THE IMPACT OF CLASSROOM-BASED PHYSICAL ACTIVITY ON ACADEMIC GROWTH

A Dissertation
Presented to
The Faculty of the Education Department
Carson-Newman University

In Partial Fulfillment
Of the
Requirements for the Degree
Doctor of Education
By
Lori L. McDonald

May 2018
Dissertation Approval

Student Name: Lori McDonald

Dissertation Title:

THE IMPACT OF CLASSROOM-BASED PHYSICAL ACTIVITY ON ACADEMIC GROWTH

This dissertation has been approved and accepted by the faculty of the Education Department, Carson-Newman University, in partial fulfillment of the requirements for the degree, Doctor of Education.

Dissertation Committee:

Signatures:

Mark Gonzales, Ed.D.
Dissertation Chair

P. Mark Taylor, Ph.D.
Methodologist Member

Matthew Drinnon, Ed.D.
Content Member

Approved by the Dissertation Committee Date: 3/28/18
Abstract

Teachers, administrators, schools, and school systems have been subjected to an increasing amount of accountability since the implementation of No Child Left Behind. With increasing accountability, there has also been an increase in the pressure that educational institutions feel to eliminate any programs that are not strictly academic. In many cases, this means eliminating programs that include physical activity. When children and adolescents are not participating in regular physical activity, they are more prone to obesity and obesity-related illnesses. Also, there have been many previous studies that have indicated that students that participate in regular physical activity have better grades, better attendance, and even better behavior. For these reasons, it is critically important that students are getting regular physical activity. One way to meet students’ need for physical activity is to implement classroom-based physical activity in our schools. This could contribute to improving the physical health of students and, possibly, academic performance as well. The primary purpose of this study is to determine the impact of regular classroom-based physical activity on academic growth in reading and math. A group of 166 students from 1st grade, 2nd grade, 4th grade, and 5th grade participated in this study. Student growth was measured after three weeks of traditional classroom methods that did not involve classroom-based physical activity. Student growth was measured again after three weeks of implementation of classroom-based physical activity. Growth measures were taken from STAR Math and STAR Reading assessments, as well as math and reading grade averages. Students in some grade levels demonstrated greater growth in math grade averages following the implementation of classroom-based physical activity, while other results were not statistically significant.
Acknowledgments

First and foremost, I would like to thank God for opening doors that I never thought would open for me. He has given me the strength and ability to accomplish this goal and continues to guide my path, every step of the way.

To my committee chair, Dr. Gonzales, I would like to express my gratitude for his continued support and encouragement.

I would also like to thank my reader, Dr. Rines, for his time and expertise in helping me present a final, polished product. I would also like to thank my committee member, Dr. Taylor, for his patience in helping me understand the intricacies of quantitative research.

In addition, I would also like to thank my administrative mentor and committee member, Dr. Drinnon. You have inspired me to pursue administration and have shown me the kind of principal that I want to be. As always, you have gone above and beyond to help me through this process, giving of your time when your time is so precious and limited. I cannot put into words how much I appreciate you and the job you do.

To Sharla and Britney, thanks so much for all of your encouragement and understanding through this process. You are the two greatest teammates I could possibly ask for.

To my oldest friend, Dana Nies, I would like to say thank you for believing in me so much. I often wish I could be half as great as the person you think I am. I love you.

To my friend and partner-in-crime Misty Hance. From off-road adventures and to kids in the hospital together. We have certainly been through a lot. And yet, the laughter never stops, and that keeps me going. Whether we are working in the same building or miles apart, our friendship continues to grow. You will always be the Marcia to my Jan, the Thelma to my Louise, and, someday, the Batman to my Robin.

To my sister, best friend, and proofreader, Susie Shortt, who is a constant inspiration to me. Your strength and constant positive, upbeat attitude is a reminder of whom I want to be. I love you.

Lastly, to my mom, Geri Pratt, who always steps in to pick up the slack. I would not have been able to do this without your help. Whether you are helping with laundry, cleaning, or keeping/transporting the kids, you always do so without question. Your help is always appreciated, even though I might not always say it. Love you bunches.
Dedication

This is dedicated to my precious family with which I have been so undeservingly blessed.

To my eldest, EllieAnn, my little scholar and actress. You understand me. We are like-minded. I have enjoyed all the afternoons we’ve worked on our separate projects, silently, in the same room with a Jane Austen movie on in the background. You are always my precious Jelly Bean.

To my LivyLea, my little comedian. You keep me laughing all the time. Thank you for always lightening the mood and helping me laugh at myself when the stress is getting to me. You are an amazing kid, Flippy.

To my Maxwell, my little traveler and ray of sunshine. Thank you for making me smile every day, regardless of how much stress I am under.

To Mike, the love of my life. Truly, apart from my salvation through Jesus Christ, you are the best thing God has ever done for me. I certainly don’t deserve you. You support me, no matter what. You are the best husband and father that anyone could ever ask for. You always go above and beyond for the kids and me. I could not have done this without you. I love you more than words can say.
Table of Contents

Abstract ........................................................................................................................................ iii
Acknowledgments......................................................................................................................... iv
Dedication .......................................................................................................................................... v
List of Tables and Figures ................................................................................................................ x

1. Chapter One: Purpose and Organization ................................................................. 1
   Background of the Study ........................................................................................................... 1
   Statement of the Problem .......................................................................................................... 2
   Purpose and Significance of the Study .................................................................................... 3
   Theoretical Foundation ............................................................................................................ 3
   Research Questions .................................................................................................................. 5
   Limitations ............................................................................................................................... 5
   Definition of Terms .................................................................................................................. 6
   Outline of the Document ......................................................................................................... 6
   Summary ...................................................................................................................................... 7

2. Chapter Two: Review of Related Material ............................................................. 8
   History of Physical Education in Schools .............................................................................. 8
   Howard Gardner’s Theory of Multiple Intelligences .............................................................. 11
   Maslow’s Hierarchy of Needs .................................................................................................. 14
   Benefits of Regular Physical Activity .................................................................................... 16
   Cognitive Benefits of Physical Activity .................................................................................. 18
   Physical Activity and Children’s Health .................................................................................. 20
   Current Levels of Physical Activity ....................................................................................... 22
Physical Activity Interventions for Children ................................................................. 25
Physical Activity and Educational Outcomes: Recent Studies ................................. 28
Conclusion .................................................................................................................. 34

3. Chapter Three: Research Methodology ................................................................. 36
   Research Design ....................................................................................................... 37
   Description of Instruments ....................................................................................... 37
   Research Procedures ............................................................................................... 38
   Data Analysis .......................................................................................................... 39

4. Chapter Four: Results of Data Analysis ................................................................. 40
   Introduction ............................................................................................................. 40
   Research Questions ................................................................................................. 41
   Analysis of Data ....................................................................................................... 41
   First Grade Results ................................................................................................ 42
   Second Grade Results ............................................................................................ 44
   Fourth Grade Results ............................................................................................. 45
   Fifth Grade Results ................................................................................................. 47
   Primary Results ....................................................................................................... 49
   Upper Elementary Results ..................................................................................... 50
   Male Results .......................................................................................................... 52
   Female Results ....................................................................................................... 53
   Findings .................................................................................................................... 56
   Summary .................................................................................................................. 58
5. Chapter Five: Conclusions, Implications and Recommendations ..................59

Introduction ..................................................................................................................59
Summary of Study .............................................................................................................59
Conclusions ......................................................................................................................60
Limitations .......................................................................................................................60
Recommendations ............................................................................................................61
Summary ............................................................................................................................62

References ..........................................................................................................................63
## List of Tables and Figures

| Figure 4.1 | 1st Grade Average Growth | 42 |
| Table 4.1 | 1st Grade Results | 43 |
| Figure 4.2 | 2nd Grade Average Growth | 44 |
| Table 4.2 | 2nd Grade Results | 45 |
| Figure 4.3 | 4th Grade Average Growth | 46 |
| Table 4.3 | 4th Grade Results | 47 |
| Figure 4.4 | 5th Grade Average Growth | 47 |
| Table 4.4 | 5th Grade Results | 49 |
| Figure 4.5 | Overall Primary Average Growth | 50 |
| Table 4.5 | Overall Primary Results | 51 |
| Figure 4.6 | Overall Upper Elementary Average Growth | 52 |
| Table 4.6 | Overall Upper Elementary Results | 53 |
| Figure 4.7 | Overall Male Average Growth | 54 |
| Table 4.7 | Overall Male Results | 55 |
| Figure 4.8 | Overall Female Average Growth | 55 |
| Table 4.8 | Overall Female Results | 56 |
 CHAPTER 1: INTRODUCTION

“In order for man to succeed in life, God provided him with two means, education and physical activity. Not separately, one for the soul and the other for the body, but for the two together. With these two means, man can attain perfection.”

-Plato

There are many trends in educational neuroscience today that provide information about what the brain needs to optimize learning. The information reveals that the brain needs frequent downtime or breaks to function at a higher level. One way to provide these types of breaks for the brain is through physical movement. Over the last several decades, much research and attention has focused on the idea of connecting advances in brain research to educational interventions (Spaulding, Mostert, and Beam 2010). The brain is a highly complicated organ that thrives on movement, and that movement is essential for learning (Hannaford, 1995). Learning through movement increases the oxygen into the bloodstream and leads to improved concentration, which helps with the brain’s readiness to learn. Taking brief exercise breaks has also been said to improve student motivation (Weslake and Christia, 2015). Many years and resources have been spent struggling to find ways of teaching that will improve standardized achievement test scores and literacy. However, these continue to decline. It is possible the key element that has been missing is simply movement (Hannaford, 1995).

Academic performance is affected by multiple dynamics. Socioeconomic status (Sirin, 2005), parent involvement (Fan and Chen, 2001), demographic factors, parental expectations and attendance (Stanca, 2006) are just a few of the factors that contribute to the successes, or lack of successes, in a student’s academic career. While the success or failure in academic performance is a complex matter that is influenced by a combination of factors related to intellectual ability
and contextual variables, physical health is also a significant factor in a child’s ability to learn and his/her academic performance (Basch, 2010). Numerous studies have confirmed physical activity improves health in many ways, including cardiovascular and muscular fitness, bone health, and cognitive and brain health (Strong et al., 2005). Thus, the value of physical activity extends beyond the mere physical benefits and impact areas of brain function that can affect the way students learn.

In many cases, state-mandated high-stakes testing has decreased the opportunity for physical activity for students. While this may have been unintentional, the effects are just as detrimental. Academic pursuits have been increasingly prioritized and, often, struggling students are removed from physical education classes and recess to participate in interventions to improve test scores (Pellegrini and Bohn, 2005). However, the idea that greater time spent on a subject equals higher test scores is not supported by research. In fact, 11 of 14 correlational studies of physical activity during the school day indicated a positive relationship between physical activity and academic performance (Rasberry et al., 2011). There is increasing evidence that physical activity makes the mind healthier as well as the body (Hillman et al., 2008).

