THE EFFECTS OF A SCHOOL-BASED PHYSICAL EDUCATION COURSE ON SEVENTH GRADE ACADEMIC ACHIEVEMENT

by

Gregory Allen Beasley

Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

Doctor of Education

Liberty University

2020

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APPROVED BY:

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ABSTRACT

This quantitative study examined academic achievement of seventh grade students from a local school district in Cincinnati, OH. Academic achievement and physical activity are both of importance and beneficial to an individual. Specifically, the purpose of this study was to determine whether students who are participating in school-based physical education (P.E.) courses exhibited higher academic achievements. The sample consisted of 290 seventh grade students for the school year (2015-2016), 312 for the school year (2016-2017), and 339 for the school year (2017-2018). For seventh grade students, archival data was received from the school, which included ethnicity, gender, Grade Point Averages (GPAs), and whether the student participated in P.E. The results were then analyzed using an Independent Samples *t*-test. According to the findings of this study, students who participated in school-based P.E. courses attained higher academic achievement in two of the three years researched.

Keywords: active brains project, no child left behind, school-based physical activity, student achievement

Dedication

For Jill (wife), Jillian (daughter), and Gregory (son). I want nothing less than to be the best for each of you.

Acknowledgments

Thank you, Father. You provide strength and encouragement to all your children. May you first receive all credit for any accomplishments I achieve. Let my life be used in ways that bring glory to your Kingdom.

My tireless wife Jill, and fun-loving children Jillian and Gregory – Your support and love got me through and gave me fuel to be my very best. It has been quite a journey and I am beyond thankful that you have been with me at every turn. For the final lap, look out Disney World, here we come!

Dad (Ed), Mom (Judy), Brother (Ed), Sister-in-Law (Marina), Mother-in-Law (Carolyn), and the rest of my family –I am full of gratitude for all the time you cheered me on during this educational marathon. You helped me to be who I am today.

Missy Thorpe (Executive Administrative Assistant) – For all of your help and support in keeping things rolling on a daily basis. Thank you.

Gary A. Sallquist, M.Div., D.Min., close friend and mentor – You are the ultimate encourager. I'm more than happy to be your wingman.

The Miami Valley Christian Academy Admin Team and Board – We've experienced some great God moments over the last five years.

Dr. Judy Sandlin – please express my gratitude for patiently guiding me through this major milestone in my life. We made it.

Table of Contents

List of Tables

List of Figures

List of Abbreviations

Association of Christian Schools International (ACSI)

Centers for Disease Control and Prevention (CDC)

National Center for Education Statistics (NCES)

No Child Left Behind (NCLB)

Ohio Department of Education (O.D.E.)

Physical Education (P.E.)

CHAPTER ONE: INTRODUCTION

Overview

The current study examined the relationship between P.E. and student achievement of seventh grade students in Ohio. This study was designed to consider the effects of school-based physical activity through P.E. class on student achievement. In this chapter, background information pertaining to the study is provided, subsequent to which the problem statement and the purpose statement are presented. The significance of the study is also explicated. The research question to which the study responds is outlined. Finally, key terms related to the study are defined.

Background

Increasing student achievement is a crucial determinant in the overall educational success of a student. Researchers are continuously seeking means to provide the best possible learning environments and resources to maximize student achievement. The incorporation of school-based physical activity should not be overlooked or eliminated as school boards, administrators, and teachers seek to find ways to develop the full potential of a student.

Most schools make physical activity available for students through school-based programs and classes (Thomas, 2004). These program offerings and opportunities are often in the form of P.E. classes, after school activities, and sports. Additionally, some schools offer opportunities for intramural sports that provide opportunities for students to become more active at the beginning of the day (McGrath, 2011). In essences, these programs provide students with opportunities for exercise, growth, development, and overall better health (National Association for Sport and Physical Education, 2001).

The measurement of an educational organization is essentially assessed through data pertaining to students' academic achievements (Symons, Cinelli, James, & Groff, 1997). This data is primarily collected through the results of standardized test scores, GPAs, and other national and state examinations. Reports, especially those of public schools, are often made available to the public so as to provide a quick overview of the state's ratings of school districts. Given that schools continue striving for maximum achievement, which result in high overall ratings, it is noteworthy to consider possible benefits of P.E.

Historical Context

For hundreds of years, physical activity has been associated with education benefits. In his famous writing, *The Republic*, Plato underscores the importance of educating both the mind and the body (Cornford, 1945). Olympic games were held in commemoration of those that possessed great strength, ability, and athleticism (Olympic games, 2014). Since one's health was of great importance, regular practices and commitments in gymnastics were a way of life.

While Plato advocated for P.E. with greater fervor than Socrates, there was still a recognized level of importance in the overall development of one's self. In this regard, Socrates states, "The man who makes the finest mixture of gymnastic with music and brings them to his soul in the most proper measure is the one of whom we would most correctly say that he is the most perfectly musical and well harmonized" (Cornford, 1945, p. 1838). These early philosophers and teachers understood P.E. to be necessary in the development of children.

Nearly 1,500 years later, a German-born American scholar named Charles Beck established the first gymnasium in the United States. In 1825, Round Hill School at Northampton, Massachusetts hired Beck to teach Latin and host the country's first gymnastics program (Grossfeld, 2010). Beck began to teach German gymnastics to the students.

Eventually, an increasing number of schools began adopting the same philosophy that would culminate to a requirement for schools. Over time, P.E. began to grow as an important part of the educational program.

Attaching great importance to physical activity for youth, Presidents Dwight D. Eisenhower and John F. Kennedy began promoting P.E. programs. In 1966, the Presidential Fitness Test Award was implemented to assess a student's physical fitness level. The test was also implemented to help prepare individuals for becoming a member in the services for war. In 1975, the House of Representatives of the United States of America voted to add P.E. as a secondary subject in schools (Blair, LaMonte, & Nichaman, 2004).

The focus of P.E. and other non-core subjects became less of a priority as schools were met with demands found in programs such as the No Child Left Behind (NCLB) Act. NCLB was created as a systematic process for measuring academic achievement in schools (NCLB, 2002). Notably, this law mandated testing of students in third through eighth grade and once in high school in reading and math (NCLB, 2002).

In Ohio and other states, the state Department of Education measures certain standards, benchmarks, and criteria to provide schools with a final grade that reflects the overall achievement of the school district. The data is an indication and reflection of the effectiveness of a school's program. Failure to reach and maintain a certain grade, results in the loss of state funds to the failing school district (Burt, 2018). Consequently, some schools place greater emphasis on testing core subjects (Ravitch, 2016). This approach has also led to schools decreasing funding and emphasis on specials classes like P.E. class in order to augment funding and emphasis on core subjects and resources to prepare students for testing (Brink, 2010). As schools seek to deliver high student achievement data, they focus more on the instruction for

core subjects in hopes that students will yield top performing results (Darling-Hammond, 2015). At the same time, student achievement may also be compromised with the decline or elimination of student-based physical activity (Barrett et al., 2015).

Social Context

The elimination of school-based physical activity causes students to suffer more consequences than mere loss of another class. For example, students lose the opportunity for a regular means of exercise and physical activity at school. The lack of physical activity has been associated with childhood obesity in several studies (Sahoo et al., 2015). Childhood obesity impacts the emotional, mental, and social aspect of a child, which is detrimental to their future success (Warschburger, 2005). In this context, one study revealed that a physical activity program for elementary students offering a moderate vigorous approach had an impact on all students (Barrett et al., 2015). Meanwhile, children who lack physical activity actually have been reported to experience lower self-esteem (McAuley et al., 2005).

Problem Statement

Extant research has highlighted the importance of physical activity and its positive effects on one's mind and body (Castelli, 2015). Increased self-esteem is also recognized to be a benefit of physical activity (Wicker & Frick, 2015). Consequently, students are more likely to perform better in other areas, including the classroom, if they feel good about themselves (Taras, 2005). Educational programs must consider the ramifications of making decisions, which prohibit students from these significant programs.

Studies show that physical activity influences main systems of the child, thus contributing to their mental activity (Eime et al., 2013; Fox, 1999; Ransford & Palisi, 1996; Wicker & Frick, 2015). Mental work augments the intensity of metabolic process in the brain,

whereas the consumption of oxygen entering the internal environment of the body is up to twenty percent. Stable, good blood supply in the cerebral cortex is necessary to ensure productive intellectual activity (Kohl & Cook, 2013). However, there is paucity of scholarly research on the effect of school-based physical activity on end-of-year GPA of middle school students (Castelli, 2015).

Purpose Statement

The purpose of this quantitative causal-comparative study was to determine the difference in student achievement between seventh grade students who participated in school-based P.E. course and those who did not. Participants were from a local school district within a suburban community in Ohio. Archival data was used for this study. The independent variable of school-based P.E. course was defined as P.E. class consisting of a curriculum to provide physical activity through a wide variety of exercises, stretches, and sports, and is taken by a student for a full year. The dependent variable of a student's academic achievement was measured by end of year GPA.

Significance of Study

The current study assumes significance for schools and school districts, given that the primary goal of an educational organization is to promote maximum student achievement. At large, education is a focus for state and federal systems in an effort to minimize achievement gaps (NCLB, 2002). Since the achievement tests students take is a main measurement for schools and school districts, some schools are focusing their efforts on teaching students, specifically towards passing those tests as way to reflect better overall test scores (Ravitch, 2016).

The current study was conducted to contribute to the understanding of a relationship between physical activity and student achievement. Studying physical activity and in particular, how it impacts academic achievement, assumes importance for all students (Donnelly et al., 2016). The current study adds to the existing body of literature to help schools and schools' districts consider the potential importance of physical activities may on the overall success of a child by highlighting the benefits associated with physical activity (Warburton, Nicol, & Bredin, 2006). However, this study is different from the extant literature as it specifically targets seventh grade students in Ohio.

A positive effect and significant relationship between physical activity, specifically P.E. and student achievement, would help encourage school boards and administrators to prioritize and maintain these classes. Furthermore, the current study provides insights into concepts relating to best practices in education.

Research Questions

RQ1: Is there a statistical difference in the end of year GPA of seventh grade students who participate in one full year of a school-based P.E. course and those who do not during the 2015-2016 school year?

RQ2: Is there a statistical difference in the end of year GPA of seventh grade students who participate in one full year of a school-based P.E. course and those who do not during the 2016-2017 school year?

RQ3: Is there a statistical difference in the end of year GPA of seventh grade students who participate in one full year of a school-based P.E. course and those who do not during the 2017-2018 school year?

