

The Effect of Physical Activity on
Third Grade Students and
Academic Achievement in Mathematics

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ABSTRACT

The purpose of this study was to determine if physical activity had an effect on 3rd grade student's academic performance in mathematics. The study was performed as a quasi-experimental study with a control and a treatment group. The control group did not receive any physical activity interventions, the treatment group received 1 minute of physical activity directly before mathematics instruction. Results showed that physical activity did not affect mathematical achievement. Future studies should include performing the study during months that would be less affected by weather and include more students in the sample.

CHAPTER I

INTRODUCTION

Overview

In a data-driven world, assessments are at the forefront of every teacher's agenda. Getting students to or above grade-level expectations is a teacher's number one priority. But how can teachers effectively help students learn and retain the sometimes-overwhelming amount of information that they are being taught each day? Students are expected to learn and comprehend more information and at a faster pace than ever before. What can educators implement to give students a beneficial edge in their education?

Math, writing and reading are some of the most important subjects for teachers to convey to their students' as these are the subjects tested in most national, state and local assessments. Because of the emphasis on math, writing and reading, other subject areas receive less attention, time, and focus during the already short school day. Howie and Pate (2012) reported that many school districts are cutting physical education due to the *No Child Left Behind* act. Recess is slowly being whittled down to a brief 15-minute period, which includes the transition to and from the classroom. The amount of time allotted for movement during the school day is diminishing for many students across the country.

A study done by Fedewa and Ahn (2011) found out that less than five percent of American schools provide students with daily physical education classes. Because of this, Hennick (2017) found that by age 19 the average person is as sedentary as a 60-year-old person. It is interesting to note that movement time throughout the school day on average is decreasing

and, at the same time, test scores seem to be stagnated. Something must be done to help students grow both in academics and in their level of movement throughout the day.

For the reasons above, this researcher wanted to find out if adding physical activity time immediately before math instruction would increase academic achievement, specifically in math scores. Research has shown that adding physical activity to a student's day has a positive influence on academic achievement. Based on these studies, this researcher took a group of third-grade students and conducted a study to find out if physical activity has an impact on academic achievement.

Statement of Problem

The purpose of this study was to examine the effects of physical activity on third-grade students in mathematical academic achievement.

Hypothesis

Physical activity will have no effect on third-grade students' mathematical academic achievement.

Operational Definitions

The independent variable in this study was **physical activity** for one minute. This was implemented immediately before math instruction. The physical activities used in the study include jogging in place, jumping jacks and burpees.

The dependent variable for the study was **academic achievement**, specifically in math. This is defined as academic achievement on the MAP test. The specific session of testing that was used for this study was the winter MAP test session.

CHAPTER II

REVIEW OF THE LITERATURE

This literature review is presented as a component of this research project to explore the effects that physical activity has on academic achievement in third grade students, specifically mathematical achievement. The three sections of this review describe physical activity inside the school and outside the school, the benefits of physical activity, and how physical activity can be used and incorporated in the classroom to increase academic achievement.

Describing Physical Activity Inside and Outside the School

Physical activity is a phrase that describes movement. Not all types of such activity are equal. Howie and Pate (2012) describe physical activity as any energy expenditure above resting which includes fitness and sports participation and physical education. With all of these options, considering which type of physical activity is the best for classroom implementation can be challenging. Another challenge to physical activity in schools is that many school districts have reported no longer scheduling physical education during the school day. The Center for Education Policy reported that, in 2011, 68% of schools cut funding to non-core academic areas, which includes physical education. With schools cutting funds for students to get physically active, it is becoming harder and harder to get students moving.

Defining an activity plan in schools can be a daunting task for anyone. Fedewa and Ahn (2011) found that students gain the largest cognitive benefits from aerobic-based physical activity. For their study they used the speed, agility, 50-yard dash and short run as aerobic indicators for students. Students showed growth in cognitive scores when performing arm strength (push up test, pull up test, or bent arm hang) and sit-ups as well. The only category to

show no impact on student cognitive growth when a variable was put in place was flexibility. The study provided physical activity to students three times per week. It was also interesting to state that among all of the outcomes, the largest gain in cognitive achievement was in mathematics.