**Statement of the Problem**

Due to the increased emphasis on academic rigor and growth, as well as increased accountability for teachers, administrators, and schools, there is a tendency in school systems to remove or limit non-academic activities. This often includes a decrease in physical activity programs. It is often assumed that removing other programs will increase time allocated for academics and, thus, will improve academic performance and growth. Similarly, in an attempt to meet the increasing demands on the teacher's time to address all instructional standards, teachers often resort to assigning more homework to cover more material. This takes time away from the
student to participate in extracurricular, after-school, physical activities. Therefore, if a strong, positive connection exists between physical activity and academics, then removing or limiting physical activity programs is harmful and counterproductive to increased academic achievement.

**Purpose of the Study**

The purpose of this quantitative study was to determine the impact of classroom-based physical activity on academic growth. The focus was on performing specified physical activities, both in type and in duration, at set intervals, and then measuring student growth on various assessments. The results after the intervention were compared with results on the same assessments after three weeks of traditional classroom activities that did not include classroom-based physical activity. The researcher attempted to determine if students experience greater growth during the three-week period of intervention than in the three-week period of traditional classroom activities.

**Theoretical Foundation**

Abraham Maslow proposed the hierarchy of needs in 1943. This is a motivational theory in psychology composed of five tiers of human needs that must be met, beginning with the basic needs, before achieving higher levels of motivation. Maslow’s hierarchy of needs is often visually presented as a pyramid, with the most basic, fundamental needs at the base, ascending to the higher-level needs for motivation at the top. The first four layers, known as deficiency needs, are the motivational needs that should be met to achieve a desire to reach the higher level needs. These needs are detailed below.

1. **Physiological needs.** These are the requirements that must be met for the human body to survive. These are physical needs that are considered the most important and should be met first.
2. **Safety needs.** Once those physical needs are met, the next level of needs pertains to safety. The need for safety can be negatively affected by issues such as family violence, abuse, financial security, war, and natural disaster.

3. **Social belonging.** After the first two levels of needs are met, the next need pertains to a sense of belonging. If this need is not met, it could mean there is an absence of friendships or family relationships. Failure to meet this need may also be noted if the individual is neglected, shunned, or ostracized.

4. **Esteem.** This pertains to a need to feel respected, including self-respect.

5. **Self-actualization.** This is when an individual both recognizes and meets his/her potential.

6. **Self-transcendence.** This is the highest level, which was not included in the original levels of need. This pertains to the premise that self-actualization cannot truly be met until one gives oneself to a higher goal or purpose outside of oneself (Maslow, 1943).

**Conceptual Framework**

Based on Maslow’s theory (1943), for students to be unencumbered by any physical deficiency, all physiological needs must be met for learning to occur. This is evident in examples such as a child that has not had adequate rest the night before school or in a child that is hungry and has not eaten breakfast, or perhaps dinner the evening before. Students in those situations cannot be expected to learn until the physical need is met. This is also applicable to the need for physical activity. Therefore, classroom-based physical activity was studied based on Maslow’s theory. By implementing short segments of activity at designated intervals during instruction, this study measured the effects on engagement and performance.
Research Questions

The central research questions used in this quantitative study were:

1. What is the impact of classroom-based physical activity on academic growth in grades 1-5?
2. Is there a difference in the impact of classroom-based physical activity on academic growth in grades 1-2 and grades 3-5?
3. Is the impact of classroom-based physical activity different based on gender?

Limitations, Assumptions, and Design Controls

This study was limited to one school in an East Tennessee school district. Ten teachers participated in this, which limited the amount of data that could be collected. Also, this school utilizes ability grouping for most subject areas and grade levels. This presented a complication because the researcher had to determine which group would receive intervention. Where ability grouping is utilized, the lower-performing group received intervention in some grades while the higher-performing group received intervention in others. Ideally, the groups would have been heterogeneously grouped regarding ability. This limited the researcher's ability to generalize in these situations. In this study, there was a certain level of trust on the part of the researcher and the teachers pertaining to the execution of the interventions. The possibility existed that some teachers did not execute the interventions as prescribed by the researcher, or that some of the control groups took extra physical activity breaks. The researcher periodically observed classrooms and video-recorded some periods of intervention. However, observations and video recordings were also limitations because they may have affected student behavior or teacher behavior.
Definition of Key Terms

The following terms are used throughout this quantitative study regarding student engagement and classroom-based physical activity.

1. **Achievement** - making gains in the learning process (DuFour and Eaker, 1998).

2. **Activity breaks** - a pause from learning in the classroom for physical activity (Let's Move, 2015). Breaks occur at designated intervals for a specific duration.

3. **Brain Breaks** - pauses for the brain in classroom work by changing activities, which may include types of physical activity (Thomas, 2004).

4. **Classroom-based physical activity** - physical activity that is integrated into the classroom curriculum on a regular basis (Schmidt, 2016).

5. **On-task behavior** - any behavior in which a student is attentive or actively engaged in the appropriate task, as assigned by the teacher (Grieco et al., 2009).

6. **Physical activity** - any bodily movement produced by the contraction of skeletal muscle that increases energy expenditure above a basal level (U.S. Department of Health and Human Services, 2008).

7. **Recess** - usually an unstructured outdoor break from learning (Pellegrini and Smith, 1993).

**Summary**

With the increasing pressure regarding high-stakes testing, many schools are limiting the amount of physical activity students are receiving per day. This change is designed to increase the amount of time that students spend on academics to improve standardized test scores. However, this practice may be counterproductive. There is a growing body of evidence that suggests increased physical activity improves cognition and brain health, which positively
affects student learning. Considering the theories of Maslow (1943) and Gardner (1983), the researcher scrutinized the physiological needs of students and how this affects their ability to learn. This quantitative study examined the impact of the implementation of classroom-based physical activity by comparing a variety of student academic measures after a three-week period of physical activity intervention with results after a three-week period of traditional classroom activities.
CHAPTER 2: REVIEW OF RELATED MATERIAL

History of Physical Education in Schools

The Greek philosopher Plato well understood the importance of physical activity. He is quoted as once saying, “In order for man to succeed in life, God provided him with two means, education and physical activity. Not separately, one for the soul and the other for the body, but for the two together. With these two means, man can attain perfection” (A Brief History of Physical Education in America’s Schools, n.d.). In Plato’s Republic, there are many implications regarding the connection between sport and education. For example, in Republic, Plato explains that physical activity serves the educational objectives of intellectual achievement, virtue and political harmony (Reid, 2007). Plato endorsed the use of gymnastikê, which is translated to "physical training." Plato believed that physical activity should be used for virtue, excellence or aretê. Plato believed aretê to be a quality of the mind, not the body. Thus, physical training was beneficial to the mind. Furthermore, Plato argued that physical training helped to harmonize the mind and soul to encourage moral strength and prepare it for the rigors of philosophy which would be demanded of public servants (Reid, 2007). This theory of Plato's, while not tested in his time, is an example of the historical thought regarding partnering physical activity with academics to achieve optimal results.

Beginnings

From the 1700s to the mid-1800s, the United States was influenced by European countries in the development of physical education programs. German immigrants introduced the use of gymnastics training on heavy apparatus, such as the side horse and parallel bars, to become fit. The Swedish, however, promoted the use of light apparatus such as wands and climbing ropes. The English brought sports and games to the United States (Mitchell, 2012). In
1823, in Northampton, Massachusetts, Round Hill School was the first to include physical education as an integral part of the curriculum. Subsequently, the first public school in the United States introduced physical education into the curriculum in Cincinnati in 1855. In 1866, California became the first state to pass a law that required students to have two exercise periods per day (Mosher, 1996). However, the real drive for physical education in America resulted from war. After the American Civil War, the fitness of soldiers became a priority and, therefore, physical education became compulsory in schools. In the 1890s, John Dewey challenged traditional educational ideas with his educational reforms. This led to the expansion of the “three Rs” to include physical education. Thomas Wood argued that the great thought of physical education is not the education of physical nature, but the relationship of physical activity to complete education. Then, he argued, the purpose was to make the physical contribute its share to the life of the individual (National Education Association, 1893).

20th Century

In the early 20th century, several educational psychologists, including Dewey, Stanley G. Hall, and Edward Thorndike, supported the role of children's play in a child's ability to learn. They held that the physical activity not only contributed to the well-being of the child but also contributed to the social, emotional and intellectual development (Mosher, 1996). After World War I, troubling statistics were released claiming that 33% of drafted United States military recruits were not fit enough for physical combat. At that point, the government interceded and passed legislation to improve the quality of physical education (A Brief History of Physical Education in America’s Schools, n.d.). Furthermore, physical-fitness testing of European and American children in the 1940s and 1950s revealed that American children were far less fit than European children. The fitness test included leg lifts, situps, trunk lifts, and toe touches. Fifty-
six percent of American children failed at least one component of the test while only 8% of European children failed one component. Accordingly, President Eisenhower established the President’s Council on Physical Fitness, which was later renamed the President’s Council of Physical Fitness and Sports. This council made recommendations that would include providing more time, equipment, and personnel for PE instruction. The President’s Physical Fitness Award, established in 1966, provided recognition for students that scored in at least the 15th percentile on tested physical activities (Millehan, 2017). This would increase the emphasis and provide a greater incentive for improvement in physical education programs in the United States. However, physical education fitness testing that was completed in the 1970s showed no improvement. This prompted a renewed interest in improving physical education programs in schools. Presidents continually collaborated with the council and their recommendations to continue to make strides toward improved fitness for school children (Millehan, 2017).

**Early 21st Century**

According to “2012 Shape of the Nation Report: Status of Physical Education in the USA,” there were existing mandates for physical education from elementary through high school. However, most states were not requiring that these mandates be followed. In 2006, Millehan reported that the number of U.S. high school students participating in a P.E. program had dropped from 42% to 28% between 1991 and 2003. Schools were accepting excessive amounts of waivers to allow students to opt out of P.E. class (Millehan, 2017). Therefore, there is a trend in the United States that is decreasing the emphasis on the importance of physical activity in schools.

With the amount of current research indicating numerous benefits to being physically active, many educational leaders are beginning to recognize the importance and necessity of
integrating physical activity programs into schools. Various school-based physical activity programs are available to schools and teachers that are designed to improve the health and well-being of students. While striving for physical fitness to provide a healthier lifestyle for students is a noble cause, general thought in the educational realm in the United States tends to view the importance of incorporating physical education into schools as purely of physical benefit. This implies that physical activity should be completely isolated from other academic pursuits. However, it is plausible that Plato’s ideology that physical activity cannot be separated from other academic pursuits is true.

