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Physical Activity and Time-on-Task

Lisa Mouw

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Physical Activity and Time-on-Task

by

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Physical Activity and Time-on-Task

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Table of Contents

List of Figures

Abstract

This action research project explored the effects of physical activity to time-on-task. The participants in this study were 24 sixth grade students in a language arts classroom at a PK-8 Christian elementary school in the mid-western states. Students were observed to determine time-on-task for the first twenty-five minutes of class. A no-treatment period was observed in order to create a baseline, followed by a treatment period to demonstrate any increase or decrease in overall time-on-task. Three-minute activity breaks were implemented at the beginning of the class time during the treatment period. These breaks included a combination of cardio- and skill-based exercises. A trained observer used a running record to note time-on-task data for each student. The students were also surveyed following the observation period. The survey results reflected a positive attitude toward the activity breaks. The results of this study indicated an improvement to overall time-on-task as a result of implementing the activity breaks. Due to the positive results, both quantitative and qualitative, the teacher in this study continued the implementation of activity breaks following the observation period.

School reform over the past 20 years has included several changes that have impacted the classroom environment and student achievement. These changes include differentiation (Tomlinson, 1999), increased standards expectations (Daggett, 2010; Jones, 2000), standardized testing (Jones, 2000), and inclusive education shifts (Hegarty, 1997). Some of these changes, such as differentiation and program shifts in inclusive education, have been positive in seeking to meet the needs of individual learners (Hegarty, 1997; Tomlinson, 1999). Other changes, such as the role of physical activity in schools, have received both positive and negative attention. As researchers gain insights into how the body functions most efficiently, a better understanding of the link between mastering standards and the role of physical activity is being clarified.

Our bodies need basic levels of nutrition, sleep, and movement to complete daily tasks well (Jensen, 2005). Physical education classes, recess times, and classroom activities are often limited in order to increase time in "core academic areas," such as math, science, and language arts (Nash, 2011; Ratey, 2008; Sibley & Etnier, 2003). Students are often expected to sit and listen for long periods of time, drastically decreasing their focus and engagement in learning. Instead of increasing learning through increased seat time, students are actually less efficient because of the lack of activity, which is needed to make the necessary brain connections for focus and learning (Zoeller, 2010). "Cutting off exercise—the very activity to promote cognitive performance—to do better on a test score is like trying to gain weight by starving yourself" (Nash, 2011, p. 36).

Exercise provides an unparalleled stimulus, creating an environment in which the brain is ready, willing, and able to learn (Nash, 2011; Ratey, 2008). Exercise also provides the necessary oxygen and glucose needed to fuel the brain (Nash, 2011). The mind and body were once believed to be completely separate functions; however, studies now indicate that they are very much connected (Ratey, 2008; Hannaford, 1995).

Movement is an area that has been studied in relation to attention and time-on-task in the classroom, as well as overall cognitive function and achievement (Donnelly & Lambourne, 2011; Jensen, 2005; Sibley & Etnier, 2003). Physical activity, along with other brain-based adaptations, can be increased in the classroom setting to enhance cognitive function and time-on-task.

Recent studies have investigated the benefits of physical activity to academic achievement and/or cognitive function in order to justify the need for physical education programs (Sibley & Etnier, 2003). It is widely accepted that physical activity has a positive impact on overall cognitive function (Zoeller, 2010). There are many educators that also believe that physical activity has a positive impact on concentration in the classroom (Sibley & Etnier, 2003). Nash (2011) connected increased diagnoses of ADHD to decreased physical activity; feet work is being replaced with additional passive learning experiences (seatwork). Students, including those with attention issues, have found other ways to off-set the passive classroom environment by taking longer or even unnecessary restroom or drink breaks, by taking the long route to turn in papers or to sharpen pencils, or by causing distractions in class to fulfill stimulus and movement needs within their bodies (Nash, 2011).

Changes have taken place in many classrooms as a result of these findings. Some examples include using exercise balls as chairs in the classroom (Bill, 2008), incorporating movement through instructional strategies (Marzano, Pickering & Pollock, 2001; Reed, 2009), and supplementing physical education classes by implementing exercises on non-physical education days in the classroom (“Do Short Activity Breaks in the Classroom Work?”, 2013).

Research studies have also identified physical activity as a cause for neurological connections and chemical changes that have been shown to improve cognitive functions (Trudeau & Shephard, 2009). Brain research indicates that the brain has plasticity, or the ability to adapt and change over time (Wilmes, Harrington, Kohler-Evans, Sumpter, 2008). "Many researchers now consider environmental influences to be more significant than hereditary factors influencing the overall function of the brain. These findings have considerable implications for educators as they directly affect pedagogical strategies used in the classroom" (Wilmes, et al., 2008).

As the body of knowledge increases concerning how the brain functions, it becomes essential for educators to be informed and current on what is being discovered and its impact on the classroom environment and instruction (Tremarche, Robinson & Graham, 2007).

> Brain research is here to stay and educators have a professional responsibility to examine the research and utilize the information for application within the classroom…It is critical for all educators to acquire a scientific understanding of brain mechanisms. Without this knowledge base, educators may not be able to be as actively involved in the decision-making process; ultimately having a profound effect on students (Tremarche, et al, 2007, p. 2).

While there have been a growing number of research studies and explorations made in connection with physical activity and the brain, there is certainly much yet to be discovered. Programs noted in this study have been implemented in classroom settings. Some have been more successful than others, due to any number of factors such as social demographics, environment, duration, and the types of activities being done.

