

Spring 2014

The effects of physical activity on on-task and off-task behaviors of an elementary school student with ADHD

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The Effects of Physical Activity on On-task and Off-task
Behaviors of an Elementary School Student with ADHD

A Project Presented to
the Faculty of the Undergraduate
College of Education
James Madison University

in Partial Fulfillment of the Requirements
for the Degree of Bachelor of Science

by Kayla Whitney Eppard

May 2014

Accepted by the faculty of the Department of Education, James Madison University, in partial fulfillment of the requirements for the Degree of Bachelor of Science.

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Acknowledgements

I would like to thank my thesis advisor, Dr. Keri Bethune, and my readers, Dr. Cheryl Beverly and Mr. Matt Trybus, for their support and advice throughout this project. I am so thankful to have found such kind, helpful, and experienced committee members who always kept me striving to learn more about what it really means to be an educator. I would especially like to thank Dr. Bethune for all of the hours we spent in her office working to make this project the best it could be. I cannot thank you enough for all of your time, especially at such a busy point in your life. Additionally, I would like to thank Dr. Susan Barnes for her help finding such amazing committee members.

I would also like to thank the James Madison University Honors Department for funding my trip to present my research at the 2014 Southern Regional Honors Council Conference in Savannah, Georgia. This was an incredible experience, and I appreciate the chance to meet honors program scholars, both students and staff, from many different universities who share my passion for learning.

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Abstract

The purpose of this study was to explore and evaluate a possible connection between the participation in a physical activity and the on-task and off-task behaviors of an elementary school student with attention-deficit/hyperactivity disorder (ADHD). Specifically, the intervention phase applied in this study hoped to increase the on-task behaviors exhibited by the student while also decreasing off-task behaviors. After observing the student in the baseline phase, the intervention was applied based on the student's choice of physical activity. Then, the researcher observed the student through whole interval recording of on-task behavior and partial interval recording of off-task behavior for ten minutes and in one minute intervals. Results showed an increase in her on-task behavior and a decrease in her off-task behavior during the times she participated in the physical activity. Additionally, social validity questionnaires completed by the student and classroom teacher show a positive experience with the intervention and the intention to continue using the physical activity to promote on-task behavior for the student.

Keywords: ADHD, on-task, off-task, elementary, student, attention

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Studying the Effects of Physical Activity on the On-task and Off-task Behaviors of an Elementary School Student with ADHD

Introduction

Statement of the Problem

Children diagnosed with attention-deficit/hyperactivity disorder (ADHD) show at least six symptoms of inattention and/or hyperactivity-impulsivity for at least six months and in at least two different environments (Heward, 2013). Possible inattention symptoms include: forgetfulness, distractibility, losing things often, not appearing to listen, not following through on details, and difficulty keeping attention on tasks, while possible hyperactivity and impulsivity symptoms include: impatience, talking constantly, often loud, running and climbing around, fidgeting, interrupting others, and problems with self-control (Heward, 2013). These symptoms often cause difficulties for individuals in social, academic, or occupational settings (Heward, 2013).

In a study on academic and social impairments of children with ADHD, McConaughy et. al. (2011) found that 15-55% of children with ADHD showed significant academic impairment, while 26-85% of children with ADHD showed significant social impairments. Additionally, research shows that more and more children are being diagnosed with ADHD, with 2.5% of children diagnosed in 2001, and 3.1% in 2010 (JAMA, 2013). Specifically, the ADHD diagnosis rate among whites increased from 4.7% to 5.6% in the same period, while diagnosis among blacks rose from 2.6% to 4.1% , and among Hispanics it rose from 1.7% to 2.5% (JAMA, 2013). Although more boys are diagnosed than girls, the study shows that the gap between sexes for black children might slowly be closing (JAMA, 2013).

Children with ADHD may currently qualify for legal individualized supports through the Individuals With Disabilities Education Improvement Act (IDEA) of 2004 and Section 504 of

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the Rehabilitation Act of 1973 (McKinley & Stormont, 2008). IDEA specifies that children with ADHD may qualify for special education if their disability has a negative impact on their educational progress. If so, the child's individualized education program (IEP) may be used to plan out services and monitor a child's special education services provided (McKinley & Stormont, 2008). Section 504 of the Rehabilitation Act outlaws discrimination due to disability by any program that receives federal financial assistance (McKinley & Stormont, 2008). Many children who do not qualify for IDEA services can find help through Section 504 of the Rehabilitation Act (Heward, 2013). This legislation requires a school to create and implement plans for the student's accommodation which can include additional time on tests, modified assignments, or preferred seating (Heward, 2013).

Since more children are being diagnosed with ADHD and show academic and social difficulties in school, ADHD is an important topic for teachers to consider. Research shows that children with ADHD are less on-task than their peers without ADHD (Kofler, Rapport, & Alderson, 2008). Kofler, Rapport, and Alderson conducted a study to understand the differences in classroom studies of students with ADHD and found that the students with ADHD were on-task about 75% of the time while their peers were on-task about 88% of the time (2008). Teachers use many different classroom strategies to assist their students with ADHD by improving on-task behavior. Intervention strategies that teachers currently implement with their students include reviewing classroom rules, reducing task demands, using positive reinforcement, teaching self-regulation skills, and providing instruction in academic skills like note-taking. DuPaul, Weyandt, and Janusis (2011) found that for children with ADHD, behavioral and academic interventions like these, in addition to medication and/or home-based behavioral interventions are critical to a treatment plan. Similarly, Johnson and Reid found that

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specific interventions that address executive function deficits of children with ADHD can increase these students' academic performance (2011). These interventions include planning out activities and tasks, setting goals, and remaining persistent (Johnson & Reid, 2011). In another study, Geng (2011) found that while results varied, non-verbal strategies were especially helpful in increasing a student with ADHD's on-task behavior. Still, other interventions address working memory difficulties in students with ADHD. Martinussen and Major (2011) suggest strategies including memory aids like graphic organizers or cue cards and scaffolding of organization like checklists and goal-setting.

Another avenue of student ADHD interventions is physical activity in the classroom. Azrin, Vinas, and Ehle (2007) conducted a study to reinforce attentive calmness of two thirteen year-old boys with ADHD and intellectual disabilities in a separate special education classroom setting. They found that vigorous physical activity as a reinforcer decreased the amount of the boys' inattention and restlessness (Azrin, Vinas, & Ehle, 1998). Kercood and Banda (2012) conducted another study to learn the effect of physical activities on the listening comprehension of children with attention problems and without attention problems. Results show that all participants, with and without attention problems, had increased listening comprehension, however, the therapy ball and doodling were equally effective among all students (Kercood & Banda, 2012).

