The Academic Effects of Kinesthetic Movement

With Multiplication Fact Acquisition Instruction for Students in Third Grade

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ABSTRACT

The study evaluated the effects of kinesthetic movement used throughout instruction to determine whether or not there were academic benefits from the use of movement with third graders in a co-taught classroom. The students were learning multiplication (facts 0-10) over a three week period of time. In the class, students were matched based on ability and separated into standard (n = 9) and kinesthetic instruction (n = 9) groups. Both groups consisted of male and female students with and without IEPs. The traditional instruction group learned the multiplication facts while staying stationary and seated at their desks. The kinesthetic movement group learned the multiplication facts while jumping or hopping as they orally recited the facts. Next, students completed a post-assessment that was identical to the pre-assessment. The null hypothesis was used in the study. There was no significant difference in the post-test multiplication scores of the kinesthetic instruction group (Mean = 66.56, SD = 20.86) and the standard instruction group: (Mean = 60.33, SD = 23.89) [$t(8) = .92$, $p = .39$]. The null hypothesis was retained. Implications for future research regarding kinesthetic movement and instruction are discussed.

CHAPTER I

INTRODUCTION

Overview

The purpose of this study was to examine the effects of kinesthetic movement on students' academic achievement in the area of mathematics and their ability to memorize and recall multiplication facts 0-10. Fact fluency is a skill numerous children struggle to master. Multiplication fact fluency becomes increasingly difficult, especially when assessing students on certain fact-families such as x6, x7, x8 & x9's facts.

Previously, educators used strategies such as flash-cards number drills to practice memorization of these facts. These types of activities favor students who possess visual, auditory and verbal learning styles. However, according to international research findings, "most learners have between zero to six perceptual modalities or strengths; auditory, visual/ picture, visual/print, tactual, kinesthetic and or verbal kinesthetic" (Dunn, Honigsfeld, Doolan, Bostrom, Russo, Schiering, Suh & Tenedero, 2009, p. 136).

If most of the emphasis is on auditory, verbal, and visual instruction, this leaves a large number of students whose learning styles are not being accounted for; including kinesthetic learners. With part of our student population being kinesthetic learners, it is only appropriate that we research the effects and potential benefits of incorporating kinesthetic movement into academic lessons. Kinesthetic learners are those who learn best by 'doing' and using a whole body approach to learning involving movement and tactile activities. To teach students who are primarily kinesthetic learners requires intentional planning on the teacher's behalf, positive behavior management to insure students are using movement during the academic setting in an appropriate manner, and dedication on both the teacher and students' behalf.

Statement of Problem

Does kinesthetic movement incorporated during multiplication fact instruction (facts 0-10) improve a student's ability to memorize and recall the product?

Hypothesis

The null hypothesis is that there will be no significant difference in the 0-10 multiplication fact test scores between students who receive standard multiplication instruction and those students who receive kinesthetic movement multiplication instruction.

Operational Definitions

***Interactive Multimodal Learning*:** "Learning environments in which what happens depends on the actions of the learner. Lessons are driven by the responsiveness to the learner's reaction during learning" (Moreno & Mayer, 2007, p. 310).

***Physical Activity/ Kinesthetic Movement*:** "Movement of the body, in general, following no specific curriculum" (Hall, 2007, p. 2).

***Kinesthetic Teaching*:** "The use of creative movement in the classroom to teach across the curriculum" (Griss, 2013, p. 1).

Kinesthetic Learners: "Individuals that learn best with an active "hands-on" approach. These learners favor interaction with the physical world. Most of the time, kinesthetic learners have a difficult time staying on target and can become unfocused effortlessly" (Gilakjani, 2012, p.2).

***Standard Multiplication Instruction*:** In this study, Standard Multiplication Instruction involves students staying seated at their desks while verbally reciting multiplication facts and writing or solving them with paper and pencil.

***Kinesthetic Movement Multiplication Instruction*:** In this study, Kinesthetic Movement Multiplication Instruction involves students standing in rows about 4 feet apart from one another in the

hallway of the school while practicing their multiplication facts. Students will proceed to verbally recite multiplication facts while jumping and announcing the product (answer to a multiplication problem) in unison. After practicing verbally stating the multiplication problem with its correct product while jumping, students will write the number model on a dry-erase board with a dry erase marker. They will also be given an opportunity to write or solve the multiplication problem using paper and pencil.

Zero - Ten Multiplication Fact Assessment: A pencil and paper test consisting of 100 multiplication problems using factors between 0-10 with as many problems as possible being answered correctly within a ten minute time limit.

CHAPTER II

REVIEW OF THE LITERATURE

Overview

This literature review seeks to explore the impact of kinesthetic movement incorporated into lessons and instruction on student academic achievement and performance. Section one provides an overview of definitions of kinesthetic movement in academic lessons. Section two discusses strategies for incorporating kinesthetic movement into academic lessons. Section three explores the benefits of kinesthetic movement in the classroom and lessons and section four explains the drawbacks of incorporating kinesthetic movement into the classroom and lessons.