Howard Gardner’s Theory of Multiple Intelligences

In 1983, Dr. Howard Gardner, Professor of Education at Harvard University, developed the Theory of Multiple Intelligences. Gardner worked in the areas of psychology, human cognition, and human potential. While the idea of visual learning, auditory learning, and kinesthetic learning was widely accepted, Gardner presented the idea of an additional three intelligences or competencies. Eventually, Gardner's theory would evolve into nine intelligences with the possibility of more being discovered. Gardner's nine intelligences include verbal-linguistic, logical-mathematical, spatial-visual, bodily-kinesthetic, musical, interpersonal, intrapersonal, naturalist and existential (Demiral, 1999).

Verbal-linguistic intelligence

This type of intelligence or learning is exhibited in great strength with activities pertaining to language. People with this type of intelligence tend to learn best by hearing, speaking, reading, discussing and communicating (Saban, 2002). A person with this learning style is also able to think abstractly and symbolically. Students with this kind of intelligence would be inclined to activities such as note-taking, storytelling, drama, writing, linking a story or
novel with other issues, making a presentation, discussing, writing a slogan, meeting, and using technology for writing (Demirel, 1999).

**Logical-mathematical Intelligence**

A person with this type of intelligence learns by making logical relationships between objects or concepts and separating those into categories. This person would ask many questions about the formation and function of matters, work with number and logical puzzles, and play strategic games, such as chess (Saban, 2002).

**Visual-spatial Intelligence**

This intelligence is predicated on the capacity to picture and perceive the visual world and reproducing one’s own visual experiences. Eye-hand coordination is a strength as well. Occupations that utilize this type of intelligence include architects, sculptors, painters, designers, and landscapers (Demirel, 2000).

**Musical-rhythmic Intelligence**

This intelligence pertains to the capability of using and presenting music. A person with this type of intelligence is strong in the areas of rhythm, melody, and tone (Demirel, 1999).

**Bodily Intelligence**

This is the ability to use the body, or parts of the body, to solve a problem, put forward a product and express feelings or emotions (Gardner, 2004). People with this kind of intelligence are strong in the area of sports. They also are unable to sit for long periods of time without moving. Students with this type of learning style have abilities such as athleticism, dancing, and role-playing. These students tend to succeed in sports, dance, and art (Mitchell and Kernodle, 2004).
Social Intelligence

This intelligence deals with understanding the emotional desires and needs of others (Saban, 2002). It is also defined as the ability to understand others, express feelings, and empathize with others (Shepard, 2004). A person high in social intelligence effectively establishes relationships and is very perceptive in detecting differences among people (Ozden, 2003).

Intrapersonal Intelligence

Gardner believed this intelligence was the most important kind of intelligence in daily life (Ekici, 2011). This person has self-knowledge and takes responsibility for his/her learning. This person enjoys working alone, as well as utilizing self-evaluation and self-awareness while learning (Demirel, 2000).

Naturalistic Intelligence

This intelligence is concerned with the natural environment, such as plants and animals. People with this type of intelligence enjoy traveling and outdoor activities. Naturalistic intelligence is associated with studies such as zoology, biology, agriculture, and botany (Gürel and Tat, 2010).

Existential Intelligence

Gardner describes this intelligence as the ability to understand oneself and to see oneself as part of a larger purpose. This includes understanding the human condition, the significance of life and the meaning of death (Gardner, 1999).

Basis of the Study

Bodily-Kinesthetic Intelligence will serve as the basis of this study. This intelligence enables the person to form a harmony between the body and the mind (Ekici, 2011). Gardner
(1983) emphasized that not each person has one intelligence, but a person may have more than one intelligence or learning style that serves as a particular strength.

**Maslow’s Hierarchy of Needs**

In 1943, psychologist Abraham Maslow published his paper, *A Theory of Human Motivation*. In this paper, Maslow (1943) established a set of needs that all humans must have filled to function at the highest possible levels. He believed the intelligence need to be arranged hierarchically, meaning that the most basic, lowest-level needs must be met before the needs in the next level can be met. Maslow’s Hierarchy of Needs is usually presented visually as a pyramid, with most basic needs at the bottom and the highest level at the top (Burton, 2012).

Maslow’s Hierarchy of Needs consists of five levels – physical, safety, love/belonging, esteem, and self-actualization. The first four levels are referred to as “deficiency needs.” If these needs are not met, a person cannot progress toward the next level. The fifth level is referred to as a “growth need” because it enables a person to reach his/her highest potential.

Physical needs are the most basic and involve needs that are required for human survival, such as air, water, food, sleep, clothing, and shelter. Safety needs pertain to the human instinct to feel secure and protected from harm. These needs include safe environment, financial security, law and order, and health and wellness. Love/belonging needs, which motivate behavior, include friendship, romantic relationships, family, social groups, churches and community organization. These allow individuals to avoid loneliness and depression. Esteem is the need for respect and appreciation. At this stage, individuals seek to gain respect via their accomplishments and want their efforts to be recognized. This includes self-esteem and peer-esteem. Self-actualization is the highest level of Maslow’s Hierarchy. It is defined as having full use of one’s own talents, capabilities, and potential. Such people seem to be fulfilling themselves and doing the best that
they are capable of doing (Maslow, 1943).

Maslow’s Hierarchy of Needs is applicable to this study. If teachers are expecting students to reach their potential, first it must be determined if students’ basic needs are being met (Kline, n.d.). Otherwise, any attempt to further knowledge is futile. Therefore, after the basic physical needs are met, the teacher would need to strive to ensure that the safety needs of the students are met. This includes health and wellness, which relates to the need for physical activity.

Benefits of Regular Physical Activity

Physical activity has repeatedly been proven to improve many risk factors for cardiovascular disease and other chronic diseases. Physical activity reduces the risk of obesity and symptoms of anxiety and depression (Center for Disease Control and Prevention, 2008). The following information outlines the results of some recent studies that assessed the benefits of physical activity in reducing cardiovascular disease, diabetes, cancer, osteoporosis and musculoskeletal issues.

Cardiovascular Disease

There is a significant reduction in the risk of death from cardiovascular disease with increased physical activity. Being active is associated with a greater than 50% reduction in risk of cardiovascular disease (Warburton et al., 2006). For example, physically inactive middle-aged women have double the cardiovascular-related mortality compared with physically active women. Even a small increase in physical activity can result in significant reduction in risk. Individuals who went from unfit to fit over a five-year period had a 44% reduction in the risk of death. Some of these benefits were gained from as little as one hour of walking per week. Patients that received cardiac rehabilitation, which involves physical activity, following a
cardiovascular incident, demonstrated a significantly reduced instance of premature death from cardiovascular disease compared to patients that received care that did not involve rehabilitation with physical activity.

**Diabetes**

Both aerobic activity and resistance training are beneficial for the prevention of diabetes. In fact, even small amounts of weight loss through diet and exercise reduced the risk of Type 2 diabetes among high-risk people by 40%-60% over a 3-4 year period. If a person already has the disease, exercise has been proven as an effective intervention for management. Aerobic and resistance types of physical activity have both been shown to help prevent and control diabetes (Warburton et al., 2006).

**Cancer**

Research has shown that routine physical activity can reduce the risk of breast and colon cancer. Higher-intensity activities yield a greater reduction in the risk of those types of cancer. Men and women who are physically active are 30%-40% less likely to get colon cancer, and physically active women are 20%-30% less likely to get breast cancer as compared with those that are inactive. Also, two recent studies of colon and breast cancer patients revealed there is a decreased risk of recurrence when one engages in regular physical activity (Warburton et al., 2006).

**Osteoporosis**

Bone mineral density has been shown to improve with weight-bearing exercise. Resistance exercise is especially beneficial. Weight-bearing and impact exercises also help to prevent bone loss associated with aging. Also, these types of training activities have been proven to reverse bone loss in pre- and postmenopausal women. The risk and incidence of
fractures are also reduced with physical activity. Among men, more intense physical activity at a younger age is associated with reduced incidence of hip fracture years later (Warburton et al., 2006).

**Musculoskeletal Issues**

Physical activity has been shown to improve musculoskeletal fitness. Improved musculoskeletal fitness is associated with better overall health and a reduced risk of chronic diseases and disability. This is especially important for older adults. Because many daily activities require musculoskeletal fitness rather than aerobic fitness, older adults can maintain functional independence through improving the musculoskeletal system. Musculoskeletal fitness also reduces the risk and incidence of diabetes, stroke, arthritis, coronary artery disease, and pulmonary disorders (Warburton et al., 2006).

The benefits of regular physical activity are multifaceted. Regular physical activity can help control weight, improve cardiorespiratory fitness, as well as reduce symptoms of anxiety and depression (Center for Disease Control and Prevention, 2008). Regular physical activity can also reduce the risk of high blood pressure and obesity. Physical activity improves body composition. Subsequently, improved body composition leads to enhanced lipid-lipoprotein profiles, improved glucose homeostasis, and insulin sensitivity. Physical activity also has a positive effect on chronic inflammation and psychological well-being. Physical activity reduces stress and depression, which affects overall health.

As detailed in Howard Gardner's theory, many students are prone to learn better if physical activity is involved. Maslow’s Hierarchy of Needs dictates that a child's health needs must be met before one can expect him/her to maximize his/her potential academically. If health needs are not met, learning potential cannot be realized. Many students are struggling with
obesity and obesity-related illness, even at very early ages. By providing additional opportunities for physical activity, children are more likely to have their health needs met and are more likely to achieve according to their capabilities and potential.

**Cognitive Benefits of Physical Activity**

It has been found that physical activity can change the brain’s physiology by cerebral capillary growth, blood flow, oxygenation, growth of nerve cells in the hippocampus, neural network density, and brain tissue volume. These types of physiological changes may be associated with improved ability to pay attention and focus, as well as processing, storing and retrieving information. A study completed with mice in which sedentary mice were compared with mice that ran an average of three miles each night on a running wheel, indicated that the hippocampus of the active mice had grown to be twice as large as the inactive mice. The hippocampus area of the brain is associated with memory and learning (van Pragg et al., 1999). The mice that were active also performed better in finding their way through mazes which demonstrated that the activity also affected the ability to learn. This may be attributable to the fact that exercise improves mood. So perhaps when one feels better, one also learns better. While these results are very intriguing, they were completed using rodents, not humans.

Research completed with human subjects shows that exercise boosts brain power. In fact, the most productive environment for processing information would include motion (Medina, 2009). In a study conducted among two populations of older adults with different lifestyles – one active and one inactive – cognitive factors were influenced greatly by activity. Physical activity had a positive effect on executive function, spatial tasks, reaction times, and quantitative skills. If those that are sedentary become involved in aerobic exercise, executive function and memory improve within four months. Exercise increases oxygen flow to the brain,
which is always accompanied by an increase in mental sharpness. Exercise also affects the molecular machinery of the brain by increasing neuron production, survival, and tolerance to damage and stress.

