EFFECTS OF A BRAIN IMPROVEMENT PROGRAM ON STUDENTS' READING ACHIEVEMENT

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Dissertation Prepared for the Degree of

DOCTOR OF EDUCATION

UNIVERSITY OF NORTH TEXAS

May 2013

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Sánchez, Edelmira. Effects of a Brain Improvement Program on Students' Reading Achievement. Doctor of Education (Early Childhood Education), May 2013, 126 pp., 17 tables, 3 figures, references, 123 titles.

How to close the reading achievement gap among K-12 students is an ongoing emphasis for educators in the 21st century. The purpose of the study was to determine if using kinesthetic movements from the Brain Gym® program improved the reading achievement of Grade 3 Hispanic and African American students. Students from four elementary schools participated in the study. The students in the control and experimental groups completed a 2004 release TAKS third grade reading assessment for the pretest and posttest. Students in the experimental group completed five selected kinesthetic movements from the Brain Gym® program five minutes at the beginning of each Monday through Friday school day. The intervention lasted 30 days and a total of 150 minutes. Data were analyzed using a 2 x 2 mixed between-within subjects analysis of variance. Findings revealed that performing the five kinesthetic movements from the Brain Gym® program did not increase students' reading achievement scores. Only the variable of time between pretest and posttest affected students' reading scores. The results from this study did not support the findings of other studies of the effectiveness of kinesthetic movements.

ACKNOWLEDGEMENTS

The completion of this paper would not have been possible without my faith in God and the help and prayers from my family, friends, church family, and colleagues. I would first like to acknowledge my husband for his patience during my countless hours of being away from home or being glued to my computer working. I thank you for believing in me especially when I didn't believe in myself. I appreciate your understanding and support for me during my adventure through this doctorate program. Next, I thank my children for the sacrifices they made during the times that I took away from them so that I could do my doctoral work after a long day at work. I know it was difficult for you, yet you still love me. I thank you all for the heavy sacrifices you have made throughout all the years I have taken to complete this project. Your words of encouragement have meant so much and helped sustain me through the rough periods. I thank my grandchildren for understanding when I couldn't attend one of your events. I know I have missed so much that I will never be able to regain; however, my love has never wavered for you. I would like to express my appreciation to Dr. George Morrison for always encouraging me to "stay the course" and for being patient with me. I thank my friend and colleague Dr. Kevin Dartt, who also helped through this process. Your friendship, support, and trust have been invaluable gifts. Finally, I must express my appreciation to the members of my committee: Dr. Lloyd Kinnison for hanging in there all along and for all the support you have given me. I appreciate Doctors Carol Hagen and Angela Randall for taking me on at a late date. My committee has played an integral part in helping me to accomplish my goal.

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CHAPTER 1

INTRODUCTION

Reading is a vital and essential part of daily life and a skill that, if not strong, brings about lifelong challenges, both academic and occupational. Therefore, reading and reading well are essential and foundational for student success. The National Reading Panel (2000) emphasized the importance of developing reading fluency in the primary grades as essential for the transfer of literacy skills to other academic areas.

Good readers are active readers who have clear goals in mind when they begin reading (Torgesen, 2007). Good readers also constantly evaluate whether the text they are reading meets their goals. They construct, revise, and question as they draw upon, compare, and integrate prior knowledge with the texts they read. Pinnell and Fountas (2009) referred to this process of reading as thinking about the text. On the other hand, struggling students have trouble recognizing the words of age appropriate text, understanding the text's language, and understanding textual meaning (Tunmer, 2007).

The United States, in its desire to be an international leader and compete in the global economy, has called for a broader effort to improve K-12 students' reading skills. In Texas state assessments began in 1980. As a result of the No Child Left Behind Act of 2001 (NCLB, 2002), students are expected to read at a third grade level by the end of that grade (U.S. Department of Education, 2012). However, student achievement has not grown to this level fast enough. Such results do not put students on a path to graduate high school or to succeed in college and the workplace (U.S. Department of Education, 2012). Rhode Island and the District of Columbia increased performance in reading at grade level by only the fourth grade, and 38 states showed no significant change in reading achievment in neither fourth nor eighth grade (National Assessment of Educational Progress [NAEP], 2011). Kentucky was the only state with gains in both the fourth and eighth grades (NAEP, 2011).