Defining Kinesthetic Movement in Academic Lessons

An ancient Chinese proverb once said "Tell me, I forget. Show me, I remember. Involve me, I understand" (Etmad, 1994, p.4). Involving students in their learning process and education is proving beneficial and critical to academic and social development. According to international research findings, "most learners have between zero to six perceptual modalities or strengths; auditory, visual/ picture, visual/print, tactual, kinesthetic and or verbal kinesthetic" (Dunn et al., 2009, p. 136). Therefore, it is only appropriate that we research the effects and potential benefits of incorporating kinesthetic movement into academic lessons. Many cognitive theorists define learning as "an inner process that changes the nervous system by the stimulus and unit of the external and internal stimulus. Each individual has different cognitive, affective and physical features so each individual's learning style is different because the environmental, cultural and genetic features that affect him/ her are different" (Durmuscelebi, 2013, p. 211). With this knowledge, educators should be cognizant of the approaches they use to teaching students new

content. All children are unique in their schema, background knowledge, academic abilities, strengths and needs.

Physical activity is referred to as "movement of the body, in general, following no specific curriculum." (Hall, 2007, p. 2) This paper will outline the importance of kinesthetic movement for students as learners as well as ways educators can integrate kinesthetic movement into academic lessons. "Throughout history, educational philosophers from Aristotle through Dewey, Whitehead, and Montessori have all encouraged the use of movement to promote learning" (Skoning, 2008, p. 3). Kinesthetic teaching is defined as "the use of creative movement in the classroom to teach across the curriculum" (Griss, 2013, p. 1). "By creating a rich, contextual environment, kinesthetic learning constructs memories connected to time, place and emotions, which we call episodic encoding. Students activate and ingrate physical, emotional and cognitive responses to what they are learning, making learning more meaningful. Another author defined kinesthetic learners as "individuals that learn best with an active "hands-on" approach. These learners favor interaction with the physical world. Most of the time kinesthetic learners have a difficult time staying on target and can become unfocused effortlessly" (Gilakjani, 2012, p.2).

Since the passage of *No Child Left Behind*, "much has been written about the 'drill and kill' response to education" (Honigsfeld & Dunn, 2009, p. 220). This strategy proposes that prior to assessing a student on their knowledge of a specific skill or subject, it is beneficial to drill the content into their lessons and instruction to the point where it becomes monotonous and tedious. Then, educators should assess students for mastery. However, there is a shift in education that suggests the idea that the 'drill and kill' approach could prove potentially harmful due

to its overuse of repetition that may lead to the "destruction of student joy in learning and motivation" (Honigsfeld & Dunn, 2009, p. 220). It is becoming increasingly popular for educators to infuse kinesthetic movement and activities into academic lessons for the purpose of teachers reaching multimodal methods of learning with their students.

In the past, typical classrooms had students sitting at their desks listening to the teacher present new information that they were required to remember. Some dialogue may occur in order to answer targeted questions with elicited responses. Through kinesthetic teaching, students get opportunities to "work with their classmates and figure out how to show the American Revolution through whole body shapes; climbing into the skin of a literary character or improving a creative-movement response to a plot element; enacting a journey through the water cycle; or arranging themselves as solid, liquid, and gas molecules to demonstrate density" (Griss, 2013, p. 1). As a consequence of this transition and way of approaching teaching, increased research is being done to document the benefits, academic achievements, drawbacks and challenges to kinesthetic learning and kinesthetic teaching.

When looking at the effects and benefits of kinesthetic movement in the classroom, it is important to note the differences between multimodal learning and interactive multimodal learning. Multimodal learning is defined as "learning environments that use two different modes to represent the content knowledge; verbal and nonverbal. Students are presented with a verbal representation of the content, and then later a corresponding visual representation of the same content" (Moreno & Mayer, 2007, pg. 310). On the other hand, interactive multimodal learning is defined as "learning environments in which what happens depends on the actions of the learner. Lessons are driven by the responsiveness to the learner's reaction during learning. The presented words and pictures used throughout instruction depend on the learner's actions during

the lesson. With this theory comes five types of interactivity: dialoguing, controlling, manipulating, searching and navigating. At the manipulating, searching and navigating stage, learners are able to move, control and play an active role in the physical aspect of their learning process" (Moreno & Mayer, 2007, pg. 310). In addition, teachers often "remain focused on verbal/ linguistic and logical/ mathematical intelligences and cater to auditory and visual learners, using inadequate measures to teach many children with disabilities… Students with learning disabilities, in particular, often receive their labels because of difficulty with linguistic or mathematical tasks… Student with special needs may have stronger skills in musical, visual, or kinesthetic intelligences" (Skoning, 2008, p. 3).

Strategies for Incorporating Kinesthetic Movement into Instruction

In most highly effective and beneficial academic lessons, the use of tactile and kinesthetic movement should be pre-planned and strategically incorporated into content lessons. In order for students to reap the full benefits of kinesthetic movement in their academic instruction, teachers should analyze the opportune moments for hands-on learning to occur as well as how to go about utilizing a multi-sensory approach to learning using movement and gross motor activities. It was mentioned in one study that "it is not a question of addressing all the individual multiple intelligences profiles of each learner in every language class but of offering a balanced approach where different 'windows on the same concept' are incorporated" (Gilakjani, 2012, p.2). For example, a study was conducted incorporating an "instructional program called 'Design-a-Plant' in which two groups of students were presented a set of different environmental conditions and asked to infer characteristics of plants that would flourish in the given conditions by designing roots, stems and leaves. One group of students were presented with an interactive and animated

pedagogical agent while the second group received the same instructional words as the first condition, but they did not receive the interactive agent by designing the plant before listening to the explanations. According to the experimental study, the group that received the interactive and animated pedagogical agent scored higher on problem-solving skills and strategies and perceived the learning process as more interesting than those students who did not receive the interactive agent (Moreno & Mayer, 2007). One can conclude that more meaningful learning occurs when the learner makes a conscious effort in cognitive processes such as choosing, organizing and incorporating new information with existing information and schema. Again, this requires predetermined planning and intentional use of tactile and interactive learning strategies by the teacher.