Another study with children randomly placed 56 children in one of three different classes in school. In one group, the students were sitting all morning. In the second group, the students were given a 20-minute break for physical activity after 90 minutes of class. The last group was given a 20-minute physical activity break before class started and then again after 90 minutes of class. The children who received two exercise breaks performed better on attention tasks than the other two groups (Altenburg, 2015). In another study, 20 minutes of walking immediately before reading, spelling, and math tests boosted students' performance on these tests (Hillman et al., 2009). Also, children who exercised for 10-20 minutes before a math test outperformed those that were sedentary (Howie et al., 2015). These are all examples of short-term studies that demonstrated the immediate effect of recess and other physical activity breaks on attention and performance. Another study exhibited long-term effects in previously sedentary children. The children were enrolled in a program in which they participated in 40 minutes of exercise per day. This improved their ability to pay attention, plan, and resist distractions (Davis et al., 2007). It was also found that when involved in the exercise program for 13 weeks, the children showed improved mathematics skills.

**Physical Activity and Children’s Health**

As social media and gaming has become increasingly popular among children and youth, interest and motivation in physical activities have diminished. This has fostered a sedentary lifestyle for many of America's children. There are many factors and characteristics of a sedentary lifestyle that are negatively affecting children's health. Inactivity among children is
becoming more prevalent. This leads to obesity, which subsequently leads to many different chronic diseases. The Centers for Disease Control and Prevention noted some disturbing trends among high school students:

- Only 27% of students have 60 minutes of physical activity per day.
- Only 52% of students participate in muscle-strengthening activities
- Only 29% of students have a daily physical education class
- 41% of students play video or computer games for three or more hours a day
- 32% of students watch television for three or more hours per day

(Faigenbaum, 2015)

Obesity is one of the greatest health challenges of the 21st century (Mainland et al., 2015). In the last two decades in developed western nations, the rate of obesity, particularly among children, has increased dramatically. Because obesity is associated with a wide range of chronic disease, children are faced with a lifetime of elevated rates of disease and decreased life expectancy (Mainland et al., 2015). Research has also shown that physical activity continues to decline among children (Bassett, 2008). There has been a decline in a wide range of structured and unstructured activities, including organized sports, gymnastics, dance classes, as well as, walking, biking, and outside play (Mainland et al., 2015). These activities seem to have been replaced with sedentary leisure activities, such as television watching, video gaming, and other internet activities (Vandewater, Shim, and Caplovitz, 2004).

It is recommended that children and youth get 60 minutes daily of moderate-to-vigorous physical activity. The benefits of this level of activity increase with greater intensity of activity. High-intensity activities, such as jogging or playing basketball, are associated with greater cardiovascular and metabolic benefits than lower intensity exercises, such as walking. However,
lower-intensity activities are still beneficial, particularly in overweight or obese children (National Physical Activity Plan Alliance, 2016). Conversely, sedentary behaviors can have a vastly negative effect on children's health. With the increasing frequency and duration of "screen time," problems with these health concerns have intensified. High levels of leisure-time sedentary activities, such as watching television and gaming, are associated with higher overweight/obesity rates and increased cardio-metabolic disease, regardless of whether the physical activity guidelines are being met (National Physical Activity Plan Alliance, 2016). These implications are immense when considering that a child can receive the daily recommended amount of physical activity, but the child's health still suffers as a result of too much time watching television or playing video games.

Evidence to support the benefits of physical activity in children and adolescents is abundant. Daily physical activity in children and youth is associated with increased health-related fitness, improvements in cardiovascular and metabolic disease risk profiles, decreased risk of cardiovascular disease in adulthood, decreased risk of developing Type 2 diabetes in childhood and adulthood, boosts in bone health and development, improvements in mental health, improvements in cognitive and academic performance, as well as betterments in motor control and physical functioning (National Physical Activity Plan Alliance, 2016).

**Current Levels of Physical Activity**

Beginning with the implementation of No Child Left Behind (NCLB) legislation in 2001, teacher and school accountability increased dramatically. This meant that standardized tests were required for every state, and it also meant that results for each school would be published and ranked or graded based on adequate yearly progress (AYP). Schools that did not meet their AYP goals were subjected to harsh penalties (Schneider and Zhang, 2013). Because of these new
pressures, some schools began to minimize physical activities, such as recess and physical education class, in order to prioritize subjects that would be tested on standardized assessments. Also, as students began to feel the added pressure fostered by NCLB requirements, it could be assumed these students began to give up extracurricular physical activities to devote more time to academics (Schneider and Zhang, 2013). However, if physical activity is connected to academic performance in a positive way, then these actions would have all been counterproductive.

In the United States, there are existing physical education requirements for students in every state. However, these requirements are not always enforced and often are inadequate for meeting guidelines for physical activity for children and youth. There are currently 21 states that require schools to provide specified minutes of physical activity each day with specified intensity level requirements as well. Those states include Arizona, Colorado, Connecticut, Hawaii, Illinois, Indiana, Iowa, Kentucky, Louisiana, Maine, Mississippi, Missouri, Nevada, New Hampshire, North Carolina, North Dakota, Ohio, South Carolina, Tennessee, Texas, and Virginia. Most states also require health education to increase knowledge regarding a healthy lifestyle, including exercise and maintaining a healthy, balanced diet. Colorado and Oklahoma are the only states that do not require health education (Levi et al., 2014).

The CDC recommends 60 minutes of physical activity per day in childhood and adolescence (2008). Unfortunately, many children and adolescents do not meet the current guidelines for physical activity. Only 21.6% of children and adolescents ages 6-19 in the United States meet the requirement of 60 or more minutes per day of moderate-to-vigorous physical activity for five days per week. Currently, according to the United States President’s Council on Fitness, Sports and Nutrition, 95% of high schools and 84% of middle schools require physical
education. However, only 69% of elementary schools do so. Thirty-eight of 50 states now require or encourage districts and schools to follow physical education standards based on the National Standards for Physical Education. According to the official United States government website, Fitness.gov, the goal of physical education in American schools is to educate students regarding how to maintain and enjoy a healthy lifestyle. However, even in schools that enforce and meet requirements regarding physical education classes and standards, these classes are often filled with practices that are not in the best interest of the students (Graham, 1992).

Activities such as dodgeball, Duck Duck Goose and Steal the Bacon are just some of the games that are very common in physical education classes but are not beneficial to students. Also, many physical education classes have low participation times with a significant amount of waiting and inactivity. In some instances, the games might have a risk of injury or harm to the student (Graham, 1992). Thus, in situations where physical education class time requirements are being met, the type of physical activity needed for the child may be lacking.

The consequences of physical inactivity are meaningful, including obesity, cardiovascular disease, high blood pressure, insulin resistance, glucose intolerance, Type 2 diabetes, osteoporosis, as well as many types of cancer, including breast, colon, endometrial and lung (Centers for Disease Control and Prevention, 2008). The potential gains in cognitive development and ability, as well as gains in academics if students are physically active, cannot be understated.

**Physical Activity Interventions for Children**

**Classroom-Based Physical Activity**

Integrating physical activity into the regular classroom is one manner of improving the level of physical activity for students. Students spend the vast majority of their waking hours in
the classroom (Brusseau et al., 2011). Therefore, the logical next step is to incorporate regular activity breaks into the school day to help children meet the physical activity requirements recommended by the CDC (2008). Taking physical activity breaks in the classroom does not mean taking a great deal of time away from instruction. Some breaks can take as little as 1-2 minutes (Thurston, 2015). The purpose of classroom-based physical activity is not only to reach those physical activity goals for each day, but also to provide a break from academic rigor to reset attention on learning (Erwin et al., 2013). Studies have shown that when students are allowed to move and stand during the school day, memory, attention, mood and academic achievement improve (Thurston, 2015). Research has shown that when we exercise, blood flow increases throughout the body, including the brain. With more blood flow, the brain gets more oxygen, which means our brains perform better (Rhodes, 2013). The brain can only handle so much input at a time. Thus, stopping for an activity that will increase blood flow is similar to hitting a reset button on the brain. This also helps with attention (Thurston, 2013). Prompting student movement for 1-5 minutes is an ideal activity to reset the brain and prepare students for more learning.

**Brain Breaks**

One of the trends that have developed as a result of educational neuroscience information regarding how the brain responds to physical activity is the idea and implementation of "brain breaks." Brain breaks are simple, transitional, physical, and mental exercises. These types of breaks can help teachers manage physiology and attention span of students. The idea is to keep the brain in the most receptive state for learning (Weslake and Christia, 2015). These types of breaks also provide the student's opportunity to breathe, relax, recharge, and focus (Townsend, 2004). They can also have a positive impact on students’ motivation and achievement (Greany...
and Rod, 2003). Expecting students to sit and engage in learning for long periods of time is not reasonable or developmentally appropriate. For that reason, brain breaks have become popular because they allow the brain to remain alert and ready to engage. Short spurts of learning are how students learn best. Therefore, brain breaks are ideal to support physical activity interventions in the classroom (Weslake, 2015).

Brain breaks can be implemented in many ways and formats. Types of brain break activities can be divided into three categories: breathing and relaxation, vigorous physical activity, and mental activity (Gay, 2013). Breathing activities usually involve some deep breathing. Deep breathing and visualization in the classroom can help with focus and well-being (Dent, 2003). Breathing exercises are often partnered with stretching to relieve stress (Dennison and Dennison, 2004). Vigorous physical activity is another manner of utilizing brain breaks. This is a way to reset the brain as well as alleviate stress and improve fitness and fine and gross motor skills (Teaching Expertise, 2004). However, it is not necessary that all breaks maintain at this kind of high intensity. An activity as simple as standing up and stretching helps with learning (Jensen, 2005). The third type of brain break, mental activity, may involve movement that is incorporated into a learning game. These may be used to increase focus and improve fine motor skills (Maskell, Shapiro, and Ridley, 2004).

Brain breaks may be implemented by interspersing brief bursts of physical activity with a series of 15 to 20 minutes of academic work time. This approach was examined in a study in which 5th-grade math students, particularly those with ADHD, showed great improvement in math. These students also fidgeted less and were more engaged (Camahalan and Ipock, 2015). Another study scrutinized several schools in Richmond, Virginia that participated in a program called Minds in Motion. In this program, students learned social studies standards through dance
for one hour every day. Students showed great improvements in social studies and other subject
areas (Compton, 2008). Other examples of brain breaks might include doing 10 jumping jacks,
running in place, doing forward rolls, or an army crawl. There are many different approaches to
implementing physical activity into a classroom, as well as many programs designed to affect
this implementation.