Purpose of Study

The purpose of this study was to compare the prevalence of on-task and off-task behaviors of a child with attention deficit/hyperactivity disorder (ADHD) when being physically active (sitting on an exercise ball, holding PlayDoh or a squishy ball, doodling) versus not being physically active. This study will answer four research questions:

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1. What are the effects of physical activity during classroom instruction on the student's off-task behavior?
2. To what extent does the implementation of a student's choice of physical activity increase the student's on-task behavior?
3. Did the teacher find the use of a chosen physical activity appropriate and beneficial?
4. Did the student find the use of a chosen physical activity appropriate and beneficial?

Dependent Variable

The dependent variable was the percentage of on-task and off-task behaviors of the student with ADHD. On-task as well as off-task behaviors were decided based on the expectations of the teacher and the participant's common off-task behaviors. Whole interval recording was used to track on-task behavior while partial interval recording was used to measure off-task behavior.

Independent Variable

The independent variable was access to the physical activity that the child with ADHD chose to use during class. The classroom teacher was consulted to determine a list of acceptable physical activities. The student was given this list of possible physical activities at the beginning of each intervention phase and chose her physical activity each time.

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Literature Review

There is a multitude of research on attention-deficit/hyperactivity disorder (ADHD). This includes background information and characteristics of ADHD, its prevalence, difficulties associated with ADHD, difficulties for students with ADHD, current services provided for students with ADHD, and recommendations for interventions in the classroom.

In *Exceptional Children: An Introduction to Special Education*, Heward defines children with ADHD as having at least six symptoms of inattention and/or hyperactivity-impulsivity for at least six months and in more than one setting (Heward, 2013). Some of these inattention symptoms include: forgetfulness, distractibility, losing things often, not appearing to listen, not following through on details, and difficulty keeping attention on tasks, while possible hyperactivity and impulsivity symptoms include: impatience, talking constantly, being loud, running and climbing around, fidgeting, interrupting others, and have problems with self-control (Heward, 2013). These symptoms cause difficulties for individuals in social, academic, or occupational settings (Heward, 2013). Specifically, Pelham et al. (2011), conducted a study to compare the distractibility of 41 boys with ADHD compared to 26 control boys, all between 7.7 and 12.6 years old. They used three distractor conditions (music, video, no distractor) during class time, while giving the students a total sum of points at the beginning of the class period, and then taking away points as the students violated the classroom rules (Pelham et al., 2011). Results show that the boys with ADHD were more distracted and disruptive and less productive than the control boys, a video distracted all participants more, and music did not significantly distract either group (Pelham et al., 2011). The authors state that for future research, the list of distractors could be expanded (2011).

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There are four subtypes of ADHD based on the collection of symptoms (Heward, 2013). These include combined presentation which shows symptoms of inattention and hyperactivity/impulsivity, “predominantly inattentive presentation; predominantly hyperactivity-impulsive presentation; and inattentive presentation (restrictive)” (Heward, 2013, p. 391). Most children with ADHD, about 55% have been diagnosed with combined type while 27% are diagnosed with the predominantly inattentive type, and 18% are diagnosed with hyperactive-impulsive type (Heward, 2013). A diagnosis of ADHD is highly subjective because it is difficult to tell where to draw the line between the behaviors of a child with and a child without ADHD (Heward, 2013). Additionally, one doctor could diagnose a child with ADHD and another doctor could determine that the same child does not have ADHD (Heward, 2013). Therefore, there is no specific criteria for diagnosing ADHD and instead the diagnosis is formed based on information from teachers and parents (Heward, 2013).

McConaughy, Volpe, Antshel, Gordon, and Eiraldi used an eighteen item rating scale to find the differences between the social behavior and academic performance of 178 6-to-11-year-olds with and without ADHD (2011). They found that the children with ADHD scored significantly lower than the control students on achievement tests including mathematics, written language, and reading tests (2011). Students with ADHD also scored significantly lower on parent and teacher ratings of their s academic skills, effort, and motivation (McConaughy, Volpe, Antshel, Gordon, & Eiraldi, 2011). The authors conclude that children with ADHD need interventions that address these areas of academic and social achievement (2011).

In a related study, Kofler, Rapport, and Alderson sought to understand the differences in classroom studies of students with ADHD (2008). They used a meta-analysis of 23 between-group classroom observations (2008). Results show that children with ADHD are, indeed, less

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on-task than their peers without ADHD; the students with ADHD were on-task about 75% of the time while their peers were on-task about 88% of the time (Kofler, Rapport, & Alderson, 2008). The authors noted that future research studies should include younger and older children with ADHD in classroom settings, because this study had a very minimal age range (Kofler, Rapport, & Alderson, 2008).

In light of all these characteristics of students with ADHD, it is important to note that a recent study through the Kaiser Permanente Southern California health plan found that the diagnosis of ADHD has increased from 2001 to 2010 (JAMA, 2013). In 2001, 2.5% of children were diagnosed with ADHD while in 2010, 3.1% were diagnosed (JAMA, 2013). They also found that there has been an increase in the diagnosis among black children (2.6% to 4.1% of black children compared to 4.7% to 5.6% of white children in the same time period), and that while boys are still more likely to be diagnosed, the sex gap between black children may be diminishing (JAMA, 2013). The change in diagnosis among Hispanic children was 1.7% in 2001 to 2.5% in 2010 (JAMA, 2013). Additionally, this study shows that children from high-income households are more likely to be diagnosed and there is a disproportionately high number of white children being diagnosed (JAMA, 2013).

Several studies have explored the difficulties ADHD presents for children. Mahone and Silverman (2008) discuss how learning and remembering information can be difficult for students with ADHD (2008). They explain that executive dysfunction is often interconnected with ADHD and that much of the time ADHD is actually more than one disorder or coexists with other disorders. Additionally, they argue that brain development of children with ADHD varies from the brain development of children without ADHD and different genders experience ADHD differently. Furthermore, they note that motor dysfunction is common in individuals with ADHD

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and includes problems with motor control of the eyes, and children with ADHD who have problems with reading comprehension do not necessarily have a particular reading disability (Mahone & Silverman, 2008).

Johnson and Reid (2011) also explore difficulties with executive functions for students with ADHD. The authors define executive functions as “cognitive processes necessary for complex goal-directed behavior” (Johnson & Reid, 2011). They explain that deficiencies in these functions, including knowledge about performing tasks, attention and memory, planning, and self-monitoring can cause the academic performance of students with ADHD to suffer. By developing and deploying strategies, setting goals, and remaining persistent, the authors say their academic performance can improve.