Tomprowski, Davis, Miller and Naglieri (2008) also found that aerobic-based physical activity had the greatest impact on academic achievement. Their study revealed that aerobic based physical activity had a large effect on cognitive performance, with the greatest gains in tests assessing executive function. Executive function relates to the student's ability to control behavior. If a student cannot control his or her behavior in the classroom they will not be available to learn either. The study also went on to show that although physical activity had a positive effect on both males and females who participated, there was stronger evidence suggesting that the physical activity helped female students more than their male counter parts.

Resaland, Moe, Bartholomew, Anderson, McKay, Anderssen and Aadland (2018) also looked at how genders differ from physical activity interventions and the effect on academic achievement. In this study, they used the Active Smarter Kids (ASK) intervention on students for seven months. During this study, they found that academic achievement was increased in both genders when ASK was introduced. For males, both low performing and high performing students had an increase in their academic achievement from a physical activity intervention. However, only low performing females showed benefits from the intervention. High performing female students did not show evidence of growth from the physical activity intervention. These authors believe that males generally prefer to be active whereas females can thrive in a sedentary classroom setting.

Benefits of Physical Activity

While some researchers say that increasing physical activity time in schools will decrease academic time and therefore hurt academic performance, it has been shown that increasing physical activity time does not hinder academic performance in students and generally increases academic achievement in students. Trudeau and Shepard (2008) showed in their studies that despite a decrease in academic time, data remained unchanged and even trended toward enhanced academic performance in students who received a physical activity intervention. The study looked at short-term and long-term effects of physical activity, generally suggesting that there was a positive effect on cognition with acute physical activity. While looking at long-term effects, the study showed that 67% of African American adolescents and 33% of Caucasians studied showed that physical activity was a significant predictor of better academic results and higher academic achievement, stating that physical activity could have an affect on academic achievement by increasing motivation and investment in school. Finally, these researchers stated that physical activity could offer protection against Alzheimer's Disease.

Watson, Timperio, Brown, Best and Hesketh (2017) also looked at short-term and long-term effects of physical activity-based interventions on academic achievement. In their study, academic achievement increased immediately following physical activity. However, the academic achievement improvement may dissipate over time, with groups showing no difference when the physical activity intervention has stopped. Another interesting point in this study was that short-term interventions using progress monitoring showed improvements in academic achievement, whereas short-term interventions using state standardized tests did not show improvement. However, one-year and three-year physical activity interventions showed great improvement on students' academic achievement through standardized tests.

Distractions are a common occurrence in classrooms and physical activity interventions can also help to ease those distractions for students. Pindus, Drollette, Scudder, Khan, Raine, Sherar, and Hillman (2016) discuss how aerobic physical interventions can help students manage distractions in the classroom. For their study they monitored student's physical activity and then gave the students a v02 max test using a graded treadmill. Their study showed that the students with a higher vo2 max performed better cognitively and had better control over distractions than other students. These researchers concluded that regular physical activity or exercise is needed to benefit cognition in children.

Integrating Physical Activity into the Classroom

Getting students moving throughout the day can have a great impact on academic achievement. Hennick (2017) discusses how by the age of 19, the average person is as sedentary as a 60-year-old. This researcher describes the inertia a student experiences when they sit for an entire day. Students need to get moving to jump-start their brain as he said, "movement bumps up effort" (p.44). Little strategies can be used throughout the day such as sky writing with a finger or jumping from one day to the next when talking about the calendar. There are websites such as go noodle.com that have videos for students to watch and follow to get physically active. Brain breaks are an important strategy that enhances student achievement as these little breaks for students help to get their blood flowing to their brain so they can function at their highest potential.

Erwin, Docheff and Beighle (2010) also identified ways to get students moving in the classroom. By having students create their own groups in different places in the classroom they will have to get up to move around. Having students act in class can be a great way to get students moving instead of sitting at their desk. Their best idea was to work with the physical

education teacher at school and create activities that can be performed in the classroom for easy, fun movement opportunities.