Definitions

1. *ActiveBrains project* - The ActiveBrains project, assesses the effects of physical exercise on brain, cognition, physical, and mental health in obese children aged eight to eleven (Esteban-Cornejo et al., 2017).
2. *No Child Left Behind Act* - A federal law aimed at closing student achievement gaps by providing all children with a fair, equal, and significant opportunity to obtain a high-quality education (NCLB, 2002).
3. *School-based P.E.* - Physical activity that is provided through a structured program during the school day, which is often delivered through P.E. class (Sahoo et al., 2015).
4. *Student achievement* - The overall measure of a student's academic progress (Mavilidi et al., 2015).

CHAPTER TWO: LITERATURE REVIEW

Overview

Current educational problems give rise to the urgency of studying the factors that ensure a high level of (mental and physical) working capacity in the learning process at school. The need to examine the patterns, the relationship between the level of physical activity, as well as the characteristics of mental activity of students now assumes paramount importance. The reason for the sharp decline in the health of student youth that began at the end of the last century is intensive educational activity that is replete with high mental stress and neuro-emotional tension (Kohl & Cook, 2013). Moreover, this tension has a progressive direction due to the increasing flow of information and the computerization of the existing learning process. Intellectual activity, with an apparent lack of physical activity, creates conditions for violations of the musculoskeletal system. In contrast, continuous intellectual work strengthens the state of tension of the human body's primary functional systems (Kohl & Cook, 2013). The experimental material accumulated in the framework of this problem shows that to the inclusion of physical acivity makes it possible to influence the human body to level out negative factors that lead to neuropsychic stress, and help maintain the emotional state at a normal level (Kohl & Cook, 2013).

The current problem is revealed by the theoretical analysis and generalization of academic data characterizing the level of the psychophysiological state of students and progressive trends in its deterioration. The urgent need for an early solution to the problem of increasing students' resistance to neuro-emotional stress in the process of educational activity may be found through the means and methods of a physical culture. Insufficient accounting of psychological knowledge on the organization of the educational process and physical activity,

disregard for the valeopsychological principles of P.E., and an indiscreet underestimation of the role and significance of physical activity causes serious damage to the child's physical and mental development, thus resulting in the misunderstnding of goals and objectives of the education and upbringing of the younger generation. A large number of studies are devoted, mainly in the field of sports and pedagogical sciences, to physical activity, in which the correlation of the physical and mental development of an individual is established. It confirms the idea of physical culture and sports as the main factors of health promotion.

Theoretical Framework

Previous research has shown that there is a strong linkage between health status and physical activity during childhood and adolescence, while emphasizing potentially negative consequences of a sedentary lifestyle in the long term. The long-held interest in the problem of the influence of various types of physical activity on the mental development arose long ago underscores the desire of scientists to pursue a person’s holistic knowledge in the unity of the physical and mental development. The association of physical activities and academic achievements can be described using the theory of sport-participation and subjective well-being. Studies examining the impact of sports participation on subjective health have shown a positive effect. Studies show that physical activities influence main systems of the child, thus contributing to the mental activity (Eime et al., 2013; Fox, 1999; Ransford & Palisi, 1996; Wicker & Frick, 2015). In addition, physical activities are perceived as a form of physical and mental training that influences/stimulates both the body and the mind. For instance, Warburton, Nicol, and Bredin demonstrated that physical activity contributed to the primary and secondary prevention of diseases, fatigue, and helped enhance mental performance (Warburton, Nicol, & Bredin, 2006).

Related Literature

Systemic Metabolic Effects of Physical Activity

The academic process of students is characterized by systematic and intensive mental workloads in the face of significant reduction of physical activity (Hildebrandt et al., 2010). According to modern psychological and pedagogical studies, the selection and application of exercises, that increase physical activity, ensure the unity of an individual's mental and physical development. A characteristic feature of learning activities is an intense excitation of the brain in a small region of nerve centers, which, in turn, is responsible for their rapid fatigue. Mastering knowledge, skills, and forming competencies in the conditions of school education, requires higher mental functions in attention, memory, thinking, and speed of processing information. To that end, intensive mental work in particular affects the state of the central nervous system and the course of mental processes causing emotional stress. Mental work intensifies the metabolic process in the brain, as a result of which the consumption of oxygen entering the internal environment of the body is up to 20%. Emotional tension, prolonged stay in a sitting position, hard work in conditions of time deficit, and neuropsychic stress reduce the sufficiency of blood circulation in the brain. Intensive mental work in conditions of impeded physical activity causes rapid fatigue of the field of vision and can lead to severe visual impairment in students. For this reason, stable, good blood supply in the cerebral cortex is necessary to ensure productive intellectual activity (Kohl & Cook, 2013).

The researchers found a linkage between the brain structure of children and their aerobics classes. In addition, students who perform physical exercises before tests in mathematics and reading have been shown to produce better results than their sedentary comrades. The same conclusion by reached by an Irish study, which showed that participants were able to cope better

with memorization tasks when they had been cycling for half an hour prior to testing (Cacciotti, Milne, & Orr, 2015). A possible explanation for this effect is that exercise increases the production of neurotropic brain factor (BDNF), a protein that promotes the health of the nervous system Another study, conducted by Mavilidi et al. (2015), shows that sports can help facilitate the study of foreign languages. Students from the first group were constantly sitting, whereas those from the second group were engaged in physical exercises before and during class. According to the findings, the second group of students that was engaged in sports coped better with eight different lexical tests and chose the correct translation of sentences more often.

Scientists in several studies have found that playing sports allow students to develop physically. As a result, physical activity had a positive effect on their academic performance in school. Scientists have followed students' physical condition and academic success on an ongoing basis. During the course of these observations, they discovered the relationship between certain physical indicators and the mental development of children as well as adolescents. In particular, scientists have linked successes with muscle strength, motor abilities, and other parameters, also observing that the students whose physical development is at a high level also demonstrate success in their studies (Ford, 2016). According to the research, sports have a positive effect on mental abilities by improving levels of concentration. During physical activity, the blood flow to the brain cells improves, which, in turn, affects the cognitive speed of data processing. During exercise, the mobility of the nervous processes of excitation and inhibition increases in the cortex of the cerebral hemispheres and other parts of the nervous system. Thus, the process of excitation is more straightforward, passing faster into the process of inhibition and vice versa (Ford, 2016). In physically developed students, the nervous system adapts better to new movements and new working conditions. However, it should be noted that

only moderate physical exertion (comparable to a person's physical abilities) has a beneficial effect on one's health (Ford, 2016).

One of the conditions for the formation and improvement of mechanisms for adaptation to mental stress is physical activity, which can act as an optimizing and as an adaptive factor. Physical loads are known to cause changes in various functions of the body, thus affecting mental performance, attention, operational thinking, as well as the amount of processed information (Vuillemin et al., 2005). Optimal selection of the physical activity regime and physical exercises will positively influence mental processes and the formation of mental resistance to intense intellectual activity. Performing physical exercises of optimal duration and intensity results in enhanced mental performance. Additionally, physical activity leads to an increase in the body's metabolic processes. Optimally matched loads, in turn, will increase mental and physical performance (Vuillemin et al., 2005).

Physical Activity and Brain Development

According to data obtained by scientists from Spain-based University of Granada, physical exercises cause changes in the structure of the brain, which has a direct impact on academic achievement (Esteban-Cornejo et al., 2017). This research was a part of the ActiveBrains project and entailed conducting clinical trials that involved more than 100 children aged 8-11 years who were suffering from obesity. This was the first scientific work to have explored the relationship of physical activity and the volume of gray matter in children with excessive body weight. More specifically, this study answered questions such as whether good and poor physical fitness, of the children, affects the brain and ultimately their academic performance. According to the findings, the physical activity associated with the cardiovascular system is associated with a significant amount of gray matter in the lower frontal gyrus and the

superior temporal gyrus. These areas of the brain are involved in reading and speech processes (Esteban-Cornejo et al., 2017). Scientists opined that the findings should be taken into account in schools as well as other public institutions related to health. They added that the school is the only organization in which all children are compulsorily gathered for at least ten years. For this reason, it is an ideal environment to apply such recommendations (Esteban-Cornejo et al., 2017).

In another study, Dutch scientists analyzed data from 10 observations and 4 interventional studies involving 12,000 children aged 6 to 18. The study concluded that school performance largely depends on the level of physical activity of students (Singh, 2012). Scientists have known that physical exercises increase the flow of blood to the brain and improve its oxygenation. For a more detailed study of this issue, the study leader, Dr. Amika Singh, and colleagues from the Medical Center of the Amsterdam Free University (VU University Medical Center) analyzed data from 14 studies, of which 12 were conducted in the United States, and 1 each in Canada and South Africa. The research was conducted between 1990 and 2010 (Singh, 2012). Scientists claim that two studies enabled them to identify convincing evidence of the positive effect of physical exercises on school performance. In addition to improving blood circulation in the brain, physical exercises also help reduce stress levels, improve the mood of students, and increase their efficiency. According to Singh, children who participate in sports, and are trained to play by the rules, become more disciplined and able to concentrate better during the lessons. Researchers also emphasize that physical activity is important at any age. Without physical exercises, it is challenging to strengthen and preserve the child's health. In this regard, it is recommended to devote daily structure times of balanced physical activity to improve the health outcomes of children (Singh, 2012).

Physical Inactivity and Declined Academic Achievement

In academic achievement, the primary determinant of the decline is inactivity. With a decline in motor activity, the metabolism and information flowing into the brain from the muscle receptors decrease, which, in turn, impedes the regulatory function of the brain and adversely affects the work of all organs. Thus, conditions for normal growth and development of the child can only be created by developing the musculoskeletal system and stimulating the function of the respiratory and cardiovascular systems. When performing an intellectual activity, the electrical activity of the muscles increases, thus reflecting the stress of skeletal muscles. The more the brain is loaded, the higher the generalized muscle tension (Ford, 2016). Effective brain activity needs to be constantly impulsed from different systems of the body, with muscles representing almost half of the "volume". Due to the active work of these muscles, a considerable amount of nerve impulses enters the brain, thus enriching it.

Physical Activity and Intellectual Activity

The relationship between physical activity and intellectual activity is manifested in the following patterns. During the process of intellectual activity, muscles unconsciously contract and strain because the impulses are coming from the strained muscles in the central nervous system, which stimulates the brain. This helps it to maintain the necessary tone (some neuro studies refer to this term as "arousal"). During the execution of actions that do not require physical effort and well-coordinated movements, muscles of the neck and shoulder girdle, as well as the muscles of the face and speech apparatus, often end up straining. This happens because the activity is closely associated with the nerve centers responsible for attention, emotions, and speech (Keeley & Fox, 2009). With prolonged and intensive engagement in writing, stress gradually moves from the fingers to the muscles of the shoulder girdle. Prolonged

performance of such work causes habituation to such stimuli because the nervous system tends to activate the cerebral cortex and maintain efficiency. As a result, the process of inhibition spreads throughout the muscular system. This, in turn, results in decreased productivity because the cerebral cortex is unable to cope with the continuing nervous excitement. Thus, the help of physical exercises and active movements is necessary to release the muscles from excess tension (Keeley & Fox, 2009). The brain and nervous system can be maintained for longer periods of time by alternating tension and contraction of different muscle groups with relaxation and stretching. This kind of movement is commonly seen in running and walking (Kantomaa et al., 2015). The condition of effective intellectual activity is related to a trained body, which helps the nervous system cope with mental stress. Activity and stability of attention, memory, and processing directly depends on the child's level of physical preparation. Meanwhile, the mental processes are contingent on the physical qualities of the body such as endurance, speed, and strength. Thus, rationally selected physical load directly affects the intensity of the brain's ability to work.