In another study exploring executive function difficulties for children with ADHD, Kofler, Rapport, Bolden, Sarver, and Raiker (2010) wanted to learn if the inattentive behavior of boys aged 8 to 12 with ADHD is related to the executive functioning and storage components of working memory. They used latent variable and effect size confidence interval analyses to measure the impact of counterbalances tasks on “central executive, phonological storage/rehearsal, and visuospatial storage/rehearsal demands” (Kofler, Rapport, Bolden, Sarver & Raiker, 2010). These results were the first to show a functional relationship between a child’s attentive behaviors and working memory: when a child was made to process additional stimuli, all children’s attentive behavior decreased, while the change in attentive behavior was more drastic in children with ADHD (Kofler, Rapport, Bolden, Sarver & Raiker, 2010). The authors stated that future research will have to correct the inadequate structural validity of test batteries to measure specific deficits or traits (2010).

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While many difficulties for children with ADHD have been studied, children with ADHD also have special gifts. In their article “Thinking Positively: How Some Characteristics of ADHD can be Adaptive and Accepted in the Classroom,” Sherman, Rasmussen, and Baydala (2006) explain that some researchers think it is not a negative thing at all, and the perception of the diagnosis is the negative part (2006). Instead of calling it a disorder, they call it a trait. Some of the gifts of students with ADHD listed include being able to work on several tasks, having a lot of energy, and being fantastic brainstormers (Sherman, Rasmussen & Baydala, 2006). The authors explain that by using the strengths of children with ADHD, and by teaching to all of Gardner’s multiple intelligences, teachers can help their students succeed (2006).

Although some of the characteristics of children with ADHD can be seen as gifts, Hawthorne (2010) discusses the belief that individuals diagnosed with ADHD are seen as having a biological dysfunction. This means that individuals with ADHD are viewed by the non-ADHD community as having something physically wrong with them like a disease. For this reason, it is believed that this dysfunction can be erased with the correct treatment and more specifically, the correct medicinal treatment (2010). Hawthorne argues that scientific, medical, social, and individual concepts have created an institutional intolerance of ADHD, where institutional intolerance means that prevailing negative expectations make life more difficult for individuals with ADHD (2010). For example, by diagnosing a child with ADHD, a teacher may expect that child to seem off-task in class. Hawthorne says that individuals with ADHD must weigh a trade-off between the positive and negative features of diagnosis (2010).

Even though the label of ADHD may be harmful to some students, there are many services that are provided for children with ADHD. Currently, many children with ADHD qualify for legal individualized supports through Section 504 of the Rehabilitation Act of 1973

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and the Individuals With Disabilities Education Improvement Act (IDEA) of 2004 (McKinley & Stormont, 2008). Section 504 of the Rehabilitation Act of 1973 outlaws discrimination due to disability in seeking federal financial assistance (McKinley & Stormont, 2008). The IDEA provides special education services to children who prove they need these special education services. To be eligible for these services the child must be deemed to have a disability. A disability is defined “as a child having ‘mental retardation, hearing impairments (including deafness), speech or language impairments, visual impairments (including blindness), serious emotional disturbance... , orthopedic impairments, autism, traumatic brain injury, other health impairments, or specific learning disabilities’” and this child must also have a need for special education services (May, 2009). In other words, the student’s disability must significantly limit the student’s performance educationally. If it is determined that the student is eligible for services, these services will be written out in an Individualized Education Program (IEP) that includes the student’s current level of performance, academic and social goals, as well as the services that the school district will provide to assist the student in reaching those goals (May, 2009). However, there are some complications to providing services for children with ADHD. In one case, a middle school student referred to as A. D. who was diagnosed with ADHD was denied services through the IDEA (May, 2009). His mother requested these services, but it was decided that his need for special services was a result of traumatic events in his life and his alcohol abuse instead of his ADHD (May, 2009).

Martin and Zirkel conducted a study to analyze 41 published court cases about eligibility for students with ADHD under the IDEA. They used the *Special Ed Connection*, Westlaw, and Lexis electronic databases to find relevant court cases prior to February, 2011. Then, they researched the results to determine if the outcome of the cases were in favor of the parent/child,

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the district, or if they were inconclusive. Results show that 41% of the outcomes were in favor of the parents/child, 46% were for districts, and 12% were inconclusive. The authors noted that this showed the courts have set a precedent that ADHD is “necessary but not sufficient for eligibility under the IDEA” (p. 416). Martin and Zirkel state that future research should include a more intense analysis of IDEA eligibility factors and the effects of the Disability Act amendments, a closer look at decisional factors, and an analysis of case law analysis to hearing officer decisions and “the major issue of free appropriate public education for students with ADHD” (p. 418).

In addition to current legal services provided for students with ADHD, there is also a large body of research on different intervention technique recommendations to assist these students in an academic setting. Specifically, Raggi and Chronis (2006) provide several strategies including: peer tutoring, computer-assisted instruction, making modifications to tasks or instructions (including breaking up tasks into smaller goals, reducing or increasing speed etc.), giving a student choices between academic tasks, providing additional stimulation (high stimulation colored letters), self-monitoring, and homework intervention strategies including finding a setting with minimum distractions and prioritizing homework tasks (Raggi and Chronis, 2006). DuPaul, Weyandt, and Janusis (2011) also provide many effective intervention strategies to improve academic achievement, behavior, communication between home and school, and collaborations between school professionals. These strategies include reviewing classroom rules, reducing task demands, using positive reinforcement, teaching self-regulation skills, and providing instruction in academic skills like note-taking (DuPaul, Weyandt, and Janusis, 2011). They found that for children with ADHD, in addition to medication and/or home-based behavioral interventions, behavioral and academic interventions are critical to a treatment plan (DuPaul, Weyandt, & Janusis, 2011).

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As Johnson and Reid (2011) discussed, children with ADHD have executive function/ cognitive process difficulties. Martinussen and Major (2011) contribute further to this idea as they discuss working memory weaknesses in students with ADHD and how it affects instruction of these students. Johnson and Reid pointed out memory weaknesses as just one of these cognitive process difficulties (2011). Martinussen and Major explain specific strategies teachers can utilize to improve instruction for students with these difficulties (2011). Through “Scaffolding Complex and/or Multistep Tasks”, teachers can help students break up information to be processed, and provide memory aids like graphic organizers or cue cards (Martinussen & Major, 2011). Through using “Scaffolds for Organization and Time Management” (Martinussen & Major, 2011), teachers can help students organize their materials, use checklists, set goals, and plan out steps to reach a goal.