Teaching the curriculum can be stressful enough for teachers. Adding physical activity into the curriculum can seem like an arduous mountain to climb. However, when physical activity is combined with the curriculum, students can truly grow academically. Chandler and Tricot (2015) showed that when physical activity is incorporated into lessons and not merely used just for physical exercise, there are benefits for students. Results from their study showed that students found learning new words less difficult when combined with physical exercise or gestures. When coupling cognitive stimulation with physical activities, brain development is considerably enhanced in various stages of learning.

Ronen and Grosu (2014) agree that combining physical activity and learning has the greatest benefit for students. In their study, they used Eshkol-Wachman Movement Notion (EWMN) that uses body movements to demonstrate symbols and signs. This specific intervention was used in an elementary geometry class, specifically with angles and symmetry. In the study, students who were in the EWMN group had better attainment of angles and symmetry than the students who were not in the intervention group. The students in the EWMN group had a much easier time mastering the skills and had a better memory of the skills than the students who were not in the intervention group. In turn they received a higher score than the students who did not use the EWMN technique.

SUMMARY

Research studies indicate that adding physical activity into the daily routines in school children will not only benefit student health but also result in higher academic achievement. By

increasing physical activity in the school setting, over 50 million children will have the potential to increase their academic performance. Trudeau and Shephard (2008) agreed that there is no denying the role of physical activity in the comprehension of academic achievement.

CHAPTER III

METHODS

Design

The purpose of this study was to examine the effects of physical activity on third grade students' mathematic academic achievement. This was a quasi-experimental study with a treatment and control group. The independent variable introduced to the students was one minute of physical activity prior to their math instruction. The physical activity that was introduced was either jumping jacks, running in place or burpees. The dependent variable for the study was mathematical achievement on the MAP test. This intervention was conducted from January 14, 2019 through February 21, 2019 for a total of twenty-four instructional days.

Participants

The study was implemented at a Title 1 school in Baltimore County, Maryland, that has around 600 students. This study included 12 randomly selected students from a class of 24 third grade students in one 3rd grade classroom. The class consisted of 12 males and 12 females, so 6 males and 6 females were selected to be part of the treatment group. There are many subgroups represented in the sample; these subgroups include students with different ethnicities and backgrounds. The participants consisted of 11 Caucasian students, six Hispanic students, two African American students, two Pakistani students and three students from other race/ethnicities. There are 3 students in the class that have IEPs or require additional adult support. This class was selected because they receive their math instruction at the beginning of the school day.

Instrument

The instrument used for this study was the winter portion of the Measures of Academic Progress assessment, or the MAP test. This test was not created by the observer but developed by the Northwest Evaluation Association (NWEA). The MAP test was reviewed for reliability and validity by the *Buros' Mental Measurement Yearbook*. In their writing, both reviewers stated that the math section of the MAP test is both valid and reliable.

Procedure

Every morning the treatment group of randomly selected students were taken into the hallway to participate. Once in the hallway the researcher would give the students a physical activity to perform for one minute. A different physical activity was performed each day, the physical activities that were used were jogging in place (the students would jog in place in the hallway for the entirety of the minute); jumping jacks, (the students would jump up, spread their legs apart and put their hands above their heads, then jump again closing their legs and putting their hands at their sides); and burpees (the students jumps with their hands reaching up, land, drop down into pushup position, perform a push up then jump back up while reaching to the sky). These physical activities were recycled for 24 days. Once the one minute of physical activity was performed, the students would then go back to class for their math instruction; the observer also would go back to class. This procedure was repeated for 24 days before the MAP test was administered. The control group did not come into the hallway to participate in the physical activity prior to the math instruction.