One way to incorporate kinesthetic movement and tactile experiences into daily academic lessons is by using peer interactions as a preferred learning style. Peers can be heterogeneously or homogeneously grouped in order to facilitate meaningful discussions, interactions, debates or even Kagan style teaching structures (Ediger, 2013). Some Kagan style teaching practices that involve kinesthetic movement include "Hand-Up, Pair-Up"; an activity that promotes meaningful discussions and interactions between heterogeneous pairs of students. Students are required to stand up and wander the classroom until they reach a peer who does not sit near them. At this point, students are required to "high-five" their peer, look them in the eyes and say "Hello, my name is …" Each student is then given one minute to verbally respond to a question or prompt. At the conclusion of both peer responses, they are required to say, "Thank you for sharing." prior to walking away and sitting down at their seat. This activity promotes manners, social skills and intentional conversation in addition to walking around the classroom. Thus, the body is given the chance to increase the heart rate and blood flow to the brain. In addition, "small groups might be established with members interacting to clarify ideas. Mannerly movement can be used

to form each group needs emphasis" (Ediger, 2013, p. 16). Aside from the social interaction benefits, these small group interactions can teach students self-control and how to move about the classroom in a purposeful manner that is respectful and conscientious of their peers working around them.

Other kinesthetic lesson structures include gallery walks and board-game templates or tic-tac-toe outlines. Gallery walks allow students to walk around the classroom or defined area with the purpose of observing and examining work completed by others. With gallery walks, note-taking can be completed allowing for rich discussion following each station visited within the gallery walk. Board-game templates or Tic-Tac-Toe outlines allow for a fun, motivating and educationally beneficial way of reinforcing concepts or important skills. These activities are often most beneficial when the use of colors, pictures, diagrams and other eye-catching images are incorporated (Honigsfeld & Dunn, 2009). These images allow for students to connect a skill, term or concept to a color, image or picture in addition to allowing tactile learning to occur.

One study conducted looked at the effects of student achievement when a special educator incorporated dance and creative movement into literature instruction with a fourth and fifth grade co-taught class of 27 students; 9 of which had disabilities. The purpose of the lesson was to analyze character development throughout a text and increase comprehension as a result. According to the study, the benefits were immediate and glaringly obvious. The students with Attention Deficit Disorder (ADD) became class leaders and head choreographers and the students with emotional disabilities became risk-takers and participated in movement activities as members in small groups which led to increased socialization opportunities with their peers. ADD is a disorder, typically found in children, which results in inattentiveness, difficulty sustaining attention to task for prolonged periods of time, and excessive activity. Children deemed gifted and

talented were able to discuss how movement aided in their understanding of character development and they were able to make meaningful predictions about how they believe characters will act and behave in future parts of the novel. This special educator was able to utilize dance in a meaningful and intentional manner which proved beneficial to her students. The benefits of kinesthetic movement throughout this lesson and study seemed to have positive and immediate effects. She also noted that undesirable student behaviors decreased as a result of the dance moves being added to the lesson. Children were able to exude their energy and urges into something physical and intentional that benefited their academic achievement. In return, they were able to avoid off-task and noncompliant behaviors (Skoning, 2008).

Benefits of Kinesthetic Movement in the Classroom

Shoval and Shulruf (2011) completed a research study looking into the benefits of kinesthetic movement. Findings suggested "students who are physically active while seeking knowledge and/ or solutions are more successful than their peers who are more socially active, even if initially they were lower achievers. Passive students demonstrated the lowest academic achievements" (p. 58). This study supports the notion that educators should encourage movement and a hands-on approach to learning and experimenting within the classroom setting.

Another benefit of incorporating kinesthetic movement into academic instruction is gender-based. Studies show "males and females tend to have different learning styles. Males tend to be more kinesthetic and tactile, and, if they have a third modality strength, it is often visual. Males also need more mobility in a more informal environment than females. They are more nonconforming and peer motivated than their female classmates, who tend to be relatively conforming and either self-, parent-, or teacher-motivated" (Jennings, 2012, p. 198). Gender differ-

ences can display a major benefit to kinesthetic movement being incorporated into everyday academic lessons. Engagement and participation will often increase in males when tactile and kinesthetic movement are incorporated in instruction. Again, there are numerous types of learners and one study suggests there are "four types of learning styles; diverters, assimilators, convergers, and accommodators. Of the four types of learning styles, the accommodator often times wants to engage in a hands-on learning experience, rather than read and research, write answers, or build theories" (Jennings, 2012, pg. 204).