In an intervention study focusing more on a child with ADHD’s behavior than cognitive abilities, Geng (2011) conducted a study to find the verbal and non-verbal strategies used by teachers that improve the long term education and behavior of students with ADHD by encouraging positive behaviors in the short term (Geng, 2011). She used qualitative research methodology to collect data on teaching strategies used in a classroom (Geng, 2011). This study was conducted in three Australian schools on six students diagnosed with ADHD including four who took medication for their ADHD (Geng, 2011). Results show that all of the teachers used verbal and non-verbal teaching strategies, such as firmly repeating a student’s name or touching a student’s shoulder to gain his attention, which only momentarily caused the students to respond in a positive way (Geng, 2011). Geng found that non-verbal strategies were more effective, the responses of each child varied, and medication was helpful with the students’ positive behavior

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(2011). The author stated that future research would be conducted to find how teachers manage their own stress levels as they respond to the behaviors of students with ADHD (Geng, 2011).

Specific strategies listed in the previously mentioned studies can be used to increase individual students' on-task behaviors.. In their 2011 study, Germer, Kaplan, Giroux, Markham, Ferris, Oakes, and Lane investigated the results of several interventions (a stoplight system for teacher assistance, a special seat, and a picture schedule) on a seven-year-old black male, named David, in a general education second grade classroom. He did not yet have an ADHD diagnosis but his guardian was seeking one (Germer, Kaplan, Giroux, Markham, Ferris, Oakes, & Lane, 2011). They used an A-B-A-B withdrawal design with a maintenance phase. Results show that there was a correlation between the intervention techniques and David's on-task behavior (2011). The authors noted that future research is needed to test this intervention strategy with a variety of students of different ages and with different needs (2011).

In their 2007 study, Azrin, Vinas, and Ehle explored a different type of intervention promoting positive behaviors: physical activity. Azrin, Vinas, and Ehle conducted their study to reinforce attentive calmness of two thirteen year-old boys with ADHD and intellectual disabilities in a separate special education classroom setting (2007). They compared baseline data to post-intervention data to measure the impact of vigorous physical activity as a reinforcer on the amount of "inattentive restlessness" in the classroom over the course of four days (Azrin, Vinas, & Ehle, 2007). Results show that vigorous physical activity as a reinforcer was effective in decreasing the amount of "inattentive restlessness" of both boys (Azrin, Vinas, & Ehle, 2007). The authors noted that future research could be beneficial by increasing the number of subjects, having subjects only diagnosed with ADHD, collecting academic attainment data, and recording data for more than four days (Azrin, Vinas, & Ehle, 2007).

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An interesting avenue of these intervention studies and recommendations is the idea that physical activity can increase attention and on-task behaviors. Peck, Kehle, Bray, and Theodore (2005) conducted a study to measure the effectiveness of yoga on increasing on-task behavior for ten elementary school students with attention problems. They used a multiple baseline design to study the effects of yoga over the course of three weeks for thirty minutes a day, twice a week (Peck, Kehle, Bray, & Theodore, 2005). Results show that yoga did increase the on-task behaviors of the students, however the findings should be read with caution because the baseline trends were slightly positive and several data points (baseline and intervention) overlapped (Peck, Kehle, Bray, & Theodore, 2005). The authors explain that future research could include an observer who does not know the purpose of the study and could use a control group of students with similar levels of attention difficulties (2005).

Finally, Kercood and Banda (2012) conducted a study to learn the effects of physical activities on the listening comprehension of children with attention problems and without attention problems. They used an alternating treatment design to measure the effects of adding motor activities (therapy balls against doodling), on listening comprehension. Results show that all participants, with and without attention problems, had increased listening comprehension, however, the therapy ball and doodling were equally effective among all students. Additionally, for students with attention problems, the performance declined when they returned to the baseline condition. The authors stated that several limitations (listening task less than ten minutes long, comprehension was asked by multiple choice questions instead of verbal descriptive responses) show the necessity for future research.

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Research Design

Participants/Setting

The participant was a second grade student in a public elementary school. The researcher/observer was assigned to a weekly practicum in a second grade classroom, and the study took place in the elementary school classroom of this child. The student, Madison (pseudonym), was selected through convenience sampling. The classroom teacher identified Madison as having been diagnosed with ADHD by a medical doctor or a psychologist. Then, after teacher and principal support were given, parent consent and student assent were attained respectively through a signed permission form and a form read out loud to and signed by the student.

Materials

The materials used during the study consisted of the observers' observation forms, as well as the supplies for the physical activity (Play-Doh, two different stress balls, and a squishy princess toy). Materials prior to the study included permission forms signed by the school principal, classroom teacher, parent, and an assent form by the child.

Experimenters

At the time of the study, the student researcher/experimenter was a senior pursuing her Bachelor of Science in Interdisciplinary Liberal Studies (IdLS) at James Madison University. Through the James Madison University Elementary Education program, she will also attain a Master of Arts in Teaching and a Virginia teaching licensure. She has previous experience working with elementary aged children both professionally and voluntarily and has taken several classes on child development and childhood education. She is a student of the James Madison University Honors Program and is undertaking this project to complete her Senior Honors Thesis.

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The thesis advisor has a M.Ed. and Ph.D. in special education, with a specialization in applied behavior analysis and positive behavior supports, and is a Doctoral level Board Certified Behavior Analyst. She has also conducted research on using coaching to improve teachers' accuracy of implementation of individual student function-based interventions, and has taught courses related to individual and school wide PBS implementation. Additionally, she has worked extensively with students with problem behaviors, severe disabilities, and autism throughout her career.

Data Collection Procedures

The student was observed for ten minutes through whole interval recording of on-task behavior in 1 min intervals. For each minute, the observer recorded (+) if the on-task behavior occurred throughout the entire interval and (-) if the on-task behavior did not occur throughout the entire interval. Additionally, off-task behavior was recorded using partial interval recording during the same 10 min observation (broken into 1 min intervals). For each minute, the observer recorded (+) if the off-task behavior occurred at any time during the interval and (-) if the off-task behavior did not occur at any point during the entire interval. After the study was conducted, the researcher collected social validity survey data from the teacher and the student on the acceptability and success of the intervention.