In Texas, according to NAEP (2011) data, White students scored on average a score of 233, and African American and Hispanic students earned 23 points less than their White counterparts. No difference between Hispanic and African American students was detectable in 2011. Texas Education Agency (TEA, 2010) data indicated the achievement gap between White students and minorities was on average 11% lower for Hispanic students and 10% lower for African American students. A majority of the students with low academic achievement in reading are functionally illiterate (Blackowicz et al., 2010; Bobo, 2009). The problem of the academic achievement gap continues to loom over educators in the United States (MacDonald & Figueredo, 2010; Paik & Walhberg, 2007).

Background of the Reading Achievement Gap in the United States

In the United States, most teachers target classroom instruction to the average student in order to meet the needs of every child and to raise students' test scores. Federal education programs, such as the Reading Excellence Act of 1998, NCLB (2002), and the Individuals with Disabilities Education Improvement Act of 2004 (IDEIA), fuel teaching to the average. Response to intervention (RTI) is a recommended practice that stems from IDEIA and has since been a focus for states and school districts (Allington, 2009; Shinn, 2007). NCLB along with IDEIA essentially ensure that schools monitor and improve the progress of populations known for traditionally not doing well academically, specifically in reading.

These targeted populations include students who have trouble with reading, come from economically disadvantaged homes, have special needs, and are considered limited English proficient (LEP; Brayboy, Castagno, & Maughan, 2007; Linan-Thompson, 2007; Snyder & Dillow, 2011). Over time, many labels have referred to students to whom learning to read does not come easily. Some of those labels are *at-risk*, *high risk*, *twice exceptional*, or *culturally and linguistically diverse learners* (Moore-Hart & Karabenick, 2009; Oropeza, Varghese, & Kanno, 2010; Sullivan, 2011), and *learning disabled* (Brown, 2009; Obiakor, Beachum, & Harris, 2010; Shinn, 2007; Sullivan, 2011).

The at-risk term is vitally important to the debate about intervening to improve students' reading abilities. When students, especially English language learners (ELLs), are poor readers in the lower elementary grades, their reading problems often become worse as they advance to higher grades and progress through high school. In high school, they are exposed to more complex concepts and courses all of which require reading. Students identified as ELL have the highest grade retention and high school dropout rates of all youth (Duran, 2008). The consequences of dropping out of high school are life changing. Young people entering high school in the bottom quartile of achievement are substantially more likely than students in the top quartile to drop out of school (Torgesen, 2007). The drop out rate, though declining, is lower for Whites and Blacks than it is for Hispanics, setting in motion a host of negative social and economic outcomes for students and their families (Blackowicz et al., 2010; Torgesen, 2007). Students with reading deficiences who leave high school before graduating, are more likely to be placed in special education, become teenage parents, commit juvenile criminal offenses, and remain less than fully literate (Brayboy et al., 2007). When these students grow up, they become adults who depend on welfare and unemployment insurance and populate prison systems (Duran, 2008; NAEP, 2011; Pinnell & Fountas, 2009).

The process of closing the gap in literacy development is widely studied and debated (Al Otaiba et al., 2009; Boscardin, Muthen, Francis, & Backer, 2008; Cooke, Kretlow, & Helf, 2010; Denton & Al Otaiba, 2011; Duff et al., 2008; MacDonald & Figueredo, 2010; Mandara, 2009; Ming & Dukes, 2008; O'Conner, Swanson, & Geraghty, 2010; Ogle & Correa-Kovtun, 2010; Rasinski, 2003a, 2003b; Rasinski, Homan, & Biggs, 2009; Rasinski, Samuels, Hiebert, Petscher, & Feller, 2011; Short, Vogt, & Echevarria, 2008; Soriano, Miranda, Soriano, Nievas, & Felix, 2011; Turner, 2010; Walker-Dalhouse & Risko, 2009; Welsh, 2006). A focus on reading fluency and comprehension stands at the forefront of addressing the reading achievement problem. Reading fluency is the ability to recognize sight words that do not need to be sounded out phonetically and to read continuous text with good momentum, phrasing with appropriate pausing, intonation, and stress (Ming & Dukes, 2008; Rasinski, 2003b). Students with reading difficulties exist in every classroom across America. They come from all educational and economic levels and represent a constant concern and challenge. Teachers find themselves working with students for whom literacy learning is difficult (Deshler & Hock, 2009; Goodwin & Ahn, 2010; Pinnell & Fountas, 2009). For their part, many students want to learn to read, and teachers want to help them learn to read and are opposed to leaving any student behind (Pinnell & Fountas, 2009).

