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MOVEMENT BREAKS: THE EFFECTIVENESS OF PHYSICAL MOVEMENT ON KINDERGARTEN STUDENTS' RECALL OF ADDITION FACTS

By

Erika Morrison

THESIS

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Title of Thesis: MOVEMENT BREAKS: THE EFFECTIVENESS OF PHYSICAL MOVEMENT ON KINDERGARTEN STUDENTS' RECALL OF ADDITION FACTS

This thesis by Erika Lynn Morrison is recommended for approval by the student's Thesis Committee and Department Head in the Department of Education and by the Assistant Provost of Graduate Education and Research.

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MOVEMENT BREAKS: THE EFFECTIVENESS OF PHYSICAL MOVEMENT ON KINDERGARTEN STUDENTS' RECALL OF ADDITION FACTS

By

Erika Morrison

A three-day action research study in a kindergarten classroom investigated the question: "Does physical movement prior to a cognitive skills task improve academic achievement with addition facts?" Fifteen kindergarten students, who are ethnically similar, yet diverse in socioeconomic status and academic ability, experienced addition fluency assessments using the iPad app, MathBoard (PalaSoftware Inc., 2014). A pre-test was administered before students participated in an optional movement break activity consisting of dance videos. Each movement break lasted approximately 8-10 minutes. After the break, students completed a similar addition post-test. In this quantitative study based in a constructivist framework, three types of data were collected including: time and accuracy scores for the assessment, observational notes about test discrepancies, and observational notes recording participation levels during movement breaks. Small groups of students were tested once per day during one of three time periods: early morning, early afternoon, and late afternoon. The combination of speed and accuracy demonstrates fluency within a subject, and were analyzed both separately and together to examine change within the results. Speed and accuracy increased a small amount over the course of the three-day study, but these increases may be un-related to the brain breaks and physical movement that students experienced. Results were mixed on an individual level for both speed and accuracy, and fluctuated over the course of the study.

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This thesis follows the format prescribed by the APA Publication Manual and the School of Education.

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CHAPTER 1: INTRODUCTION

Blending learning and physical movement together in a general education classroom is an idea researchers and teachers have examined because of the positive effects that have been demonstrated in some past studies (Jensen, 2000). Imagining a drinking glass, one cannot continue to pour water into the glass and expect it to stay contained once the glass is full. The brain works in the same way as the glass analogy; meaning, once the brain has exceeded the amount of information it can process at one time, the rest of the knowledge is forgotten. One way the body empties the metaphorical glass is through exercise and taking breaks. Because the human brain is designed to learn through short bouts of information acquisition, it is important to follow learning with a short break to allow the brain to process newly learned information (Jensen, 2000). In some studies, physical activity has been known to improve learning, thus teachers across the nation are including movement breaks in their classrooms (Ratey, 2008). Teachers employ brain breaks in the classroom at times when students appear sluggish or distracted, when long lessons exceed students' attention spans, or during transition times between activities. Using brain breaks throughout the day offers students the opportunity to re-energize their body while giving the brain the time it needs to process learning and prepare for future learning. u

In my experience as an educator, kindergarten students are commonly excited to learn, accept a challenge, and take advantage of any opportunity to be active. The brain of an average student is growing quickly each day, not only as he or she learns the content standards taught in school, but as he or she grows and matures (Sprenger, 2008). As 5-

year-olds, students are better able to form memories compared to what they were capable of previously, their vocabulary is expanding, and the electrical activity within their brain is increasing. Beyond these major growth areas, children at the age of six are beginning to understand logic and reason. Their attention and focus begin to improve as they are able to set long-term goals for themselves (Sprenger, 2008). The 21 students in my classroom exhibited these same characteristics on a daily basis.

Math fact fluency is also an important part of school curriculum. As part of the Common Core Standards (Key Shifts in Mathematics, 2014), kindergarten students are expected to be fluent in addition and subtraction in sums to five, as well as have a solid understanding of how to solve addition and subtraction problems with sums to 10.

On a regular day, my students took part in 90-minutes of language arts instruction, 60 minutes of math instruction, 40-60 minutes of unstructured playtime, and 40 minutes of a special area class. Throughout the day, writing, social studies, and science concepts are taught along with social skills and problem solving techniques. All of these areas are taught with the looming presence of accountability in achieving grade-level content standards. Hence, students begin taking assessments to gage retained knowledge very early in their academic careers. Kindergarten does not currently have set rates to be considered fluent in addition or subtraction. However, Delta Math, the assessment tool used by my district to determine Title 1 services in mathematics, has given specific rates for first-grade students to achieve in the fall based on kindergarten content. On this assessment, students have 1 minute to answer 12 addition problems. Students are considered fluent if they answer at least 10 questions correctly in the 1-

minute time frame. With the recent push for increased academics, a problem has emerged within my classroom.

Statement of the Problem

After spending four years teaching kindergarten, my experiences have led me to conclude that children at this age tend to be very active. Whether my students are in the classroom or on the playground, they love to move and be active. However, pressures to perform on standardized tests leave little or no time to exercise and recess is often replaced with additional academic time. In 2008, 44% of schools increased English Language Arts (ELA) and math instruction for elementary students while cutting back on one or more of the following areas: science, social studies, special area classes, lunch, and/or recess (McMurrer, 2008).

A transition toward teaching more of the tested-content areas leaves children more sedentary in the classroom than they have been in the past with a firmer push to learn and retain content. Having children sit for long periods of time is problematic because neurons struggle to communicate as the body becomes more stagnate (Willis, 2006). When neurons stop communicating they do not have time to rest. Retention of new information then becomes difficult and frustrating when the creation of new chemicals to form synaptic bonds becomes slower.

In seeing the need for physical movement within my students and their apparent need to take a break to absorb further learning, I searched for a way to solve these problems. Since I had employed brain breaks within my classroom for the past two years, I was curious if what I was doing was beneficial for my students. By conducting this

study I sought to discover how best to use movement within my classroom to enhance student learning.

Theoretical Framework

With problem solving as a driving force for my study, I find the Constructivist Approach to be at the heart of my theoretical framework. I have constructed my own knowledge based on experience, tested my own ideas in the classroom, and I continue to examine and apply related knowledge to create new approaches in best teaching practices (Moursund, 2007).

While the Constructivist Approach is a framework that guides my research, the Achievement Goal Theory seems to capture a portion of my students' approach. As students set goals for their personal achievement they are ultimately making choices driving their behavior toward the objective they are striving to achieve (Maehr & Zusho, 2009). The motivation for these goals differs from student to student and may even differ based on the time of day for some children. While some students set goals for themselves to answer a higher quantity of questions than they had previously, some may want to beat their own personal best time. Others set goals to finish quickly in order to move on to the next activity. Whatever the motivation, my students display a yearning to achieve their goals and do well in school.

Industry vs. Inferiority is another framework that guides my research on behalf of my students. Some students sought out an opportunity to test and practice their new skills because they wanted to do well and feel that they have succeeded in math. Other times during this study, students who had not been as successful in the past felt a sense of inferiority, thus they did not enjoy taking the fluency assessments (Heffner, 2001).

Research Question

With this action research project, I am interesting in studying the effectiveness of movement breaks on the academic achievement of kindergarten students in the area of addition fact fluency. The question guiding my study is, "Does physical movement prior to a cognitive skills task improve academic achievement with addition facts?"

Definition of Terms

The following terms are important to the understanding of this study:

Academic achievement. When students reach satisfactory or superior levels of academic performance on outlined curriculum or pre-determined goals (Cuseo, n.d.).

Action research study. Inquiry conducted by a member of a school staff with the goal of gathering information about how they teach, how their students learn, or how the school operates. A major goal with action research is to inform one's personal teaching practice with newly gained knowledge (Mertler, 2012).

Addition facts. A type of addition problem containing two whole numbers, that when added, have a sum smaller than 20. These problems should be memorized for quick recall after students have an understanding of the concept (Laurendeau, 2008).

Addition fluency. A combination of both speed and accuracy with calculations (Key Shifts in Mathematics, 2014). Recall of facts should be quick and effortless with the goal of retrieving answers from long-term memory (Cholmsky, 2011).

Brain break/movement break. A short break in teaching consisting of physical movement; possibly dancing, running in place, jumping, stretching, and/or focused breathing. In this study, brain breaks are teacher-led or video-based activities lasting approximately 8-10 minutes each.

Kindergarten students. Children enrolled in kindergarten, ranging in age from 4-6 years old.

NCLB. No Child Left Behind Act, an education policy passed in 2001 by the Federal government with the idea of reforming standards-based education. Under this law, all students are to be proficient in ELA and math by the year 2014 as measured by a standardized test (Lewis, 2014).