A critical moment in this situation is the determination of an appropriate level of physical activity which facilitates the attainment of optimal performance level. The effect of complete recovery is possible only at a certain level of loads that corresponds to the level of physical training of a person. In this case, a small physical exertion will not have a significant impact. On the contrary, excessive loads will lead to over fatigue and a significant decrease in efficiency (Keeley & Fox, 2009). Therefore, the effect of intense physical activity on mental activity manifests itself in the activation of protective processes, which is an essential means of increasing the mental efficiency of students. Such dynamic exercises contribute to the expansion of mechanisms and methods of protective-adaptive processes in the brain. In this regard,

activities that improve health and general physical condition, such as P.E. and sports, have a beneficial effect on students' academic performance.

Studies supplementing the list of positive effects of regular physical activity have found a positive effect on both brain health and academic performance. In particular, a study of scientists from Spain examined these issues and concluded that the most important indicators are cardiorespiratory activity and motor endurance of children (Esteban-Cornejo et al., 2015). In their study, scientists focused on three aspects of physical fitness: cardiorespiratory activity, muscle strength, and motor endurance. They not only studied the impact of each factor separately, but also evaluated the collective effect of all factors on school performance and achievements. The senior author of the study, Irene Esteban-Cornejo of the University of Madrid Medical University, explains that these indicators are closely related, which poses some challenges in calculating the degree of influence of each of them. However, they have set the goal of calculating the separate influence of each of these factors on the school performance of children (Esteban-Cornejo et al., 2015). The researchers analyzed data from the UP & DOWN Study, which examined 2,038 Spanish children aged 6 to 18 years old, and collected complete data on physical fitness, physical, and mental health of participants, as well as their achievements. Cardiorespiratory activity is a measure of the quality of the heart and lungs, evaluated by determining the extent to which they can deliver oxygen and nutrients to the muscles during physical exercise. In order to measure this value, participants performed an exercise on shuttle running and undertook other tests to determine the maximum degree of aerobic training. The motor endurance includes speed of movement, agility, and coordination, which was studied with the help of agility exercises, car dynamometry, and long jumps from standing position. The researchers used student grade scores at the end of the school year for

core subjects to assess academic performance (Esteban-Cornejo et al., 2015). According to their findings, cardiorespiratory activity and motor endurance were associated with children's performance both individually, and in combination. However, the connection between general physical fitness and school performance was found to be rather weak. The speed, agility, and coordination were influenced by performance, rather than the ability to aerobic loads. Furthermore, the magnitude of muscular strength in itself was not associated with academic achievement (Esteban-Cornejo et al., 2015). According to scientists, their study is a call to increase physical activity in schools. In addition, it puts emphasis between different directions of P.E. and recommends the development of those directions that stimulate a high running speed, overall agility, and coordination. In addition to physical exertion, evidence also suggests that physical activities has a beneficial effect on the child's brain. It was concluded that exercises can help improve the executive region of the brain that is responsible for making decisions, solving problems, regulating behavior, and performing other important cognitive functions.

Increased Physical Activity Yields Higher Academic Performance

Scientists from Spain conducted the following study to test the influence of sports on the academic progress of adolescents (Asociación RUVID, 2013). The results of the experiment showed that young athletes have significantly higher academic performance as it relates to test scores. Ana Seder of the University of Jaime Primero in Spain conducted a study that witnessed the participation of 313 adolescents. Among them, 124 practiced at least ten hours a week, whereas 189 participants were not athletes. The participants were required to complete two questionnaires. One questionnaire determined academic knowledge, whereas the second one showed physical activity. It was concluded that teenagers who are engaged in competitive sports, possess more knowledge in all subjects, and have more motivation and free time to

devote to an active way of life. The study also pointed out that combining sports with study offers many benefits. There is the idea of harmonious development, which is based on the fact that the development of certain qualities helps develop other abilities. Motor activity, which is aimed at activity in sports activities, is a direct mechanism for developing self-control and self-regulation. This is the key to the success of adolescents, who can combine study and exercise (Asociación RUVID, 2013).

A joint group of British researchers from the universities of Bristol, Glasgow, and Dundee, with the participation of an American colleague from the University of Georgia, studied data on nearly 5,000 adolescents aged 11, 13, and 16 years in the Avon Longitudinal Study of Parents and Children (ALSPAC). This study washeld in the South-West of England by Bristol University (Booth, 2013). The participants were offered to wear a bracelet with a physical activity meter (for the speed of movement) during the week. According to the findings, with the recommended physical load in these countries for the age groups, one hour a day on average, the boys were active 29 minutes a day, whereas the girls were active 18 minutes. This is significantly less than the required indicators. The situation is actually even more serious when reviewing recent studies that suggest one hour per day is not enough to enable a child to develop in an optimal manner. The scientists compared the data with the indicators of academic achievement in mathematics and natural science disciplines. In all three age groups, a strong correlation was found between physical activity and learning ability. This correlation was particularly noticeable at the age of 15-16 when school children pass exams at the end of the academic year. Every additional 17 minutes of physical activity for boys and 12 minutes for girls was found to increase the examination score by one point (Booth, 2013). A particularly strong connection between academic achievement and physical activity was found in female representatives. Scientists

believe that the brains of girls react more strongly to increased physical activity (Booth, 2013). When the children were at the age of 11, the researchers measured their physical activity for 3-7 days using an accelerometer. In order to cut off the influence of other factors, Booth and her colleagues also took into account the weight of children at birth, the time of the study, the age of mothers, the intake of fish oil by mothers, the time the child reached puberty, as well as other social and economic variables. Subsequently, the researchers evaluated the successes of adolescents in English, mathematics and the natural sciences at the age of 11, 13 and 15-16. The results showed that the more the student gave time to P.E., the better the student learned at any age. Scientists suggest that physical exercises affect the brain of gender differently (Booth, 2013).

Scientists noted the regularity of people in good physical shape, also had a high level of IQ. Opinion polls in schools showed that children who enjoy P.E. class and attend sports are more successful than their counterparts who do not like physical exercises. Walking on a daily basis and doing sports a couple of times a week is enough for the brain to work well. For example, scientist Jan Janssen from Ontario conducted lifetime studies of different people with different levels of activity. Meanwhile, deficiency of motor activity affects all the systems of the body, which is the most prominent sign is obesity and reduced endurance. After studying these indicators over the past 46 years, researchers at the University of South Australia recently stated that the endurance of children and adolescents aged 9-17 years on average decreases by 5% worldwide every ten years. To the consequences of hypodynamia, learning impairment was added (Tomporowski et al., 2008). Resultantly, the endurance of the student has an impact on academic performance and mental functioning.

Scientists from the University of Nebraska also confirmed that fitness classes have a positive impact on the performance of girls in school. According to scientists, the reason for this trend is the production of iron, which occurs during fitness classes. After conducting a number of studies, specialists determined that constant exercise eliminates stressful stimulation of the brain. At the same time, the presence of iron in the body can cause problems with the digestive system, which is also a matter of concern. Karst Kohler said that specialists observed about 200 girls during the course of these experiments. Some of them attended sports and fitness classes three times a week. All the other girls spent a lot of time studying. As a result, it turned out that the first group showed good results. Scientists posit that iron, which is produced in the body as a result of playing sports, stimulates the brain and helps get rid of extra pounds, besides strengthening muscles (Hylok, 2011).

Physical Activity Improves Memory and Slows Aging

Studies have shown the effect of long and intense physical exertion on memory. Even slight strain of muscles affects the functioning of the brain. Scientists from the Georgia Institute of Technology (USA) conducted a series of experiments in which they showed that physical exercises improve episodic memory in people (Weinberg, Hasni, Shinohara & Duarte, 2014). Scientists conducted an experiment where participants were asked to view as many as 90 photos on the computer screen. All these photos were divided into different groups with the image of positive events, negative, and neutral. One group of participants went to the gym, where they did 50 weight lifting exercises, while the other group did not do physical exercises. All participants returned to the laboratory, where they were shown another 180 photos. Subsequently, they were asked to try to remember all the photos seen. As it turned out, those participants who practiced physical exercises remembered 60% of all photos, whereas those who did not less than 50%.

People, who were engaged in physical exercises, remembered the emotional color of photos better. According to Dr. Lisa Weinberg, this research shows that people do not need to spend a lot of time to improve their memory; just a few minutes of exercise would suffice (Weinberg, Hasni, Shinohara & Duarte, 2014). The results also established a correlation between physical activity and academic performance.

According to a study by scientists from the University of Eastern Finland, a high level of physical activity is associated with improved performance in school children in grades 1-3, especially among boys. Under this framework, scientists evaluated the impact of physical activity and sedentary lifestyles on the progress of 186 school children (grades 1-3) in subjects such as reading, writing, and arithmetic (Haapala et al., 2017). Higher levels of physical activity of school children in the changes were associated with improved reading skills, and participation in physical activity was found to contribute to the achievement of arithmetic. This trend was most pronounced in boys. It is noteworthy that walking to and from school or cycling also improves their reading skills, unlike their less active peers (Haapala et al., 2017). In addition, boys who spent more time improving the level of reading and writing skills in their spare time, improved their performance in these subjects, unlike those who did not engage in this activity during their spare time. In turn, students who played computer games or video games in moderate quantities in their free time, increased their academic performance in arithmetic, unlike those who devoted a small amount of time to these games. It should be noted that girls were not found to have statistically significant associations between the level of physical activity, sedentary lifestyle, and academic achievement. The obtained results testify to the potential improvement of school children's progress in some subjects by increasing their level of physical

activity during breaks between classes and participating in organized sports (Haapala et al., 2017).

Scientists from the O'Donnell Brain Institute (USA) have found that a low level of physical activity accelerates the degradation of brain tissue, thus resulting in impaired cognitive functions and memory impairment. They established a linkage between the findings of a study with the academic achievements. The study confirms the hypothesis that physical activity can improve brain health and slow the process of its aging. Researchers used brain MRI and cognitive tests in order to assess the status of participants. They also took into consideration various cardiorespiratory parameters: heart rate, respiratory rate, blood pressure, and pulse oximetry. It was concluded that the worst physical state and low activity level correlated with a more pronounced cognitive decline (UT Southwestern Medical Center, 2018).