An additional benefit to incorporating kinesthetic movement into the classroom is the fact that "many at-risk adolescents in middle school and high school tend to be tactile learners, kinesthetic learners or both. Because adolescents have not biologically developed strong auditory skills, at-risk adolescent students are particularly unlikely to remember about 70% of what they hear or read. Thus, they do not read well and struggle to maintain concentration while learning; especially if they are not interested in the required reading. Even when teachers incorporate PowerPoint presentations that are more visually stimulating, it is not enough for students at this developmental age. Some of the best strategies for teaching students at this particular age include engaging them with hands-on and bodily manipulative instructional resources that allow them to learn on their feet. These teaching practices will allow them to make lasting connections between connections and their applications (Honigsfeld & Dunn, 2009).

Finally, "according to the most recent enrollment figures, 98% of children are enrolled in public schools, representing more than 47 million students in the United States. With these numbers in mind, public schools are an ideal site for interventions designed for the primary prevention of obesity in children. Ironically, schools are also a barrier to physical activity. Children are required to sit quietly for the majority of the day to receive academic instruction. A typical

school day can be described as sedentary. (Gibson, Smith, DuBose, Greene, Bailey, Williams, Ryan, Schmelzle, Washburn, Sullivan, Mayo & Donnelly, 2008). With childhood obesity on the rise and becoming a major concern for healthcare and the future of our students, one must analyze the benefits of kinesthetic movement within the classroom. Maintaining and promoting good health is one significant benefit. "Integrating physical education and "core" subject matter, allows for multiple learning styles to be targeted, thus increasing the opportunities students have to use the various learning styles that best fit them to take in new information and allow for learning to occur (Hall, 2007).

Drawbacks to Kinesthetic Movement in Academic Lessons

When analyzing the benefits of kinesthetic learning structures and practices within the academic setting, we must consider the drawbacks and potentially negative aspects. When teaching students with disabilities, it is often noted that they struggle to learn new concepts and skills, even with supports in place. In fact, "students officially classified with ADD/ADHD (Attention Deficit-Disorder/ Attention Deficit-Hyperactivity Disorder) have no well-developed perceptual strengths prior to their high school years" (Dunn et al., 2009, p. 136). In addition to cognitive disabilities, one must consider physical disabilities or impairments. When having students physically move about the classroom and utilize their bodies as a means of learning new content, we must keep under consideration that some students are physically unable to stand, jump, walk or perform other kinesthetic movements. Therefore, intentional planning of alternative movements should be considered. This way, educators and students are mindful of individual's capabilities.

It is known that studies support males utilizing kinesthetic movement within class lessons. However, studies also show "females, more than males, tend to be auditory, conforming,

auditory-oriented, and better able to sit passively in conventional classroom desks and chairs. Females also tend to need significantly more quiet while learning (Jennings, 2012). Again, this is where it is necessary for teachers and educators in general to be mindful of their student's genders and preferences.

The greatest drawback of kinesthetic movement in instruction has been identified in numerous studies and findings. The use of kinesthetic movement and tactile lessons requires significant planning and intentionality. Therefore, teachers must provide the time and instructional planning periods to determine when movement would be most beneficial and time-efficient. Many teachers indicate that they need more time to incorporate physical activity into their lesson plans, chiefly because of the requirements set forth by the *No Child Left Behind Act*" (Gibson, et al., 2008, p. 136). Unfortunately, teachers feel a demand to incorporate this physical activity, rather than a desire to do it. This can take away from the excitement and vigor of kinesthetic movements and activities.

Another potential drawback to kinesthetic and tactile movement within lessons is the idea that teachers should have a strong behavior management system in place prior to incorporating some of the physically engaging practices. This is because "much noise and disorder may transpire if smooth arrangement is not evident. It could be more difficult for learners to be attentive and concentrate on the tasks at hand" if clear expectations and guidelines are not set for what kinesthetic movement and tactile learning should looks like, sound like and feel like (Ediger, 2013, p. 16). Having students up and out of their seats participating in whole-body kinesthetic movements as a means of learning a new skill requires teachers to strategically model what instructional movement should sound like and look like. Otherwise, students may view this as a time to get rambunctious or talkative and lose focus of the intent of the lesson. Teachers will

have to set clear expectations for noise volume control and physical responsibility expectations with the students.

CHAPTER III

METHODS

Hypothesis

The null hypothesis is that there will be no significant difference in the 0-10 multiplication fact test scores between students who receive standard multiplication instruction and those students who receive kinesthetic movement multiplication instruction.

Design

This study used a pre-test/post-test design in which the pre-test data was used to form ability matched groups. The impact of the intervention was assessed through comparing post-test scores. The independent variable in this study was the type of multiplication instruction—standard or kinesthetic movement. The dependent variable was the performance on a 0 x 10 multiplication test.

Participants

Participants in this student attend a local public elementary school in a suburban area on the East Coast. About 70% of students live on a military base due to their parents/ guardians being in the military. The remaining 30% of students live in surrounding apartments, condos, trailer parks or motels. Total enrollment at the school is about 530 students. Additionally, 49% of students attending the school receive Free and Reduced Meals. Students in this study were third graders ranging from 8-9 years of age, with the exception of one 10 year old student. All students in this class are students who have been identified as those who typically perform below grade level expectancy on math assessments and math subtests or standardized assessments. Twelve male students and 6 female students participated in this study, making a total of 18 students. Group #1; Standard Multiplication Instruction Group, included 9 students. Eight males

were in Group #1; 4 of whom have academic Individualized Education Plans (IEP). One female was in Group #1 and she is not in special education. In Group #1 there were 4 Caucasian students, 2 African-American students, and 3 Multi-Racial students. Group #2; Kinesthetic Movement Multiplication Instruction Group, included 9 students. Four males were in Group #2; 1 of which has an academic IEP. Five females were in Group #2, 3 of which have academic IEP's. In Group #2 there were 4 Caucasian students, 4 African-American students, and 1 Hispanic student.

