

Physical Activity and Its Effect on Academic Achievement on
Third Grade Students

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Abstract

The purpose of this study was to determine if third grade students would achieve higher on a one hundred question multiplication quiz when they receive more physical activity. Students in the study received two minutes of cardiovascular physical activity each day before math class. The measurement tool was the pre- and post-test scores out of one hundred. This study was a quasi-experimental design. Results show that physical activity that students received did impact academic achievement. Future studies are recommended involving more accurate measurements of physical activity as well as a different means of measuring academic success.

CHAPTER I

INTRODUCTION

Overview

In today's classrooms, teachers are told that every minute must be used wisely. Schedules are laid out at the beginning of the year so time is used effectively for the 7 hours students are in school. When creating schedules, administrators often give priority to some subjects over others. For example, reading and math are the two subjects that consume most of an elementary school student's day in the researchers school. Content such as science, social studies, and health are allotted a small time frame, a maximum of 40 minutes of our school day. But what about play? When do the students get to move and get out of the seats that they have been in all day? Is there a way to integrate activity within the school day and within our curriculum that will benefit our students as well as improve mathematical achievement? According to the Baltimore County Public Schools philosophy and wellness policy Rule 5470, physical movement is an important and unique part of a daily instructional program. The county also states that physical activity contributes to the development of motor and social skills, maintenance of fitness, personal health, and brain development. Finally, the county believes that physical activity is the method by which learning takes place and involves the "whole child" by providing psychomotor, cognitive, affective benefits. This philosophy sparked an interest in the researcher because knowing from personal experience, students do not get daily physical activity, especially after elementary age.

The researcher wanted to find out if physical activity really does reach the whole child and in return, improve academic achievement. As the researcher continuously sits in data meetings with reports of test scores continuously falling, it made the researcher wonder if this has to do

with the lack of physical activity that our students receive on a daily basis. Upon further research, it should be noted that the researcher found multiple other studies that state just implementing 20 minutes of physical activity a day has shown to improve grades in both English and mathematics (Trudeau & Shephard, 2008). Also, Mullender-Winjnsmma, Hartman, Greeffm Bosker, Doolaard, and Visscher (2015) implemented movement directly into teaching. Students would move their body to solve mathematical problems which not only gets the students moving but opens up more areas of their brain. With all of these findings on physical activity having positive effects on student academic achievement, the researcher wanted to conduct her own study with the group of third grade students.

Statement of Problem

The purpose of this study was to examine the effects of physical activity in 3rd grade students on mathematic academic achievement.

Hypothesis

Physical activity for third grade students will have no impact on mathematic multiplication timed tests.

Operational Definitions

The independent variable for this study was the physical activity implemented before math. The types of physical activity included cardiovascular exercise such as jumping jacks, running in place, high knees, and cross jacks.

The dependent variable for this study is academic achievement. This was defined as achievement on their 100 question multiplication fact quiz. Students were given a pre-test and a post-test to measure achievement.

CHAPTER II

REVIEW OF THE LITERATURE

This literature review examines the effects of physical activity on third grade students and their mathematic academic achievement. The first section of the review will focus on the benefits of physical activity on academic success. The second section will discuss the importance of physical activity on the brain and embodied cognition. Finally, the third section will suggest ways of implementing physical activity into the classroom.

The Benefits of Physical Activity on Academic Success

Implementing physical activity in the school day by twenty minutes or more has been shown to improve student performance on perceptual and decisional tasks as well as boosting grades in both English and mathematics (Trudeau & Shephard, 2008). Watson, Timperio, Brown, Bestm and Hesketh (2017) assessed studies of implementation of physical activity. They found that studies that had interventions of shorter duration tended to show improvement of academic achievement. They also found that seven out of the eight studies reported significant improvement in academic achievement following the intervention periods, ranging from 4 weeks to a year.

It has been proven that integrating the physical activity directly into the teaching of a concept can have a positive effect on mathematic success. For example, Mullender-Winjnsmma, Hartman, Greeffm Bosker, Doolgaard, and Visscher (2015) implemented movement that students would perform during their learning. For example, students might jump 6 times to solve the multiplication fact 2×3 . Similar exercises were used such as marching and jogging in place. This study in particular measured time-on-task. Student's time-on-task was significantly higher during

post-intervention suggesting that the students may have benefitted from the integration of the physical activity implemented into their learning.

Ronen and Grosu (2014) also implemented an intervention program that would integrate movement into mathematics, specifically geometry. Noted in their research, Ronen and Grosu state that the use of spatial intelligence is very essential to the development and improvement of young children's mathematical thinking and competences. The Eshkol-Wachman Movement Notation (EWMN) enables movement activities that engage the visual perception and spatial-kinesthetic perception as well as in grapho-motor functions and motor-visual coordination. In order to connect movement and learning, the movements chosen need to be movements in which the learners do not have automatic control.