**Stimulating Maturity Through Accelerated Readiness Training (SMART)**

SMART is a program that integrates brain stimulation and enhancements into the regular
curriculum (Palmer, Giese, and DeBoer, 2007). SMART stimulation can occur in several
different locations within the school: the classroom, utilizing walls, floors, desks, and tables;
physical education/gymnasium spaces; and playground, using playground equipment. Vestibular
stimulation involves exciting and enjoyable head and body rotations that improve attention span
(Palmer, Giese, & DeBoer, 2007). When students are involved in activities such as balance and
movement that activate the vestibular and other sensors, there are increases in neuro-
development growth compared to students in traditional classes. By implementing these neuro-
stimulator types of activities, far higher levels of content acquisition and retention are possible
(Palmer, Giese, and DeBoer, 2007).

**Physical Activity and Educational Outcomes: Recent Studies**

**The Relationship Between Physical Fitness and Academic Achievement**

A study conducted in the Northeastern United States sought to determine if there was a
correlation between physical fitness and academic achievement. Just over 1,800 students in 4th
grade, 7th grade, and 8th grade that attended a racially and economically diverse urban public
school district were evaluated for fitness. The students’ standardized test scores in English and
mathematics were examined, along with several areas of physical fitness. The researchers
measured students’ cardiovascular endurance, abdominal strength, flexibility, upper body strength, agility and body mass index (Chomitz et al., 2009). Results demonstrated that higher fitness levels were associated with passing the academic tests. The students’ fitness was more strongly connected to success on the math assessments than the English assessments. In fact, the students’ odds of passing the math tests were increased by 38% for every unit increase in the number of fitness tests passed (Chomitz et al., 2009). The students' odds of passing the English assessment did improve, but only showed a 24% increase per unit increase in the number of students taking the fitness test. From these results, the researchers concluded that there are five possible reasons for the fit students outperforming their peers that were less fit. It was determined that motivated students might demonstrate overall achievement orientation that affects both academic and physical activities. Additionally, fitness may mean overall health, which would also affect academic achievement. Physical activity could improve concentration and classroom behavior, which then affects academic achievement. Physical activity may improve mental health and self-esteem, which would also affect academic achievement. Finally, exercise and fitness may improve cognitive function (Chomitz et al., 2009).

**Physical Activity Breaks and Student Learning: A Teacher-Research Project**

Camahalan and Ipock (2015) conducted a study with teachers over five, one-hour math classes in which students were learning long division. The teachers integrated kinesthetic movements, and physical activity breaks with math instruction. The students that were selected had below average performance in math. Three of the students had been diagnosed with ADHD, and one student had been diagnosed as emotionally disturbed. The goal was to determine if activity breaks would help to improve attentiveness. The researchers also hoped to improve the students' ability to perform long division problems. The researchers' priority was to measure
specific types of off-task behavior, including head down on a desk, pencil tapping, doodling, and not being able to identify where the class is in solving the current problem if called on. The five one-hour math sessions were spread out throughout one week, with one session per day. Each day, students were instructed in long division, with kinesthetic movements set to an acronym that was used to help students remember the steps in long division. Also, for every 15 minutes of academics, students were provided five minutes of physical activity. These activities included dance, stretching, jumping jacks, and movement games. The results of this study indicated this physical activity breaks decreased off-task behaviors. There was also an improvement in the concept of long division when comparing the students' pre- and post-tests. The teachers noted that the students seemed calmer and that the dynamics of the classroom seemed to shift from teacher-directed instruction to more student engagement and involvement after participating in these activities.

**Thank You, Miss Katherine: Teaching Dance in an Academic Setting Can Improve Student Learning and Boost Student Self-Confidence**

Compton (2008) scrutinized the effects of the implementation of a program called Minds in Motion in 16 schools in Richmond, Virginia. Each year, the director of the program meets with 4th-grade teachers to determine which area of content to work on. In this particular year, the teachers chose the story of Jamestown and the birth of America. Students learned several dances that tell the story of America’s birth and the settlement of Jamestown. The yearlong curriculum ends with a dance performance for the school to demonstrate what the students have learned through dance and drama. Students were taken from class one hour every day for these dance classes. The objective of this study was to determine numerous outcomes that would be measured by student and parent surveys at the end of the school year. The results of these
surveys were overwhelmingly positive. Fifty-five percent of students reported that Minds in Motion made them a better student, 65% reported working better with other students, 58% reported better concentration, and perhaps most importantly, 59% of the students reported that they learned to believe in themselves. The researchers compared the 16 Minds in Motions schools with 16 similar schools in the same area. Minds in Motion schools scored higher than the other schools. The most remarkable evidence is that these 16 schools took an hour of instruction away from students every day to teach dance. Not only did standardized test scores not drop; they improved. There was also a positive effect on student self-esteem and engagement. Although dance is not the typical physical activity implemented in schools, it is an example of physical activity leading to improvements in academic performance. The fact that these students received an hour less of traditional instruction than their counterparts and still outperformed them is quite important in understanding the effects of various types of physical activity.

**Student Academic Performance Outcomes of a Classroom Physical Activity Intervention: A Pilot Study**

In a study conducted in a Southeastern elementary school, 29 3rd grade students were assigned to either the intervention group or the control group. The interventions were implemented for 20 weeks. For the intervention group, teachers allowed students 20 minutes or more for physical activity throughout their school day, apart from their regular recess or physical education time. The control group continued with traditional, seated work in their classrooms. The researchers used the students’ reading and math fluency, standardized test scores, and student grades to measure the success of the intervention (Erwin et al., 2012). The results of this study indicated that physical activity had a significantly positive effect on both reading and math
fluency, as measured by CBMs. Nevertheless, the standardized test scores did not have the same implications. However, the researchers concluded that physical activity breaks do not negatively affect student performance or behavior and that math and reading fluency significantly improved with physical activity breaks (Erwin et al., 2012).

**Effect of Physical Education and Activity Levels on Academic Achievement in Children**

Research was conducted to determine the effect of physical education classes, as well as physical activity in general, on academic achievement in middle school students over the course of a school year. The participants in this program were 214 6th grade students that were randomly assigned to physical education classes. Academic achievement was based on individual grades for each of the four core subjects – math, language arts, science, and world studies, as well as one standardized test score. This study revealed that students who engaged in vigorous physical activity outside of the typical physical education class showed improved academic achievement over groups that only had one 40-minute physical education class per week and the groups that had no physical education class. Although the physical education classes lasted 40 minutes, they only consisted of 19 minutes of moderate physical activity. Students that engaged in vigorous physical activity had significantly higher grades than those that did not. Although there was no significant difference in the academic performance of those enrolled in physical education class and those that were not, higher grades among this population of students was an effect of other extracurricular, vigorous activity (Coe et al., 2006).

**The Association Between School-Based Physical Activity, Including Physical Education, and Academic Performance**

In 2010, the Center for Disease Control and Prevention analyzed 50 unique studies about the connection between different types of school-based physical activity and academic
performance. This analysis of 50 studies published between 1985 and 2008 examined four approaches to physical activity in school and the impact on academics. There were 251 associations between school-based physical activity and academics. Of those, 50.5% were positive, 48% were not significant, and 1.5% were negative. The academic performance results were grouped into three categories: academic achievement (grades, test scores), academic behavior (on-task behavior, attendance), and cognitive skills and attitude (concentration, memory, mood). The four types of school-based physical activity are physical education classes, recess, extracurricular physical activity and classroom-based physical activity. The first approach is that of school-based physical education. This is a very traditional approach to physical education classes in schools. This isolates physical activity from other subject areas. Of the 50 studies, 14 researched the effects of physical education classes. Most of these studies examined the effect of increasing the amount of time spent in physical education class. Overall, the studies determined that increasing time spent in physical education classes had either a positive effect or no effect on academic achievement. In like manner, the studies indicated that increasing physical education time did not have a negative effect on academic achievement.

The second approach to physical activity in schools is activity in recess. This is most often an unstructured time that allows for socialization, but also separates physical activity from academics. Of the 50 studies reported by the CDC, eight addressed recess. All of the studies addressing recess found one or more positive associations between cognitive skills, attitudes, and academic behavior; none of the studies found negative associations.

The third approach scrutinized students' level of activity outside of school to ascertain how after-school activity levels affect academics. This approach also separates physical activity from academics. Nineteen studies pertained to physical activities organized by the school, but
outside of the regular school day. This includes, but is not limited to, school team and individual
sports. The studies found one or more positive associations between extracurricular physical
activities and academic performance in each of the 19 studies (CDC, 2010). The fourth approach
to implementing physical activity in schools is called classroom-based physical activity, and
includes activities such as the brain breaks discussed earlier. This approach allows for short
physical activity breaks of 5-20 minutes to be embedded in instruction throughout the school
day. These types of breaks can be short bursts of physical activity integrated into learning
activities or given as a pure physical break in between learning activities. Nine CDC studies
utilized this classroom-based approach. Eight out of the nine studies found positive associations
between classroom-based physical activity and academic performance indicators such as
standardized math, reading and language arts test scores, as well as in behavior (CDC 2010).
There were no negative associations found.

Conclusion

As educators and philosophers such as Plato understood long ago, there must be exercise
for the body to optimize exercise for the brain. Much research exists that indicates that physical
activity, particularly classroom-based physical activity, is associated with positive academic
behaviors and performance. This research is vast and continues to grow.

From a theoretical standpoint, it is important that educators understand the issue
presented in Maslow’s Hierarchy of Needs; that every person has health needs which must be
met before optimal learning can occur (Maslow, 1943). This health need includes physical
activity. When scrutinizing Gardner’s Theory of Multiple Intelligences, it can be assumed that
many students may possess bodily-kinesthetic intelligence, which indicates those students would
learn better with increased movement and activity in the classroom (Gardner, 1983). Thus, there
is a firm theoretical basis supporting the need for physical activity in the classroom.

From a physiological perspective, the role of physical activity in preventing disease is immense. Obesity is perhaps the most important health issue among children (Mainland et al., 2015). With increased physical activity, obesity rates can be drastically improved. A healthier child will be able to learn unencumbered by health needs, such as those that would be created by obesity (Maslow, 1943). A student who feels better can learn better.

Additionally, and perhaps most importantly, this study addressed the practical application of classroom-based physical activity for teachers and students. Current problems in the United States created by health issues due to a lack of physical activity may seem too great to overcome. However, educators spend significant time with their students. If physical activity could be integrated, educators could begin to discern those positive effects in physiology and cognition, and children could develop healthy, lifetime habits that could improve the overall quality of life for many years.
CHAPTER 3: METHODOLOGY

The purpose of this study was to determine the impact of classroom-based physical activity on academic growth among students in grades 1-5. Effects of classroom-based physical activity based on gender and grade level were also scrutinized.

Research Questions

The central research questions used in this quantitative study were:

1. What is the impact of classroom-based physical activity on academic growth in grades 1-5?
2. Is there a difference in the impact of classroom-based physical activity on academic growth in grades 1-2 and grades 3-5?
3. Is the impact of classroom-based physical activity different based on gender?