Overall Health Improvements

The Society for Research in Child Development, USA, reveals the relationship between physical health and the development of cognitive abilities, as well as the child's academic performance. In recent years, the physical activity of children has significantly decreased, while the number of people with obesity, hypertension and diabetes mellitus has sharply increased. One of the key challenges discussed in the monograph, which contains the results of > 20 studies, is the issue of increased attention to the level of overall academic performance. By devoting more time to preparing for academic testing, children automatically cease to be physically active. As a result, there is a deterioration in their cognitive abilities, thus decreasing academic achievements. During the school year, about 55.5 million children are being trained in US schools. The findings of this study reveal that there has been a persistent tendency to reduce the level of physical activity.

According to existing recommendations, the child should give ≥60 minutes of physical activity per day. Moreover, schools regularly host a variety of activities aimed at maintaining physical health. However, according to the Centers for Disease Control and Prevention (CDC), only 30% of school children took part in such events in 2012. Most school children did not participate in any form of planned physical activity during the school week. Nevertheless, physically active children tend to outperform their inactive peers during their studies. The results of the study help to better understand this issue. Scientists have found that physical activity contributes to the development and increase of the volume of brain departments that are responsible for cognitive abilities and memory. In particular, experts noted an increase in the basal ganglion and hippocampal area in physically active children. They also identified the ability to concentrate more than their less active peers. Researchers concluded that physical loads contribute to the development of the child's brain properties without being distracted by competing stimuli during the performance of the assignment. This quality helps children stay focused for longer and continue to carry out the task. Specialists also report the possibility of using physical activity as a non-drug therapy in hyperactive children as well as children with autism spectrum disorder. According to Dr. Charles Hillman, a professor of kinesiology and public health, the results are important for the work of school administrations and relevant US government bodies, since the onus is on them to decide on the promotion of physical activity in school, which is where children spend most of their time. (Chaddock-Heyman, Hillman, Cohen & Kramer, 2014).

According to Maria Chiara Gallotta from the University of Rome, attention and concentration are the key elements of teaching that contribute to the increase of academic performance. Therefore, scientists studied the relationship between physical stress, attention,

and concentration level in school children (Gallotta et.al, 2015). The test was performed among 138 children aged 8 to 11 years, alternating between periods with and without physical activity. For three weeks, the children took three exams for 50 minutes. They engaged in physical activity before the first test and attended other activities prior to the second one. Before the third stage, they alternated physical exercises with other lessons. Tests were aimed at measuring the concentration and speed of responses. The results were found to be optimal when testing was preceded by either physical activity or training. The speed of answers to questions has increased by 9% after usual classes and by 10% after physical activity. Mental activity improved concentration levels of school children by 13%, and physical activity by 10% (Gallotta et.al, 2015).

The academic progress of children in school has a direct correlation with the degree of their physical activity, both in P.E. classes and in everyday life. Within the framework of the research, 14 different independent studies were organized at the medical center of Amsterdam, in which scientists analyzed the performance of more than 12,000 children aged from six to 18 years old (Howie & Pate, 2012). Simultaneously, they attempted to identify the main factors based on which one child manages to receive the best marks for main subjects, rather than others. It is traditionally believed that children with a high level of physical activity tend to show poor performance, as their attention is less engaged in training. At the same time, excellent students, as a rule, are known to demonstrate a low level of physical activity. However, in practice, such representations are not true. According to the researchers, physical activity plays a very important role in the development of children. In fact, it is due to physical activities that there is an improvement in blood permeability, including the brain, thereby resulting in better thinking (Howie & Pate, 2012). A high degree of physical activity is an indicator of the normal

development of a child. Also, physical activity enables children to relieve stress and improves their mood, which also helps them in the learning processes. Additionally, it helps them to focus and improves their ability to remember and operate on certain volumes of information. According to researchers, children should engage in physical acidity for at least one hour a day. However, there are no precise instruments or measurement techniques to ascertain the number of exercises or activities that would be sufficient for optimal development and achievement of high academic achievements (Howie & Pate, 2012).

People who train regularly are more productive and attentive, which contributes to their enhanced academic achievements. Physical loads help the brain to form the so-called executive functions: consistency, working memory, and the ability to prioritize. Children with hyperactivity and attention deficit disorder are recommended to have outlets for physical activity as an alternative to medical treatment (Grissom, 2005). In addition, exercises contribute to the production of serotonin and increase the flow of oxygen to the brain, which, in turn, affects the ability to think clearly and creatively. The creative ascent manifests immediately after training and lasts a few more hours. Moreover, physically active people are able to offer more interesting ideas than their less active counterparts. Regular training increases the pain threshold and reorganizes the structure of the brain, helping to deal with stress and fatigue. Furthermore, training is a direct path to emotional stability, that helps reduce anxiety, and create cognitive flexibility. Scientists conducted a study on 59 healthy, but inactive people. Within half a year, some of them attended aerobics, whereas others continued stretching. Six months later, scientists observed an increase in the brain volume and the content of gray and white matter in participants from the group that was engaged in aerobics. The changes were not recorded by those people who went on stretching (Grissom, 2005).

Efficient functioning of a brain is critical in demonstrating high academic achievements (Trudeau & Shephard, 2010). Physical exercise lead to the appearance of a dominant movement in the cortex of the cerebral hemispheres of the brain: the area that that has a beneficial effect on the state of the muscular, respiratory and cardiovascular systems, and raises the tone of the child (Trudeau & Shephard, 2010). With mental work in the cerebral cortex, closed cycles of excitation are formed, characterized by great persistence and inertia. This, in turn, contributes to poor sleep, apathy, irritability, muscle tension, convulsions, and under-recovery of the nervous system during the day. The system, organs, and muscles of man with prolonged mental work cease to serve as a source of impulses to the brain, which are the mechanism of the nervous system's self-regulation. They become a source of monotonous sensory impulses that limit the formation of monotonous tension of the nervous system (Trudeau & Shephard, 2010). Muscles account for 35-55% of the total body weight. After being reduced, they create a large number of nerve impulses, which enrich the flow of sensations of the brain. An active self-regulation of the brain takes place with the help of impulses from the muscles. Mental efficiency is an inextricable part of the general state of health, with physical activity playing a huge role in this process. During the course of the study, students' performance was determined, and compared with the average indicators of the institution. To imbue clarity, a group of 27 people of different ages was taken regularly during the school year. This group attended classes in volleyball, football, and basketball sections three to four times a week for one and a to two hours. Additionally, on a weekly basis, they participated in competitions of various levels from November to April. The progress of these students was assessed based on the results of the winter and summer examinations of the school year. Active students (63%) passed with high marks in the winter session, whereas the less active students (37%) received a satisfactory grade

(Trudeau & Shephard, 2010). The results confirmed that active studies of students in groups of sports increased their academic performance. This is attrbuted to the fact that they are distinguished by a good state of health, physical fitness, functional readiness of the basic systems of the body, the stability of mental performance, and other psycho-physical qualities, such as perseverance and purposefulness (Trudeau & Shephard, 2010).

According to researchers, regular physical exercise helps improve the manner in which the brain functions. Additionally, brain efficiency is directly related to academic achievements. This is caused by the chemical reactions taking place in the body, which have a beneficial effect on the nervous system and help promulgate new cells. When a person regularly engages in sports, his or her brain begins to intensively produce substances that increase mood and do not make them feel tired. Scientists conducted a survey among office workers. The survey participants, who were engaged in fitness at work during the lunch break, noticed that they thought more clearly and performed more tasks during the workday. Movement charges the body with energy and reduces fatigue. Scientists also found that physical activity at a young age develops cognitive abilities, and can improve memory among the elderly. This is attributed to the fact that during physical activity, various chemical processes are triggered, which provide a link between nerve cells in the brain (Donnelly & Lambourne, 2011).

Experiments have unequivocally confirmed that physical exercises positively affect the mental capacity of a person. Proper mental capacity influences academic achievements. Researchers from the University of Minnesota began by testing almost 3,000 healthy people aged 15-25 years. During the first year of the study, young people regularly ran on a treadmill with the registration of cardiovascular performance. These tests were repeated again only 20 years later, during which they were not observed. As part of the tests, they were asked to run as long

as possible until the exhaustion or the appearance of dyspnea. In the cognitive tests performed, 25 years after the beginning of the study, the participants' memory and thinking abilities were measured. Participants who ran longer on the treadmill, after 25 years, showed better results in academic tests and thinking abilities. David Jacobs argued that although many studies show the benefit of good heart health for the brain, this work is another important study that should visually show young people how important it is to preserve the high functionality of their brains for years. It also highlighted the benefits of performing aerobic exercises such as running, swimming, cycling, or fitness classes. Jacobs stressed that he adheres to the concept of health preservation, by using a set of stresses on a person, including social, physical, and mental activity. On the other hand, Dr. Simon Ridley said that an increasing amount of evidence suggested that exercise can reduce the risk of cognitive impairment, and many studies showed a link between healthy habits and increased intellectual ability. It is established fact that memory and attention are the dominant cognitive abilities that determine the quality of mastering knowledge by student athletes (Rasberry et al.,2011).

Summary

In this chapter, studies on the influence of motor activity on cognitive development of students have been analyzed. Research has shown that academic progress of physically active students is higher because they are distinguished by a good state of health, physical fitness, the functional readiness of the basic systems of the body, the stability of mental performance, as well as other psycho-physical qualities, such as perseverance and purposefulness. It is impossible to form and perfect these components properly without proper application of physical activity. It is for this reason that the academic performance of physically active students is found to be better. In order to ensure normal functioning of brain activity, it is necessary for the brain to receive

certain impulses from the various systems of the body. The muscles constitute the mass of these impulses. The student's educational process is negatively affected by weak physical preparedness. With poor physical preparedness, the level of fulfillment of the requirements of educational activity is reduced. In contrast, physical activity improves mental performance, health, and overall physical conditions, which have a positive impact on the students' academic performance.

Physical activity and sports are given a lot of attention due to their positive influence on the physical health of children, which leads to improved academic performance. In addition, there is a strong belief that regular physical activity involves the strengthening of brain function and the knowledge of what has a positive effect on academic performance. Studies conducted by scientists show that students who engage in sports also receive higher grades. Sports activities can positively influence the progress of students by enhancing the thinking process. This effect of sports load is attributed to several causes. Firstly, when playing sports, blood and oxygen quickly enter the brain. Secondly, with physical exertion, the level of endorphins in the blood increases, which ameliorates stress and improves mood. Thirdly, the rate of formation of new nerve cells increases and the plasticity of the synapses is maintained in the body.