Embodied and enactive approach to cognition has made a substantial contribution to understanding skill acquisition in the domain of sports and can be extended into the learning of knowledge rich learning areas such as STEM (science, technology, engineering and mathematics) (Chandler & Tricot, 2015). It is argued that education that regularly embodies cognition and movements placed the learner naturally in the world rather than just being a spectator. Students need to be experiencing their learning with their whole body rather than just observing their learning. Physical exercise has larger impacts when integrated directly into the learning task rather than separately. It has been shown that math performance was maintained for at least 1 year after the end of one intervention. Simple gestures on learning have been found in domains such as mathematics and science have positive results explained by enriched encoding and more efficient use of working memory subsystems.

The Importance of Physical Activity on the Brain and Embodied Cognition

The human brain evolved to solve problems in the physical environment using sensory input, perceptual processing, and muscle control or, the sensorimotor system (McClelland, Pitt, Stein, 2014). Gesture and miniature muscle movements are a key part of language production and comprehension and by tensing muscles in the body it is helping to improve mental focus.

Embodied cognition is based on the notion that cognitive processes develop from goal-directed interactions between organisms and their environment (Chandler & Tricot, 2015). This article continues on to discuss how cognitive and sensorimotor processes are closely intertwined. So, while visual and motor processes in the brain are active during cognitive tasks such as reading and problem solving, semantic codes are activated during the performance of motor tasks. Also, it is assumed that an action, in addition to just seeing or hearing information, can provide the memory with additional cues to represent and later retrieve the knowledge gained. The article also notes that the positive effects of just simple gestures on learning have been found in mathematics, language, and science. Simple gestures have also been found to offload working memory. This frees up working memory resources that can be used to create a deeper understanding of the content being learned. Physical activity has also been known to have positive effects on the brain in relation to depression. The study conducted by Field, Diego, and Sanders (2001) shows that students that had a higher level of exercise had better relationships with their parents and their peers. These students also had more family and peer support and reported less depression. High levels of exercise were associated with better relationships as it built better social support. Students with a higher family and peer support system have a greater chance at academic success.

Integrating Physical Activity into the Classroom

In current educational practices, students are learning new material by rote memorization rather than fully engaging with the material in which they are being taught. According to the article by Kornak (2017), children should be introduced to the practice of brain breaks. Implementing brain breaks does not have to take up a lot of time. In fact, Kornak notes that introducing brain breaks should be three times a day for three minutes. During this time, students should become quiet. The teacher will then lead the students through mindful breathing and exercises. The ultimate goal of these brain breaks is to help students stabilize emotional thinking and help them refocus (Kornak, 2017). These brain breaks allow students to get a better handle on their stress levels allowing them to focus on lessons and retain information that is being taught to them.

Another simple way to integrate movement into the classroom is to make everything as kinesthetic as possible. According to the article by Hennick (2017), some kindergarten teachers have suggested the students dance throughout the day. If students are asked to sit down, they dance into their seats. It was also suggested that students “sky write” to practice forming letters in the air as they spell the words. Hennick also notes that students can also incorporate movement when counting. Every twenty numbers students can perform a new action such as driving a car, paddling a kayak, or picking apples. Yoga and GoNoodle videos are also suggested. Teachers should also find creative ways to incorporate movement for upper-elementary students. Teachers should combine curricular topics with getting kids walking outdoors, in settings that naturally lend themselves to lessons about weather, history, or literature (Hennick, 2017). For middle school students who seem to be more sedentary during their school

day, teachers can implement Zumba or boot camp exercises with resistance bands, squats or pass around medicine balls.

Integrating physical activity into academic content is a valuable aspect of the school day for both students and teachers, however, many teachers are unaware that movement provides benefits to children (Erwin, Docheff, & Beighle, 2010). Many teachers are unaware the quick activities to get students moving can be beneficial to a student's health as well as their learning. "Freeze" allows students to move around in their personal space. When the teacher says "freeze", students will stop and look at the teacher. "Groups of" is the same concept as "freeze" but when "groups of" plus a number is called, students must quickly find a group of 4 for example and then freeze. Another example of implementing movement into learning is called "health nuts". Teachers in lower elementary grades can play this game and integrate it into their health lessons by having students do jumping jacks or jog in place when they hear a healthy food or habit being discussed. This game could also be modified for the area of mathematics as well, for example, with math facts.

Summary

Physical activity is a vital part of everyone's life. It is important to realize that this activity is especially important in the lives of children both in and out of school. Physical activity can positively impact mathematic achievement in elementary school classrooms. Implementing the physical activity into the curriculum is not only beneficial to student health, but to their academic achievement as well.