Hypothesis and Null Hypothesis

The hypothesis is that physical activity breaks throughout class time affects positive change in student engagement and therefore positively influences factors such as test scores and grades. The null hypothesis is that physical activity has no effect on engagement; thus, test scores and grades would also not be affected. A quantitative research design was used, and the types of data utilized for this study include grade reports, common formative assessment pre-test scores and post-test scores, and STAR assessments. In this study, the researcher tried to determine how physical activity affects student academic performance levels. Scores and grades were compared between a three-week period of traditional classroom activities with a three-week period of physical activity intervention among the same population of students.
Research Design

Participants for this study were chosen from an East Tennessee school, serving grades K-5, with an approximate enrollment of 300 students. Of these students, 60% are Caucasian, 25% are English Language Learners, and 70% are eligible for free and reduced lunch. This is a high achieving school that has been named a National Blue Ribbon School. Three classes each from grades 1-2 and two classes each from grades 3-5 were studied. The researcher compared scores from a three-week period of traditional classroom activities with results from a three-week period of physical activity intervention among the same population of students. The researcher collected data throughout one six-week period of study.

Measures

Three different measures were used in this study to examine the impact of classroom-based physical activity on student achievement.

Grade reports, which were generated every six weeks, were used to determine student performance in each content area. Student work scores were averaged for the six weeks, and grades were reported in the form of a percentage that correlates to a letter grade.

Common formative assessment, pre-test and post-test data for math standards taught, were utilized. Prior to beginning a new unit in math, each teacher administered a pre-test. The same math test was subsequently administered to students at the end of an assigned unit to determine growth in that unit of study. Common formative assessments are common practice in this school. The purpose of using formative assessments is for driving instruction. However, for this study, these assessments served as a method for measuring growth.

STAR assessments were used to measure math skills and reading comprehension. Students are assessed several times throughout the school year.
**Sampling and Population**

Convenience sampling was utilized for this study. This allowed the researcher to be close to the study for regular observations. This particular school has a significant number of English-Language Learners (ELL). The school also has a very high percentage of students who receive free or reduced lunch, which is an indicator of economically-disadvantaged students.

Three 1st grade classes, three 2nd grade classes, two 3rd grade classes, two 4th grade classes, and two 5th grade classes participated in the study.

The 1st-grade group was comprised of 50 students. Of these students, 52% were male, and 48% were female. Of the 1st-grade students, 16% were ELL, and 78% were economically disadvantaged. The 2nd-grade group was comprised of 52 students, of which 54% were male, and 46% were female. Additionally, 21% of these students were ELL, and 67% were economically disadvantaged. The 3rd-grade group consisted of 46 students, of which 57% were male, and 43% were female. Of these students, 11% were ELL, and 67% were economically disadvantaged. The 4th-grade group was comprised of 52 students, of which 42% were male, and 56% were female. Of these students, 15% were ELL, and 73% were economically disadvantaged. The 5th-grade group consisted of 48 students, of which 46% were male, and 54% were female. Of these students, 4% were ELL, and 83% were economically disadvantaged.

**Data Collection Methods**

During the three-week period of classroom-based physical activity intervention, teachers took breaks every 20 minutes to engage in five minutes of physical activity. This occurred during direct instruction time as well as independent and group work times. Teachers stopped instruction or academic activity every 20 minutes to pause for no more than five minutes of physical activity. The physical activity implemented included rotations of jumping jacks,
stretching and dance breaks, all with music and in that order, for each break. For example, the first break consisted of jumping jacks set to music for no more than 5 minutes. This would be followed by 20 minutes of academic activity. The next break would be stretching activities set to music, followed by 20 minutes of academics. The last break would be a dance break set to upbeat music. Subsequently, the rotation started over, and the researcher conducted weekly walk-through observations of the classes throughout the six-weeks of study.

This study was initiated at the beginning of a new six-weeks grading period. Grade averages from the end of the three-week period of intervention were compared with the grade averages from the three-week period of traditional classroom activities. Also, STAR assessments were completed prior to the beginning of the six-week period. The assessments were subsequently administered again at the end of the first three-week period and again after the second three-week period. Pre- and post- common formative assessment data was collected throughout the six-weeks grading period, and assessments were administered at the beginning and end of every math unit of instruction throughout the six weeks. All of these measures assessed the student growth in each particular area. Next, the growth of the students during the classroom-based physical activity intervention was compared with the growth from the period of traditional classroom activities.

Teachers at this school use a computer program for recording, storing, and averaging student grades. The researcher obtained grade reports from the school attendance secretary for analysis. The STAR scores are also recorded and stored online. Lastly, the teachers will submit the pre- and post-test given to the researcher for analysis.
Data Analysis Procedures

In this study, a t-test will be used for analyzing the difference in results in grade reports, pre- and post-test growth in math common formative assessments, and STAR scores both with and without physical activity breaks. A t-test was chosen because paired scores can be analyzed. The independent variable for this study was physical activity, and the dependent variable was student achievement. The researcher compared results of the pre- and post-test scores and then compared the gains of the three weeks of intervention with the three weeks of no additional physical activity. Ending grade averages for each three-week period of the study were also compared. Lastly, the researcher compared overall results of the primary grade groups to those of the upper elementary grade groups as well as looking at differences, if any, in gender.

Time Frame

This study began in January 2018, at the beginning of the second semester at the research school. Traditional classroom activities without physical activity were implemented for three weeks. The experimental interventions were conducted for three weeks. The study was conducted in 12 classes, six in grades 1-2 and six in grades 3-5. At the end of each three-week period, data was collected and analyzed to determine the effect that the classroom-based physical activities had on student growth.

Research Procedures

At the end of each three-week period of the study, data was collected and analyzed in order to test the hypothesis. The researcher's hypothesis is that physical activity breaks throughout class time makes a positive difference in student engagement and, thus, positively influencing factors such as test scores and grades. This hypothesis was tested by examining student progress and growth made during each three-week period.
Grade reports were analyzed first. Students receive a numerical grade average at the end of each six weeks. The numerical grades for each student in each of the 12 classes participating in the study were collected at the end of each three-week period. The differences in those scores for each student were calculated and compared to determine if the researcher’s hypothesis was true on this particular measure.

Next, teacher-created, common formative assessments (CFA) in the area of mathematics were scrutinized. Teachers administered two separate tests, pre, and post, throughout the course of each three-week period. Specific math skills to be tested were determined by the teachers based on curriculum guides and standards for their particular grade level. Also, the pacing of these tests was determined by the teachers to incorporate into their units of study with appropriate timing. Growth was measured for each test by comparing pre-test to post-test. The amount of student growth during the experimental physical activity intervention was compared with that of the growth during the three-week period without physical activity to determine the level of effectiveness of physical activity intervention.

The STAR assessment was the final measure to be examined. All students are given these assessments that test math skills and reading comprehension. This assessment was administered again at the end of each three-week period of the study. Growth numbers were compared between the two three-week periods in order to determine the validity of the researcher’s hypothesis.
CHAPTER 4: RESULTS AND DATA ANALYSIS

The purpose of this study was to determine the impact of classroom-based physical activity on academic growth. The researcher also looked for differences in the impact of physical activity on academic growth for upper elementary grade levels vs. primary grade levels and male vs. female. Forty-six 1st grade, 50 2nd grade, 25 4th grade, and 45 5th grade students participated in this study. This was a quantitative study in which the researcher compared academic growth in reading and math after the pre-treatment period with the academic growth in reading and math after the three week period of implementation of classroom-based physical activity. Two measures in both reading and math were compared.

The researcher originally anticipated an additional 50 3rd grade students and an additional 25 4th grade students to participate in the study. Some teachers opted out of participation in the program prior to its implementation. Therefore, there were fewer participants than originally expected. Also, due to time constraints as a result of missed school days for illness and inclement weather, the CFA measure was not available for analysis. Therefore, the four measures used in this study were math grade averages, reading grade averages, STAR Math scores, and STAR Reading scores. The nine teachers participating in this study kept logs of physical activity completed throughout the implementation phase. The researcher also completed walk-through observations to assure the physical activity was being carried out with fidelity and specificity as prescribed by the researcher.

The study took place over a period of six weeks. The first three weeks consisted of the pre-treatment phase, in which students participated in traditional classroom activities that did not include physical activity breaks throughout the day. The second three-week period was the implementation phase of the study, in which teachers took physical activity breaks every 20
minutes for three minutes, rotating through a prescribed routine of physical activity that included jumping jacks, stretching/yoga, and dance.

**Research Questions**

The researcher conducted this quantitative study in order to determine the answers to the following questions:

1. What is the impact of classroom-based physical activity on academic growth in grades 1-5?
2. Is there a difference in the impact of classroom-based physical activity on academic growth in grades 1-2 and grades 3-5?
3. Is the impact of classroom-based physical activity different based on gender?

**H$_1$**: Physical activity breaks throughout class time make a positive difference in student engagement and, therefore, positively influence factors such as test scores and grades.

**H$_0$**: Physical activity has no effect on engagement; therefore, scores and grades will not be affected.

**Analysis of Data**

To determine the impact of classroom-based physical activity on academic growth, the researcher measured the amount of growth in each assessment during the three week period without physical activity intervention and compared that with the amount of growth measured during the implementation phase. In this study, a population of students in grades 1, 2, 4 and 5 was assessed. A two-tailed, two independent means t-test was used to compare the academic growth of students under traditional classroom methods with the growth of students in classrooms that incorporate physical activity into academics. These tests were completed to answer the following research questions and to test the hypothesis.
Research Question #1: What is the impact of classroom-based physical activity on academic growth in grades 1-5?

$H_1$: Physical activity breaks throughout class time make a positive difference in student engagement; therefore, positively influence factors such as test scores and grades.

1st Grade Results

The first-grade participants consisted of 46 students in three separate classrooms. There were 23 males and 23 females. Students were assessed in reading (STAR Reading, reading grade averages) and math (STAR Math, math grade averages) after three weeks without the treatment and again after three weeks with the treatment.

Figure 4.1

![1st Grade Average Growth](image)

**Pre-treatment.** As shown in Figure 4.1, on the STAR Reading assessment, students’ mean growth was +34.40 on the scaled score. The 1st-grade reading grades showed mean growth of +3.55 percentage points. STAR Math scaled scores showed a mean growth of +22.86 and math grade averages showed mean growth of -4.13 percentage points.
**Post-treatment.** After three weeks of treatment, 1st-grade students demonstrated the mean growth of +14.11 on STAR Reading scaled score. Thirty-eight percent of these students showed greater growth post-treatment than pre-treatment. Student growth was -1.06 in reading grade averages with 28% of students demonstrating greater growth post-treatment than pre-treatment. STAR Math assessment results indicated a mean growth of +9.14, with 37% of students showing greater growth pre-treatment than post-treatment. Students demonstrated a mean growth of +10.51 in math grade averages, and 74% of students showed greater growth post-treatment as opposed to pre-treatment.

