview Children's Centre?

_____
_____
_____
_____

7. Is your child currently receiving any other form of therapy (i.e. speech-language, Applied Behaviour Analysis (ABA)-based services, etc.)? If yes, please specify the type and duration.

_____
_____
_____
_____

8. Does your child have any pre-existing medical conditions or anything that would preclude them from certain physical movements (ie. Surgery). Please explain.

_____
_____
_____
_____

9. Does your child show any repetitive or stereotypic behaviours during the day? If yes, what type of behaviours does your child exhibit?

_____
_____
_____
_____
_____

10. If you answered yes to the previous question, what is the frequency of such behaviours?

- ☐ 1 time/day
- ☐ 2-5 times/day
- ☐ 5-10 times/day
- ☐ 10 + times/day

_____
_____
_____
_____

11. Does your child participate in physical activity outside of school? (eg. Swimming lessons)

- ☐ Yes
- ☐ No

_____
_____

12. Does your child make verbal requests?

- ☐ 2 words
- ☐ 5 words
- ☐ 5+ words

_____
_____

13. Does your child have a sensory sensitivity to music? (eg. doesn't like music)

- ☐ Yes
- ☐ No

_____
_____
_____

Appendix 7: 4-Point Teacher Questionnaire

1. Will you continue to include multiple short bouts of physical activity throughout the day in your curriculum?

2. Did you notice a difference in your student's behaviors? (eg. Improved concentration, on-task behavior, academic achievement, reduced stereotypic behaviors)

3. Did you notice anything else change within the student's demeanor after including short active breaks in the curriculum? (eg. Improved social interactions with peers)

4. Do you have any comments on the program itself? Feedback on certain aspects you thought were helpful or challenging or parts you may change in the future.

Appendix 8: Baseline and Follow-Up Coding Template

Student ID		Time	On-task	Off-task	Self-stim	Setting
Date		0:00-0:30				
Session #		0:30-1:00				
		1:00-1:30				
		1:30-2:00				
		2:00-2:30				
		2:30-3:00				
		3:00-3:30				
		3:30-4:00				
		4:00-4:30				
		4:30-5:00				
		5:00-5:30				
		5:30-6:00				
		6:00-6:30				
		6:30-7:00				
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		17:00-17:30				
		17:30-18:00				
		18:00-18:30				
		18:30-19:00				
		19:00-19:30				
		19:30-20:00				

On-task
0- Not on task
1- Active
2- Passive
3- Distracted
Off-task
0- Does not go off task
1- Motor
2- Passive
3- Verbal
Self Stimulation
0- Absent
1- Present
Classroom Setting
1- Free Play
2- Independent work (teacher present)
3- Independent work (teacher absent)
4- Group work (teacher present)
5- Transitioning
6- Snack
7- Watching movie
8- Out of camera view
9- Not Applicable
DPA
1- Engaged
2- Observing
3- Not engaged

Appendix 9: Intervention Coding Template

Student ID		Time	On-task	Off-task	Self-stim	Setting	DPA
Date		0:00-0:30					
Session #		0:30-1:00					
		1:00-1:30					
		1:30-2:00					
		2:00-2:30					
		2:30-3:00					
		3:00-3:30					
		3:30-4:00					
		4:00-4:30					
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		24:00-24:30					
		24:30-25:00					

On-task
0- Not on task
1- Active
2- Passive
3- Distracted
Off-task
0- Does not go off task
1- Motor
2- Passive
3- Verbal
Self Stimulation
0- Absent
1- Present
Classroom Setting
1- Free Play
2- Independent work (teacher present)
3- Independent work (teacher absent)
4- Group work (teacher present)
5- Transitioning
6- Snack
7- Watching movie
8- Out of camera view
9- Not Applicable
DPA
1- Engaged
2- Observing
3- Not engaged