Some areas needing further study are the effects of shorter durations of physical activity, as well as which combinations of physical activity are most effective for specific groups, and whether or not the time of day plays a role in the effectiveness of the physical activity. Middle school students (grades 5-8) have also not been studied specifically in regard to the effect of activity breaks to time-on-task. The purpose of this project is to explore how brief physical activity breaks involving both cardiovascular and skill-based movements impact time-on-task in a sixth grade classroom.

Purpose

The purpose of this study was to explore how physical activity impacts time-on-task. The following overarching research question will be addressed.

Research Question

1. How will the implementation of physical activity breaks impact time-on-task in the classroom?

    a. Will the three-minute duration of the activity breaks increase time-on-task?

    b. Will the selected cardiovascular and skill-based exercises increase time-on-task?

Definition of Terms

For the purpose of this research study, the following definitions will be used. The definitions provided are those of the researcher unless otherwise noted.

Brain-based activity: an activity that affects brain function.

Brain buttons: a Brain Gym exercise consisting of placing one hand over the naval, while the other hand stimulates points between the ribs (Hannaford, 1995, p. 118).

Brain connectivity: the neurological connections that take place for cognitive function.

Cognitive function: the brain's ability to take in, organize, and apply knowledge or information.

Cross-lateral: a movement that moves across the mid-line of the body, activating both hemispheres of the brain, such as the Cross Crawl, a Brain gym exercise, placing a hand on the opposite knee in a repeated and/or alternating movement (Hannaford, 1995, p. 81, 119).

Focus/attention: the ability to keep attention on information shared or on a given task.

Hook-up: a Brain Gym exercise consisting of crossing legs in standing position, crossing hands, linking them, then twisting up help at the chest level. The tongue is positioned at the roof of the mouth, which is intended to bring attention to the mid-brain, connect emotions in the limbic system of the brain, and also to aid in balance. (Hannaford, 1995, p. 120)

Neurogenesis: new brain cell growth (Jensen, 2005, p. 11-12).

Plasticity: the brain's ability to be flexible, or molded by input. The more it is used, the stronger and more flexible it becomes (Ratey, 2008, p. 35-36).

Time-on-task: the ability to focus or keep attention on information shared or on a given task.

Literature Review

Neurological and Physical Connections

Studies have taken place over the past decade linking neurological connections and physical activity. Jensen (2005), shared that brain research has been “explosive and hopeful” for more than a decade. “We have discovered that exercise is strongly correlated with increased brain mass, better cognition, mood regulation, and new cell growth” (Jenson, 2005). Further, new cell growth can be enhanced or impaired by experiences and activities: neurogenesis. With increased access to technology, such as MRI (magnetic resonance imaging), PET (positron emission tomography), and NMRI (nuclear magnetic resonance imaging) machines, brain research is no longer limited to animal and post-mortem brains for analysis (Gozuyesil, Dikici, 2011; Tremarche, et al, 2007).

Jensen (2005) pointed out how our experiences and actions lead to changes in our brains. While once believed to be an area of our bodies that could not regenerate or grow new cells, the brain has been proven do so through exercise and other activities (Ratey, 2008). This concept of plasticity increases and highlights the opportunities for the brain to learn and grow (Ratey, 2008; Wilmes, et. al., 2008). The limitations of previous understandings about the brain’s ability to grow and adapt, no longer hinders educators in providing experiences that take advantage of these opportunities for cognitive growth in students through the integration of physical activity in the classroom.

Research Studies

Scientific research also confirms that physical activity has a positive influence on human brain health and function (Dishman, Berthoud, Booth, Cotman, Edgerton, Fleshner, Zigmond , 2006). Physical activity strengthens the basal ganglia, cerebellum, and corpus callosum -- each essential areas of the brain (Jensen, 2005). Exercise also fuels the brain with oxygen and increases brain connections between neurons, and has been known to increase neuron growth (Jensen, 2005). Research studies also suggest that amine levels in the brain, which are connected to focus and attention, increase with physical activity (Jensen, 2005).

Relating to the benefits of physical activity to cognitive function, there have also been studies connecting obesity to cognitive function and academic achievement. Six of the seven studies done showed a negative effect of a higher BMI (body mass index) and academic achievement. (Donnelly & Lambourne, 2011) "The relation between fitness, fatness, and academic achievement provides a unique opportunity to use physical activity as an intervention that may impact the health and academic achievement of children simultaneously" (Donnelly & Lambourne, 2011, p. S38).

Studies have been done to explore the effects of physical activity on people of all ages and demographics, including students with physical disabilities and attention disabilities (Nicholson, et al., 2010; Verret, Guay, Berthiaume, Gardiner, & Béliveau, 2010). Participants in a study focused on physical disabilities and cognitive ability were found to have a lower overall cognitive function. It was noted by the researcher that those who have physical disabilities have limited access to opportunities to participate in physical activities in school (Nicholson et al., 2010).

Thought there are no conclusive results, but there is a lot of evidence to support the hypotheses that connect physical activity to increased cognitive function. Studies have explored oxygen saturation and angiogenesis in the brain, increased neurotransmitters shown through EEG testing, and also the BDNF, brain-derived neurotrophic factor, demonstrating neurotrophins (Ploughman, 2008). “BDNF gives the synapses the tools they need to take in information, process it, associate it, remember it, and put it in context” (Ratey, 2008). All of these provide valuable insights into the cognitive benefits of physical activity.