Instrument

The assessment instrument used within this study consisted of a pre and post-assessment that were identical in style and questions or content. Students were provided with 10 minutes to complete 100 multiplication problems consisting of factors between 0-10. The pre and post-assessments were created by a researcher, and there is no validity or reliability data**.**

Procedure

Prior to beginning any aspects of this research study, permission had to be granted by school administration to remove students from their general education setting and into the hallway while practicing multiplication facts while jumping. Since students would not be in the general education classroom receiving the same instruction as their peers during math fact practice, permission had to be granted first. After permission was granted, all students were administered a multiplication pre-assessment consisting of 100 facts with factors ranging from 0-10 and products up to 100. Students were provided with 10 minutes to complete the assessments. Next, pre-assessments were scored and two ability matched pairs were created based on these scores. For example, if student "A" scored 16/100, student "B" scored 18/100, student "C" scored 65/100 and

student “D” scored 63/100, then student “A” and “C” would be place in the Standard Multiplication Instruction Group, while students “B” and “D” would be placed in the Kinesthetic Movement Multiplication Group. This would place “ability matched pairs” in both groups following the pre-assessment. Then, students within the pair were assigned to conditions which allowed the post-assessment scores from both groups to be compared to one another in order to determine which if the kinesthetic movement, or hopping, made a positive difference in student’s abilities to recall products to multiplication problems. There was no significant difference in the pre-test multiplication scores of the kinesthetic instruction group (Mean = 22.11, SD = 22.79) and the standard instruction group (Mean = 19.44, SD = 17.16) [t (8) = .61, p = .56]. Consequently, it was not necessary to control for pre-existing group differences when comparing post-test scores. The Standard Multiplication Instruction Group consisted of students who would remain in their seats while practicing the multiplication facts. This was taught by the third grade general education teacher. The Standard Multiplication Instruction Group received instruction and practiced their multiplication facts while staying seated at their desks. The teacher would verbally and visually display multiplication problems on the board and instruct students to use a dry-erase marker and dry-erase board in order to solve the problems. Students are to stay seated while completing their work. The Kinesthetic Movement Multiplication Group was taken into the hallway while receiving multiplication instruction. This group received instruction from the special education teacher (this researcher). Each day during the multiplication instruction time, students went into the hallway with dry-erase board and dry-erase markers with the teacher, and the teacher would display a multiplication problem on a larger dry-erase easel. Then students stood in two rows with 5 students in one row and 4 students in the next row. Upon being shown

the multiplication problem on the large dry-erase easel, students would verbally repeat the problem. Then, they were instructed to repeat "____ x ____ = … (hop)… _____. " This way, students would hop or jump prior to verbally stating the product to the multiplication problem. Also, when students were practicing skip-counting, they hopped or jumped while stating each number. For example, if skip-counting by 3's while solving the equation 3 x 4 = 12, students would hop each time they stated the following number and recite; "Three times four equals… 3 (hop), 6 (hop), 9 (hop), 12 (hop), 12!". The purpose of the hopping was to provide opportunities for movement as well as opportunities for students to make the physical connection of hopping to the verbally stated number as they skip count while solving the multiplication problem.

The students were taught multiplication facts over a 3 week period. The order in which the math facts were taught was based upon knowledge of what students were introduced to in second grade and Common Core Standards and expectations for their graders. Then, the facts were grouped into "alike" facts as well as facts that have a strong emphasis on commonly used skip-counting such as x2, x5 and x10's facts. Day #1 consisted of the 0-10 Multiplication Math Facts Pre-Assessment as well as multiplication facts with x0 and x1. Students were administered the Pre-Assessment during the beginning part of their mathematics instructional period on Day #1 and scores were analyzed which allowed groups to be made during teacher planning period. This allowed for Day #1 of the multiplication instruction to occur at the end of this initial day. At the end of each school day during regular Science/ Social Studies instructional time, students were administered their 30 minutes of Multiplication instruction. Day #2 consisted of multiplication facts x5 and x10. Day #3 consisted of multiplication facts x2. Day #4 consisted of multiplication facts x0, x1, x5, x10, and x2. Day #5 consisted of multiplication facts x3. Day #6 consisted

of multiplication facts x4. Day #7 consisted of multiplication facts x6. Day #8 consisted of multiplication facts x3, x4, and x6. Day #9 consisted of multiplication facts x7. Day #10 consisted of multiplication facts x7 again. Day #11 consisted of multiplication facts x8. Day #12 consisted of multiplication facts x8 again. Day #13 consisted of multiplication facts x9. Day #14 consisted of multiplication facts x7, x8, and x9. Day #15 consisted of a random review of all multiplication facts x0-x10 and finally the 0-10 Multiplication Math Facts Post-Assessment. Each multiplication lesson lasted 30 minutes total. This consisted of a 15 minute teacher-led discussion with practice, 10 minute "student practice" time (a stationary group seated at their desks, or a group that would be hopping/ jumping in the hallway for kinesthetic purposes) and a 5 minute period of time where teachers could provide students with a mini-quiz or feedback. The 5-minute period was used as a time for teachers to determine student understanding of the facts practiced that day during the lesson. During each lesson, students spent approximately 10 minutes hopping/ jumping if they were in Group #2; Kinesthetic Group. This would occur during the 10-minute "student practice" block of time.