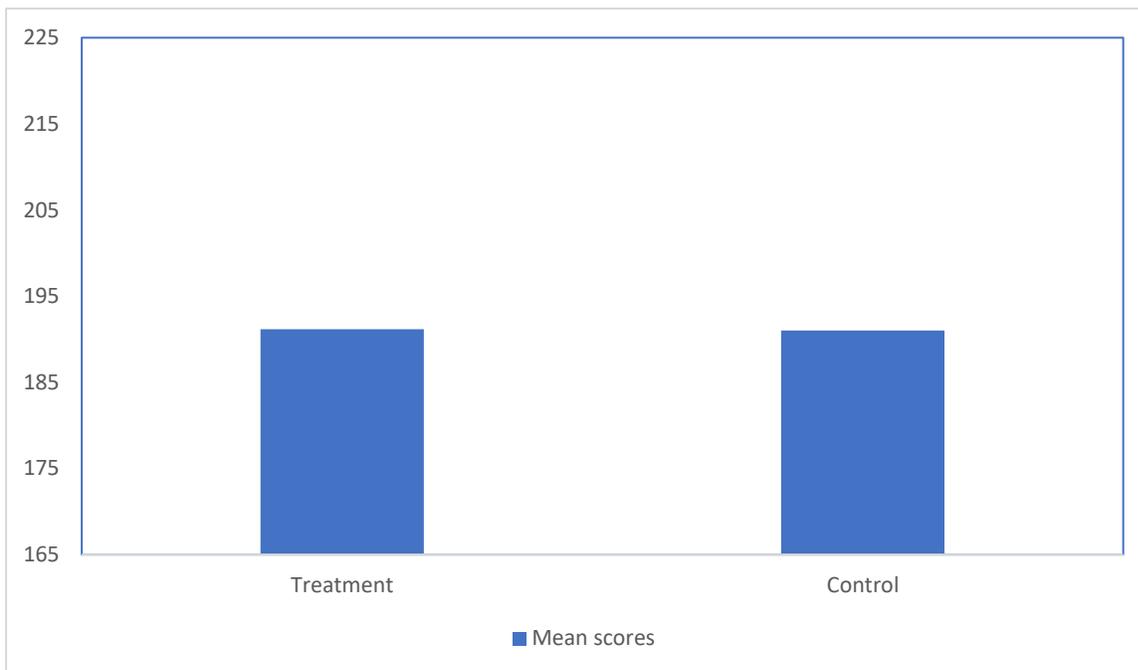
CHAPTER IV

RESULTS

The analysis of this study revealed the math mean score for the students who were pulled out to perform physical activity directly before math instruction was 191.17 and the mean for the control group was 191.00. Thus the difference was not statistically different, $t(22)=0.03, p=.97$. There was no difference between the scores of the control and the treatment group.

Figure 1

Math mean scores for the students who received physical activity directly before math instruction and the control group.



CHAPTER V

DISCUSSION

The purpose of this study was to examine the effects of physical activity on mathematical academic achievement of third grade students on the MAP test. The null hypothesis that physical activity will have no effect on third-grade students' mathematical academic achievement was supported.

Implications of the Results

Analyzing the data showed there was no significant increase in test scores between the control group and the treatment group. The control group's mean score for the test was 191.0 while the treatment group's mean score was 191.2. Findings revealed that physical activity had no effect on student mathematical achievement.

Theoretical Consequences

The theoretical consequences implied by this study suggest that physical activity does not have an impact on mathematical academic achievement in third grade students. The results from this study did not support the research that was discussed in Chapter II. All of the research that was presented in the Review of the Literature suggested that physical activity would have an impact on academic achievement. However Ronin & Grosu (2014) suggest that physical activity must be integrated with the academics for it to have an impact on academic achievement.

Threats to Validity

Threats to validity that were noted during this study included the number of snow days during the intervention period due to snow days. This study was implemented from January 14, 2019 through February 21, 2019. During that time period, there were five snow days that occurred. Because the students were not in school, they did not receive the physical activity or the math instruction. Another threat to validity was absent or tardy students. The physical activity was performed at the beginning of the day. If a student was late to school, a bus was late to arrive at school, or a student was sick and could not attend school, the student would not receive the physical activity or the math instruction. A final threat to validity was that there was no baseline data available for these students prior to taking this test. Students could have shown growth in academic achievement but this was not possible to ascertain.

Connections to Previous Studies/Existing Literature

There were not many studies with the same results as this study. Most studies regarding physical activity and academic achievement showed an increase in academic achievement when physical activity was introduced. Tomprowski et al. (2008) discussed that physical activity showed a significantly positive result when associated with math achievement. However, one study did state that a CDC review concluded that physical activity may have no effect on academic achievement (Howie and Pate, 2012). One study suggested that for students to increase academic achievement with physical activity, the physical activity must be integrated with learning. Ronen and Grosu (2014) argue that for students, learning which integrates physical activity makes learning easier to master and is easier to remember, which creates positive experiences. One final possible reason for no growth in academic achievement for the third-grade students could be that physical activity could be used more efficiently with just students

who previously showed low performance. A study by Resaland et al., (2018) study showed that in 10-year-old elementary school students the low performing students benefitted the most academically from the physical activity intervention.