Dependent Variable

The dependent variable was the percentage of on-task and off-task behaviors of the student with ADHD. Whole interval recording was used to track on-task behavior while partial interval recording was used to measure off-task behavior. On-task behavior was counted as having body oriented to the teacher, staying in teacher designated area unless given permission to leave area, and appropriately engaged in the activity as directed by the teacher without

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becoming disengaged for more than ten seconds. Off-task behavior was counted as speaking without permission of the teacher; not following teacher directions for more than 10 seconds, walking away, or physical refusal; using materials or items in way not designated by teacher or without teacher permission, playing with hair for more than 10 seconds including: running fingers through hair, tilting head and shaking back and forth, or tilting forward and using her hair to block vision.

Independent Variable

The independent variable was access to the physical activity that Madison selected to use during the whole group lesson. The student was given a list of possible items to hold in class that included: PlayDoh, two different stress balls, and a squishy princess toy. The teacher was consulted to determine a physical activity that she did not consider disruptive to the rest of the class, and it was decided items the student could hold would be most appropriate. Madison was asked each time if she would like to hold an item and which item she wanted.

Experimental Design

This study had a single subject AB design. There first was a baseline recording phase (phase A) where on-task and off-task behavior were recorded prior to the intervention. Then, there was an intervention phase (phase B) where the intervention was applied and the on-task and off-task behaviors of the student were once again observed. Then, results were compiled based on the differences in the child's behavior between the two phases. See below for additional details of each phase.

General Procedures

General study procedures. The student observer first interviewed her paired elementary school practicum cooperating teacher to identify an appropriate student candidate. Once the

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candidate was found, teacher, principal and parent consent were given as well as student assent. The observer then conducted a baseline assessment of the student's on-task and off-task behavior. The observer conducted the intervention by providing physical activity options to the student as approved by the cooperating classroom teacher. The student chose a physical activity option, and the observer recorded the student's on-task and off-task behaviors while the student held the chosen item. These observations took place during teacher-directed activities led by the classroom teacher. The observer compiled this information and made a conclusion on the difference in Madison's on-task and off-task behaviors while participating in the physical activity and while not participating in the physical activity.

Baseline. During 10 minute observations collected during typical whole group lessons led by the classroom teacher, the observer took data using the data collection forms on the student's on-task and off-task behaviors. The observer did not intervene with the student in any way including reinforcing on-task behavior or providing access to the physical activity. The intervention observations all occurred during a range of teacher led, whole group instruction including mathematics block, reading block, and daily calendar time.

Intervention. During typical 10 minute observations conducted during the same typical lessons led by the classroom teacher, the observer gave Madison a choice of teacher approved physical activities. Then, the observer observed and documented Madison's on-task and off-tasks while she had access to the physical activity. Like during Baseline, the intervention observations all occurred during a range of teacher led, whole group instruction including mathematics block, reading block, and daily calendar time.

Inter-observer reliability. Inter-observer reliability was collected across all phases of the study. The researcher trained the second observer to use the data collection system by

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modeling the accurate data collection method with one 10 min observation, then provided opportunities to score recordings together until 90% agreement is reached across three separate opportunities. A second researcher simultaneously observed 30% of all observations of the student using the same data recording sheet. The second observer's results were compared with the researcher's results using an item-by-item method. The experimenter calculated the reliability coefficient by dividing the number of agreements by the sum of agreements and disagreements. Inter-observer reliability was found to be 100%.

Social validity. The social validity of the study was determined based on questionnaires given to the classroom teacher and the student. These questionnaires asked questions that helped determine if this was a useful and undistruptive activity for both the teacher and the student. These questionnaires are attached in Appendices D and E.

Procedural fidelity. The second observer used a checklist to collect data on the extent to which the researcher/observer appropriately implemented the intervention during 20% of all intervention phase observations of the student. Procedural fidelity was calculated by dividing the number of steps the researcher correctly performed by total number of steps. The observer correctly performed four out of four steps, and procedural fidelity was found to be 100%.

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Results

Inter-observer Agreement

Data was taken on 40% of baseline observations and 20% of intervention observations. An average of 100% inter-observer reliability was found across all observations.

Problem behavior. For student problem behaviors, inter-observer agreement was collected in 30% of the experimenter's observations. 100% inter-observer reliability was found across all observations.

Replacement behavior. For student replacement behaviors, inter-observer agreement was collected in 30% of the experimenter's observations. 100% inter-observer reliability was found across all observations.

Procedural Fidelity

The second observer observed the experimenter to ensure that the intervention observation data was collected as designed. The second observer used an intervention fidelity checklist (see Appendix C). Fidelity data were collected across 20% of intervention sessions and averaged 100% accuracy.

Results of Research Questions

Research Question 1: What are the effects of physical activity during classroom instruction on the student's off-task behavior?

Results of the data of Madison's off-task behavior are shown in Figure 1. During the baseline phase, Madison's off-task behavior is stable at a middle to high level. It appears to be decreasing and then levels off before entering the intervention phase. During the intervention phase, the data line remains stable but is decreasing at a higher level. Thus, Madison's average off-task behavior decreased during the intervention phase as compared to the baseline phase.