The results of the post-assessment were compared using a non-independent samples *t*-test.

CHAPTER IV

RESULTS

There was no significant difference in the post-test multiplication scores of the kinesthetic instruction group (Mean = 66.56, SD = 20.86) and the standard instruction group (Mean = 60.33, SD = 23.89) [t (8) = .92, p = .39] (please see Table 1). Consequently, the null hypothesis that there will be no significant difference in the 0-10 multiplication fact test scores between students who receive standard multiplication instruction and those students who receive kinesthetic movement multiplication instruction failed to be rejected. The concluding data indicates student progress and growth with learning multiplication facts (0-10) will not differ significantly if traditional or kinesthetic instructional strategies are implemented.

Table 1

Means, Standard Deviations, and *t*-test Results for Multiplication Post-Test Scores

Group	N	Mean	Std. Deviation	*t*-statistic
Kinesthetic Instruction	9	66.56	20.86	.92 (NS)
Standard Instruction	9	60.33	23.89	

NS = non-significant at $p < .05$.

CHAPTER V

DISCUSSION

The purpose of this research study was to determine if students receiving kinesthetic movement while learning multiplication facts 0-10 differed in their fact acquisition from those who learn the multiplication facts 0-10 under traditional methods in which they remain seated. The null hypothesis was that there would be no significant difference in the 0-10 multiplication fact test scores between students who received standard multiplication instruction and those students who received kinesthetic movement multiplication instruction. The null hypothesis failed to be rejected. No significant difference was noted between students who received kinesthetic movement while learning multiplication facts 0-10 and those who did not.

Implications of Results

Results from this study implied that students were not likely to learn their multiplication facts better using a kinesthetic method as compared to a traditional method. While student scores from one group to the other did not significantly differ, one could conclude kinesthetic movement implemented during instruction does not hinder student performance. The implementation of jumping/ hopping while learning multiplication facts supported some students' desire to move and be out of their seats while learning. This was especially beneficial for students who present with ADHD characteristics because it fulfilled their internal desire to move and exert energy. For some students, knowing they will have the opportunity to jump while practicing their multiplication facts may cause them to feel and display increased engagement and motivation throughout instruction.

Keeping this in mind, educators have to be mindful that these kinesthetic strategies and methods of teaching should be efficient and naturally "flow" within the lessons. This way, they

are applicable and easily relatable for the students participating in the learning process. One study suggested that modifying existing lessons to incorporate tactile and kinesthetic elements into lessons can be "easily disseminated, requiring no change to the current curriculum, few additional supplies (if any) and minimal cost to schools" (Gibson et al., 2008, p. 10). This would be ideal for all educators as they begin the shift from drill and practice to a hands-on physically engaging approach to learning.

Many studies suggest "students who do not respond to traditional teaching are likely to be engaged by hands-on, activity-oriented lessons" (Honigsfeld & Dunn, 2009, p. 221). This should be considered when preparing engaging lessons that incorporate physical activity and movement throughout the lessons. While considering this, teacher support should be addressed. As mentioned before, some teachers never started implementing the kinesthetic movements within lessons or stopped shortly after because they did not receive feedback from trainers (Al-Yaseen, 2011). This situation supports the idea that while tactile and kinesthetic activities may be beneficial for the majority of students, they will not be effective or reach their maximum potential if sufficient training and teacher support is not put into place.

One implication of the results is that the area or space teachers are using to implement the kinesthetic movement should be carefully considered. In this study, the hallway was used as the open space to jump or hop while completing multiplication facts. This space was more open than being in the classroom surrounded by desks and chairs; however, it still restricted students in space and they were unable to stand too far away from each other, otherwise they could not hear directions.

Ideally, a large area would be available for students to use while receiving the kinesthetic instruction such as a gymnasium or empty classroom. That leads to the next challenge which

was voice volume. Practicing the multiplication facts in the hallway required students and teachers to keep a quiet speaking volume careful to not disturb other classes. Additionally, the kinesthetic group was often interrupted and forced to pause for safety reasons in the middle of jumping and solving facts because another student had to walk by. While there was no furniture to set up, students were required to bring a dry-erase board and dry erase marker with them into the hallway to allow them to solve problems in a written fashion that they may be solving incorrectly while jumping and verbally stating. Therefore, these materials had to be placed against the wall on the floor in the hallway in order to stay out of the way while students were working. Again, this was a manipulative or material that students were required to remain responsible for throughout the research study.