Physical movement. A motion carried out by the body.

Significance of the Study

As a teacher, I strive to improve addition fluency among my kindergarten students because these skills are the foundation for more complex mathematics in future grade levels (corestandards.org, 2014). Through this action research, I am striving to understand if my teaching actions are helping my students achieve greater academic success by researching the effects of brain breaks in my classroom. Ultimately, I am seeking the inspiration and adoption of best practices in student learning and physical movement within my classroom through research of this topic.

Limitations

Limitations of this study include the reality of the classroom context and the nature of addition facts for kindergarten students. The reality of the kindergarten classroom is that students are diverse four- to six-year olds whose motivation and focus frequently vary. Additionally, this study was also limited in that some students did not participate in the brain breaks. Sometimes children chose not to participate because they did not care for the movements they were being asked to perform while others preferred to watch. Also, having conducted a classroom inquiry in the last month of school,

addition with sums to 10 was a concept my students understood quite well; therefore, accuracy scores stayed within a small range of scores. If students improved their speed but did not maintain their accuracy, the data would seem to show a decline in fluency.

Summary

In this action research study, I am striving to find answers to my question: Does physical movement prior to a cognitive skills task improve academic achievement in addition facts for kindergarten students? Brain research indicates physical movement supports neuron growth in both children and adults (Ratey, 2008). Yet, with the ever-increasing pressure for students to succeed on tests, schools have been cutting back on the amount of time allotted for physical movement (McMurrer, 2008). Every day I see the benefits of giving my students time to move and be active through their body language, attention span, and overall concentration, but I would like to support my teaching practices with data. I am interested in finding how evidence-based practices translate into achievement gains for my students. I posit that a classroom in which a child's mind and body are connected through movement and learning is pivotal for the engagement of all learners. Through this study, I am striving to explore an educational trend in teaching using the mind-and-body-connection.

CHAPTER 2: LITERATURE REVIEW

With the current focus on mathematics and language arts, time for children to be active is often pushed aside (McMurrer, 2008). Children are frequently being asked to sit for long periods in an effort to cover more material despite brain research indicting physical activity improves learning (Ratey, 2008). In an effort to understand more about using physical movement breaks to aid learning in my classroom, I have found many studies to be helpful in framing this study, although the particular duration and specific intensity of physical activity necessary to impact learning is still unknown at this point.

An Educational Transformation

A report from the Center for Educational Policy released in 2008 revealed that of 349 schools surveyed, 44% had cut English Language Arts (ELA) and math instruction for elementary students while cutting back on one or more of the following areas: science, social studies, special area classes, lunch, and/or recess (McMurrer, 2008). Sixty-two percent of schools surveyed said they had increased the amount of time teaching ELA and math. Of the schools in the report that had reduced time, 53% had reduced social studies and science instruction by 75 minutes each per week. Prior to NCLB, 36% of schools reported teaching nearly 3 hours less of math and ELA, 50 more minutes of recess and 40 more minutes of physical education in a week.

Physical Movement and Attention

The influence of acute exercise on preschoolers' cognitive function was examined in a qualitative study conducted by Palmer, Miller, and Robinson (2013). Sixteen

students, 13 boys and 3 girls, were assessed at their preschool in a rural town in the southeast region of the United States. The background of each child, along with socioeconomic status, race, or ethnicity was unknown; however, the town's median household income is $12,000 above that of the nation's. Students experienced two conditions before being assessed using a picture deletion task for preschoolers (PDTP). The two conditions, exercise or sedentary, were assessed at different times and the PDTP was counterbalanced to protect from repeated testing in fixed sequence. Both conditions lasted for 30-minutes each before students were assessed. Children were evaluated by the same individual during each assessment, and tests were administered within five minutes after experiencing one of the two conditions. Accelerometers were worn by all students to make sure students were considerably more active during the exercise break and determine a percentage of time spent exercising vs. being sedentary (17.6 min, σ =3.52; 2.36 min, σ =2.01). Using the PDTP test, missed targets were considered omissions signifying failure to sustain attention. Each identified distracter was considered a commission signifying a failure in response inhibition. Wilcoxon signed-rank tests were conducted with both conditions as the independent variable and the PDTP scores as the dependent variables. Children made fewer omission mistakes on the PDTP test after they had exercised (M=25.6, σ =12.3; M=44.3, σ =28.7) and there were no significant changes after analyzing the commissions. Thirty-minute sessions of exercise improved the sustained attention of preschoolers over sedentary conditions. This study is important to the framework of my own study because the findings indicate students are better able to attend their attention to a task after an exercise break.

In an effort to shed light on activity levels of students during a typical school day, Mahar et al. (2006) set out to evaluate the effectiveness of a classroom-based physical activity program concerning on-task behavior during instructional time. Physical activity was measured for grades K-5 and on-task behavior was assessed in two classes of 3rd and 4th grade each. One hundred thirty-five students took part in intervention classes, and 108 students in the control classes. Intervention consisted of the classroom teacher leading a movement break lasting approximately 10 minutes at least once a day. Physical activity was measured using pedometers in both control and intervention classes. Students wore the pedometers during the school day and data were recorded for 5 days. The intervention groups averaged 782 more steps a day compared to their control counterparts. The number of steps during a physical movement activity ranged from 160-1233 steps. These data were analyzed using independent-groups t-tests and Cohen's delta. On-task behavior was studied by outside observers for 30 minutes before and after a movement break. A multiple-baseline across-classrooms design was used to determine the effectiveness of the movement breaks on students in this area. Repeated-measures analysis of variance (ANOVA) and Fisher's LSD tests were used to analyze data for this area of the study. Improvements in on-task behavior after the intervention took place (70.9 S = 15.3 vs. 79.2 S = 11.4, $p < 0.017$, increase of 8%), while no significant changes were noted in the baseline data (71.3 S = 16.3 vs. 68.2 S = 14.5). The largest change in results came when analyzing data for the students who were off-task more than 50% of the time they were observed as their on-task behavior was observed 20% more ($p < 0.0001$). Using movement breaks in the classroom are beneficial to student activity levels and are advantageous for teachers and students in regards to increasing on-task behaviors.

Physical Movement and Academic Achievement

While many research studies about physical fitness with children have focused on young children or adolescence, Eveland-Sayers, Farley, Fuller, Morgan, and Caputo (2009) examined the health-related physical fitness and academic achievement of 134 students in grades three, four, and five. In the spring of 2005, students from two different schools were studied after both the parents and student gave their consent to study the results of the TerraNova standardized test (reading/language arts and mathematics components) along with physical fitness test results. Students from all socioeconomic statuses and achievement levels may not have been represented in this study. TerraNova test scores were reported from the school principal to researchers and the physical education teacher shared physical fitness testing results. In each school, physical fitness testing was administered in the same way using the same measures: 1-mile run, BMI, hamstring flexibility (sit and reach) and abdominal muscle endurance (curl up). Descriptive statistics for all variables, both physical and academic, were analyzed using Pearson's Product Moment Correlations. This type of analysis inspected the relationship between student achievement with the TerraNova test and the physical fitness test for both samples of boys vs. girls and the entire group of volunteers. Fischer's r-to-z transformation tested for statistical differences in the correlation coefficients for boys and girls as well. Eveland-Sayers et al. found students with faster mile times scored higher on the math component of the assessment ($r = -.28$, $p < -.01$) while there was no significant correlation with the reading/language arts component. However, girls with faster mile times did fair better than boys with faster mile times on the reading/language arts portion of the test ($r = -.31$ and $r = -.36$, $Z = 1.66$, $p < .05$). While there was no significant

correlation between BMI and achievement on either the math or language arts/reading portion of the assessment, students who fared better on the sit-and-reach and curl up tests scored higher on the math component of the TerraNova assessment ($Z = 1.66$, $p < .05$). Academic achievement scores were greater when mile times decreased, a student's BMI did not affect their performance on either the math or literacy portion of the assessment, and muscular fitness (abdominal muscles and hamstring muscles) was positively correlated to math achievement. Additionally, a significance was found between the faster mile times for girls with both literacy and math assessments, while the boys' results did not have a high connection with mile time and literacy assessment.