Furthering ideas about brain connections, Ploughman (2008) provided information about these neurological elements and processes being discovered and explored: “Neurotransmitters such as serotonin and norepinephrine, facilitate information processing” (p. 237). Neurotrophins are proteins that are regulators of neurons during development, but can also protect and even restore injured or aging neurons. What was previously thought to be irreparable and irreplaceable, neurons can be repaired and replaced as recent brain research indicates (Jensen, 2005; Ratey, 2008). BNDF is the brain-derived neurotropic factor which “supports neuronal survival and differentiation of neurons in a developing brain as well as synaptic machinery in the adult brain” (Ploughman, 2008, p. 237). The increasing knowledge about neurons encourages further explorations into what types of activities may foster a growth in brain connectivity.

“The influence of physical activity in the developing brain is promising area of research that could benefit children with physical and cognitive impairments” (Ploughman, 2008, p. 237).

A meta-analysis was also done confirming the positive relationship between physical activity and cognitive and academic performance (Sibley & Etnier, 2003). Ploughman (2008) cautioned that while IQ and socioeconomic status may confound the connection of physical activity to overall cognitive and academic performance, the results of the meta-analysis (Sibley & Etnier, 2003) are convincing.

Many physical activities have been studied in various contexts from 30-45 minutes physical education classes to traditional classroom settings, but also go beyond the walls of schools ("Do Short Activity Breaks in the Classroom Work?", 2013; Kubesch, et al., 2009; Verret, et al., 2010; Nicholson, Kehle, Bray & Van Heest, 2010). Those using these physical activity exercises to foster brain connectivity have included individuals with special needs as well as individuals ranging from infancy to the elderly.

Sibley and Etnier (2003) examined studies focused on overall cognitive function as a result of physical activity. Their research noted that the physiological mechanisms in the studies examined explain how increased blood flow, alterations of neurotransmitters, structural changes to the nervous system, and modified arousal levels occur because of physical changes that take place during exercise. However, the review of these studies was inconclusive regarding the connection between physical activity and cognitive performance.

Arousal is another related element of a person's ability to focus attention. In examining the relationship between physical activity, brain health, and academic performance of school-aged children, studies indicated that a moderate arousal increases a person's immediate attention through the increase of neural activity in the reticular formation of the brain (Trudeau & Shephard, 2009).

Electroencephalagraphy (EEG), a simple measure of arousal levels from certain physical activities and the release of chemicals in the brain such as serotonin, has mixed results in terms of the effect of arousal on learning. Repetitive exercises like walking or moderate jogging generally have a calming effect on the brain, which can aid in concentration and lowering stress levels. In relation to the concentration of neurotransmitters, the initial level of arousal determines whether or not they will facilitate or hamper learning. One study revealed that fifteen minutes of walking and stretching increased concentration for students in grades 2-4 (Trudeau & Shephard, 2009). Additional studies also indicated a positive impact on academic performance, concentration, and on-task behavior ("Active education: physical education, physical activity, and academic performance", 2007).

In order to create arousal to gain and maintain attention, Ratey (2008) suggested doing an aerobic activity and then a skill-based activity, or doing a complex activity (such as tennis) that combines both. He noted that aerobic exercise elevates neurotransmitters, new blood vessels and cells. The skill-based activity strengthens and expands the networks using the growth from the aerobic activities (Ratey, 2008). A study done on rats showed a 35% increase in the BDNF when comparing those who simply ran versus those who did a more skill-based acrobatic aerobic activity (Ratey, 2008).

In a study of exercise and cognitive function, researchers found that vigorous rather than moderate exercise levels resulted in overall higher grades for the sixth grade student participants (Zoeller, 2010). The study also identified a combination of aerobic and strength activities had the best results (Zoeller, 2010).

Studies on the Impact of Physical Activity

A study on increased physical activity for students with ASD (Autism Spectrum Disorder) found that attention and engagement in the classroom following a 12-15 minute physical activity increased. When the treatment stopped, the levels of attention and engagement returned to levels before treatment was administered. This study did not address varying durations of the administered physical activity (Nicholson, et al, 2011).

The growing number of diagnosed cases of ADHD (Attention Hyper Activity Disorder) in students has brought about many studies of how best to remedy symptoms for those dealing with this disorder, especially in the classroom setting. As more is discovered about physical activity and the benefits to cognitive function, researchers are beginning to explore how this information might benefit those with ADHD and other attention disorders. The results of one study indicated increased information processing as well as sustained attention following the exercise treatments, while not showing an increase in achievement based on test scores (Verret, et al 2012). While this study was conducted to highlight students diagnosed with ADHD, much of the research referred to in this study confirms much of what Jensen (2005) and Ratey (2008) have concluded about the cognitive benefits of physical activity for those who do not have a mental disorder or impairment (Verret, et al., 2012).

Studies dedicated to investigating the role physical activity plays in student focus, cognitive function, and academic achievement have brought attention to and interest in programs and activities that can be used in the classroom setting (Donnelly & Lambourne, 2011; Ericsson, 2008; Ploughman, 2008; Sibley & Etnier, 2003; Tremarche, et al, 2007; Trudeau & Shephard, 2009; Zoeller, 2008;). The need or desire for opportunities to implement physical activity in the classroom setting has grown due in part to limitations brought on by other educational reforms.