The act of jumping or hopping during math instruction was highly motivating and students appeared to be more enthusiastic about learning multiplication. They would often ask if it was time to "do multiplication jumps yet?" and demonstrated active participation throughout instruction. Although the students receiving kinesthetic instruction were highly motivated and they looked forward to completing their multiplication with jumping each day, review of behavioral expectations was required each time the multiplication jumping or hopping was completed in order to try and prevent undesired behaviors from occurring. Some of the students became slightly rambunctious during instruction that required a pause in teaching in order to address the off-topic behaviors. Behavioral and physical expectations and guidelines should be clearly addressed with students prior to implementing the kinesthetic hopping movement in order to avoid undesired or distracting behaviors.

Theoretical Consequences

After reviewing the results of this study, it is safe to conclude that students who received

kinesthetic movement throughout multiplication fact instruction did not perform significantly better than those who did not. While students in the kinesthetic group did not outperform students in the non-kinesthetic group, positive benefits were noted throughout lesson implementation that would allow one to conclude it has potential benefits; behavioral, academic and motivational benefits. Students in the kinesthetic group were often eager to begin multiplication practice each day. Additionally, students who tended to exhibit increased physical activity and difficulty staying seated or focused for longer durations of time were often successful throughout the multiplication instruction involving kinesthetic movement because it allowed them to jump and exert physical energy while reinforcing a newly learned skill. One possible cause of this is the fact that students were practicing multiplication facts while jumping or hopping and had movement heavily incorporated into their daily math activities. Also, the kinesthetic group of students was required to verbally state the numerical multiplication problem being solved. For example, they would be required to recite "Six times nine equals fifty-four". Therefore, students who are generally talkative throughout instruction were granted permission and encouraged to verbalize their thinking and the math equation itself. This increased student participation and engagement. This supports the theory that kinesthetic movement being infused into academic instruction benefits learners who tend to feel the urge to move and be physically active. Some of these students may include those with ADHD or most boys (Jennings, 2012, p. 198).

The theory of context dependent learning indicates that individuals retrieve information better if the context of their retrieval is the same as the context in which the material was learned (Grant, Bredahl, Clay, Ferrie, Groves, McDorman & Dark, 2008, p. 617). In the current study, students in the kinesthetic group were required to jump or hop while practicing their multiplication facts. On the other hand, when it came time for them to complete the assessments or end of

lesson exit tickets, these students were expected to sit at their desks and not hop or jump. Since the contexts of the learning and the retrieval were different in this study, the students may not have fully demonstrated their knowledge.

Threats to the Validity

This study included multiple threats to validity that are critical to consider when analyzing data. One threat to validity includes the low number of students in the study itself. Consequently, this causes low statistical power and made it more difficult to determine if the groups differed in their multiplication math fact knowledge in the end.

Another validity threat relates to students' personal or the at-home challenges they face while not present in school. It is important to consider students' home-lives and some of the challenges they face outside of school that will likely affect the way they perform in school, and in particular, how it may affect their performance during the course of the study. In a study with a low number of participants, significant life events of just one student could impact findings. Although the details will not be discussed in order to protect anonymity, negative psychosocial factors may have influenced the results of the study.

Additionally, a threat to validity in this particular research study relates to the participants age and gender and the subsequent limitations to generalization. While the third grade students in the kinesthetic group did not outperform those in the non-kinesthetic group, it is not possible to conclude kinesthetic movement is or is not definitely more beneficial than non-kinesthetic movement. This study included third grade males and females in the area of mathematics. Previously completed studies mentioned throughout this research paper suggest male students benefit most from kinesthetic movement throughout the school day (Jennings, 2012, p. 198). Therefore, this researcher may have received different results had she assessed all males or all females

versus a combination. Also, results may have been differed with a sample of older students.

Connections to Previous Studies/ Existing Literature

A study completed by Shoval and Shulruf (2011) examined the effects of kinesthetic movement with a sample of 158 students from three different schools. The sample consisted of five second grade and third grade classes. Students were learning about angles by integrating movement into the math subject lessons. According to the research findings, the more active students were ones who were performing poorest at the start of the school year. By the end of the study, they were the ones with the greatest improvement in achievement. One interpretation of the research to explain the significant growth and progress included the idea that while moving, each participant was an "initiator, whether his/ her movement relates to the movement of the learner that precedes him or is disassociated from it" (p. 68). The researchers went on to conclude that "this has an important advantage in that every child, including a lower achiever, has the opportunity to initiate movement" (p. 68).

The Shoval and Shulruf (2011) study found kinesthetic movement and cooperative learning being incorporated into academic instruction proved beneficial to student achievement. While the results from the multiplication fact acquisition study did not prove the same with the use of kinesthetic movement being incorporated with hopping or jumping, it is important to consider possible contributions that may have had an effect on the two research initiatives differing results. The research study conducted by Shoval and Shulruf used 158 study participants as opposed to 18 students. Additionally, Shoval and Shulruf utilized second and third graders from three different schools in order to gain a broader view and conclusion with regard to the study results. On the contrary, the kinesthetic study assessing multiplication fact acquisition used students from one, third grade class at the same school. Having a small experimental group reduced

validity that may have impacted the overall findings.

The use of kinesthetic movement during instruction is something that is becoming increasingly popular and used across more subject areas than just physical education. As research continues to unfold and present new findings regarding its benefits, more and more educators are beginning to incorporate it into everyday instruction. Most kinesthetic activities are "designed to be self-corrective exercise where students do not require teacher feedback because the resources themselves have the correct answers built into them" (Honigsfeld & Dunn, 2009, p. 222). Creating student independence while learning is ideal and allowing students to take ownership in their actions and choices throughout the learning process can provide powerful teachable moments. However, these kinesthetic activities must be strategically taught and implemented in order to avoid chaos in the classroom or other challenges.