As shown in Table 4.1, the STAR Reading growth results were not significant at $p < .05$ ($t$-value 1.64399, $p$-value .103747). The growth in reading grade averages was also not significant ($t$-value 1.97507, $p$-value .057257). STAR Math scaled score growth pre-treatment vs. post-treatment was also not significant ($t$-value 1.7481, $p$-value .084101). However, math grade averages did show statistically significant greater growth post-treatment than pre-treatment ($t$-value -5.26715, $p$-value < .00001).

### Table 4.1 1st Grade Results

<table>
<thead>
<tr>
<th>Assessment</th>
<th>t-values</th>
<th>p-values</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAR Reading</td>
<td>1.64399</td>
<td>.103747</td>
<td>not significant</td>
</tr>
<tr>
<td>Reading grade</td>
<td>1.97507</td>
<td>.057257</td>
<td>not significant</td>
</tr>
<tr>
<td>averages</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STAR Math</td>
<td>1.7481</td>
<td>.084101</td>
<td>not significant</td>
</tr>
<tr>
<td>Math grade averages</td>
<td>-5.26715</td>
<td>&lt; .00001</td>
<td>significant</td>
</tr>
</tbody>
</table>
2nd Grade Results

The 2nd-grade participants consisted of 50 students in three separate classrooms. There were 27 males and 23 females in this group. Students were assessed in reading (STAR reading, Reading grade averages) and math (STAR Math, math grade averages) after three weeks without the treatment and again after three weeks with the treatment.

Figure 4.2

![2nd Grade Average Growth](image)

**Pre-treatment.** As shown in Figure 4.2, the 2nd-grade STAR Reading results showed mean growth of +3.98 in the scaled score. For the reading grade averages, there was a mean growth of -0.02 in percentage points. STAR Math results showed a mean growth of +21.18 in the scaled score. In math grade averages, there was a mean growth of +0.13 percentage points.

**Post-treatment.** After the three weeks of treatment, students showed a mean growth of -3.76 on STAR Reading scaled scores. In this assessment, 46% percent of students demonstrated greater growth post-treatment than pre-treatment. Reading grade averages showed
a mean growth of +1.04 percentage points, and 50% of those students demonstrating greater growth post-treatment compared to pre-treatment. There was a mean growth of +6.12 scaled score points in STAR Math, with 35% of students modeling greater growth post-treatment compared to pre-treatment. There was a mean growth of -2.0 percentage points in math grade averages, with 49% of students showing greater growth post-treatment compared to pre-treatment.

As shown in Table 4.2, in second grade, none of the results were significant at \( p < .05 \).

Table 4.2 2nd Grade Results

<table>
<thead>
<tr>
<th>Assessment</th>
<th>t-values</th>
<th>p-values</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAR Reading</td>
<td>-0.35401</td>
<td>.724102</td>
<td>not significant</td>
</tr>
<tr>
<td>Reading grade averages</td>
<td>-1.37788</td>
<td>.171378</td>
<td>not significant</td>
</tr>
<tr>
<td>STAR Math</td>
<td>1.72269</td>
<td>.088165</td>
<td>not significant</td>
</tr>
<tr>
<td>Math grade averages</td>
<td>1.20666</td>
<td>.230529</td>
<td>not significant</td>
</tr>
</tbody>
</table>

**4th Grade Results**

There was only one teacher participant from 4th grade because this grade departmentalizes and this participant only teaches math. Therefore, only math assessments were used for 4th-grade pre-assessment vs. post-treatment comparison. There are a total of 25 students, of which 12 are male, and 13 are female. Students were assessed in math (STAR Math, math grade averages) after three weeks without the treatment and again after three weeks with the treatment.
**Pre-treatment.** As shown in Figure 4.3, students showed a mean growth of +2.44 in scaled scores on the STAR Math assessment. Students’ pre-treatment growth was -5.72 percentage points in math grade averages.

**Post-treatment.** The STAR Math assessment scaled score growth post-treatment was +15.64 in the scaled score, and 56% of these students showed greater growth post-treatment compared to pre-treatment. Math grade averages post-treatment showed mean growth of -9.52 in percentage points; 40% of students showed improved growth post-treatment as opposed to post-treatment.

As shown in Table 4.3, no 4th-grade math assessments were statistically significant at $p < .05$. 
Table 4.3 4th Grade Results

<table>
<thead>
<tr>
<th>Assessment</th>
<th>t-values</th>
<th>p-values</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAR Math</td>
<td>-1.10987</td>
<td>.272584</td>
<td>not significant</td>
</tr>
<tr>
<td>Math grade averages</td>
<td>0.85654</td>
<td>.395955</td>
<td>not significant</td>
</tr>
</tbody>
</table>

5th Grade Results

There were 47 5th grade participants in separate classes, 21 males, and 26 females.

Students were assessed in reading (STAR Reading, reading grade averages) and math (STAR Math, math grade averages) after three weeks without the treatment and again after three weeks with the treatment.

Figure 4.4
**Pre-treatment.** As shown in Figure 4.4, STAR Reading results for 5th grade showed a mean growth of +6.98 in scaled score points. In reading grade averages, students showed a mean growth of -0.81 in percentage points. There was a mean growth of +5.38 scaled score points on the STAR Math assessment pre-treatment. In math grade averages, there was a mean growth of -5.70 percentage points.

**Post-treatment.** STAR Reading results post-treatment presented a +13.93 mean growth in scaled score points. Forty-nine percent of those students exhibited greater growth post-treatment than pre-treatment. In reading grade averages, there was a mean growth of -0.66 in percentage points. Forty-nine percent of those students indicated increased growth post-treatment compared to pre-treatment. STAR Math scaled scores revealed a mean growth of +1.33, with 46% of students exhibiting improved growth post-treatment over pre-treatment. Lastly, math grade averages revealed a mean growth of -1.48 in scaled score points.

As shown in Table 4.4, of these results, the differences in growth pre-treatment vs. post-treatment for STAR Reading, STAR Math, and reading grade averages were not significant at $p < .05$. However, students demonstrated statistically significant greater growth post-treatment than pre-treatment in math grade averages.
Table 4.4 5th Grade Results

<table>
<thead>
<tr>
<th>Assessment</th>
<th>t-values</th>
<th>p-values</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAR Reading</td>
<td>-0.37788</td>
<td>.706475</td>
<td>not significant</td>
</tr>
<tr>
<td>Reading grade averages</td>
<td>0.06015</td>
<td>.952166</td>
<td>not significant</td>
</tr>
<tr>
<td>STAR Math</td>
<td>0.25787</td>
<td>.797204</td>
<td>not significant</td>
</tr>
<tr>
<td>Math grade averages</td>
<td>-3.14379</td>
<td>.002274</td>
<td>significant</td>
</tr>
</tbody>
</table>

Research Question #2: Is there a difference in the impact of classroom-based physical activity on academic growth in grades 1-2 and grades 3-5?

Primary Grades Results

There were a total of 94 primary grade participants (50 male, 44 female) in this study. These students were assigned to six different classes. Students were assessed in reading (STAR Reading, Reading grade averages) and math (STAR Math, Math grade averages) after three weeks without the treatment and again after three weeks with the treatment.
**Pre-treatment.** As shown in Figure 4.5, the overall primary grade scores for STAR Reading exhibited a mean growth of +17.45 in the scaled score. Reading grade averages indicated a mean growth of +1.72. Pre-treatment STAR Math scores demonstrated a mean growth of +1.74. Finally, there was a mean growth of -2.11 in math grade averages.

**Post-treatment.** In STAR Reading results, there was a mean growth of +10.59 post-treatment with 42% of students showing greater growth post-treatment than pre-treatment. In reading grade averages, there was a mean growth of +0.09 with 38% of students exhibiting greater growth post-treatment than pre-treatment. There was a mean growth of +10.96 scaled score points in STAR Math scores. Thirty-six percent of those students revealed greater growth post-treatment than pre-treatment. In math grade averages, there was a mean growth of +3.80 percentage points with 61% of students disclosing greater growth post-treatment than pre-treatment.
When scrutinizing combined primary grade growth, as seen in Table 4.5, STAR Reading and reading grade average results were not statistically significant at $p < .05$. Math grade averages demonstrated statistically significant growth post-treatment over pre-treatment.

### Table 4.5 Primary Results

<table>
<thead>
<tr>
<th>Assessment</th>
<th>t-values</th>
<th>p-values</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAR Reading</td>
<td>0.76618</td>
<td>.444528</td>
<td>not significant</td>
</tr>
<tr>
<td>Reading grade</td>
<td>1.28303</td>
<td>.201036</td>
<td>not significant</td>
</tr>
<tr>
<td>STAR Math</td>
<td>1.75556</td>
<td>.080923</td>
<td>not significant</td>
</tr>
<tr>
<td>Math grade averages</td>
<td>-3.05833</td>
<td>.002547</td>
<td>Significant</td>
</tr>
</tbody>
</table>

**Upper Elementary Results**

There were 72 upper elementary grade participants in math (31 males, 41 females) and 47 upper elementary grade participants in reading (21 males, 26 females). 5th-grade students were assessed in reading (STAR Reading, reading grade averages), and 4th-grade students and 5th-grade students were assessed in math (STAR Math, math grade averages) after three weeks without the treatment and again after three weeks with the treatment.
Pre-treatment. In STAR Reading, as seen in Figure 4.6, there was a mean growth of +6.98 scaled score points. There was -0.81 percentage points mean growth in reading grade averages pre-treatment. In STAR Math, there was a mean growth of -5.54 pre-treatment and a -4.27 mean growth in math grade averages.

Post-treatment. There was a mean growth of +13.93 scaled score points in STAR Reading. Forty-nine percent of these students demonstrated greater growth post-treatment compared to pre-treatment. In reading grade averages, there was a post-treatment mean growth of -0.66 percentage points with 49% of students exhibiting greater growth post-treatment than pre-treatment. In STAR math scores, there was a mean growth of +7.05 points in the scaled score. Fifty percent of students showed greater growth post-treatment than pre-treatment. Additionally, in math grade averages, there was a mean growth of -4.27 percentage points with 54% of students presenting greater growth post-treatment than pre-treatment.
Scrutiny of upper elementary grade results determined there were no statistically significant differences in growth of any of the assessment areas, as shown in Table 4.6.