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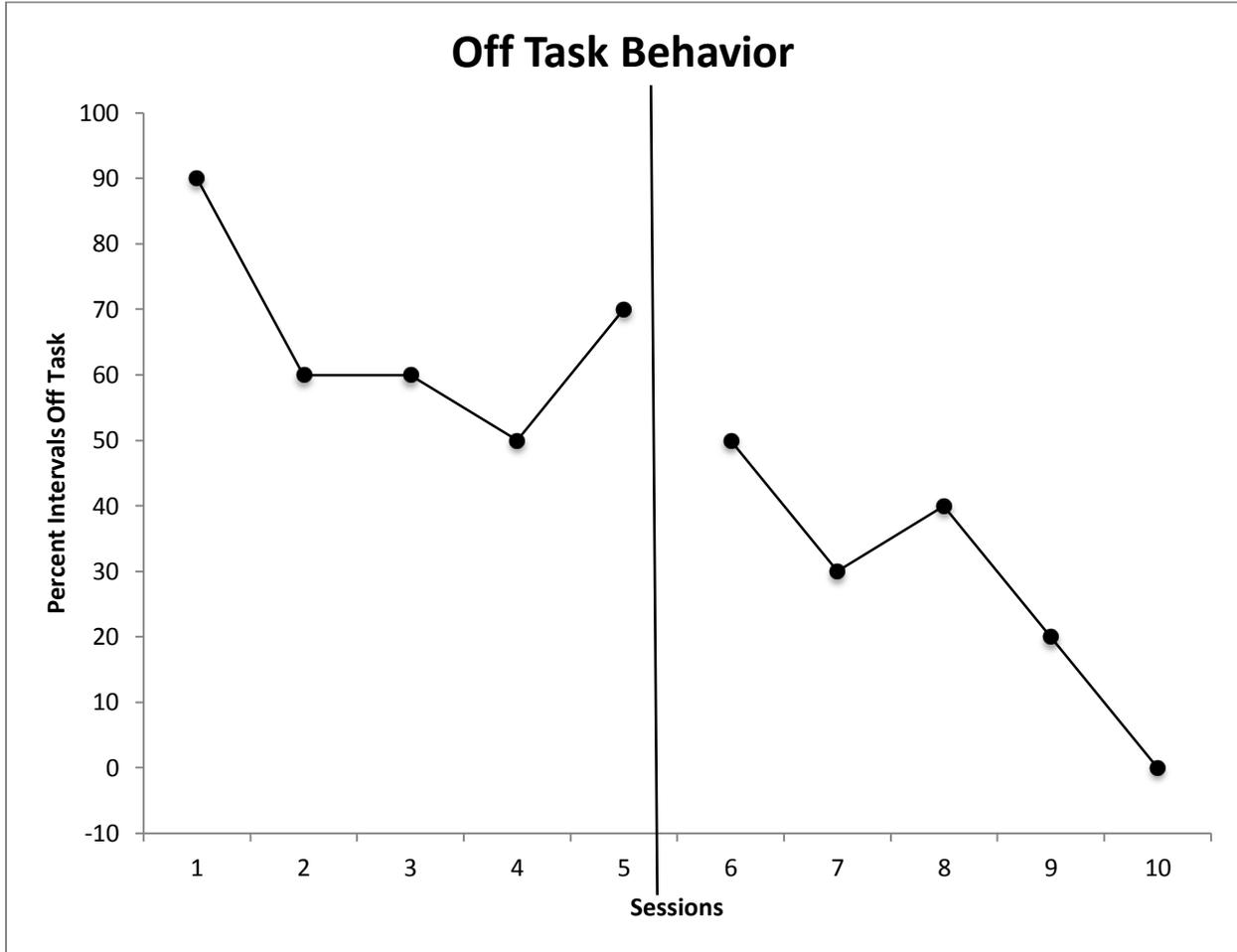


Figure 1

Research Question 2: To what extent does the implementation of a student's choice of physical activity increase the student's on-task behavior?

Results of the data of Madison's on-task behavior are shown in Figure 2. During the baseline phase, Madison's on-task behavior appears to increase but levels off before entering the intervention phase. The data path during the baseline phase is stable at a low to middle level. During the intervention phase, the data path is in the middle to high level. The data path is also increasing and stable. Thus, Madison's average on-task behavior increased during the intervention phase as compared to the baseline phase.

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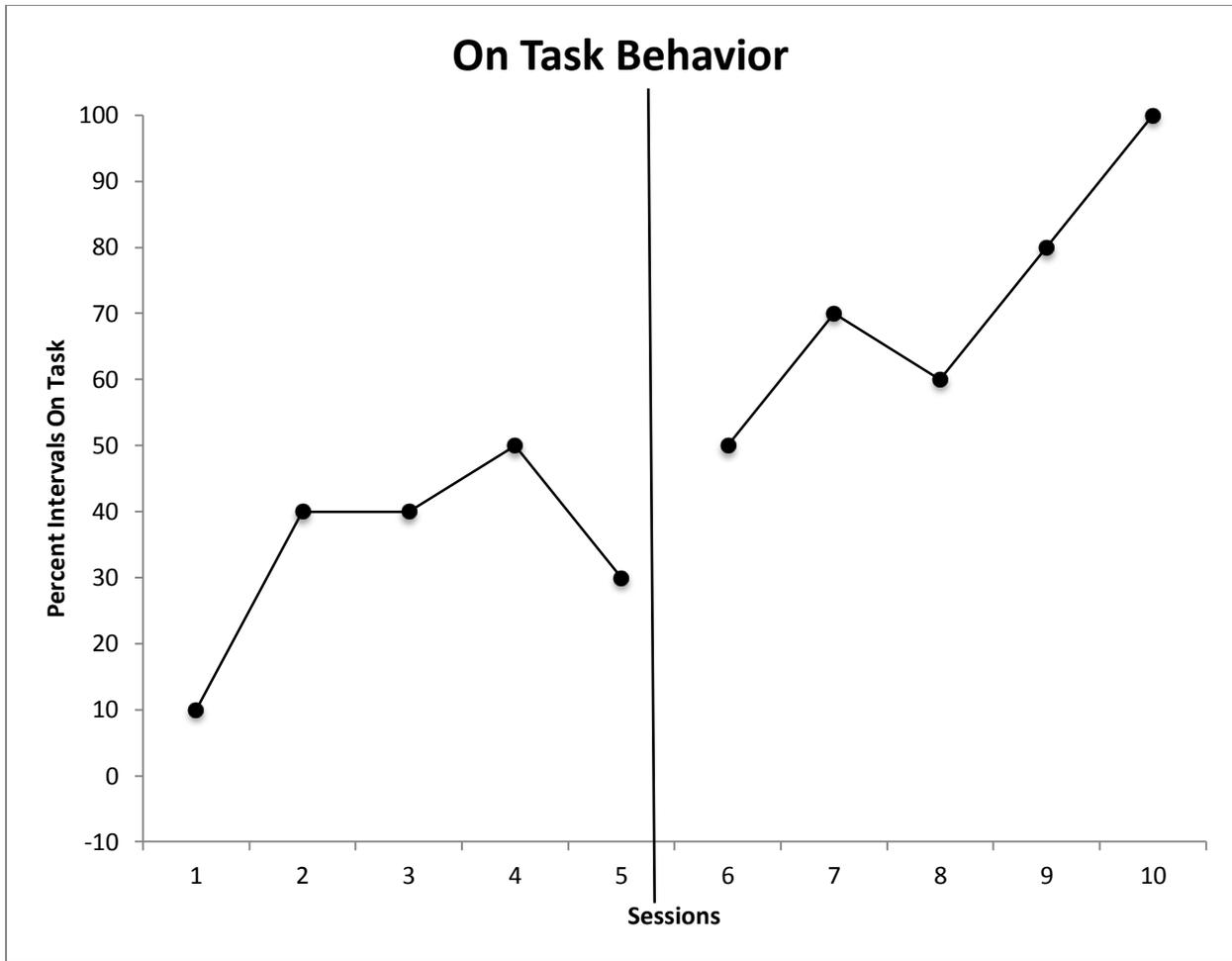


Figure 2

Research Question 3: Did the teacher find the use of a chosen physical activity appropriate and beneficial?