An action research study conducted in a fifth-grade algebra class studied the effectiveness of learning algebra concepts on gifted learners after participation in 10-minute breaks (exercise and sedentary) (Brightup, 2010). Eleven students (each 10- or 11-years-old), all with mid-upper socioeconomic status level, were part of a six-week study. In the study, students were subjected to a ten-minute break at the beginning of their algebra class before being taught a new skill. For the first three weeks, students were given sedentary breaks in which they could read, draw, or rest. In weeks 4-6 students were asked to take part in physical movement activities for the 10-minutes. Before the study, Brightup conducted a pre-test of material to be covered in the upcoming unit. A portion of these same questions were used for summative quizzes after the first condition and then again after the second three week period. Throughout the study, students were able to earn points for correct demonstration of the skills needed to complete an algebra problem. Results of this study were mixed. While the week 3 and week 6 class mean test score increased by 25%, the overall analysis turned up fluctuating

trends as well as insignificant data. The formative and summative mean scores for weeks three and six showed grades of 76% and 80% (sedentary and movement break respectively). Although not all students participated in vigorous physical movement during weeks four through six, Brightup concluded that different types of breaks work best for different people. During the study, eight students earned their lowest score during the sedentary condition and four students earned their lowest score during the movement break. Alternately, six students earned their highest score during the sedentary condition while six earned their best score during the movement break. This study is important to my research because it is similar in goals, methods, and analysis. The findings also help me as an educator realize there may not be a single answer to helping students achieve their best results. Instead, one approach may work best for some students while others respond better to alternative approaches.

Similar to the previous study, Maeda and Randall (2003) sought answers as to whether just five minutes of physical activity could improve second graders math fluency scores. Where some studies have tested longer durations of physical activity on academic achievement, this study focused on very short movement interventions. Nineteen students, 7 boys and 12 girls, were given the opportunity to run and/or walk around a given route after their lunch period at their elementary school in Hawaii. The teacher gave them five minutes to exercise before all students would return to their classroom to take a one minute math fluency assessment in which they would try to answer as many addition problems in the given time period. Afterward, the teacher would score the number of correct answers and find the median score for the class to make one data point. Using a multiple treatment reversal design, the teacher established baseline data one

week, had the students walk for their movement break the second week, run the third week, and return to no movement for the fourth and fifth week to determine if the movement was truly effecting the students' math fluency. The remainder of the study consisted of alternating between weeks when the class would run, followed by a week the class had no movement prior to the test. The teacher found the largest difference in scores with her below-grade-level students when they were given the chance to exercise. The students performing at grade level also increased their math fluency scores when given the opportunity to exercise. The teacher noted positive changes in her students' on-task behaviors, and anxiety levels on the days the class partook in movement before the test.

Schools may be concerned with the idea of spending time on physical movement breaks as opposed to using that time to pursue academic content. Taking a closer look at a cluster randomized controlled trial studying fourth and fifth grade students conducted by Ahamed et al. (2007) would be helpful in examining whether increased time spent on physical activity made standardized test scores decrease. Of the 10 schools from the Vancouver and Richmond school districts, only eight schools remained in the final analysis providing 143 boys and 145 girls of ethnically diverse backgrounds as participants. In this study, schools were assigned to one of three conditions, two of which implemented 15 minutes of in-class physical activity each day and one group served as the control. The difference between the two groups implementing movement during the day was the amount of external facilitation. Throughout the year, teachers were asked to keep track of the amount of physical movement their students were receiving each day. Students were also asked to rank their movement with a PAQ-C questionnaire. The achievement was assessed using the Canadian Achievement Test (CAT3), which assessed

reading, language, and mathematics. All schools took the test on the same days and each school had the same amount of time for instruction before the assessment took place. Independent t-tests were used to compare descriptive variables between the conditions. No differences in achievement scores were found when comparing the two conditions, concluding that 10-15 minutes of time spent on physical activity each day does not hinder academic performance. This study is important to my own research because it suggests that my choices as a teacher to spend time exercising throughout the day will not hinder my students' learning over time.

In another study attempting to discover the effects of physical activity on academic performance, Katz et al. (2010) took their study a step further to include a look at behavior, physical fitness, and health outcomes of 1,214 second- through fourth-grade students. The students were predominately white, and half of the children came from households receiving food stamps. In 2004, 49% of girls and 37% of boys failed the aerobic capacity requirements set forth by the Missouri Physical Fitness Assessment. The design of the study allowed for two of seven schools to be assigned to the control group, leaving three schools to implement the physical movement intervention. The two groups were similar in demographic characteristics but not in weight. Teachers were taught to lead students in varied lengths of activity bursts throughout the day during "down time" with the expectation of increasing physical activity to at least 30 minutes a day within the classroom. Pre- and post-tests were measured using the following tools: Fitnessgram (endurance, strength, and flexibility), report card (classroom behavior), School Physical Activity and Nutrition Questionnaire (SPAN) (physical activity attitude), Missouri Academic Performance test (MAP) (academic performance), student data supplied by the

nurse (BMI and medication record). A range of data analysis tools were used including: t tests, Pearson's x^2 tests, repeated-measures analysis of variance, and Mann-Whitney tests. No significant difference between the two conditioned groups were found with concern to academic achievement on the MAP test, although the control group had a greater amount of students who improved their reading and math scores compared to the intervention group (28.6% vs. 20.8% in math; 21.1% vs. 16.1% in reading). In this study, movement breaks throughout the day were concluded to be beneficial on physical activity levels, fitness, and measure of health, specifically reducing medication for asthma and ADHD, and improving abdominal and upper-body strength. Additionally, behavior was not changed significantly in either of the conditions over time.

The effects of participation in physical education class along with the overall physical activity of students was examined in relationship to the academic achievement of sixth grade students by Poulka Coe, Pivarnik, Womack, Reeves, and Malina (2006). Two hundred fourteen students, randomly assigned to one of two groups (PE first semester or PE second semester) were examined using BMI measurements, a 3DPAR (physical activity recall), report card grades, and Terra Nova standardized test scores. The System for Observing Fitness Instruction Time (SOFIT) was used to determine activity levels of students enrolled in PE classes and found that students were moderately-vigorously active for 19 minutes of their daily, 55-minute class period. Using un-paired t-tests and Kriskall-Wallis analysis, researchers determined that academic achievement in both report card grades and Terra Nova test results were not affected (55.3 S = 27.5 (first semester) vs. 60.6 S = 20.3 (second semester)) by taking PE class at a particular time during the year. However, students who took part in vigorous physical activity as

determined by the 3DPAR survey in both first ($p < 0.0006$) and second semesters ($p < 0.049$) achieved higher academic scores as opposed to their classmates who were not active. Additionally, standardized test scores did not show significant differences in response to the level of physical activity for students. Poulka Coe et al. concluded that academic performance may be improved with vigorous physical activity taking place outside of school.

Yet another study with regards to academic achievement is a case study conducted by PE teachers in Naperville, Illinois, a demographically advantaged high school with a 97% graduation rate (Ratey, 2008). In this study, freshman students taking a reading class to improve reading fluency and comprehension had the option to volunteer to take PE class before school, just before their reading class, as opposed to during the school day. In the PE class, students were subjected to a fitness-based approach to exercise where heart-rate attainment goals were set based on each student. At the end of the semester, students taking the reading class immediately following the PE class had increased their reading and comprehension by 17% as opposed to their peers who elected to take the reading class for their eight hour (an improvement of 10.7%). Because of these results, guidance counselors at Naperville High School started recommending all students take their PE class before their toughest class to prepare their brain for optimal learning.

Academic achievement has been measured in various forms and in various content throughout studies, however, addition fluency is important to kindergarten standards, thus this study focuses on addition fluency with sums to 10.

Math Fact Fluency

Math fluency instruction begins in kindergarten with addition and subtraction fluency standards. It has been suggested that teachers begin teaching math fact fluency by introducing small amounts of math problems at the student's level while teaching strategies to solve the equations (Cholmsky, 2011). Students continue to practice as they begin committing new learning to long-term memory. After students have developed an understanding for the answer of the equation, they are better able to recall the answer quickly, and effortlessly (Frawley, 2012). With continued practice, automaticity occurs, allowing the child to recall the answer from long-term memory instead of solving each problem. Math fact fluency is important for a number of reasons. One major reason being the amount of math facts involved in doing challenging math problems, which increases as students progress throughout school (meaning if students struggle with math facts they will take more time to complete a problem). Also, students who are more fluent with math facts tend to be more successful on standardized tests, in addition to the fact that math fluency success helps students have a better understanding of word problems, concept problems, data interpretation, and reasoning items (Cholmsky, 2011). Even for a student as young as first grade, future membership in high and low achieving groups is predicted by a student's fluency rate (Geary et al., 2009). With the importance of teaching math fact fluency looming, I followed recommendations from the National Math Panel with this study as their final report recommended math fact automaticity development occur with the use of well-designed computer-based software (Cholmsky, 2011). My study has also noted advice from Cholmsky who explained the idea that if performance benchmarks were well aligned with the student's fluency level, increase in

retrieval speed may occur over time. Gojak (2012), the current (2014) president of the National Council of Teachers of Mathematics, has disagreed with the emphasis placed on speed within fluency, and has argued that accuracy and flexibility are also crucial to becoming truly fluent in mathematics. She explains that using flexibility when completing math problems is vital to fluency as students should be able to think about the problem they are trying to answer and determine the best course to achieve the solution. Gojak also explained that flexibility is a part of accuracy commonly not accounted for with fluency. She clarified that one should be able to think about if their answer is reasonable, record their work in an understandable fashion, and consider the operation's meaning (2012). Although I agree with this statement, flexibility was not measured during this study although speed and accuracy were.