Increasing standards and accountability for student achievement, through measures like the "No Child Left Behind" Act, have resulted in decisions to decrease recess time by an average of 50 minutes per week in participating schools, as well as a decrease in physical education time (Jarrett, 2013; Thomas & Jacob, 2011). Some schools, such as one in Atlanta, have even been built without a playground. One Atlanta superintendent even commented, "We are intent on improving academic performance. You don't do that by having kids hanging on the monkey bars" (Jarrett, 2013).

However, other school leaders are finding that there is more need for recess than ever before. Some Atlanta area schools that previously created policies against recess, have since reinstated recess into the school schedule (Jarrett, 2013). A high school in Vermont has implemented a 15-minute recess break for its students and both students and teachers have found this to be beneficial to student focus and attitude (Atkins, 2015).

A researcher at Iowa State University studied activity breaks in the elementary classroom that had positive impact on students' overall cognitive ability. In his study, students were given a cognitive function test while sitting at seats. After participating in a moderate physical activity, students demonstrated improved cognitive function (Curtis, 2015).

Programs and Approaches

Many programs have been and continue to be implemented in schools with goals of increased physical fitness, attention/focus, and overall academic achievement (Allen, Nicklesen, & Zgonc, 2010; Hannaford, 1995; Jensen, 2005; Marzano, et al, 2001; Nash, 2011). The overall goal in each of these programs was to heighten a student's ability to focus and learn.

Marzano (2001) suggested time limits for direct instruction (ex. sixth grade = 12-15 minutes) in addition to meaning-making instructional practices to allow for this complex process of learning to occur for students. In addition, Marzano suggested that educators implement other changes to allow for a comfortable physical/social environment to encourage engagement and learning.

Jensen (2005) noted several activities to “purposefully integrate movement activities into everyday learning” (p. 66). The activities vary from walking while sharing, to role-playing and quick games to energizers increasing blood pressure and epinephrine levels to combat drowsiness and/or restlessness. The activities include skill and coordination-based movement in cross-laterals and stretching. Cardiovascular activity for high energy are recommended, then stretching or skill-based activity for calming (Jensen, 2005).

Movement and brain cycle scheduling are important aspects to keep in mind when planning instruction. Because students may feel drowsy or restless at certain points of their brain cycle, Jensen (2005) recommended that teachers allow for their students to get up and stand at the back of the room to move or stretch quietly before returning to their seats to continue the learning activity. This freedom increases overall productivity for each student, as cycles do not happen at the same time for all members of the class.

In addition to simply allowing time and flexibility for students to move or stretch, some programs provide more structured plans for movement during and between focused learning time. One such program, *Sensory Diet,* is defined as a carefully designed, personalized activity plan that provides the sensory input a person needs to stay focused and organized throughout the day (Wilbarger, 2002). *Sensory Diet* activities have been commonly used by occupational therapists in and outside of the school setting. Occupational therapists and educators (Eisner, 2012; Henry, 2009; Nackley, 2001) who desire to implement these types of activities are encouraged to use a combination of various gross and fine motor exercises along with those that foster midline crossing, as well as calming exercises throughout the day in order to function well in each task. Depending on the circumstances and goals in mind, certain physical activities will be more effective than others. The *Sensory Diet* approach is very flexible in implementation, providing a variety of activities and combinations, all of which can be completed in brief amounts of time.

Hannaford (1995) suggested a movement plan to be used between learning sessions or classes that includes both physical exercise and stretching. Hannaford (1996) stated that movement "anchors" thought, allowing for processing of information and skills to happen. Hannaford implemented *Brain Gym* techniques, reporting that her students were more attentive and also scored higher in reading, writing, and math testing and overall grades. Hannaford (1996) stated that these activities stimulate the production of neurotrophins released at the synapses of the nerve cells, causing the growth of dendrites, leading to increased overall brain connections. Her explanations are consistent with the work of Jenson (2005) and Ratey (2008).

The Brain Gym ™ program emphasizes "activating the full mind/body function through simple integrative movements, which focus on specific aspects of sensory activation and facilitate integration of function across the body midline" (Hannaford, 1995, p. 112). One learning readiness sample routine includes the following exercises: The first exercise is called Brain Buttons. This movement is said to create alertness through attention to the gravitational center of the body, alerting the vestibular system, further stimulating blood flow and oxygen to the brain. Students who participated in this exercise noted an increased alertness.

The second exercise in the routine is the cross crawl. When done slowly, the author suggested that it increases fine motor involvement, which results in brain connections in the frontal lobe, the basal ganglion, and the cerebellum.

The third exercise in the sample routine is the hook-up movement. This exercise, when held for two or more minutes was said to help lower stress levels and bring clarity to the mind.

Another *Brain Gym* exercise serves to refocus and reenergize a person during a longer work/learning session. It includes a series of stretching and breathing movements that are said to activate the vestibular system mentioned previously (Hannaford, 1995). Other *Brain Gym* exercises foster writing ability, memory, as well as both visual and auditory learning (Hannaford, 1995).

Prepping the Brain for Learning is another physical activity approach to helping students make the most of learning experiences by providing activities that foster brain connections. These activities vary from building and activating background knowledge, storing and retrieving information, making learning meaningful to addressing more biological factors such as environment, nutrition, and movement (Allen, et al, 2008). Allen et al., (2008) confirmed that neurological research has explained why many activity-focused and brain-based approaches have been successful.