CHAPTER III

METHODS

Design

The purpose of this study was to examine the effects of physical activity in 3rd grade students on mathematic academic achievement. This is a quasi-experimental study with a pre and post-test design. The independent variable of this study was the physical activity. The activity consisted of two minutes of cardiovascular movement before working on multiplication facts. The dependent variable was academic achievement. This was defined as achievement on a 100 question multiplication fact quiz. This intervention was conducted from February 6, 2018 through March 6, 2018. This was a total of 4 weeks and a total of 20 school days.

Participants

The students in this study were twenty-six third grade students in an average sized elementary school. There were fifteen girls and eleven boys and all were physically capable to participate. This school is a Title 1 school in Baltimore County with an average enrollment of 520 students. Within this class there are many subgroups represented which included students of different ethnicities and backgrounds, such as, African American, Iranian, and Caucasian. In this class there are no students that had an IEP or required any additional supports from support staff. This class was selected because it was the math class assigned to the observer as the classroom teacher. The observer has created a positive relationship with the class by creating a safe environment of respect and rapport before beginning.

Instruments

This study used one measure which was a pre and a posttest. This posttest was not created by the observer but was already developed by Baltimore County Public Schools curriculum. This test was measured for validity by the county to measure the mastery of

student's multiplication facts through ten. The pre and the posttest were identical and were given exactly four weeks apart. The pre and posttest had one-hundred multiplication questions on it that students were asked to complete in a maximum of five minutes after completing their two minutes of cardiovascular exercise.

Procedure

Throughout the four weeks of the study, students were asked to do two minutes of cardiovascular exercise then complete multiplication problems immediately following the exercise. The cardiovascular activity varied each day such as jogging in place, jumping jacks, and high knees. The teacher also participated in these activities along with the students to keep the engagement high. Each day, the students would come into math class and stand behind their chairs. Students would raise their hand and try to guess which cardiovascular exercise we were going to do that day. After guessing, the teacher would reveal the daily exercise and set the large timer on the projector screen. Activities were varied to keep student interest. The timer showed both minutes and seconds as it counted down for the students to see. The student's whole body was constantly moving during this 2 minute period. Jumping jacks had both arms and legs moving, high knees had students knees moving up and down and their arms reaching for the sky, and jogging in place the students were moving their legs to imitate running and moving their arms alongside their bodies. Students would count down when it got to 10 seconds remaining. When the timer went off, students took three cleansing breaths and started their multiplication fact sheet independently. After students finished, we would go over the answers together and grade their work as a class.

CHAPTER IV

RESULTS

This study examines the effects of physical activity in third grade students on academic achievement. The purpose of this study was to determine whether physical activity has a significant impact on student academic achievement. There were two variables that were of interest in this study. The dependent variable was the academic achievement. This variable was operationally defined as achievement on a 100 question multiplication fact quiz. Each quiz was graded from zero to one hundred percent. The independent variable was physical activity that the students participated in daily. This variable was operationally defined as consisting of two minutes of cardiovascular movement before working on multiplication facts.

The researcher's first observation based on the data above there is a significant difference between the pre and the post-test averages. According to the data, the average for female students taking the pre-test was 55% which significantly increased to 74%.

$t(14) = -3.92, p < .05$, while males had an average of 56% which significantly increased to 70% $t(10) = -2.394, p < .05$. Overall the mean score on the pre-test was 55.73% which significantly increased to 72.69%, $t(25) = -4.57, p < .05$. The total average, as well as both male and female average show a significant difference between the pre- and post-test.

Table 1 provides pre and post-test averages for both males and females in third grade math as well as the total average. Their mean performance in this mathematics test was over a four-week period.