The results of this question can be seen through the social validity questionnaire completed by the classroom teacher at the end of the intervention phase (See Appendix D). The classroom teacher who has over twenty years teaching experience, mostly answered positively about her experience with the study. When asked “To what extent do you believe the physical activity intervention improved your student’s on-task behavior?” she rated the change a four out of five on a scale ranging from one being no change and five being an extreme change. She also noted that the student “was able to stay focused for longer periods of time.” When she was asked about

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the impact of the study on Madison and other children in her class, she responded “Children were excited and at times a bit crazy about her having something that they didn’t.” She rated this change a three out of five on the same scale, indicating a minor change. When the teacher was asked if she would use the physical activity intervention with Madison in the future, she said “Yes, it really seemed to make a difference!” and gave this question a four out a five rating on a scale from “Definitely will not use” to “Definitely will use.” Then, when she was asked about any changes she would make, she noted: “None other than possibly explaining to the remainder of the class why it is okay for her to hold a toy.” Finally, in the comments section at the end of the questionnaire, she said “I enjoyed watching this intervention activity unfold. The results were interesting ☺. Thank you!”

Research Question 4: Does the student find the use of a chosen physical activity appropriate and beneficial?

The results of this question can be seen through the social validity questionnaire completed by Madison at the end of the intervention phase (Appendix E). This questionnaire was read to Madison by the student researcher. The researcher asked Madison to respond to each question by pointing to a check mark if her answer was “yes,” the x if her answer was “no,” or the question mark if she was not sure. When asked if she liked working with the student researcher, Madison answered “yes.” Additionally, she answered “yes” to the questions “Did working with the JMU student help you have better behavior?” and “Did your activity help you focus better?” She also responded positively to questions asking if she liked learning in this way, and if she would like to continue doing the activity in class. She answered “no” to “Did your activity interrupt the lesson?” As a whole, the results of the questionnaire show that Madison enjoyed using the

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squishy toy in class, she felt it helped her pay attention and have better behavior, and she wanted to continue using it in class.

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Conclusion

Discussion of Results of Research Questions

Research Question 1: What are the effects of physical activity during classroom instruction on the student's off-task behavior?

The results of the study show a positive relationship between the use of the squishy ball and the minimization of the student's off-task behavior. During baseline observations, the data showed stable, high-level, off-task behavior. Then, during the intervention phase, the data showed decreasing off-task behavior. The results show that Madison had less off-task behavior during the times she had access to the squishy ball to a noticeable degree. Also important to note is that Madison's greatest amount of average off-task behavior during the intervention phase was only as high as her least amount of off-task behavior during the baseline phase. This shows that during all intervention sessions when she had access to the squishy toy, Madison's off-task behavior was less prevalent or equal to any of the times she did not have access to the toy.

Research Question 2: To what extent does the implementation of a student's choice of physical activity increase the student's on-task behavior?

Corresponding to the decrease in off-task behavior, this study saw an increase in Madison's on-task behavior. Baseline observations showed low and stable on-task behavior. During the intervention phase, Madison's on-task behavior was stable, increasing, and was at a higher level. Like off-task behavior, all averages of on-task behavior during the intervention phase were equal to or higher than during baseline observations. As such, Madison's on-task behavior increased during the times she had access to the squishy toy.

Research Question 3: Did the teacher find the use of a chosen physical activity appropriate and beneficial?

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Based on the data in the teacher validity questionnaire, the teacher felt the use of the squishy toy to be both appropriate and beneficial. The classroom teacher answered positively to most questions. She mentioned that at some points other children were overexcited by Madison's use of the squishy toy and that she would change the study to include an explanation to these students about her use of the toy. Otherwise, the teacher expressed great interest in the study and positive results because of the intervention stage of the study.

Research Question 4: Does the student find the use of a chosen physical activity appropriate and beneficial?

Through a student validity questionnaire presented by the student researcher, Madison answered positively to each question, saying that she enjoyed the intervention stage. Like the teacher, she felt that this activity helped her pay attention. However, unlike the teacher, she did not believe it interrupted classroom lessons. This might be because Madison feared being able to use the toy again in the future or simply because she did not believe it caused a distraction. While explaining the appropriate use of the toy, the student researcher made clear that Madison should not distract other students and that if she purposely showed it to students while using it during lessons, she may not be able to use it again. Either way, Madison showed a positive experience with the physical intervention and a desire to continue using the squishy toy.

Contributions of this Study

This study has contributed to the literature on classroom interventions for off-task behavior of students with ADHD in multiple ways: (a) this study shows that physical activity interventions can have a positive effect on decreasing off-task behavior and increasing on-task behavior for the target participant, (b) it shows a personalized intervention for a single student,

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and (c) it gives specific examples of on-task and off-task behaviors for a specific student diagnosed with ADHD.

First, this study shows a positive correlation between access to use of a physical activity and an increase in on-task behaviors of a specific student with ADHD. This contributes to previous research by showing the potential for physical activities to increase on-task behavior for students with ADHD. Additionally, choice was an important aspect of this study as Madison was able to pick her physical activity.

Second, this study is important for literature on ADHD interventions because of its focus on one student. Instead of making wide generalizations about all children with ADHD, this study looks at the difference a personalized intervention system can make for a specific student. Every student with ADHD is different and all methods will not work for all students.

Third, instead of simply giving generic definitions of ADHD, this study focused on helping a student decrease her specific off-task behavior and increase her on-task behavior. Rather than say a student with ADHD fidgets, this study explains Madison's specific off-task behavior including "running fingers through hair, tilting head and shaking back and forth, or tilting forward and using her hair to block vision."

Limitations and Recommendations for Future Research

A first limitation of the study is the absence of an experimental design allowing experimental control. This limits the ability of the researchers to prove the intervention was solely responsible for a child's possible change in behavior. A future study could include more participants where the same physical activity intervention was introduced to all participants though a different research design. This design could allow for experimental control and could potentially determine if the effects could be replicated in additional students with ADHD.

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The small sample size of one student could be seen as a second limitation. This limits the researchers' ability to make generalizations about other students with ADHD. However, making generalizations about large populations is not the purpose of an AB research design; it instead seeks to focus on one individual. Again, this study could be repeated in the future with entire class or with several students diagnosed with ADHD. In a study with multiple students, each student could be given the same physical activity intervention or each student could choose his or her physical activities.