For decades, the search for ways to prevent and improve reading difficulties, which include brain-based education, has influenced educators and administrators alike (Jensen, 2009). Extensive searches for investigating ways by which educators can help all students learn how to read have dominated much of the educational literature for the last 50 years (Pinnell & Fountas, 2009). The problem of students not reading well is especially common among minority and culturally diverse students such as African American and Hispanic students (Allington, 2009; Chard et al., 2008; Pinnell & Fountas, 2009; Martinez, Aricak, & Jewell, 2008). Between 1989 and 2009, the percentage of public school students who were White decreased from 68% to 55% in all four regions of the U.S., and the percentage of Hispanic students doubled from 11% to 22% (Snyder & Dillow, 2011).

By 2009, Hispanic enrollment in public schools in Texas exceeded 11 million students between the ages of 5 to 17 years who spoke a language other than English (NAEP, 2011). In 2008-2009, the number of students between the ages of 3 and 21 years in special education services was 6.5 million, with 13% of all public school enrollments having reading ability as a disability. Also in 2009, greater percentages of Hispanic and African American students attended high-poverty elementary and secondary public schools than did Whites. In 2009, 19% of 5 to 17 year olds were from families living in poverty up from 15% in 2000 and 17% in 1990. A relationship was found between teachers' low perceptions of the students attending high-poverty schools and special education referrals (Brown & Parsons, 2008; Obiakor et al., 2010; Sullivan, 2011).

Since the early 1990s, significant gaps between racial/ethnic groups have remained steady (Aud et al., 2011). The reading achievement gap demonstrated no measureable change in the average Grade 4 reading score between 2007 and 2009 (Aud et al., 2011; NAEP, 2011). The US's national Grade 4 reading scores were unchanged between 2009 and 2011 (Aud et al., 2011).

For Grade 12 students, the average reading score increased by only two points between 2005 and 2009. In 2009, White students scored 27 points higher in reading than African American students and 22 points higher than Hispanic students (NAEP, 2011; Aud et al., 2011). Neither score gap was significantly different from the respective score gaps in previous assessment years. The average combined reading literacy score was not measurably different from the average score of the 34 Organization for Economic Co-operation and Development (OECD) member countries. The OECD provides a forum that compares different countries school systems and how they are preparing their young for modern life. While Hispanic and African American students have made strides in narrowing the achievement gap that separates them from their White counterparts in reading achievement, they still lag behind. Even the small signs of progress have done little to close the achievment gap since the implementation of NCLB (Muhammad, 2009). Pinnell and Fountas (2009) suggested that while educators greet increased scores with cautious optimism, a gain of a few points for one cohort does not necessarily hold true in the assessment of the next cohort, nor does it tell much about the overall state of literacy education.

No initiatives adopted by educators to increase reading achievement have made much difference. Students continue to perform with the same average scores and have a hard time learning to read (Aud et al., 2011). Although many schools often provide some literacy intervention, many lack sufficient resources. Some of the resources lacking include teachers skilled in literacy development and appropriate learning materials to help older students in elementary school reach grade-level standards in reading.

To increase students' reading scores with the NCLB (2002), Congress appropriated over $140 billion to states to provide schools with the necessary resources for ensuring reading improvement among students and to mandate specific guidelines for reading research, instruction, and accountability. For their part, the nation's 16,000 school districts spent millions of dollars on educational products and services developed by textbook publishers, commerical providers, and nonprofit organizations (Allington, 2009). NAEP (2011) reported that total expenditures for instruction per student in public school elementary and secondary schools rose 39% between the 1989-1990 and 2007-2008 school years. In 2007, the US spent $10,768 per student on elementary and secondary education, 45% more money than the OECD average of $7,401 spent per student (NAEP, 2011).

Schools, according to Pinnell and Fountas (2009), adopted reading program after reading program confusing teachers and failing to change what students learned. Many of the programs provided the same instruction to every student without noticeable curriculum changes. Through all these program adjustments, students still earned the same average reading scores and teachers continued to be challenged by students finding it difficult to learn to read, which in turn affected student performance in other content areas as well (NAEP, 2011).