Regular physical activity contributes to physical and mental health throughout the life of a person. Several research studies complement the list of positive effects of regular physical activity on brain health and academic performance. In particular, studies show that cardiorespiratory activity and motor endurance of children are the most important indicators. Physical exercises can improve cognitive abilities by increasing the flow of blood and oxygen to the brain, which then increases the levels of norepinephrine and endorphins. This, in turn, reduces stress levels in people and improves their mood, while simultaneously increasing growth

factors that help create new nerve cells and maintain synaptic plasticity. Motor activity, which can act as an optimizing factor, is one of the conditions for the formation and improvement of mechanisms for adaptation to mental stress. Motor activity leads to increased metabolic processes in the body. Optimally matched loads improve mental and physical performance, which has an impact on academic performance in school.

The results of the aforementioned research studies suggest that optimal physical activity is one of the most important means of reducing the neuro-emotional tension in the learning process. Students who are on an extended motor mode have more advanced adaptive capabilities and high efficiency, showing better academic achievements. They improve the functionality of those bodily systems that are usually subjected to the greatest stress under the influence of mental activities. Consequently, the tone of the central nervous system and, above all, the brain, witnesses a positive change, which leads to an increase in the mental capacity for work and normalization of neurodynamics, as well as a decrease in the tension of adaptive mechanisms facilitating the fastest adaptation of students to the educational process. Expansion of the range of motor abilities contributes to the improvement of the child's adaptive capacity to long intellectual loads by optimizing the functioning of the basic systems, which ultimately contributes to the rationalization of the student's activity. This makes it possible to significantly improve the functional and psychological state of students, thus solving the problems of qualitative learning programs.

As it was possible to establish, people who are actively engaged in physical activity, often exhibit a greater ability to think effectively. Some parts of the brain can be trained only through the movement. Physical activity has a positive impact on logical thinking, the ability to find optimal and rational solutions. Many children are not interested in sports or being

physically active. However, even small, but regular physical activities contribute to a more harmonious development. In addition to improve functioning of the brain, physical exercises also reduce stress levels, improve the mood of students, and increase their efficiency. It is asserted that children who participate in sports competitions and are trained to play by the rules become more disciplined and able to concentrate better during the lessons Thus, the sport lifestyle also contributes to intellectual development, resulting in high academic achievements.

A study of literature on the impact of motor activity on the development of cognitive abilities of school children of different ages ascertained the urgency of the problem of optimizing the motor, physical, and intellectual loads of students and improving the system of continuing education in general. Normalization of sports and training loads in improving the cognitive development of children of different ages is one of the decisive levers in the struggle for mental and physical health of school children. Several studies suggest that optimal physical and sports loads have a positive effect on the preservation and strengthening of health. This then leads to high efficienty of mental functioning, showing better academic results.

The practical significance of the research is that the contained theoretical propositions and experimentally substantiated conclusions can be used to improve the quality of teaching, upbringing, and sports process in the school. Improvement of the education system will be facilitated by increasing the intensity of intellectual activity that then leads to overloads of curricula, as well as by the organization of the optimal motor mode of schoolchildren, thus contributing to the preservation and strengthening of their overall health and wellbeing. Physical activity affects learning achievements, which is why boys and girls must spend more time on physical activities, in order to help them improve their academic performance in mathematics, reading, and natural sciences. Researchers emphasize that physical activity is significant at any

age. Without physical exercises, it is challenging to strengthen and preserve the child's health. Correspondingly, students who engage in sports achieve good academic performance in the future.

CHAPTER THREE: METHODS

Overview

The benefits associated with students' involvement in physical activities have been the subject of several studies by both individual research and educational institutions. There is a clear need for well-designed studies focusing on the association or link between physical activity and academic outcomes. The chapter begins with a restatement of the nature of the study and its purpose, before moving on to the research design, research questions and hypotheses, the participants and the setting, measurements, procedures, and lastly data analysis.

Design

A quantitative causal-comparative research design was employed. Under this design, the goal was to compare and examine the GPAs of seventh grade students who participated in school-based physical activity and those who did not. A causal-comparative research design was applicable because GPAs were collected by the researcher from archival data. According to Gall, Gall, and Borg (2007), a causal-comparative research design aims to discover possible causes and effects of a personal characteristic by comparing individuals where a particular variable is present with those where the same variable is lacking. The independent variable was school-based physical activity, which was defined as one full year of participating in P.E. class. Similarly, the dependent variable is academic achievement, which is defined as end of the year GPA where A = 4.00 points, B = 3.00 points, C = 2.00 points, D = 1.00 point, and F = 0.00, and was calculated by considering the mean score of all subjects within a year.

Research Questions

The research questions that this study aimed to answer were as follows:

RQ1: Is there a statistical difference in the end of year GPA of seventh grade students who participate in one full year of a school-based P.E. course and those who do not during the 2015-2016 school year?

RQ2: Is there a statistical difference in the end of year GPA of seventh grade students who participate in one full year of a school-based P.E. course and those who do not during the 2016-2017 school year?

RQ3: Is there a statistical difference in the end of year GPA of seventh grade students who participate in one full year of a school-based P.E. course and those who do not during the 2017-2018 school year?

Null Hypothesis

The null hypotheses for were:

$H_0$1: There will be no statistically significant difference in the end of year GPA of seventh grade students who participate in one full year of a school-based P.E. course and those who do not during the 2015-2016 school year.

$H_0$2: There will be no statistically significant difference in the end of year GPA of seventh grade students who participate in one full year of a school-based P.E. course and those who do not during the 2016-2017 school year.

$H_0$3: There will be no statistically significant difference in the end of year GPA of seventh grade students who participate in one full year of a school-based P.E. course and those who do not during the 2017-2018 school year.

Participants and Setting

Participants

Participants of this study were seventh grade students from a local school district in a suburban community in southwest Ohio. The seventh-grade enrollment at this school determined the number of participants in the study. Seventh grade students in the 2015-2016, 2016-2017, and 2017-2018 school years were used for this study.

A convenience sampling method was utilized. The number of participants sampled was 290 (2015-2016), 312 (2016-2017), 339 (2017-2018) which according to Gall et al. (2007), exceeded the required minimum of 100 for a medium effect size with statistical power of .7 at the .05 alpha level. The sample consisted of seventh grade students, of which there are 151 males and 139 females (2015-2016), 159 males and 153 females (2016-2017), and 175 males and 164 females (2017-2018). The sample's ethnic makeup consisted of 5 Asian, 3 African American, 273 Caucasian, 2 Hispanic, and 7 Multi Racial (2015-2016), 4 Asian, 1 African American, 294 Caucasian, 5 Hispanic, and 7 Multi Racial (2016-2017), and 1 Asian, 2 African American, 315 Caucasian, 6 Hispanic, and 12 Multi Racial (2017-2018). The students were separated in two groups with the distinction between groups being those students who participated in school-based physical activity during their seventh-grade year and those who did not. Figures 1 through 6 graphically illustrate the demographics considered for this study.

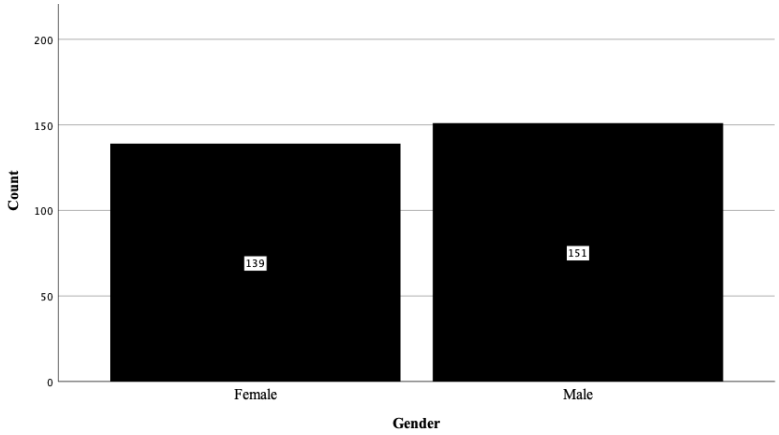

Figure 1. Gender of Students (2015-2016).

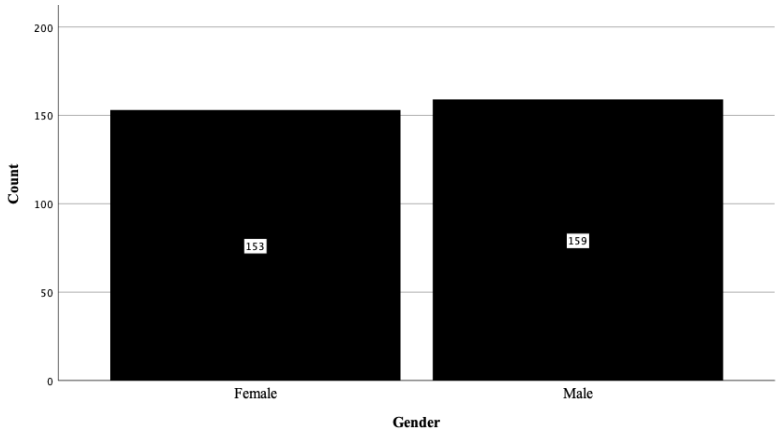

Figure 2. Gender of Students (2016-2017).

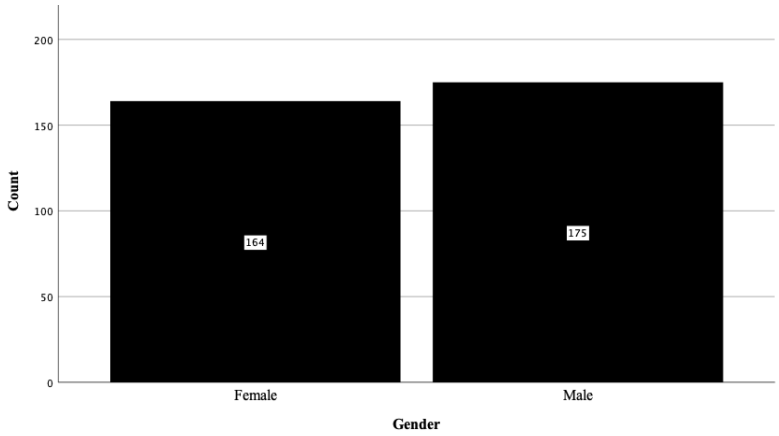

Figure 1. Gender of Students (2017-2018).