Physical activity can be purposed for classroom use to improve overall learning (Allen, et al, 2008). Hannaford, as cited in Allen, et al (2008), stated that 85% of school-age children are kinesthetic learners, emphasizing the importance of incorporating kinesthetic learning activities into the classroom. Examples of kinesthetic activities include touching, manipulating, and moving as new information is processed (Allen, et al, 2008).

Cross-lateral activities are kinesthetic movements allow for movement across the mid-line of the body. Midline activities are particularly helpful for tracking while reading, but have not been directly connected to focus and attention. However, an increased ability to take in information through reading could lead to more time-on-task (Allen, et al, 2008).

Brain breaks are described as opportunities for students to do a kinesthetic activity while reviewing/processing new information just given (e.g. walking around the room while saying vocabulary words). Any activity where interaction and movement take place gives students a chance for a brain break, allowing them to stand up, move, and engage in the learning (Allen, et al, 2008).

While many of these approaches have been used with success in the classroom setting, there are concerns and cautions to consider. McCall (2012) shared her evaluation of some programs or approaches circulating through schools. While *Brain Gym* exercises may be helpful in getting students moving, this exercise program is too simplified in its explanations and rationale for how and why these are helpful. McCall (2012) further explained that these exercises are “being presented with pseudoscientific assertions that contradict scientific concepts and may mislead children concerning the workings of their bodies” (p. 43). McCall also challenged educators to find out what is truth and what is myth regarding brain research.

Worden, Hinton and Fischer (2011), further stated that, “Ignoring important findings from educational neuroscience can be just as dangerous as uncritically embracing brain-based products or interventions.” Educators and parents need to be more knowledgeable about how to “distinguish legitimate findings from misinterpretations and neuromyths” (Worden, et al, 2011).

While neither McCall (2012) nor Worden (2011) conducted a research study, their analysis of the studies and programs being done and the cautions shared, encourage educators to critique and thoughtfully consider what information to apply to the classroom setting. Real learning takes a lot of work and concentration and is a complex process (Jensen, 2005). Educators need to do all they can to remove distractions and hindrances and provide preparations to foster the most effective learning possible.

An issue to be addressed in further study of the connection between physical activity and the brain would be the effect of duration and intensity level of the exercises implemented. One meta-analysis exploring this issue indicated that activity levels that benefit cognition may not necessarily be as intense as those levels required to increase cardiovascular fitness (Ploughman, 2008, p. 238). The one area that some studies suggest may be affected by intensity is the executive performance of the brain, because of increased neurotransmitter levels (Ploughman, 2008).

Neuroscience research has opened a floodgate for studying what impacts the learning process and how we approach learning in the classroom. Jensen (2008) encouraged educators to be knowledgeable about the current findings, to apply it to the classroom and to share what we have learned with our students. “While brain research alone can’t tell us how to teach children, understanding the brain leads to uncovering underlying learning mechanisms” (Worden, et al, 2012, pg. 10) The connection of learning and movement has been widely accepted in the lower elementary grades, yet the neurological connections that have been demonstrated from and connected to movement impact the brain throughout life (Jensen, 2005; Ploughman, 2008).

There is still much to be learned in order to fully understand the connections of physical activity and the brain. Each study and discovery provides more knowledge and insight for those in both the medical field and those in education. Educators have a unique and important role in exploring, critiquing, and determining application in the classroom as a result of these findings and information.

Methods

Participants

The participants in this study were 24 sixth graders at a private school in a rural area of Northwest Iowa. Twenty-three students were Caucasian and one student was African-American. One student received daily medication for a diagnosis of Attention Deficit Disorder (ADD). One student has Juvenile Arthritis (JA) that may have limited his ability to participate in the exercises from day to day. No students were on a formal modified learning plan; however, 25% of the class received small group or one-on-one intervention when needed.

Materials

Activities performed during the 3-minute break periods were chosen from the *Sensory Diet* and *Smart Moves* resources, as well as chosen by the researcher based on the level of cardiovascular or skill-based characteristics. (See Appendix A for a complete listing of exercises and descriptions).

No materials were needed to perform the exercises being used in this study. The students needed a two-foot by five-foot space within the classroom to do each movement. The students remained in the same seating arrangement throughout the study.

The measurement tool used was a running record that identified whether or not a student was on-task based on behaviors exhibited (See Appendix B).

Research Design

This study measured time-on-task after a three-minute activity break consisting of two minutes of cardiovascular exercise and one minute of skill-based exercise. The cardiovascular exercises used in this experiment were one minute of running in place, followed by thirty seconds of jumping jacks and thirty seconds of floor mountain-climbers. The skill-based exercises were thirty seconds of cross-crawls and thirty seconds of hook-ups (Hannaford, 1995).

Data was collected over a three-week period, four days each week. The first week data created a baseline with no treatment. The treatment was implemented during the remaining two weeks. The exercises were done following a forty-minute instruction period, before a second forty-minute instruction period began. Two days each week, the treatment time was 9:20 A.M. The remaining treatment times were at 11:05 A.M. each week.

Observations of each student were made in four 5-minute intervals following the exercises. Participants were given a score, as noted in Appendix B, indicating his or her level of time-on-task. Comments were also made regarding any specific information about what the student was doing at the time of the observation as well as any redirections students needed outside of the 5-minute interval recordings. The observer also recorded general comments about classroom activities and overall classroom climate following the activity breaks.