Summary

Research on the topic of physical movement for the overall benefit of children seems to show positive correlation (Ahamed et al., 2007; Katz et al., 2010; Ratey, 2008), while academic achievement and physical movement have mixed results or insignificant relationships (Eveland-Sayers et al., 2009; Brightup, 2010; Maeda and Randall, 2003; Poulka Coe et al., 2006). Attention and on-task behavior appear to improve after a physically active break, but grades and standardized test scores do not show growth as a result of being active. While each study varies in its findings of showing an association between physical activity and academic achievement, one constant remained in many studies, and that is the idea that students who spent time on physical movement breaks did not have hindered academic performance or increased off-task behavior as a result of taking breaks for movement during the school day.

CHAPTER 3: METHODS

Finding a way to help students harness their energy and activate their brain has been a combination I have been searching for. Action research is a tool of choice for many educators, as it informs teaching practice within a teacher's own classroom and guides future teaching with the knowledge acquired (Mertler, 2012). The effectiveness of movement breaks on the academic achievement of kindergarten students in the area of addition fact fluency is one of many aspects of teaching where action research is important not only to the teacher, but for the students as well. When teachers are able to learn more about their craft and justify the teaching decisions they make with validated data, students are the ones who will benefit most. Delving into the benefits and/or drawbacks of using brain breaks in my classroom along with the effects on addition fact fluency is how I sought to help future students maximize their learning and satisfy their impulse to be physically active.

Participants

This action research project was conducted using students in my class at a K-4 Title One school located in Michigan's Upper Peninsula. Each student, 10 boys and 11 girls, ranged in age from five- to six-years-old. The children in this study varied in socioeconomic status, ability level, and educational background. Parent consent was obtained for 15 students (seven boys and six girls). All students in the class took part in the activities and data collection, however; only the data for students with consent forms were included in this study.

Context

This research study was conducted in one kindergarten classroom in a school of approximately 370 kindergarten through fourth-grade students. The classroom is situated adjacent the school playground and has many student-made drawings hanging on the walls, baskets of books on the shelves, and small manipulatives to play with. This study was conducted on three days in the spring of the school year, three weeks before school concluded.

For the 2013-2014 school year, students in this study took part in "extra iPad math" during the day. Throughout the year, students took turns practicing short addition quizzes in an effort to improve fluency. Students taking part in the study were accustomed with two iPad programs when practicing addition fluency, Xtramath and MathBoard. Both programs gave students opportunities to increase their automaticity rate while maintaining accuracy.

The students were also accustomed to brain breaks at various times throughout the school day. Transition times, moments when students had been stationary for more than 10 minutes, or parts of the day when students appeared fatigued or distracted were all times brain breaks were employed. Breaks were often video-based dances projected on to a large screen by a projector. Each day, one student chose the specific breaks for the entire day so videos varied based on the child's interest. Breaks lasted approximately 8-10 minutes, after which students were led in calming, breathing techniques to refocus the student for learning.

Data Collection

Data were collected over the course of six days, three of which provided complete sets of information when all students took part in the pre- and post-tests and brain breaks during the day. Three types of data were collected during this study: pre- and post-test scores and times, brain break participation levels, and observational notes about discrepancies that occurred while each student took the math quiz. I recorded two forms of data collection, while one form was recorded by the iPad app.

Participation level. During the study, all students took part in brain break activities at least three times throughout the day: once in the early morning before teaching began, once after lunch, and once again mid-afternoon. The brain breaks were of similar cardio intensity and lasted approximately the same amount of time. Brain breaks consisted of dancing videos for the entirety of this study. Before a brain break took place, one group of students was assessed using the math quiz. Three groups of seven students were formed because of the length of time necessary for testing, as well as the ability to keep observational notes on a limited number of students at one time. While the selection of students in each group did not affect the study in any way, each group was a random assembly of students at various mathematical ability levels. During the brain breaks, I recorded an observational note of the level of participation each student demonstrated. Throughout the study I did not participate in brain breaks with the students although I occasionally had taken part throughout the year. During the study, each student was assigned a numerical rating between zero and three depending on his or her participation in the physical movement break (zero denoting no participation, one denoting 1-3

minutes of participation, two denoting 4-7 minutes of participation, and three denoting 8-10 minutes of participation).

Addition fact scores. Students took a short addition assessment twice daily throughout the study, once before a brain break and then once again immediately following the break. MathBoard, the app used throughout this study, allowed me to specify the number of questions students answered (10), the range of numbers students saw while taking the quiz (0-5), and the way in which time was recorded (elapsed time). Each student had their own account that logged their pre- and post-test times and scores within the app. After the brain break, the same group of students completed a different, randomly generated 10-question addition quiz. Throughout the study, students took the quiz at a different time throughout the day. Each group took the quiz once in the morning, once in the early afternoon, and once mid-afternoon over the course of the 3-day study.

Discrepancy notes. While students took the quiz, I observed how each child was performing and recorded notes such as: Did the child know the answer but click on the incorrect answer? Was the child distracted while taking the quiz? Was the child interrupted? Did the child use their fingers to solve the problem and count incorrectly? Observations were recorded on a check-box spreadsheet allowing me to make notes of discrepancies with the math assessment. It should be noted that no data was altered as a result of a discrepancy.

Data Analysis

While many forms of analysis could have been used to examine the data collected in this study, I chose to use the mean, maximum, and minimum, as I commonly would within my classroom. These measures of central tendency were helpful in understanding

patterns in the data in addition to finding relationships. Pre- and post-test speed, pre- and post-test accuracy, activity level in comparison to speed and accuracy, as well as the test discrepancies were all examined. Scores were evaluated on the individual and whole-class levels. Each individual and class set of data were analyzed by day in addition to an overall analysis examining scores throughout the three-day study as well.

Summary

Recall that the purpose of this study is to understand if my teaching actions were helping my students achieve greater academic success compared to math fact performance without physical activity. Beginning with a problem within the classroom, I used a systematic approach to collect and analyze data that fell within the constraints of the existing classroom practices. The adoption of best practices for student learning and physical movement is an outcome I am attempting to complete through the reflective nature of action research.

CHAPTER 4: RESULTS

Does physical movement prior to a cognitive skills task improve academic achievement with addition facts? In this chapter, results of an action research study conducted over three days in a kindergarten classroom address this question. Students were given a pre-test of 10-addition problems before taking part in an optional physical movement break. After the break, students were tested again using a randomly generated 10-question addition quiz. Time and accuracy were recorded for each assessment and analyzed using measures of central tendency.

Speed/Time

Remembering that fluency is a two-part definition that combines both speed and accuracy with calculations (Key Shifts in Mathematics, 2014), speed, also referred to as time, was an important part of the results in this study. Time was recorded by the iPad app as soon as the student clicked the "begin" button and ended the moment the student clicked the "save answer" button. Times for both pre- and post-tests were recorded in seconds and input into an Excel spreadsheet for analysis.

Analyzing data on an individual level, eight students had their fastest quiz score on a pre-test as opposed to seven students who had their fastest scores recorded on a post-test. Six students had their slowest quiz score on a pre-test as opposed to nine students who had their slowest scores recorded on a post-test. There was not a large difference in the amount of students who scored their fastest time on a pre-test and the number of students scoring their fastest time on a post-test. The same was indicated for slowest times on a pre- or post-test as well (see figure 1).

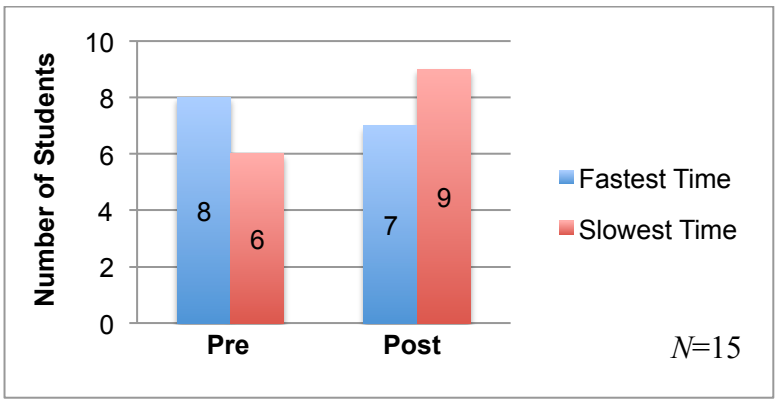

Figure 1. Individual Fastest/Slowest Times by Test.