Additionally, research is being completed to analyze how kinesthetic movement impacts the brain during the learning process. Some research suggests that "new information must be ingrained within a student's neural networks in order for learning to occur and the process by which this is achieved is through movement. As sensory fibers are recruited during movement, they carry impulses from the muscles to the brain. Essentially, the more muscles activated, the more learning will occur" (Hall, 2007, p. 3).

With the above in mind, kinesthetic movement may have greater benefits to students who typically struggle to remain seated or focused throughout instruction. Increased research is being completed analyzing the relationship between students with disabilities (particularly those with symptoms similar to ADHD) using kinesthetic movement throughout instruction as a way to engage them and provide them with opportunities for movement while learning new skills and strategies. One researcher suggests "by teaching through the universal language of movement,

we can offer a chance for real success to children who may be caught in a spiral of academic failure. At the very least, kinesthetic teaching throws a lifeline to kinesthetic learners, who often can't sit still and are seen as disruptive or learning disabled" (Griss, 2013, p. 2).

While it appears research continues to support the idea of movement being embedded into academic learning experiences, it is important to note that the findings continue to develop and become clearer as time goes on and more studies are analyzed.

Implications for Future Research

After reviewing multiple research studies, it is evident that "over the past decade, schools and teachers alike have had increased pressure placed upon them with respect to student academic performance" (Hall, 2007, p. 1). Likewise, "decades before state education departments began adopting phrases such as 'active' or 'engaged' learning as an instructional mandate or standard, learning style researchers demonstrated that children learn significantly more, and more easily, when they are actively participating instead of passively listening" (Dunn et al., 2009,
p. 139). With these two statements in mind, it is crucial that educators find an efficient and effective way of actively engaging students in learning. Incorporating movement and kinesthetic elements into their instruction is one way to increase active learning behaviors. Results from this research study provide information about kinesthetic movement being used throughout instruction and its impact on academic performance. While students receiving kinesthetic movement throughout instruction did not out outperform those who learned their multiplication facts seated at their desks, more research would be required in order to confidently conclude that kinesthetic movement does not have a differential impact on students' ability to learn new skills than more traditional, sedentary methods.

As mentioned previously, the two study groups used throughout this research study had a low number of participants. In order to increase validity with future research similar to this one, the researcher would suggest incorporating a much larger number of study participants. In addition, the members of the matched pairs were not randomly assigned to the groups. Instead, the students' assignments were alternated based on ability such that the higher scoring person in the pair was always put in the kinesthetic group. Although statistical analysis did not indicate there was a significant difference in pre-test performance between the two groups, in future research the researcher would ensure the two groups were randomly assigned to further reduce any pre-existing differences between the groups.

Students in the kinesthetic group were taught using jumping or hopping as a way of incorporating movement into their instruction yet, when it came time to assess them, they were required to sit stationary at their desks. Future researchers who study the relationship between academic performance and kinesthetic movement should be more cognizant of context dependent learning and including kinesthetic movement in the method of assessment so that it aligns with the delivery methods throughout instruction.

Other ideas for future research analyzing benefits of kinesthetic movement used throughout academic instruction include restricting subject groups to being all male or all female as well as comparing the benefits of kinesthetic movement with males as opposed to females.

As mentioned previously, students were highly engaged and motivated while practicing their multiplication facts using the jumping or hopping throughout instruction. Therefore, future studies could analyze motivation, participation, and engagement with students receiving kinesthetic movement during instruction versus those who do not.

When considering the area or space in which students were being assessed, another possibility for future research includes a study which analyzes whether or not students benefit most from being taught in a large, open area (gymnasium, basketball court outdoors, etc.) or a smaller enclosed area such as a hallway or even a classroom while receiving the kinesthetic movement.

Finally, a future study could examine the effects of integrating kinesthetic instruction with traditional instruction. For example, teachers could implement the kinesthetic movement two days per week (perhaps every other day) in order to allow students the chance to practice their multiplication facts in other forms using other strategies at their desks. This way, they may become more proficient with their skip counting and other strategies prior to practicing them while jumping. Student performances could be compared between a traditional group, a kinesthetic group, and an integrated kinesthetic/traditional group.

Conclusions/ Summary

This research study analyzed the impact of kinesthetic movement on student achievement with respect to third grade math students learning multiplication facts. While this study did not prove students receiving kinesthetic movement throughout instruction performed with higher achievement than those who did not, they also did not perform at a significantly lower level. Incorporating kinesthetic movement into instruction proved to be engaging and motivating. It is important to note that the study was limited in terms of content matter and the characteristics of the students. Consequently, more research should be conducted surrounding this teaching strategy in order to determine whether kinesthetic activities are more effective than traditional instruction under certain circumstances.

Educators today are expected to support their students in reaching increasingly challenging standards with higher expectations. Keeping this in mind, it is critical that educators consider a large range of teaching strategies and student learning styles. In order for educators to meet all student's academic and behavioral needs, they should provide them with opportunities to practice learning new material in a variety of ways that will build upon their individualized strengths and support their unique needs.

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