A trained observer measured time-on-task every five minutes for twenty minutes following the treatment each day, during regular instruction time. Time-on-task was measured by observed characteristics such as participation, following instructions, and eye contact. The trained observer also noted any redirections that took place during the 20-minute time period and recorded general observations about focus, climate, and tasks or activities being done. This observer was an administrator in the school and makes regular appearances in the classroom and common areas of the building, so the students would not have been influenced by his presence in the back of the room.

Results

Data Analysis

After the implementing and observing of the effects that the exercises had for time-on-task, the activity breaks were found to have some effect on overall focus of students participating in the study. The participant group did improve time-on-task by more than 1 standard deviation during the treatment period. The total possible score for each student was eight per twenty-minute observation period, with a total possible score of two points for being completely on task and engaged for each 5-minute interval. The class average improved from 6.67 to 7.74 between the pre-treatment and post-treatment periods (See Figure 1).

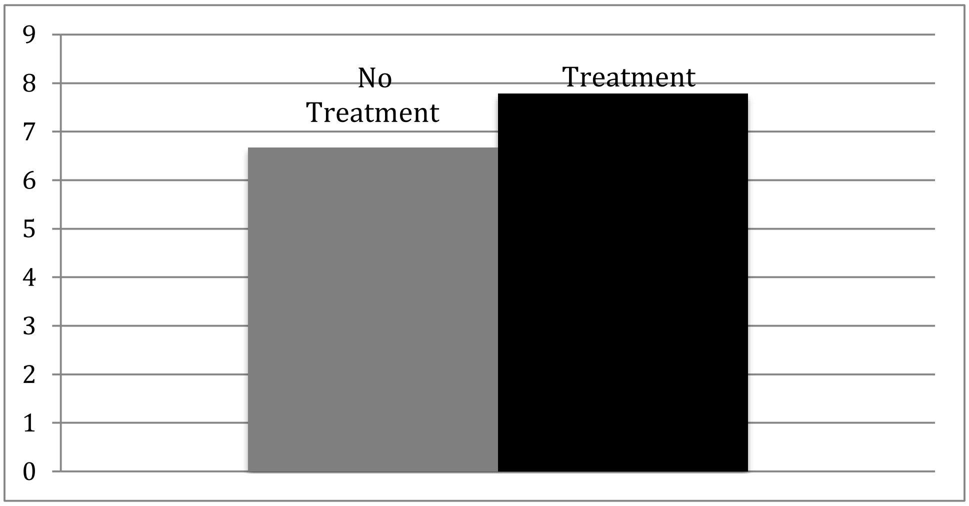

Figure 1: Bar graph showing the comparison of the class average for time-on-task before and during the treatment period.

The 9:25-9:45 observation period was found to be less effective than the 11:10-11:30 observation period (See Figure 2).

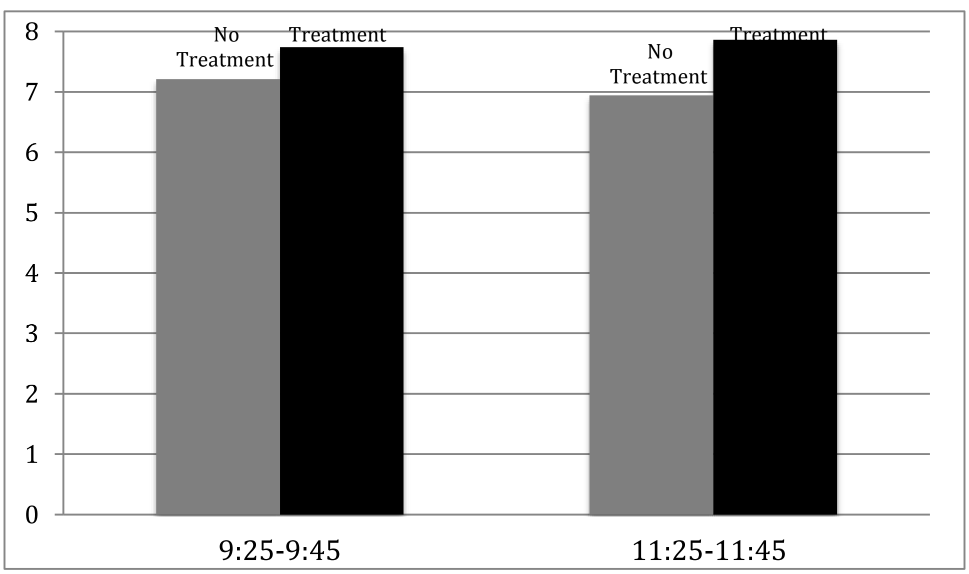

Figure 2: Bar graph showing the comparisons of the time periods before and during treatment.

The improvement in overall time-on-task for the boys was greater than for the girls, increasing by 1.87 average after treatment compared to an increase of .42 average increase for the girls after treatment (See Figure 3). This is likely due to the fact that many of the girls were already on-task prior to treatment and did not have much room for an increase in time-on-task.