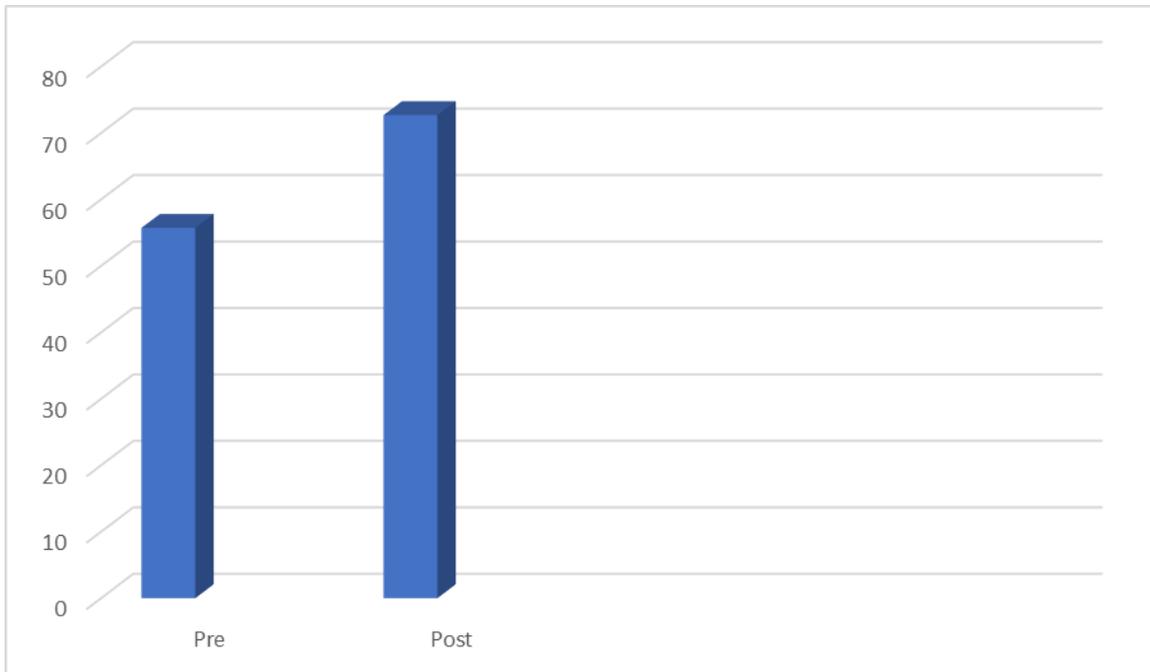


FIGURE I: Mean Pre and Post-Test Scores

Table 1:

Mean Scores of Students

Gender	Pre-Test	Post-Test	
	Mean	Mean	Number of Students
F	55.47	74.33	15
M	56.09	70.45	11
All Students	55.73	72.69	26

CHAPTER V

DISCUSSION

The purpose of this study was to examine the effects of physical activity in third grade students on academic achievement. The null hypothesis, physical activity for third grade students will have no impact on mathematic multiplication timed tests, was not supported.

Implications of Results

The researcher saw an increase in total mean score from 56% to 73%. The mean score for both experienced a significant increase in scores. The mean score for females started at 55% and ended at 74% while the males started at 56% and ended with a mean score of 70%. This shows that physical activity had an effect on academic achievement of third grade students.

Threats to Validity

There are both internal and external threats to validity for this study. One external threat to validity is that this group was not randomly selected by the researcher. This group was assigned to the researcher in the beginning of the school year. An internal threat to validity was the level of participation that the students completed the physical activity. Some students completed the cardiovascular exercises correctly while others did not. For example, some student motivation to participate in these daily physical activities varied. Another internal threat to validity was the daily multiplication quizzes given to the students during the multiplication unit. Student scores may have increased based off of repetitive practice from county curriculum and not necessarily the added physical activity. Finally, maturation between the pre and posttest could also be a threat to internal validity. This was a four week study so students had an additional four weeks to practice their multiplication facts before the post-test.

Connections to Previous Studies/Existing Literature

There are several other researchers who have studied the effects of physical activity and its impact on academic achievement. Trudea & Shephard (2008) agree that just by simply implementing 20 minutes of activity a day into the classroom has been proven to improve student performance on perceptual and decision making tasks, as well as boosting grades in English and mathematics. Mullender-Winjnsmma, Hartman, Greeffm Bosker, Doolgaard, and Visscher (2017) also say that integrating the activity directly into the teaching can help students academically improve. One example they gave was to have students use body movements such as jumping jacks to answer a multiplication equation. Another example they have was to have students “air write” phonics patterns so that the motion reminds the students of their learning. More continued research from Chandler & Tricot (2015) shows that students need to be experiencing learning with their whole body, rather than just being a spectator in learning. Simple gestures also offload some working memory for students, freeing space in the brain which allows students to have a deeper understanding of the content in which they are learning. Finally, a study conducted by Field, Diego, and Sanders (2001) shows that students that had a higher level of exercise had better peer and family relationships which in turn results in greater chances of academic success.

Implications for Future Research

The results from this study has revealed implications for future research. If the researcher were to conduct this study again there would be a few things done differently. First, the researcher would want to be sure that the group of students was a more heterogeneous group. The researcher would also implement a more accurate way to keep the students accountable in the participation of the exercises. The researcher would do this by implementing a more

engaging exercise by using a brain break site such as “GoNoodle” rather than having students do jumping jacks, etc. Finally, the researcher would like to measure the academic achievement differently. The researcher would like to measure based off on a phonics assessment to see if implementing the motions, as Chandler & Tricot (2015) mention within the learning, is as beneficial as they have found.

Summary

The results of this study have shown that there is a positive relationship between physical activity and academic achievement. There was a significant difference in scores from the pre and posttest given to the students both in overall total as well as both for male and female students. Previous research suggests that there is a positive relationship between physical activity and academic achievement and based on the results of this study the researcher agrees with that research. This research suggests that the implementation of exercise both within the daily teaching and as brain breaks would positively benefit students in their mental health, physical health, as well as in their academic achievement.

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