When analyzing data by day, three students had their fastest quiz score recorded on the first day of the study followed by four on the second day, and eight on the third day (see table 1). Seven students had their slowest quiz score recorded on the first day of the study followed by six on the second day and two on the third day (see figure 2). Largely, students recorded the fastest scores on day three.

Table 1. Personal Fastest/Slowest Times

	Day 1		Day 2		Day 3	
Student	Pre	Post	Pre	Post	Pre	Post
1	47	70	56	39	34	41
2	40	57	42	39	40	45
3	53	58	36	48	40	42
4			75	70	75	87
5	41	34	51	39	50	38
6	40	30	23	32	25	32
7	60	32	46	33	37	26
8			64	86	46	50
9	69	48	68	59	41	43
10	38	48	34	28	30	32
11	37	47	46	55	45	47
12	65	50			75	42
13	56	43	49	60	45	48
14	124	101	116	102	70	113
15	45	56	49	59	41	61

Note. Green represents fastest time and red represents slowest time.

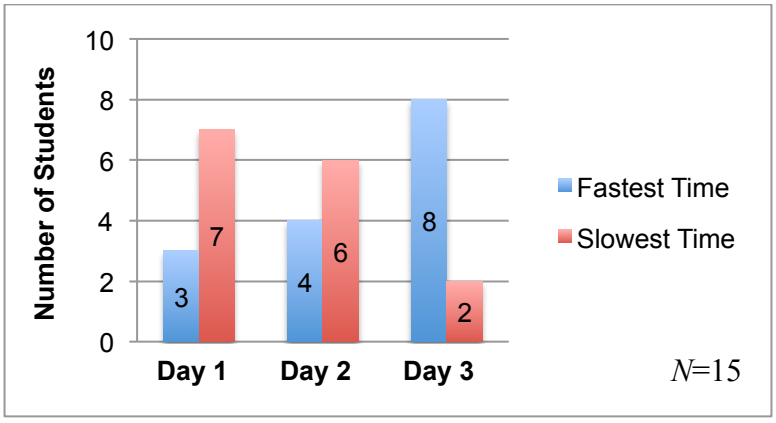

Figure 2. Individual Fastest/Slowest Times by Day.

Overall, there were 24 occurrences of an increased amount of time, while there were 18 occurrences of decreased time from pre- to post-test. A further breakdown of these data finds that on the first day of the study, six students increased their time while seven students decreased their time (see figure 3). On Day 2, six students increased while eight decreased (see figure 4) On Day 3, 12 students increased their time while three decreased their time (see figure 5). Day 3 indicated the highest number of students who achieved their fastest time for completion of the addition quiz on the pre-test (see figure 6). Overall, the class average for speed fell from 53.42 seconds ($\sigma = 20.7$) on Day 1 to 48 seconds ($\sigma = 19$) on Day 3 (an increase in speed of 5.42 seconds). However, Day 2 showed an increase in time of .27 seconds up to 53.7 seconds ($\sigma = 21.6$) when compared to Day 1 (see figure 7).

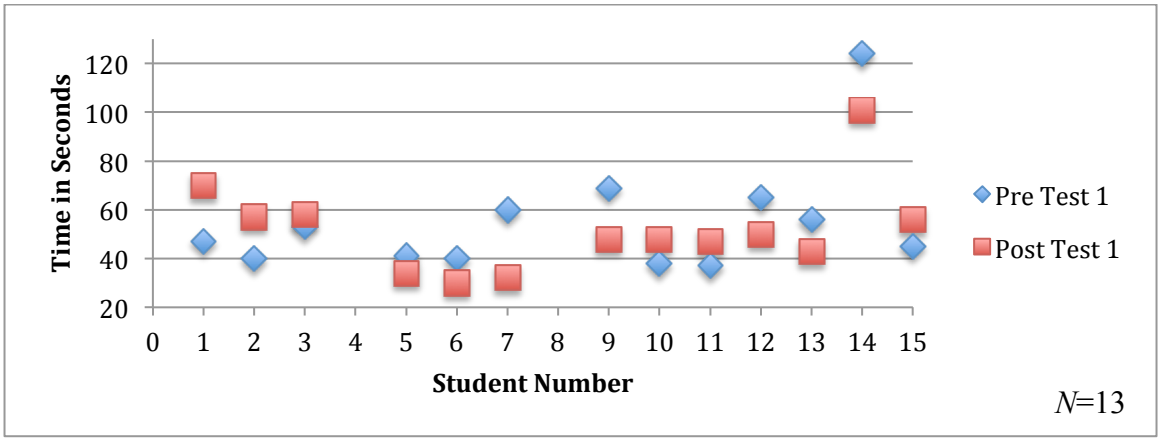

Figure 3. Day 1 Individual Speed.

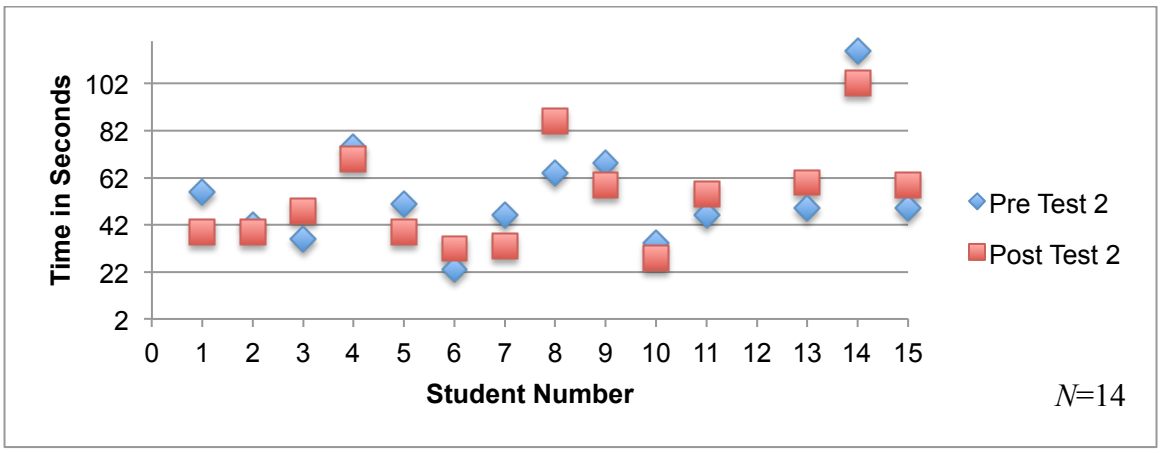

Figure 4. Day 2 Individual Speed.

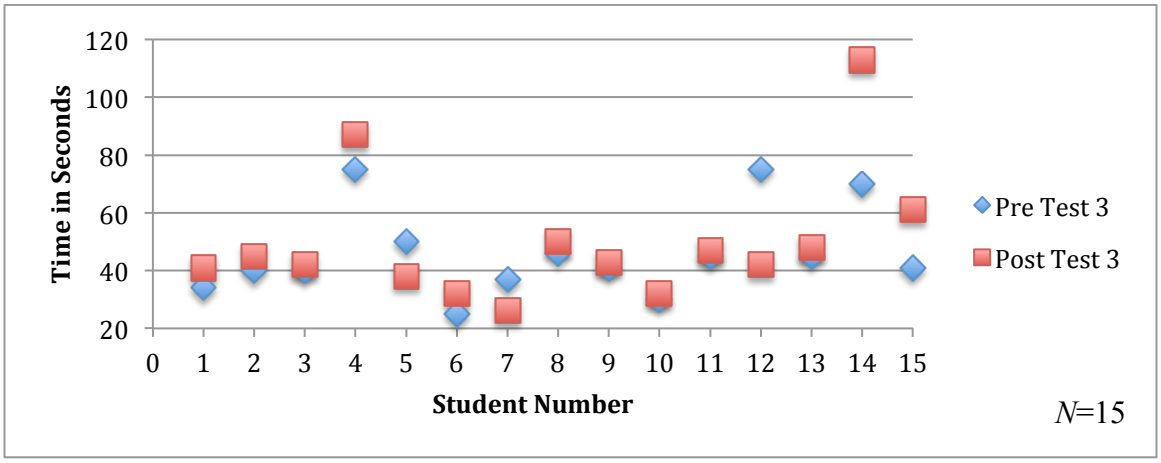

Figure 5. Day 3 Individual Speed.