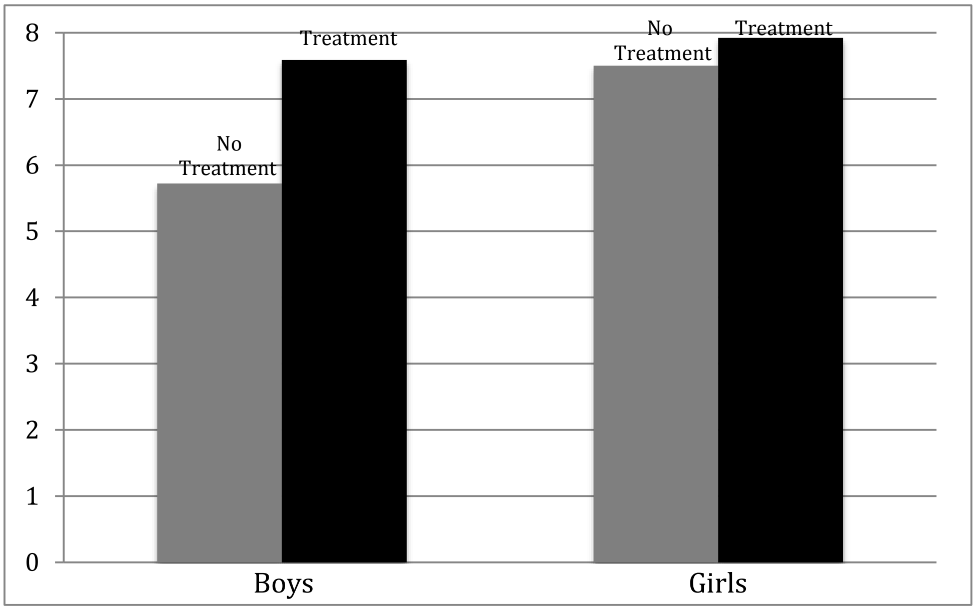

Figure 3: Bar graph showing the comparison between girls and boys before and during treatment.

The student who is on medication for ADD improved after treatment at a similar rate as others in the group who scored at or near the same no-treatment score. Those who benefitted most from the activity breaks were those who struggle with attentiveness overall; however, these students also had the most room for improvement from no treatment to the treatment period.

Students needing redirection were considered as data was analyzed. During the second week of the implementation, students needing redirection dropped by nearly half from 13 redirections in the first week of implementation, and only 8 in the second week. Six students needed repeated redirection on the first day of treatment and on the final day there were only two students needing redirection.

Findings

The first research question addressed whether or not 3-minute activity breaks increase time-on-task for sixth grade students. The research data indicated that there is an increase of time-on-task. Those who benefitted most from these activities were those who were less focused prior to the treatment implementation.

The second research question addressed whether or not the 2-minute cardiovascular and 1-minute skill-based exercises increasing time-on-task. The combination used in this study increased time-on-task. However, it cannot be determined whether the duration, activity types, or a combination of both factors led to the improved time-on-task.

Discussion

Summary

This study sought to determine whether or not physical activity breaks would increase time-on-task. Overall, the study results indicated that because of the physical activity breaks, the focus of students improved and the students had a positive attitude toward participating. Other sections of this grade level were aware that activity breaks were taking place with the treatment group and these students also wanted to implement the exercises into the classroom routine.

The difference in results for time-on-task between the early and late time periods may have been a result of students during the later period have had more overall passive time by this point in the day, than at the earlier time. Another variable impacting the difference in time-on-task scores may have to do with the fact that even though the students had only one academic period between the morning recess break and our structured activity break, like the earlier time period, not all students take advantage of being physically active during the unstructured recess break after the two academic periods earlier in the morning.

The students were surveyed following the observation period (See Appendix C). All 24 students responded positively to the implementation of the activity breaks in our classroom routine. Seven students stated that the exercises made them feel more relaxed, and fourteen students stated that the exercises made them feel more energized, more focused, or ready to work. Only a few students made negative comments, one noting the limited space to do the exercises, another about disliking some of the more strenuous activities, and another stating that he did not always do the exercises to the degree intended because he did not feel like putting for the effort.

The general climate of the classroom was noted by the observer as “calmer and more focused” after the activity breaks were implemented, especially in the second consecutive week of implementation. This was a significant enough improvement in addition to the increased time-on-task for the continuation of the activity breaks in this classroom setting. It has also been added to other sections of students, as well as to other times of the day in which students might benefit from a break between academic periods.

Limitations

The treatment period was limited to a three-week period. Due to inclement weather, two of the eight treatment days did not allow for activity breaks and observations to take place. However, the results indicated that breaks between treatment days did not negatively affect the time-on-task following days where the activity breaks did not take place. The exercises were still completed by the students on a fourth day during each of the two weeks, but were not observed for data.

The students remained in the same seating arrangement throughout the treatment period. Absences of students in the classroom also may have affected the overall focus and the attentiveness of specific students. Absences may also have affected the observation data, as four students were absent during one or more of the observation days.

The variety of activities that take place from one day to another in the classroom also played a role overall focus and time-on-task. Some days, the treatment period consisted of teacher-directed activities, while other days were more independent or group-based tasks. The longer the activity breaks took place, the more able the students were able to transition and stay on task.

Implications

Physical activity breaks have shown a positive effect on classroom time-on-task and climate for the group studied. Programs described in the literature review had similar findings in a variety of age levels, demographics, and formats. The brief duration along with the variety of options for exercises, and the ability to implement in small spaces of a classroom setting make this a simple program to implement in multiple classroom settings. There is little to no cost involved, as there are no tools needed, and resources are included in this study.

Beyond the classroom setting, this program could also be used for adult groups, in the workplace or educational settings, as well as in any setting where there is a need for a break from long sitting periods for any age group.