Table 4.6 Upper Elementary Results

<table>
<thead>
<tr>
<th>Assessment</th>
<th>t-values</th>
<th>p-values</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAR Reading</td>
<td>-0.37788</td>
<td>.706475</td>
<td>not significant</td>
</tr>
<tr>
<td>Reading grade</td>
<td>0.06015</td>
<td>.952166</td>
<td>not significant</td>
</tr>
<tr>
<td>Math grade averages</td>
<td>-0.42382</td>
<td>.67242</td>
<td>not significant</td>
</tr>
<tr>
<td>STAR Math</td>
<td>-0.64013</td>
<td>.52316</td>
<td>not significant</td>
</tr>
</tbody>
</table>

Research Question #3: Is there a difference in the impact of classroom-based physical activity on academic growth in males and females?

Male Results

Of the 166 students that participated in this study in grades 1, 2, 4 and 5, there were a total of 84 male participants.
**Figure 4.7**

![Overall Male Average Growth](chart)

**Pre-treatment.** As seen in Figure 4.7, on the STAR Reading assessment, male scores indicated a mean growth of +14.59 in the scaled score. There was a mean growth of -0.51 in reading grade averages. On the STAR Math assessment, there was a mean growth of +16.27 in scaled score points. Finally, math grade averages revealed a mean growth of -1.85 in percentage points.

**Post-treatment.** There was a mean growth of +16.67 in STAR Reading scaled score points in male students post-treatment. In reading grade averages, there was a mean growth of +1.06 percentage points. On the STAR Math assessment, there was a mean growth of +7.68 among all male participants post-treatment and a mean growth of -1.23 in math grade averages.

As shown in Table 4.7, of these results, none are statistically significant at $p < .05$. 
Table 4.7 Overall Male Results

<table>
<thead>
<tr>
<th>Assessment</th>
<th>t-values</th>
<th>p-values</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAR Reading</td>
<td>-0.07103</td>
<td>.943478</td>
<td>not significant</td>
</tr>
<tr>
<td>Reading grade</td>
<td>-1.45442</td>
<td>.149093</td>
<td>not significant</td>
</tr>
<tr>
<td>averages</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STAR Math</td>
<td>1.54585</td>
<td>.124193</td>
<td>not significant</td>
</tr>
<tr>
<td>Math grade averages</td>
<td>-0.35836</td>
<td>.72072</td>
<td>not significant</td>
</tr>
</tbody>
</table>

Female Results

Of the 166 students that participated in this study in grades 1, 2, 4 and 5, 82 were female.

Figure 4.8

Overall Female Average Growth

Pre-Treatment  Post-Treatment
Pre-treatment. As shown in Figure 4.8, among all female participants, there was a mean growth of +12.50 in STAR Reading scaled scores. There was a mean growth of -0.29 percentage points in reading grade averages. On the STAR Math assessment, there was a mean growth of +10.87 among females pre-treatment. On math grade averages, there was a mean growth of -2.85 in percentage points.

Post-treatment. Among all female participants, there was a mean growth of +6.34 on the STAR Reading assessment. In reading grade averages, there was a mean growth of -0.61 percentage points. On the STAR Math assessment, there was a mean growth of +6.62 post-treatment. There was a mean growth of -2.67 percentage points in math grade averages.

These results, as shown in Table 4.8, indicated there was no statistically significant difference in growth pre-treatment compared to post-treatment.

<table>
<thead>
<tr>
<th>Assessment</th>
<th>t-values</th>
<th>p-values</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAR Reading</td>
<td>0.65068</td>
<td>.516361</td>
<td>not significant</td>
</tr>
<tr>
<td>Reading grade averages</td>
<td>0.30733</td>
<td>.759258</td>
<td>not significant</td>
</tr>
<tr>
<td>STAR Math</td>
<td>0.46858</td>
<td>.64003</td>
<td>not significant</td>
</tr>
<tr>
<td>Math grade averages</td>
<td>0.33612</td>
<td>.737369</td>
<td>not significant</td>
</tr>
</tbody>
</table>

Findings

Research Question #1: What is the impact of classroom-based physical activity on academic growth in grades 1-5?

H₁: Physical activity breaks throughout class time make a positive difference in student engagement, and therefore, positively influence factors such as test scores and grades.
$H_0$: Physical activity has no effect on engagement, and therefore, scores and grades will not be affected.

STAR Reading growth results for pre-treatment vs. post-treatment in 1$^{st}$ grade, 2$^{nd}$ grade, and 5$^{th}$ grade were statistically insignificant. Growth results for reading grade averages were also insignificant for these grade levels. STAR Math growth results pre-treatment vs. post-treatment were statistically insignificant for 1$^{st}$ grade, 2$^{nd}$ grade, 4$^{th}$ grade, and 5$^{th}$ grade. Growth results for math grade averages for 2$^{nd}$ grade and 4$^{th}$ grade were statistically insignificant. However, growth in math grade averages in 1$^{st}$ grade and 5$^{th}$ grade showed statistically significant greater growth post-treatment than pre-treatment, thus, supporting the hypothesis.

**Research Question #2:** Is there a difference in the impact of classroom-based physical activity on academic growth in grades 1-2 and grades 3-5?

When comparing growth results in STAR Reading and reading grade averages for primary grades and upper elementary grades, both groups demonstrate no significant difference in growth when comparing pre-treatment and post-treatment. The combined upper elementary group also presented no significant change in growth post-treatment over pre-treatment in STAR Math and math grade averages. STAR Math growth also revealed no statistically significant results for the primary group. However, the primary group exhibited a significant change in growth in math grade averages with post-treatment scores producing greater growth than pre-treatment scores.

**Research Question #3:** Is the impact of classroom-based physical activity different based on gender?
There was no significant difference in either male or female students pre-treatment vs. post-treatment. Thus, it can be determined that there is no difference in how classroom-based physical activity affects academic growth in male and female students.

**Summary**

While the body of existing research regarding the impact of physical activity on academics is overwhelmingly positive, the results of this quantitative study show statistically insignificant results for most areas. However, math grade averages showed statistically significant improvement in 1st grade, 5th grade, and in overall primary results, thus, indicating that classroom-based physical activity had a positive impact on academic growth. Factors contributing to these results, findings, conclusions, limitations, and recommendations are discussed in Chapter 5.
CHAPTER 5: CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

A growing body of evidence and advances in neuroscience indicate that physical activity can be linked to cognitive performance, as well as brain structure and function (Donnelly et al., 2016). The impact of physical activity on cognition implies a link to academic performance. Thus, inactivity and excess weight are associated with poor academic achievement (Davis and Pollock, 2012). Perhaps the most compelling connection between academics and physical activity is the effect of physical activity on behavior and attention span. Many studies have indicated a connection between exercise and improved behavior, and the ability to pay attention. When behavior and attention improve, this implies an improvement in learning and in the ability to retain information.

Summary of the Study

This quantitative study was conducted over a period of six weeks. One hundred sixty-six students in 1st grade, 2nd grade, 4th grade and 5th grade were assessed in STAR Reading and Math, and current grade averages were recorded at the beginning of the six weeks, prior to the beginning of the study. The first three weeks of the study consisted of traditional classroom activities that did not include classroom-based physical activity. Students were assessed again at the end of the first three weeks to determine the growth experienced throughout the three weeks of traditional classroom activities without classroom-based physical activity. For the last three weeks of the study, students were given breaks every 20 minutes for three minutes of physical
activity during all academic segments of the day. Students did jumping jacks set to upbeat music for the first break, stretching activities as guided by videos from GoNoodle.com for the second break, and dance breaks, also as guided by videos from GoNoodle.com, for the third break. The activity breaks continued in this pattern throughout the day. In this study, the researcher sought to determine the impact of classroom-based physical activity on academic growth. Also, the researcher scrutinized results to determine if there was a greater impact on primary students or upper elementary students and if there was a greater impact on male or female students. While the majority of the findings were not statistically significant, there was a significant improvement in academic growth in some areas.

**Conclusions**

Although most of the findings of this study indicate that classroom-based physical activity does not have an impact on academic growth, there are some improvements shown in the area of math grade averages. This reveals that students’ performance on daily math tasks, activities, and unit/teacher-created assessments showed greater growth when physical activity breaks were implemented on a regular basis in 1st grade and 5th grade. However, it may be difficult to generalize these results because this study was completed at one school within one set of demographics. Also, the implementation phase of this study lasted only three weeks, which also makes it difficult to generalize for the impact of classroom-based physical activity on students for the long-term.

**Limitations**

The primary limitation of this study was the restricted amount of time available for the implementation phase. A three-week implementation period did not provide ample time to discern the effects of classroom-based physical activity fully. Consistent implementation of
physical activity was also a limitation of this study. Teachers kept logs of the physical activity breaks for each day, the time of each activity, and the time allotted for the activity. Although the types of physical activity, duration, and frequency were prescribed by the researcher, these guidelines were not consistently followed. Inconsistency in the implementation could influence the results. This study was also conducted during a time period in which students were not taken outside for recess on a consistent basis due to weather conditions. However, the weather was unseasonably pleasant during the first three weeks of this study in which students were not given activity breaks. Thus, these students were taken outside for recess more often than normal for this time of year. Accordingly, study results may have been impacted because students received additional physical activity in recess during both phases of the study. Teacher attitudes could also have been a limiting factor. Some of the teachers were reluctant research participants. These teachers were not as consistent in their implementation of the program with students. It is also important to note those teachers who demonstrated positive behaviors and seemed most enthusiastic about the study were those who were assigned the two grade levels that produced a significantly positive result in one assessment area.

**Recommendations**

To fully understand the impact of classroom-based physical activity, future research should be conducted. Data collection should occur in other regions of the country to gain a better understanding of generalizations that can be made regarding classroom-based physical activity. It is also recommended that the study is conducted in a similar manner over an extended period of time. It is very difficult to generalize regarding the impact of classroom-based physical activity when the implementation was studied for only three weeks. Ideally, this implementation phase should extend to at least one semester and potentially one full school year.
While many of the results of this study were statistically insignificant, the positive, optimistic results regarding the effect on 1st and 5th-grade math grades prompt recommendation that several follow-up studies be completed to enhance the body of research linking physical activity and academics.

**Summary**

Many previous studies have been conducted on the topic of physical activity and how the brain is affected. Numerous studies have linked physical activity breaks to improved engagement and attention. This quantitative study sought to verify whether improved engagement and attention would subsequently contribute to greater academic growth. In answering the first research question regarding the general impact of classroom-based physical activity, while the results were not overwhelmingly significant, there is optimism in this field of study.

With further research on this topic and factors that contribute to the success of classroom-based physical activity, a body of research-based data could be acquired that would provide a basis for developing a universal model for the implementation of classroom-based physical activity.
References


Compton, C. (2008). Thank you, Miss Katherine: Teaching dance in an academic setting can


Dent, M. (2003). Saving our children from our chaotic world. Dunsborough, Australia:

Pennington.


Greany, T., Rod, J. (2003). *Creating a learning to learn school*. Bodmin, UK: Campaign for


Opportunities for Participating in Learning in Reclaiming Children and Youth, 12(4): 210-216.