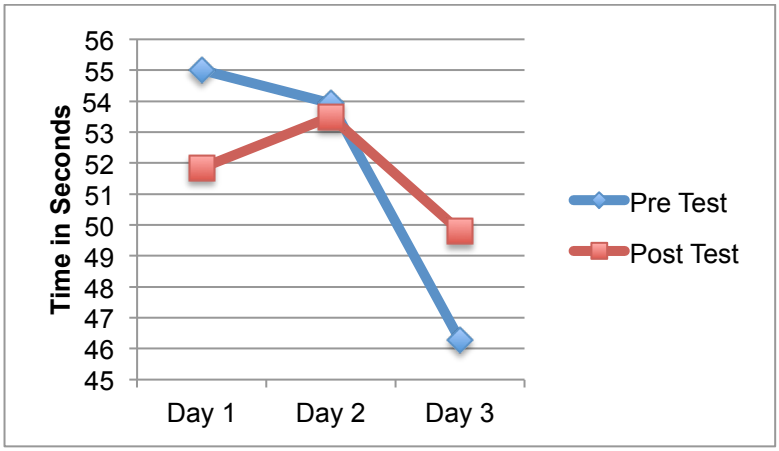

Figure 6. Class Average Speed on Pre/Post-Test.

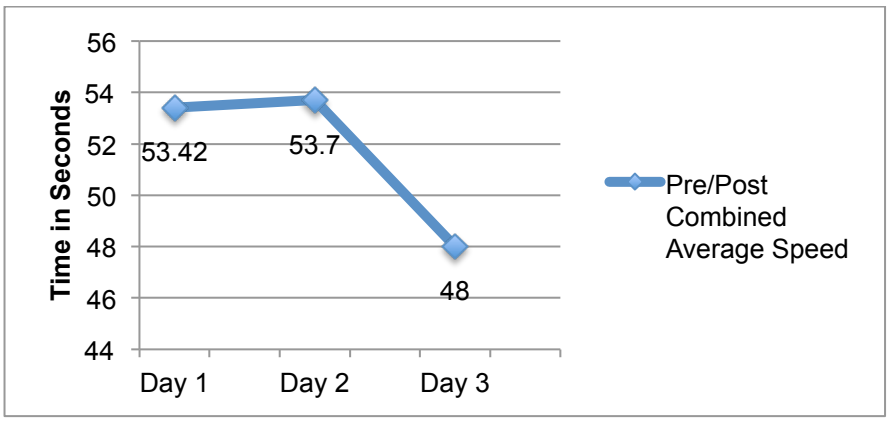

Figure 7. Class Average Speed.

Accuracy

Accuracy was measured by the percentage of addition problems answered correctly. A ceiling effect was limiting in this study, as many students (66.6%) achieved a 100% on pre-tests. Room for improvement was limited, as no student scored below an 80% on an assessment. Overall, 72.6% of students earned a 100% on either a pre- or post-test. Students had a solid understanding of the concept of addition as seen in the ceiling effect; therefore, there was less fluctuation with scores. Although accuracy is a very important aspect of fluency, I assumed that students in this study would retain their accuracy while improving their speed, thus, it may appear as if there was more of an emphasis on speed within this study. Individual accuracy results can be compared in figures 8-10.

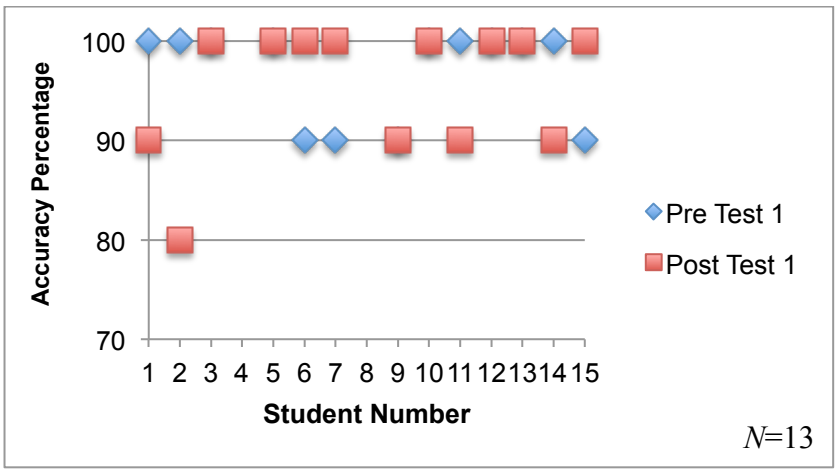

Figure 8. Day 1 Individual Accuracy.

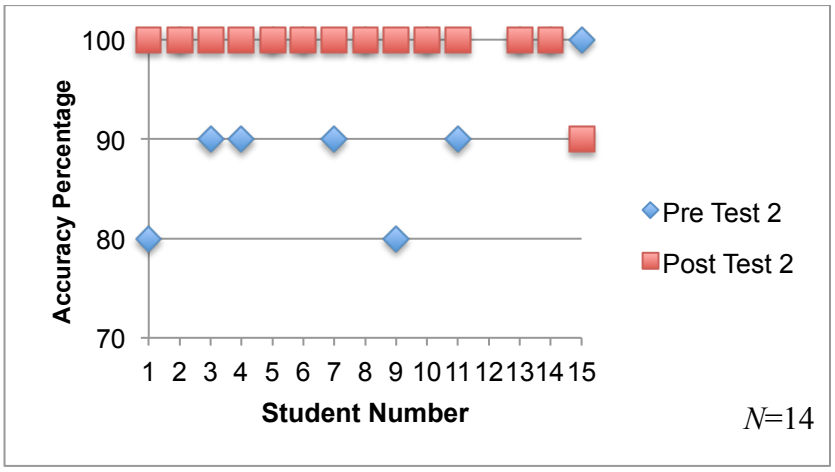

Figure 9. Day 2 Individual Accuracy.

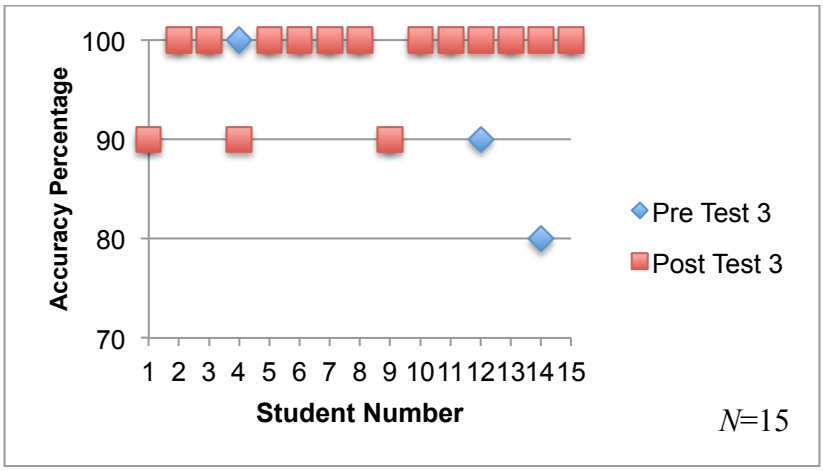

Figure 10. Day 3 Individual Accuracy.

Examining data on an individual basis, 11 students increased their accuracy between a pre- and post-test, six decreased in accuracy, and 25 accuracy scores remained the same from pre- to post-test. The average accuracy increased by 1.1% over the course of the three days of the study (96.2, 96.8, and 97.3). (See figure 11) Students' accuracy from pre- to post-test increased on Day 2 (12.2%) and Day 3 (2.7%), but decreased 1.5% on Day 1. The lowest accuracy was recorded on the pre-test on Day 2 while the Day 2 post-test recorded the highest accuracy at 99.3%. (See figure 12)

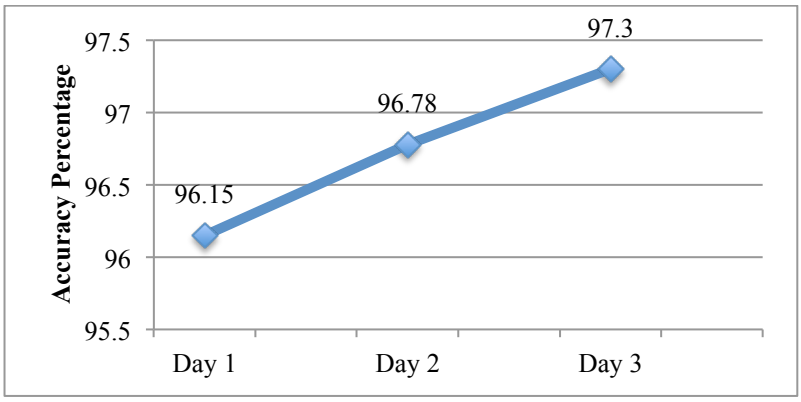

Figure 11. Class Average of Accuracy.