Considerations for Further Study

One question that resulted from this study is what role redirecting plays in a student's ability to remain on-task. Many students needed redirection before and during the treatment. It was difficult to determine what role the redirections should play in the overall scores during the observation period in this study. Redirecting is a part of teaching and is done in a variety of ways for groups of students and individuals in the classroom setting. Because there are many factors including seating arrangements, what activities are being done, and individual student needs, the determination of what "counts" as a redirection may vary from one observer to another.

A second question is the duration to which students are able to benefit from the exercises in remaining on task. This study only included observations for the first 20 minutes following the activity breaks. It may be helpful to have the observation period extended.

A third question that might merit further consideration is to what extent a student's participation in the exercises affected their individual focus? Most students in the study were excited about participating, but some were reluctant in certain exercises or just did not do the exercises to the degree that other students did.

A broader question for further study is what effect the activity breaks have on academic achievement? In the participant section of this study, it was noted that approximately 25% of the students needed regular assistance or reinforcement of concepts following a lesson. Data was not collected regarding which students needed assistance before and during the treatment period.

As a continuation to this study, the researcher will try various combinations of the exercises, using variations of two minutes of cardiovascular and one minute of skill-based exercises, observing and comparing the effectiveness of each combination to time-on-task. The researcher will also try the activity breaks at different times of the day with different groups of students.

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Appendix A

Activity Break Exercises

Suggested format: 2 minutes of cardiovascular, 30 seconds of skill, and 30 seconds of calming.

Cardiovascular Options *choose 2 for each activity break

- Running in place
  (optional-tapping knees or heels with hands or raising arms also)

- Marching in place with raising hands
  (optional- kicking feet out in front and raising hands upward and outward)

- Jumping jacks

- Cross jumps
  (jump out to a straddle, then in crossing feet, then back out to a straddle again)
  (optional- hands on hips, arms out, up, or alternating)

- Mountain climbers
  (push-up position, climbing by alternating feet OR standing and hop with each "climb" raising the hand with the opposite knee)

- Burpies
  (standing position with hands on hips, then hands to the floor and feet hopping downward, then back up toward hands again and stand)

- Bicycling
  (lie on back, arms by side or under head, pedaling motion with legs)

Skill-based Activities *Choose 1 for each activity break.

- Cross crawls
  (hand to knee, elbow to knee, hand to opposite heel, hand to opposite shoulder, and hand to nose)

- Crazy eights
  (Make a figure eight with arms, fingers, legs, feet, etc. Can be done simultaneously or alternating sides)

- Arm and leg circles (wide or narrow)

- Squats
  (optional- leg and arm raises)

- Crab-crawl
  (alternating leg lifts and arm lifts)
- Push-ups
  (optional- alternating arm lifts and leg lifts)

- Chair push-ups
  (forward or backward)

- Toe reaches- standing or sitting, alternating or straight up and down.

Calming Activities *Choose one for each activity break.

- Chair pulls and pushes
  (sit in chair, grab the sides of seat with hands and pull up or push down raising body)

- Wall pushes
  (lean into and push wall with hands for 30 seconds)

- Standing straddle
  (shifting weight from one leg to the other- optional raising of arms also, slow breathing with this movement)

- Hook ups
  (stand, crossing one foot over another, then cross arms and tuck them up toward chest- slow breathing in and out for 30 seconds)

- 8-7-4 breathing with hands and arms relaxed
  (8 seconds in, 7 seconds hold, 4 seconds out)

*Activities compiled by researcher's personal exercise experience and also from the Sensory Diet and Smart Moves resources.

*All activities can be done in a 2x5 foot space per student.

Appendix B

Observation of On-Task and Off-Task Behaviors

Teacher:______________________________ **Grade Level**:___________

Date:_____________ **Time**:_______________ **Subject**:_____________________

Student	Time When Sweep Began					
	9:25	9:30	9:35	9:40	Comments	Redir.
Student 1						
Student 2						
Student 3						
Student 4						
Student 5						
Student 6						
Student 7						
Student 8						
Student 9						
Student 10						
Student 11						
Student 12						
Student 13						
Student 14						
Student 15						
Student 16						
Student 17						
Student 18						
Student 19						
Student 20						
Student 21						
Student 22						
Student 23						
Student 24						

Key

0=not engaged or off-task (daydreaming, talking with or distracting others, working other tasks)
1=eye contact/listening (passive, but not off-task)
2=participating/engaging in lesson (raising hand, following instructions, doing lesson activities)

Observation of On-Task and Off-Task Behaviors

Teacher:_____________________________ **Grade Level**:___________

Date:________________ **Time**:_______________ **Subject**:_____________________

Student	Time When Sweep Began					
	11:10	11:15	11:20	11:25	Comments	Redir.
Student 1						
Student 2						
Student 3						
Student 4						
Student 5						
Student 6						
Student 7						
Student 8						
Student 9						
Student 10						
Student 11						
Student 12						
Student 13						
Student 14						
Student 15						
Student 16						
Student 17						
Student 18						
Student 19						
Student 20						
Student 21						
Student 22						
Student 23						
Student 24						

Key

0=not engaged or off-task (daydreaming, talking with or distracting others, working other tasks)
1=eye contact/listening (passive, but not off-task)
2=participating/engaging in lesson (raising hand, following instructions, doing lesson activitie

Appendix C

Student Follow-Up Survey

Name_________________ Student # _______ Date ______________

1. Do you enjoy the activity breaks we have been doing in class?

2. What do you like or dislike about doing the exercises?

3. How do you feel after the exercises, during class time?