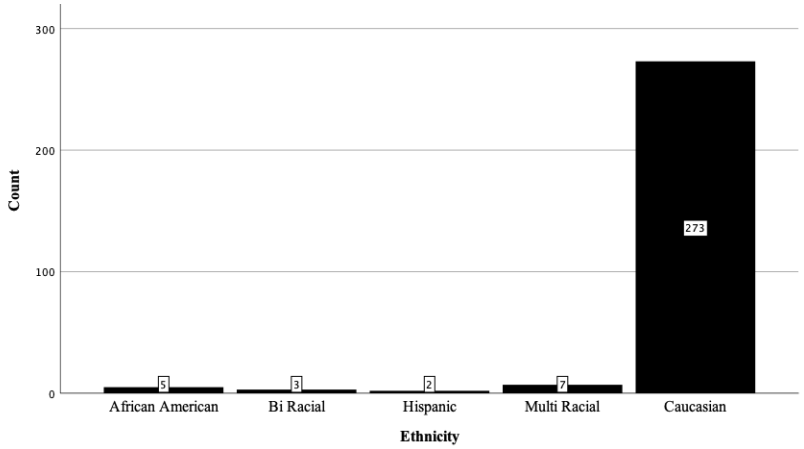

Figure 4. Ethnicity of students (2015-2016).

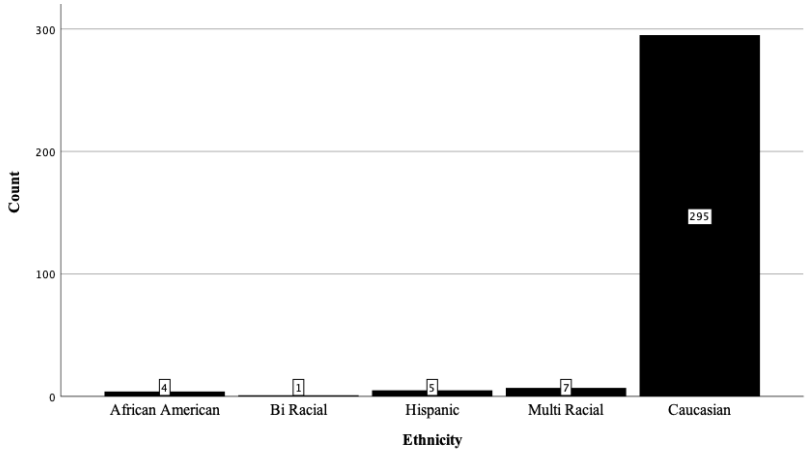

Figure 5. Ethnicity of students (2016-2017).

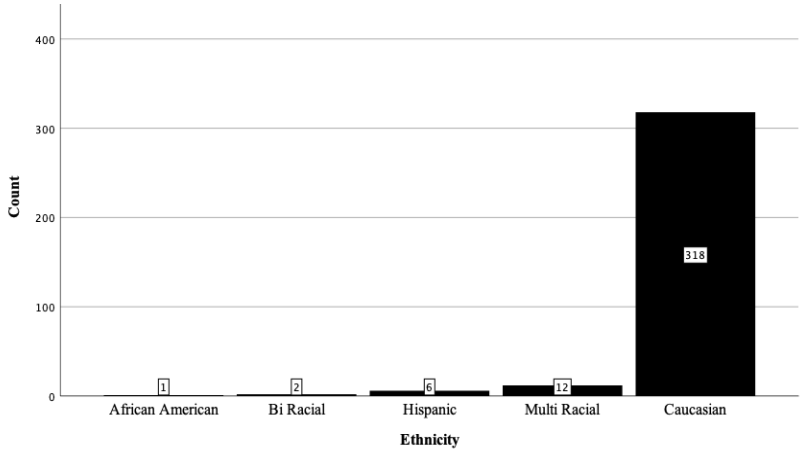

Figure 6. Ethnicity of students (2017-2018).

The group of students participating in school-based physical activity consisted of 27 females and 38 males (2015-2016), 48 females and 46 males (2016-2017), and 31 females and 57 males (2017-2018). The group's ethnic makeup consisted of 5 Asian, 3 African American, 2 Hispanic, 7 Multi Racial, and 48 Caucasian (2015-2016), 1 Hispanic, 2 Multi Racial, and 91 Caucasian (2016-2017), 2 African American, 1 Hispanic, 4 Multi Racial, 81 and Caucasian (2017-2018).

On the other hand, the group of students that did not participate in school-based physical activity consisted of 112 females and 113 males (2015-2016), 105 females and 113 males (2016-2017), and 133 females and 118 males (2017-2018). The group's ethnic makeup consisted of 225 Caucasian (2015-2016), 4 Asian, 1 African American, 4 Hispanic, 5 Multi Racial, and 204 Caucasian (2016-2017), and 1 Asian, 5 Hispanic, 8 Multi Racial, and 237 Caucasian (2017-2018).

Setting

School-based physical activity consisted of courses in P.E. The purpose of the P.E. course is to provide an atmosphere and concentration towards physical wellness as well as its importance to overall health. The course provides students with an opportunity to learn fitness concepts and conditioning techniques in order to help them maintain optimal physical fitness. Students learn the basic fundamentals of strength training, aerobic training, and overall fitness training, and conditioning. The course is offered in all four quarters for the student's seventh grade year for a duration of 50 minutes each school day. As part of a daily routine, students begin class with warm up exercises and stretches. Evaluations are based on individual participation and various fitness tests.

Measurements

The GPAs of each seventh-grade student was used for the purpose of assessing academic achievement. The independent variable and dependent variable were physical activity and academic achievement, respectively. Physical activity is operationalized as participation in the school-based physical activity class. Thus, physical activity is a nominal variable that takes on two values: engaging in P.E. course (coded as 1), and not engaging in physical activity P.E. course (coded as 0).

The dependent variable, student academic achievement, was operationalized as the overall GPA of the student's complete year in seventh grade. The GPA was used as a ratio scale measure of students' academic achievement. GPA was valued between 0.00 and 4.00 and calculated such that A = 4.00 points, B = 3.00 points, C = 2.00 points, D = 1.00 point, and F = 0.00 points, and denoted a simple mean score for the given school year. The student's final grade was an average of a daily participation grade where each student received an A, B, C, D, or F accordingly. The teacher inputted the student's grade into ProgressBook, which is an online classroom management tool that integrates grade book, lesson plan, and attendance. This web-based system, which provides real-time information, is accessible by parents and students. ProgressBook automatically calculates each student's grade based on the input of the teacher. The Guidance Department is responsible for finalizing all student achievement data before archiving the data with the school's central office. A grade of A, B, C, or D was required to satisfy state requirements for passing the P.E. course. Numerous studies have used GPA to evaluate academic success (Dubuc, Aubertin-Leheudre, & Karelis 2017; Aaltonen, et.al, 2016; Xu & Sansgirv, 2018).

Procedures

The researcher obtained approval from the Liberty University Institutional Review Board (IRB) in order to conduct the study. The IRB request was necessary in ensuring that the study conforms to the ethics of research and does not subject the participants to considerable risks. The IRB board only approves studies that meet the necessary safety, privacy and confidentiality requirements. The researcher sought permission from the school administrator where the research was performed and scheduled a face-to-face meeting with the school administrator. In the meeting, the researcher detailed the study, including its purpose, value, and data requirements. The discussion emphasized the measures that were put in place in order to protect the privacy and confidentiality of the students selected for the study. The research proceeded after the administrator granted permission for the study and provided the archival data of seventh-grade students' GPAs over the selected school years (2015-2016, 2016-2017, 2017-2018). The data was obtained from the central office department before being downloaded onto a flash drive in the form of an Excel spreadsheet. All student names were removed by the central office and replaced by a code that was assigned to protect student identity. The central office was asked to provide the following information: school year, race, gender, GPA, PE course or no PE course. See Appendix D for the letter requesting data.

Data Analysis

An Independent Samples *t*-test was employed in the analysis of the collected data. According to Green and Salkind (2011), a *t*-test is appropriate because it will evaluate the difference between the means of two independent or unrelated groups. For each group, outliers were screened for using Box and Whisker plot. A potential outlier is cause for inspection of the

data to determine if data collection errors need to be corrected (Howell, 2011). Assumption of Normality was conducted using a Kolmogorov-Smirnov test. In a similar vein, the assumption of Equal Variance was conducted using a Levene's Test of Equality of Error Variance which helped in verifying equal error variance for both groups (Gall et al., 2007). A *t*-statistic was reported, and Eta squared was used to measure the effect size. All tests were ran at the 95% confidence level.

CHAPTER FOUR: FINDINGS

Overview

This purpose of this quantitative casual comparative study was to determine if there was difference between student achievement of seventh grade students who participated in P.E. classes and those who did not. An Independent Samples *t*-test was used to test the hypothesis. The section on findings includes the following: research question, null hypothesis, data screening, descriptive statistics, assumption testing, and results.

Research Questions

RQ1: Is there a statistical difference in the end of year GPA of seventh grade students who participate in one full year of a school-based P.E. course and those who do not during the 2015-2016 school year?

RQ2: Is there a statistical difference in the end of year GPA of seventh grade students who participate in one full year of a school-based P.E. course and those who do not during the 2016-2017 school year?

RQ3: Is there a statistical difference in the end of year GPA of seventh grade students who participate in one full year of a school-based P.E. course and those who do not during the 2017-2018 school year?

Null Hypothesis

$H_0$1: There will be no statistically significant difference in the end of year GPA of seventh grade students who participate in one full year of a school-based P.E. course and those who do not participate during the 2015-2016 school year.

$H_0$2: There will be no statistically significant difference in the end of year GPA of seventh grade students who participate in one full year of a school-based P.E. course and those who do not during the 2016-2017 school year.

$H_0$3: There will be no statistically significant difference in the end of year GPA of seventh grade students who participate in one full year of a school-based P.E. course and those who do not during the 2017-2018 school year.

Data Screening

Data screening was conducted on the dependent variable of each variable. The data was sorted by the researcher on each variable and scanned for inconsistencies. No data errors or inconsistencies were identified. Box and whiskers plots were used to detect outliers on each dependent variable and are illustrated in Figures 7, 8, and 9. The figures reveal that no outliers were identified.

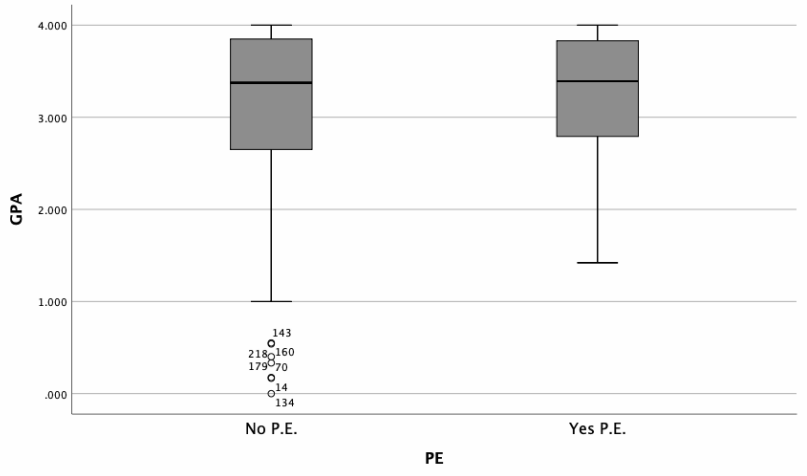

Figure 7. Box and whisker plots (2015-2016 students).