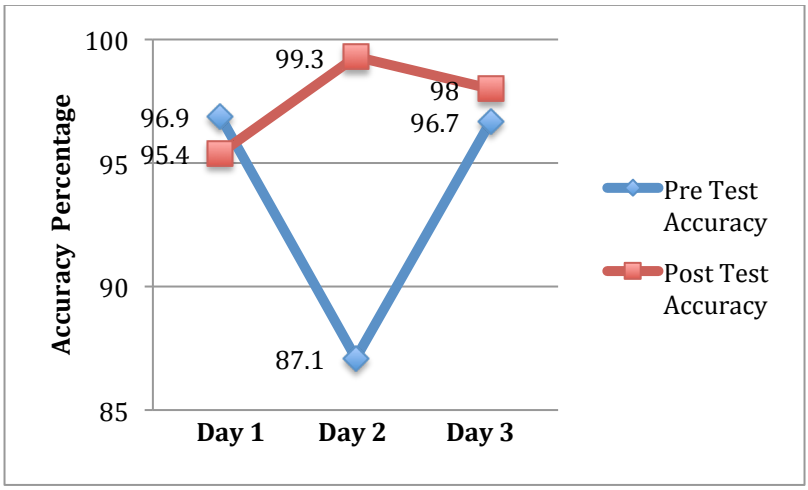

Figure 12. Class Average of Accuracy on Pre- and Post-Tests.

Speed and Accuracy

It is also important to note fluency growth when speed and accuracy are examined together. Of the 42 pre- and post-tests, there were 22 occurrences of students earning 100% on both tests. When analyzing the speed of these students, no trend was seen. However, there was an increase in average speed over the 3-day study of 7.6 seconds. Day 1 resulted in an average speed of 48.6 seconds ($\sigma = 9.7$), followed by 54.6 seconds ($\sigma = 28.4$) and 41 seconds ($\sigma = 8.9$) for Day 2 and Day 3 respectively. The average pre-test time for students achieving 100% on both tests was 46.86 seconds ($\sigma = 18.8$) as opposed to the average post-test time 47.27 seconds ($\sigma = 18.2$), a difference of 1.41 seconds. It should also be noted that the number of students earning 100% on both tests increased over the study as well ($N = 5, 7, 10$). This indicates that students became more consistent with accuracy over the 3-day study.

Activity Level

Participation in the brain breaks was not mandatory during the study; therefore, there were a range of student activity levels. While the time for the breaks remained fairly constant among the testing periods (9-10 minutes), the actual brain break varied in that different videos were chosen. Each day, a different student was given the opportunity to choose the videos he or she wanted to perform for the brain break from a list of pre-determined exercise dance videos. Each of the videos the students performed were of similar intensity. While some students chose to move vigorously for the entirety of the break, others were more lackadaisical in their movements or simply did not take part. Each student was observed during the break and assigned a participation level ranging from zero to three (zero meaning no participation, one meaning 1-3 minutes, two

meaning 4-7 minutes, and three meaning 8-10 minutes of active participation). Participation ratings were strictly based on minutes of participation and not intensity of participation. These activity levels were compared to the fluency rates for the addition assessment. There was only one occurrence of a student who chose not to participate at all during a break, while there were three occurrences of students who moved for 1-3 minutes during the break, 13 occurrences of students who moved for 4-7 minutes, and 25 occurrences of students who moved for 8-10 minutes. More students were active than not during these breaks as seen in figure 13. Students performing brain breaks at a level 3 (8-10 minutes) were almost as likely to achieve a faster time as they were a slower time on the post-test. Also, students performing brain breaks at a level 2 (4-7 minutes) were more likely to increase the amount of time it took them to complete the addition quiz. An examination of participation level on fluency achievement indicated the following: of the occurrences when students participated with a level 3 during a break, 13 students decreased the time it took them to complete the math assessment while 11 increased in time. When examining accuracy for students who participated at a level 3 during brain breaks, seven students increased their accuracy, four decreased, and 14 stayed the same (see figure 14). Accuracy scores were not greatly affected by the student's level of participation in brain breaks. Level 2 participation indicated 10 instances when students became slower taking the math assessment while four became faster. Three occurrences of an increase in accuracy along with one decrease and nine that stayed the same were recorded with this study as well. Level 1 participation resulted in two students recording slower times and one occurrence of a faster time all while there was one occurrence each of students who increased, decreased, and remained the same with accuracy. Overall,

both speed and accuracy did not have a high association with student activity level during brain breaks.

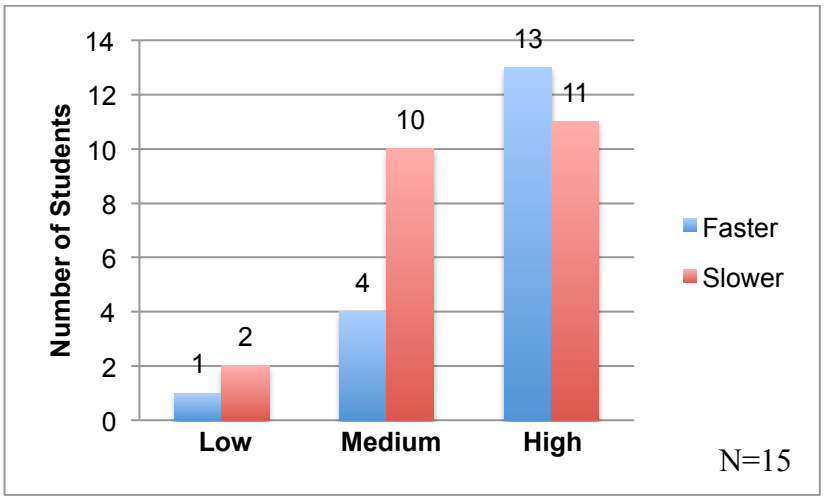

Figure 13. Participation Level and Speed.

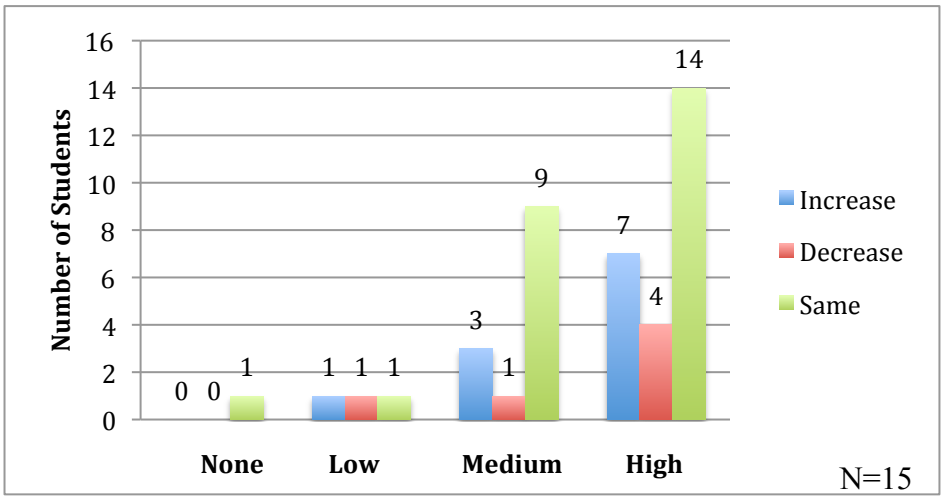

Figure 14. Participation Level and Accuracy.

Discrepancies

Throughout the course of the study, I kept track of discrepancies that occurred while students were taking the addition quiz. Four types of discrepancies were pre-selected to be observed: distraction, interruption, correct answer with incorrect input, and correct application of math concept with incorrect answer. The nature of doing research

in a kindergarten classroom means there are many distractions and interruptions that take place. Some interruptions were quite short and students were able to refocus quickly. Other times, the distraction or interruption made refocusing extremely difficult or impossible for the young learner to accomplish. Throughout this study, some students were more prone to distraction than others (60% of students were affected by one of the pre-selected discrepancies). Also, the activity the class was taking part in while students were pre- or post-testing made a difference on the number of interruptions and distractions a student faced during an assessment. Overall, there were more discrepancies with pre-test results than with post-test results. Of the four categories I was observing, distraction was the category most often observed. Over the course of the study, nine discrepancies were recorded on pre-tests, yet only four were recorded on post-tests. Day 1 had two distractions, one interruption and one occurrence of an incorrect input although the correct answer was known (the student said the correct answer aloud, clicked on the wrong answer and saved it before trying to erase the incorrect answer). There were no discrepancies with the post-tests on Day 1. Day 2 had the most discrepancies (seven total) of the three-day study. During the pre-test there were two occurrences of distraction and incorrect input each, in addition to one interruption. During the post-test, there was one distraction and one interruption each. On Day 3, two students were distracted on the pre-test while only one student was interrupted on a post-test. See Table 2. Overall, discrepancies played an important role in the results of the study whether they occurred during a pre-test or a post-test.