A third limitation is the use of the practicum student teacher as the primary data collector and interventionist. This does not allow the use of this intervention by a typical classroom teacher, and does not that this teacher would be able to implement these intervention strategies throughout the school day. A recommendation for a future study would be to include the classroom teacher as a data collector and interventionist. In this way, the teacher would be able to implement these strategies more often. This would also allow the student to do the physical activity more often and during different times of the day and week.

A fourth limitation is that an emotional component is lacking; this study only looks at intervention as opposed to other aspects including the emotional burden of being singled out. A recommendation for future research would be to include all students in a classroom in the intervention phase physical activity. An additional recommendation would be for the researchers to utilize interviews to learn more about the perspectives of other students in the classroom.

A fifth limitation of this study is that it does not teach the participant valuable long-term skills and self-advocacy. For future research, the participation of the student in the physical activity could be monitored over a longer period of time. Additionally, the researcher could train

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the student to monitor her own use of the squishy toy and observe the student's independent use of the toy.

A sixth limitation was that academic achievement was not measured as a part of this study. A future study could include data on the participant's academic performance during the baseline phase and the intervention phase.

Implications For Practice

Several implications for practice can be suggested by the results of this study. First, physical activities as interventions for off-task behavior have been modeled through this study. Teachers or administrators who are interested in using physical activities to promote on-task behavior could refer to this study while planning similar interventions. Students with attention difficulties could be allowed to participate in physical activities to see if these activities positively affected their on-task and off-task behaviors. Additionally, physical activities could be implemented on a classwide or schoolwide level which could include activities such as kneading Play-Doh, squeezing a squishy ball, or sitting on balance balls during appropriate times of the day. As outlined in this study, students could be taught how to do the activity including any rules that go along with the activity to minimize distractions and maximize learning for all students. Educators interested in implementing a similar program might look to creating class-wide or school-wide intervention plan that could involve many more students. A second implication, as suggested by the classroom teacher through her social validity questionnaire, is that for future practice with an individual student, the physical activity could be explained to students who are not included in the physical activity. This would alleviate confusion and excitement over certain students being allowed to participate in a specific activity while others are not. It could be

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explained to students that the student who is participating in the activity needs to do so because it helps the student pay attention.

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Appendix A: Menu of Physical Activity Choices

Choices:

- Zebra stress ball
- Softball stress ball
- Play-Doh of different colors
- Squishy Princess toy

Discussion of expectations based on choice:

Before she chooses: "You can choose any of these items: Plah Doh, the Zebra, the baseball, or the squishy doll. But, no matter which one you choose, there will also be rules about what you can do with it. It is to help you pay attention in class so you have to be able to listen and respond to Mrs. _____ while using it. We want to help you pay attention, so you can't play with the toy in ways that will make it harder for you to pay attention."

If she chooses:

Plah Doh- "You can hold the Play-Doh still, sit it on your desk, sit it on your desk and push it down a little bit, or roll it around in your hands. But, you still have to be looking at Mrs. _____. Whenever she asks the class a question, or asks the class to say something, you have to answer back. You can't make shapes out of it, throw it around, share it with other kids, or distract other kids with it."

Stress balls and squishy ball- "You can hold it in your hands but you can't bounce it or throw it around. You still have to be looking at Mrs. _____. Whenever she asks the class a question, or asks the class to say something, you have to answer back. You also can't share it with other kids or distract other kids with it."

After she chooses: "Can you tell me what the rules are?"

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Appendix B: Student Interval Recording Sheet

IOA: Y / N (IOA Score = _____)

Date:	Problem Behavior:
Student Name (pseudonym):	Replacement Behavior:
Session:	
Recorder:	

	Replacement Behavior
Date:	
Session:	
Time in min & s	+ = Behavior occurred 0 = Behavior didn't occur
1:00	
2:00	
3:00	
4:00	
5:00	
6:00	
7:00	
8:00	
9:00	
10:00	
Total	
Percent	

	Problem Behavior
Date:	
Session:	
Time in min & s	+ = Behavior occurred 0 = Behavior didn't occur
1:00	
2:00	
3:00	
4:00	
5:00	
6:00	
7:00	
8:00	
9:00	
10:00	
Total	
Percent	

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Appendix C: Intervention Fidelity Checklist

Observer: _____(Name Removed)_____

Session:	7 (Intervention)						
Date:	10-14-13						
1. Gives student menu of physical activity choices	+						
2. Instructs student on physical activity	+						
3. Gives student the opportunity to do the activity during teacher-centered instruction	+						
4. Collects data during the student's use of physical activity	+						
Total Correct Steps:	4/4						
Percent Accurate:	100%						

+ = Step performed correctly

- = Step not performed or performed incorrectly

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Appendix D: Teacher Participant Social Validity Questionnaire

Teacher Participant Social Validity Questionnaire

1. How many years have you taught? How many years teaching your current grade?

27 total 21 (I think)

2. What teaching licenses do you currently hold? Circle/list all that apply.

Elementary (K-5/K-6) PK-4

Special Education: List category _____

Other Masters in reading education

3. To what extent do you believe the physical activity intervention improved your student's on-task behavior? Please explain.

No	1	2	3	4	5	Extreme
Change	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	Change

She was able to stay focused for longer periods of time.

4. Did the intervention impact the student in other ways? Please explain.

No	1	2	3	4	5	Extreme
Change	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	Change

Children were excited and at times a bit crazy about her having something that they didn't.

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5. Was there a change in the behavior of the other students in your classroom?
Please explain.

No	1	2	3	4	5	Extreme
Change	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	Change

Please see comment on # 4

- Do you plan to continue using physical activity intervention for this student or other students with ADHD in the future? Why or why not?

Definitely will	1	2	3	4	5	Definitely
not use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	will use

Yes, it really seemed to make a difference!

6. What changes would you make to this intervention strategy?

None other than possibly explaining to the remainder of the class why it is okay for her to hold a toy.

7. Please list any other comments you find relevant.

I enjoyed watching this intervention activity unfold. The results were interesting 😊.
Thank you!

Appendix E: Student Social Validity Questionnaire

1. Did you like working with the JMU student?



2. Did working with the JMU student help you have better behavior?



3. Did your activity help you focus better?



4. Did your activity interrupt the lesson?



5. Did you like learning this way?



6. Do you want to keep doing the activity in class?