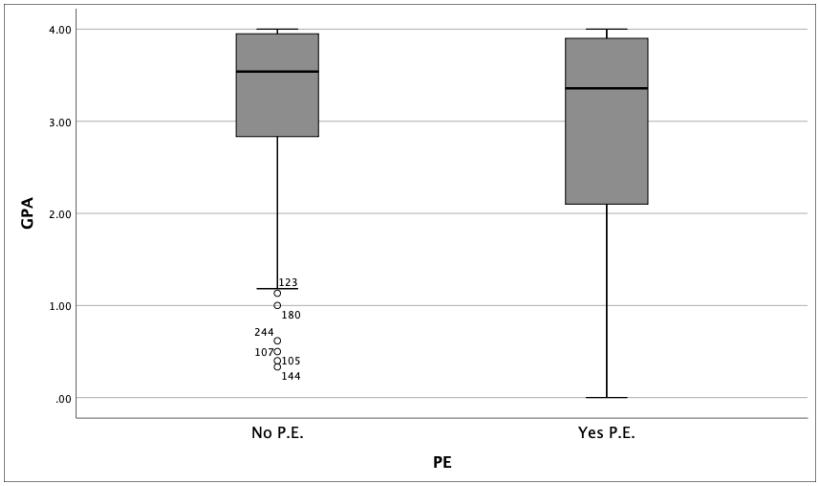

Figure 8. Box and whisker plots (2016-2017 students).

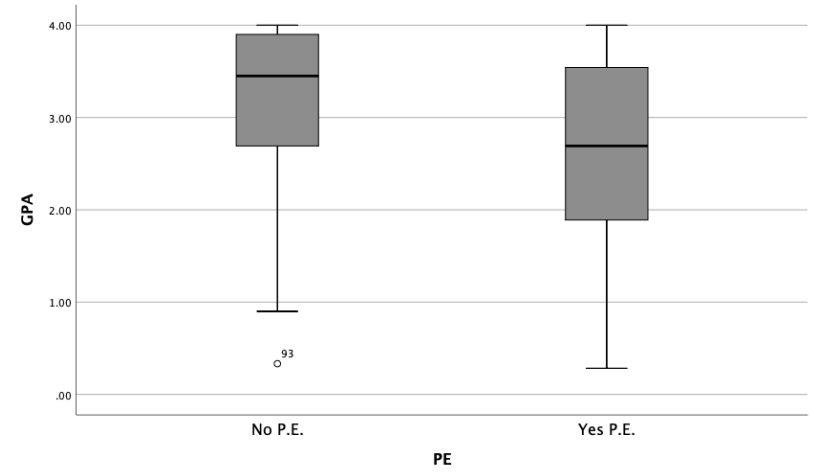

Figure 9. Box and whisker plots (2017-2018 students).

Descriptive Statistics

Descriptive statistics were obtained on the dependent variable for each group. The sample consisted of 941 participants, 52 (17.9%) of which received P.E. and 238 (82.1%) of which did not received P.E. as a seventh grade student in 2015-2016, 94 (30.1%) of which received P.E. and 218 (69.9%) of which did not received P.E. as a seventh grade student in 2016-2017, and 88 (26%) of which received P.E. and 251 (74%) of which did not received P.E. as a seventh grade student in 2017-2018. End of year GPA was also gathered for each group. Tables

4.1, 4.2, and 4.3 depict the number of students who participated in P.E. classes and those who did not along with their corresponding GPA.

Table 4.1

Descriptive Statistics (2015-2016 seventh grade students)

PE		N	Minimum	Maximum	Mean	Std. Dev.
No P.E.	GPA	238	0	4	3.11771	0.866881
	Valid N (listwise)	238				
Yes P.E.	GPA	52	1.42	4	3.18227	0.74455
	Valid N (listwise)	52				

Table 4.2

Descriptive Statistics (2016-2017 seventh grade students)

PE		N	Minimum	Maximum	Mean	Std. Dev.
No P.E.	GPA	218	0.33	4	3.2416	0.81727
	Valid N (listwise)	218				
Yes P.E.	GPA	94	0	4	2.9459	1.03428
	Valid N (listwise)	94				

Table 4.3

Descriptive Statistics (2017-2018 seventh grade students)

PE		N	Minimum	Maximum	Mean	Std. Dev.
No P.E.	GPA	251	0.33	4	3.1865	0.80994
	Valid N (listwise)	251				
Yes P.E.	GPA	88	0.28	4	2.6118	1.0388
	Valid N (listwise)	88				

Assumption Testing

Assumption of Normality

The Independent Samples *t*-test requires that the assumption of normality be met. Given that the sample size exceeded 50 participants, normality was examined using Kolmogorov-Smirnov. The assumption of normality was not met for both groups of seventh grade students (2015-2016), both groups of seventh grade students (2016-2017), as well as seventh grade students (2017-2018) who did not participate in P.E. However, the researcher continued with the analysis because the *t*-test is considered a robust test related to this assumption. The assumption of normality was met for seventh grade student (2017-2018) who participated in P.E. Please refer to Tables 4.4, 4.5, and 4.6 for Tests of Normality.

Table 4.4

Tests of Normality (2015-2016 seventh grade students)

		Kolmogorov-Smirnova			Shapiro-Wilk		
	PE	Statistic	df	Sig.	Statistic	df	Sig.
GPA	No P.E.	0.154	238	.000	0.866	238	.000
	Yes P.E.	0.136	52	0.017	0.897	52	.000

a Lilliefors Significance Correction

Table 4.5

Tests of Normality (2016-2017 seventh grade students)

		Kolmogorov-Smirnova			Shapiro-Wilk		
	PE	Statistic	df	Sig.	Statistic	df	Sig.
GPA	No P.E.	0.177	218	.000	0.851	218	.000
	Yes P.E.	0.172	94	.000	0.877	94	.000

a Lilliefors Significance Correction

Table 4.6

Tests of Normality (2017-2018 seventh grade students)

	PE	Kolmogorov-Smirnova			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
GPA	No P.E.	0.158	251	.000	0.878	251	.000
	Yes P.E.	0.091	88	0.071	0.948	88	.000

a Lilliefors Significance Correction

Assumption of Homogeneity of Variance

The Independent Samples *t*-test requires the assumption of homogeneity of variance be met. This assumption was examined using the Levene's test. While the assumption of homogeneity of variance was met for 2015-2016 seventh grade students where ($p = .395$), it was not met for 2016-2017 seventh grade students where ($p = 0$), and for 2017-2018 seventh grade students where ($p = .001$). However, the researcher continued with the analysis because the *t*-test is considered a robust test related to this assumption. Please refer to Tables 4.7, 4.8, and 4.9 for Levene's test of Equality of Error Variance.

Table 4.7

Levene's Test of Equality of Error Variance (2015-2016 seventh grade students)

		Levene Statistic	df1	df2	Sig.
GPA	Based on Mean	0.726	1	288	0.395
	Based on Median	0.403	1	288	0.526
	Based on Median and with adjusted df	0.403	1	280.525	0.526
	Based on trimmed mean	0.495	1	288	0.482

Table 4.8

Levene's Test of Equality of Error Variance (2016-2017 seventh grade students)

		Levene Statistic	df1	df2	Sig.
GPA	Based on Mean	17.646	1	310	.000
	Based on Median	11.395	1	310	.001
	Based on Median and with adjusted df	11.395	1	307.022	.001
	Based on trimmed mean	16.95	1	310	.000

Table 4.9

Levene's Test of Equality of Error Variance (2017-2018 seventh grade students)

		Levene Statistic	df1	df2	Sig.
GPA	Based on Mean	11.858	1	337	.001
	Based on Median	11.208	1	337	.001
	Based on Median and with adjusted df	11.208	1	337	.001
	Based on trimmed mean	12.323	1	337	.001

Results

An Independent Samples *t*-test was conducted to determine whether there was a difference in GPAs between seventh grade students who participated in P.E. and those who did not. The independent variable and dependent variable were academic achievement and GPA, respectively.

For the 2015-2016 seventh grade students, the researcher failed to reject the null hypothesis at the 95% confidence level where $t(288) = .498$, $p = .619$, $\eta^2 = .029$. No statistically significant difference was found between GPA of the 2015-2016 seventh grade students who did not take P.E. ($M = 3.12$, $SD = .87$) and seventh grade students who did take P.E. ($M = 3.18$, $SD = .74$).

For the 2016-2017 seventh grade students, the researcher rejected the null hypothesis at the 95% confidence level where $t(310) = -2.698$, $p = .007$, $\eta^2 = .15$. A statistically significant difference was found between GPA of the 2016-2017 seventh grade students who did not take P.E. ($M = 3.24$, $SD = .82$) and seventh grade students who did take P.E. ($M = 2.95$, $SD = 1.03$).

For the 2017-2018 seventh grade students, the researcher rejected the null hypothesis at the 95% confidence level where $t(337) = -5.303$, $p < .001$ $\eta^2 = .08$. A statistically significant difference was found between GPA of the 2017-2018 seventh grade students who did not take P.E. ($M = 3.19$, $SD = .81$) and seventh grade students who did take P.E. ($M = 2.61$, $SD = 1.04$). Please refer to Tables 4.10, 4.11, and 4.12 for Independent Samples *t*-test results.

Table 4.10

Independent Samples t-test (2015-2016 seventh grade students

			GPA	
			Equal variances assumed	Equal variances not assumed
Levene's Test for Equality of Variances	F		0.726	
	Sig.		0.395	
t-test for Equality of Means	t		0.498	0.549
	df		288	84.097
	Sig. (2-tailed)		0.619	0.584
	Mean Difference		0.064555	0.064555
	Std. Error Difference		0.12958	0.117551
	95% Confidence Interval of the Difference	Lower	-0.19049	-0.169204
		Upper	0.3196	0.298313

Table 4.11

Independent Samples t-test (2016-2017 seventh grade students)

			GPA	
			Equal variances assumed	Equal variances not assumed
Levene's Test for Equality of Variances	F		17.646	
	Sig.		0	
t-test for Equality of Means	t		-2.698	-2.46
	df		310	145.305
	Sig. (2-tailed)		0.007	0.015
	Mean Difference		-0.29565	-0.29565
	Std. Error Difference		0.10957	0.12018
	95% Confidence Interval of the Difference	Lower	-0.51124	-0.53318
		Upper	-0.08006	-0.05812

Table 4.12

Independent Samples t-test (2017-2018 seventh grade students)

			GPA	
			Equal variances assumed	Equal variances not assumed
Levene's Test for Equality of Variances	F		11.858	
	Sig.		0.001	
t-test for Equality of Means	t		-5.303	-4.712
	df		337	126.045
	Sig. (2-tailed)		0	0
	Mean Difference		-0.57466	-0.57466
	Std. Error Difference		0.10837	0.12197
	95% Confidence Interval of the Difference	Lower	-0.78783	-0.81603
		Upper	-0.36149	-0.33329

CHAPTER FIVE: CONCLUSION

Overview

This dissertation study researched the association between physical activity and student achievement among seventh grade students over a three-year time period. In light of the relevant and theoretical literature, this chapter contains a review of findings, which is included in the discussion section. Following is a comparison of the dissertation research to past studies, implications of the findings, delimitations and limitations, recommendations for future research, as well as a summary of findings.