Table 2. Discrepancies Among Individual Student Assessments

	Day 1				Day 2				Day 3			
	Pre		Post		Pre		Post		Pre		Post	
Student	Speed	ACC	Speed	ACC	Speed	ACC	Speed	ACC	Speed	ACC	Speed	ACC
3	53	100	58	100	36	90	48	100	40	100	42	100
	Pre-Test 1: Distraction											
4					75	90	70	100	75	100	87	90
	Pre-Test 2: Incorrect Input											
5	41	100	34	100	51	100	39	100	50	100	38	100
	Pre-Test 2: Distraction and Interruption											
8					64	100	86	100	46	100	50	100
	Post-Test 2: Distraction											
9	69	90	48	90	68	80	59	100	41	90	43	90
	Pre-Test 1: Incorrect Input, Post-Test 2: Distraction											
11	37	100	47	90	46	90	55	100	45	100	47	100
	Pre-Test 2: Incorrect Input											
12	65	100	50	100					75	90	42	100
	Pre-Test 3: Distraction											
13	56	100	43	100	49	100	60	100	45	100	48	100
	Post-Test 2: Interruption, Pre-Test 3: Distraction and Interruption											
14	124	100	101	90	116	100	102	100	70	80	113	100
	Pre-Test 1: Distraction and Interruption, Pre-Test 2: Distraction, Post-Test 3: Distraction											

Note: ACC denotes Accuracy and purple highlighting indicates the assessment affected by a discrepancy. *N*=15

Summary

Measures of central tendency were used to determine the results of this study. Both speed and accuracy were examined as part of addition fact fluency when short movement breaks were employed in the classroom. Addition fluency and its association with movement breaks concluded with varied results by each student and will be examined in the next chapter.

CHAPTER 5: DISCUSSION AND CONCLUSIONS

In this action research study conducted in a kindergarten classroom, I examined the question, "Does physical movement prior to a cognitive skills task improve academic achievement with addition facts?" In this three-day study, students engaged in short movement breaks between pre and post addition fluency quizzes. Student activity levels during the physical movement breaks were recorded in addition to observational notes of discrepancies that occurred while students took the assessment. Both time and accuracy scores were recorded by the iPad app administering the addition assessment. I used measures of central tendency to analyze data for patterns and statistical relationships. Conclusions from data analysis indicated a possible correlation between speed and accuracy with addition facts when an optional physical movement break was employed between a pre- and post-test. The constructivist framework guided my research and will continue to do so in future studies as I form knowledge, test ideas, and examine and apply knowledge to hone my teaching skills (Moursund, 2007).

Speed

No statistically significant relationship existed between the time it took to complete an addition quiz and the participation level during a brain break in this study. Over the course of the study, the time a student took to complete the quiz after a brain break increased in 24 occurrences while there were 18 occurrences of students recording a faster time on a post-test. For the first two days of the study, students were almost as likely to improve their speed as they were to decrease their speed when comparing their post-test time to the pre-test time. Day 3 indicated a difference, in that 12 of the 15

students increased their post-test speed. Also, on the Day 3 pre-test, six students achieved their fastest time taking the addition assessment.

The class average for speed did improve over the course of the study by an average of 5.42 seconds, but through analysis of the pre- and post-test scores, I can conclude that the brain breaks may not have been a factor in this outcome. The added daily practice with math fluency may have contributed to the increase in speed over the study.

Accuracy

Throughout the study, class accuracy improved from an average of 96.2% to 97.3% (an increase of 1.1%). Overall, 11 occurrences of improved accuracy, 6 occurrences of decreased accuracy, and 25 occurrences of accuracy that remained the same existed within the data. The fact that accuracy improved from a pre-test to a post-test on two of three days does not lend itself to prove a relationship between movement breaks and accuracy. Day 1 indicated a decrease in accuracy of 1.5% while Day 2 shows a jump in accuracy achievement with a 12.2% increase recorded. Day 3 indicated an improvement of 1.3% with regards to accuracy. The ceiling effect is a limitation of the study in that students were not able to attain accuracy higher than 100% on an assessment (66.6% of students attained this score on a pre-test). It is difficult to know the relationship between accuracy and participation level in a brain break as the majority of students were active during a break leaving a small group to compare inactivity and achievement. However, if significance were judged on achieving the same or improved accuracy, results indicate 90% of assessments administered during the study resulted in an increase or constant in accuracy.

Activity Level

Participation in physical movement during brain breaks varied among students. Generally, most students were active during a break, but the types of breaks students experienced were not considered to be vigorous. Although students did move about demonstrating a range of gross motor movements, notes of direct observation of students during a break would have shown that they were not breathing heavily, did not display flushed cheeks, and were not perspiring. The brain breaks students experienced in the study focused heavily on following gross-motor dance moves and did not consist of an abundance of cardio movements. The researcher in this study also did not make students participate in movement breaks. Participation was encouraged, but not all students took the opportunity to exercise during the break. In an examination of the scores recorded from fully participating students, data from this study do not support brain breaks having an affect academic achievement in addition fluency for kindergarten students.

Discrepancies

As stated previously, limitations of this study are tied to the nature of testing in a kindergarten classroom. Kindergarten students often fluctuate in their motivation levels, engagement in activities, and participation levels. This was apparent on both pre- and post-tests when some students focused heavily on completing the assessment and attaining a high score, while others talked or sang a song about the test. Still, others played with the additional features the assessment app offered or watched their peers take part in a different activity. Although attention was an area I wanted to improve through the use of brain breaks in my classroom, I did not have the opportunity to assess attention level within this study. Past research has found a link between physical movement and

attention (Palmer, Miller, & Robinson, 2013; Mahar et al., 2006); however, the focus of this study was purely a search for possible relationships between academic achievement and physical movement. Although attention was not a focus during my current study, Information Processing theory is an aspect of learning that affects my students daily. My students' ability to attend to and process information is crucial to their success in school. Because various elements influence selective attention I find it highly important to ensure my lessons create meaning for students, lessons and information are presented in a way that does not exceed students' ability level, and ensuring lessons do not exceed the attention span of what students are capable of controlling (Heck & Wild, 2011). With attention span being an important aspect of learning, I did note similar behaviors during the discrepancy notes portion of data collection and found that distractions and interruptions played a major role in the results. Students in kindergarten are highly reliant on their teacher, and despite directions not to approach the table when a student was taking a math quiz, there were many occasions when the student taking the quiz was interrupted and then distracted by a classmate. The fact that more discrepancies occurred on the pre-tests may indicate a better focus for students taking the post-test, but this cannot be verified or validated using any of the data I collected. Sixty-percent of students were affected by one of the pre-selected discrepancies. It should be noted that of the nine discrepancies recorded on pre-tests and four recorded on post-tests, six distractions occurred during the study, along with three interruptions and three occurrences of students knowing the correct answer and inputting it incorrectly.

Further Investigation

Further investigation is warranted with this topic, as the results seem to be inconclusive. Future research might benefit from studying physical movement and academic achievement at a higher-grade level in which students have better developed intrinsic motivation. A larger set of data spread over a longer time would be beneficial for analysis as well. In the future, I would like to analyze more data to determine if there is a positive association between academic achievement and gender with regards to the brain breaks. Types of brain breaks (cardio/stretching/mixed cardio and stretching) and time spent on movement breaks are also other avenues I would like to investigate. Further research could also explore physical movement breaks and the relationship to other areas of the curriculum.

Future Implications

As an educator, I can continue to justify brain breaks in my classroom for the overall health and enjoyment of my students despite the findings of this study. Although there was no strong evidence between participation in brain breaks and academic achievement in addition fluency, I will continue to use movement in my classroom as a way to keep students alert and engaged in learning (Maeda & Randall, 2003; Mahar et al., 2006). Prior experience with brain breaks had led me to believe that brain breaks were helping my students make large gains on an academic level, but this study has proved my hypothesis to be incorrect in some aspects while inconclusive for others. I feel confident in the findings of this study though, that students are not hindered by movement breaks, similar to the findings of studies conducted by Ahamed et al. (2007) and Katz et al. (2010). I cannot justify the use of brain breaks solely for academic achievement purposes

under the current practice I have employed; however, I will continue to monitor student achievement and behaviors following these movement breaks and change the format accordingly so I can best combine much needed physical movement with best practices in teaching and learning.

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