Implications for Future Research

The results of this study showed implications for future research. First, the study should be performed during months that have a less chance of weather effecting the study. The days that were lost due to snow and sickness could have affected the data that was received after taking the test. If the study was performed in warmer months, there would be less chance of snow days that would result in the students missing school, as well as fewer instances of students being sick. Second, the study should be done with a larger sample of students. Only 12 students were in the control and treatment groups. With a larger sample of students there would be more data to analyze to truly see if physical activity has an effect on mathematical academic achievement.

Conclusion

The results of this study show that there is no significant evidence that physical activity impacts mathematical academic achievement in third grade students. However, Hennick (2017) stated that the average 19-year-old person is as sedentary as a 60-year-old. Fedewa and Ahn (2010) discussed that only about five percent of schools provide students with daily physical activity. With less and less movement for children, more research must be done to see if physical activity can play a role in improving academic achievement in students.

REFERENCES

- Chandler, P., & Tricot, A. (2015). Mind your body: The essential role of body movements in children's learning. *Educational Psychology Review*, 27(3), 365-370.
doi:10.1007/s10648-015-9333-3
- Erwin, E.H., Docheff, D., & Beighle, A. (2010). Get kids moving in the classroom. *Journal of Physical Education, Recreation & Dance*, 81(9), 15-17.
- Fedewa & Ahn. (2011). The effects of physical activity and physical fitness on children's achievement and cognitive outcomes: A Meta-Analysis. *Research Quarterly for Exercise and Sport*, 82(3), 521-535. doi:10.5641/027013611x13275191444107
- Hennick, C. (2017) The motion quotient: How teachers are transforming classroom instruction with movement-and why it matters for brain development. *Scholastic Teacher*, 127(1), 42-44.
- Howie, E. K., & Pate, R. R. (2012). Physical activity and academic achievement in children: A historical perspective. *Journal of Sport and Health Science*, 1(3), 160-169.
doi:10.1016/j.jshs.2012.09.003
- Pindus, D. M., Drollette, E. S., Scudder, M. R., Khan, N. A., Raine, L. B., Sherar, L. B., & Hillman, C. H. (2016). Moderate-to-vigorous physical activity; Indices of cognitive control, and academic achievement in preadolescents. *The Journal of Pediatrics*, 173, 136-142.
doi:10.1016/j.jpeds.2016.02.045
- Resaland, G. K., Moe, V. F., Bartholomew, J. B., Andersen, L. B., McKay, H. A., Anderssen, S. A., & Aadland, E. (2018). Gender-specific effects of physical activity on children's academic performance: The Active Smarter Kids cluster randomized controlled trial. *Preventive Medicine*, 106, 171–176. <https://doi.org/10.1016/j.ypmed.2017.10.034>

- Ronen, T., & Grosu, E. F. (2014). "It's easy to learn from movement": Learning through the Eshkol-Wachman Movement Notation (EWMN). *Palestrica of the Third Millennium Civilization & Sport.*, 15(3), 193-199
- Tompotowski, P. D., Davis, C. L., Miller, P., H., & Naglieri, J. A. (2008). Exercise and children's intelligence, cognition, and academic achievement. *Educational Psychology Review*, 20(2), 111-131. doi:10.1007/s10648-007-9057-0
- Trudeau, F. & Shephard, R. (2008). Physical education, school physical activity, school sports and academic performance. *International Journal of Behavioral Nutrition and Physical Activity*, 5, 1-12. doi:10.1186/1479-5868-5-10.
- Watson, A., Timperio, A., Brown, H., Best, K., & Hesketh, K. D. (2017). Effect of classroom based physical activity interventions on academic and physical activity outcomes: A systematic review and meta-analysis. *International Journal of Behavioral Nutrition and Physical Activity*, 14(1), 1-24. doi:10.1186/s12966-017-0569-9