Discussion

The purpose of this study was to explore the association between physical education and academic achievement among seventh grade students. Prior research on physical activity revealed benefits of academic achievement and overall better physical health and well-being. Studies focusing on the benefits of physical activity were incorporated in the literature review (Singh, 2012; Mavilidi et al., 2015; Ford, 2016; Esteban-Cornejo et al., 2017). However, there is paucity of research when it comes to seventh grade students.

This dissertation study assessed a sample of 994 seventh-grade students respectively n= 290 (2015-2016), n = 312 (2016-2017), n = 339 (2017-2018) in order to better understand the differences in academic achievement in seventh grade students who participated in P.E. classes and those who did not. The theoretical construct for this study underscored the fact that physical activities influence main systems of a person, thus contributing to the mental activity (Eime et al., 2013; Fox, 1999; Ransford & Palisi, 1996; Wicker & Frick, 2015).

Discussion of Research Question One

RQ1: Is there a statistical difference in the end of year GPA of seventh grade students who participate in one full year of a school-based P.E. course and those who do not during the 2015-2016 school year?

The results showed no statistical difference between the GPA of seventh grade students who participate in one full year of a school-based P.E. course and those who did not. Thus, the null hypothesis was not rejected. The results for research question one was found to be different than those of research questions two and three in that the null hypothesis was rejected in research questions two and three.

The results of research question one contradicted the findings of the majority of literature referred to in this study that found a linkage between physical activity and academic achievement. The literature included a study that associated cardiorespiratory activity and motor endurance, both individually and in combination, with children's performance. However, general physical fitness such as weight training and aerobic loads was not found to have an impact on academic performance. The magnitude of muscular strength in itself was not found to be associated with students' academic achievement (Esteban-Cornejo et al., 2015).

The school in this study reported a different P.E. teacher for the 2015-2016 school year, which may be a possible factor for differing results between the other two years researched. Other factors that may be considered are the possibility of different teaching methods, curriculum, and assessments between teachers, which were not available to the researcher.

Discussion of Research Question Two

RQ2: Is there a statistical difference in the end of year GPA of seventh grade students who participate in one full year of a school-based P.E. course and those who do not during the 2016-2017 school year?

The results showed a statistical difference between the GPA of seventh grade students who participate in one full year of a school-based P.E. course and those who did not. Thus, the null hypothesis was rejected.

These results were in line with the findings of the majority of literature mentioned in this study. Several studies (Singh, 2012; Mavilidi et al., 2015; Ford, 2016; Esteban-Cornejo et al., 2017) found positive relationships between physical activity and academic achievement among youth ranging from 6-18. One study in particular revealed that the flow of blood to the brain cells improves during physical activity, which affects the cognitive speed of data processing. During exercise, the mobility of the nervous processes of excitation and inhibition increases not only in the cortex of the cerebral hemispheres, but also other parts of the nervous system (Ford, 2016).

Discussion of Research Question Three

RQ3: Is there a statistical difference in the end of year GPA of seventh grade students who participate in one full year of a school-based P.E. course and those who do not during the 2017-2018 school year?

The results showed a statistical difference between the GPA of seventh grade students who participate in one full year of a school-based P.E. course and those who did not. Therefore, the null hypothesis was rejected.

Similar to the results in research question two, students who participated in physical activity were found to have statistically higher academic achievement results. Research revealed that people who incorporate physical activity are more productive and attentive, which is reflected in their improved academic achievements. Physical loads help the brain to form the so-called executive functions: consistency, working memory, and the ability to prioritize. Exercises contribute to the production of serotonin and increases the flow of oxygen to the brain. This, in turn, positively affects the ability to think clearly and creatively (Grissom, 2005).

Implications

This study adds to the existing body of literature that seeks to determine an association between physical activity and academic achievement. Previous studies have shown that physical activity contribute to the mental activity of children by influencing their main systems (Eime et al., 2013; Fox, 1999; Ransford & Palisi, 1996; Wicker & Frick, 2015). These findings reiterate the overall theme in the literature and support the hypothesis in research questions two and three that physical activity is beneficial. In 2018, the CDC released guidelines that children and adolescents ages 6 through 17 years must participate in 60 minutes or more of moderate-to-vigorous physical activity each day (United States Department of Health and Human Services, 2018).

Academic Achievement

Academic achievement must remain as a top priority for all educational organizations. In seeking ways to increase academic achievement, the studies in this report (Singh, 2012; Mavilidi et al., 2015; Ford, 2016; Esteban-Cornejo et al., 2017), in conjunction with the finding of research questions two and three, support physical activity as one of those means. In other research, students who participated in physical exercise, before tests in mathematics and reading,

showed better results (Kohl & Cook, 2013). School boards should note these findings and make sure that children receive adequate amounts of physical activity during school hours. Implementations of physical activity can be accomplished through various means such as physical education courses, indoor or outdoor recess, and other creative measures promoting physical activity.

Self-Esteem and Mental Health

Studies revealed that children who lack physical activity actually had lower self-esteem (McAuley et al., 2005). Given that mental health issues have been on the rise, improving self-esteem is a growing concern and focus for many schools (Chu et.al, 2014). School boards, teachers, and parents should note research that revealed an increase in self-esteem as a result of physical activity (Singh, 2012).

Obesity

The lack of physical activity has also been associated with childhood obesity in several studies (Sahoo et al., 2015). Childhood obesity impacts the emotional, mental, and social aspect of a child, which is detrimental to their future success (Warschburger, 2005). According to one study, a physical activity program for elementary students that offered a moderate vigorous approach had an impact on all students (Barrett et al., 2015). Therefore, due consideration should be given by all those who manage children or programs for children to afford them opportunities and encourage physical activity.

Differences of Results in Research Questions

The students who participated in physical education for the 2015-2016 school year were not found to show better academic measurements than those who did not. This is in contrast to the results found in research questions two and three where students who participated in physical

activity did achieve better academic outcomes. As previously stated, the school reported a different physical education teacher for the year 2015-2016. It is also possible that instructional methods, curriculum, and philosophy of assessments between teachers may have contributed to the differing outcomes.

Delimitations and Limitations

This study was not impervious to limitations. Research was specific to seventh-grade students to help add to the literature, which was lacking for this age group. The researcher also chose to incorporate all students in the seventh grade and not make comparisons between genders. The scope of discussion could have potentially been a factor since the researcher may not have the same level of experience as other researchers. In addition, the measurement tool of GPA, used to determine participant outcomes in physical education, may not be considered the best measuring tool. This study also did not report specifics of curriculum and class structure, which may be helpful in determining specifics that produce greater results.

Recommendations for Future Research

Recommendations for future research in the field of physical activity and academic achievement include: (a) Increase population demographics for all school-aged students; (b) Compare outcomes of genders; (c) Incorporate the quantity of school-based physical activity to understand correlation; (d) Compare morning school-based physical activity results with afternoon school-based physical results; (e) Incorporate a variable to include sports to understand if additional physical activity impacts results; (f) Consider length of time in participating in physical activity; (g) Participation in various sporting activities; (h) Specific curriculum criteria; (i) Various measurements of physical activity; and (j) Qualitative studies specific to individuals who participate in physical activity.

Summary

A relationship was found between physical activity and academics in two out of three of the research questions. Additionally, physical activity should be highlighted as a benefit in more expanses than just academic achievement. These benefits include enhanced self-esteem, increased amount of gray matter in parts of the cerebral cortex (Esteban-Cornejo et al., 2017), heightened flow of blood into the brain (Ford, 2016), and improved oxygenation (Singh, 2012). The current literature regarding school-based physical activity and academic achievement, along with the findings of this study, are lacking further review. Therefore, further research should be considered to understand the relationship of academic achievement with other types of physical activities, such as sports programs for student-athletes and duration of physical activity. Lastly, qualitative research may be taken into consideration in order to help understand participants' emotional and mental benefits when participating in school-based physical activity.

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APPENDIX

Appendix A: Letter to IRB

March 15, 2019

John Smith
Chair, IRB
Liberty University
1971 University Blvd
Lynchburg, VA 24515

Dear Dr. Smith,

I am submitting the following research for review by the *IRB Name,* entitled Effects of physical activity on student achievement. The principal investigator is Greg Beasley. The study does not have co-investigators. The study will take place at Three River's School District in Cincinnati, OH.

The research will involve accessing database data on seventh-grade students' grades in reading, English, mathematics, social studies, and science, and their involvement in physical activity across three school years. The identification number of the students will only be used for sampling purposes after which they will be deleted.

Thank you for your attention and consideration. I am available to provide further information. You can contact me via phone (513)807-2957 or email, gbeasley@liberty.edu.

Respectfully,

Gregory Beasley

Liberty University Doctoral Student

Appendix B: Timeline

Activities	Duration (Weeks)								
	1	2	3	4	5	6	7	8	9
Contact with the school and pre-data collection preparation									
Sampling and Data collection									
Data Analysis									
Report Development									
Revision									
Printing, Binding, and Presentations									

Appendix C: Budget

Item	Cost ($)
Laptop Computer	500
MS Office Package (Word, Excel)	100
IBM SPSS	115
Telephone	50
Data (internet access)	50
Travel Expenses	50
Miscellaneous	0
Total	**865**

Appendix D: Letter Requesting Data

May 2, 2019

Central Office
Dr. Craig Hockenberry, Superintendent
Three River School District
401 North Miami
Cleves, OH 45002

Dear Dr. Hockenberry,

Thank you for agreeing to share your school's data with me that will solely be used to complete my dissertation as a Liberty University student.

With your permission, the research for the study will require archival data of seventh-grade students' GPA s over the selected school years (2015-2016, 2016-2017, 2017-2018). Please have central office remove all students' names and replaced by assigning a code to protect student identity. The following information is what I am requesting to complete my research: school year, race, gender, GPA, PE course or no PE course.

I guarantee confidentiality of the information. Thank you, again.

Respectfully,

Gregory Beasley

Liberty University Doctoral Student