Title I of the NCLB (2002), special education and bilingual education initiatives, the American Recovery and Reinvestment Act of 2009 (ARRA), and the Blueprint for Reform (U.S. Department of Education, 2010) and efforts regarding reauthorizing the Elementary and Secondary Education Act (ESEA) represented intiatives trying to ensure that the achievment gap between the poor, disabled, minority, and ELL students would be closed (Paik & Walhberg, 2007; Snyder & Dillow, 2011). Currently among these initiatives, NCLB Title I reading programs have added at best about two months worth of reading gains per year for struggling readers, while special eduation programs have not added any gains in reading. In order for struggling students to attempt to catch up with their peers, these programs would need to double or even triple the rate for students' reading acquisition (Allington, 2009).

In recent years, educators have turned their attention to the emotional side of learning (Immordino-Yang & Damasio, 2007; Jensen, 2009, 2010; Ratey & Hagerman, 2008; Sousa, 2006). These educators have been concerned with students' emotional and intellectual growth and how such growth affects students' reading abilities. Immordino-Yang and Damasio (2007) contended that when educators fail to appreciate the importance of students' emotions, they fail to appreciate a critical force underlying student learning. Jensen (2009, 2010) suggested that students' social-emotional capacities powerfully affect and even determine whether they develop the ability to listen and communicate; to concentrate; to recognize, understand, and solve problems; to cooperate; to modulate their emotional states; to become self-motivating; and to resolve conflicts adaptively.

Literacy, according to Blackowicz et al. (2010), is the key to academic success. They suggested that a child who can read by the third grade is unlikely to be involved with the criminal justice system. On the other hand, four out of five African American and Hispanic (but mostly African American) incarcerated juveniles read two or more years below grade level. This achievement gap in reading exists between minority and non-minority students and between disadvantaged and more advantaged students (Paik & Walhberg, 2007; Short et al., 2008).

Statement of the Problem

The literacy achievement gap exists for students who come from low socioeconomic status (SES) backgrounds, those with special needs, and those who are limited English proficient (LEP; Brayboy et al., 2007; Linan-Thompson, 2007; MacDonald & Figueredo, 2010; Obiakor et al., 2010; Snyder & Dillow, 2011). The achievement gap between minority and non-minority students and between the socioeconomically disadvantaged and their more advantaged peers continues (Aud et al., 2011; National Association for the Education of Young Children, 2011). Many students come from low SES with free or reduced-price lunch benefits, have special needs, and are LEP (Brayboy et al., 2007; Linan-Thompson, 2007; MacDonald & Figueredo, 2010; Obiakor et al., 2010; Snyder & Dillow, 2011). Some content that the achievement gap may be due to the belief that students from challenging circumstances may suffer from limited intelligence (Boscardin et al., 2008; Matthews, 2010; Rodriguez & Bellanca, 2007; Rovai, Gallien, & Stiff-Williams, 2007).

One dimension of low achievement can be observed between ELLs and native English speakers. ELL students have difficulty learning to read in a language that is not their primary language. Meanwhile, with the continued growth of LEP students in classrooms, the relationship between literacy proficiency and contiuned low academic achievement in reading strengthens (Paik & Walhberg, 2007; Short et al., 2008). Many students who live in poverty do not read at grade level. Socioeconomically disadvantaged Hispanic and African American students, in particular, lag behind. Researchers, educators, and policy makers share the responsibility to protect the students who are at-risk of failure and provide a solution.

Brain-based education could be one solution for closing achievement gaps between minority students and their more advanced counterparts. The overall goal of brain-based education is to bring insights from brain research into the arena of education. This effort is designed to enhance teaching and learning. Proponents of brain-based education, such as Jensen and Sousa (2009), have advocated for a diverse group of educational practices and approaches. Jensen and Sousa maintained that the unprecedented explosion of new findings related to the development and organization of the human brain need to be applied in school settings. These findings can inform educational practice in meaningful ways to help students. One such application involves multiple intelligences.

Intelligence, according to Gardner (2004), is multi-faceted and includes the seven intelligences of linguistic, muscial, logical-mathematical, spatial, bodily-kinesthetic, interpersonal, and intrapersonal. As a result of scientific advances and Gardner's unique intelligence theory, educators developed brain-based education approaches to learning (Jensen, 2010). Gardner advocated the use of enriched educational environments that nurtured students' full range of abilities via their multiple intelligences. Cain, Caine, McClintic, and Klimek (2008) advocated the use of different activities so that students attention is captured due to the novelty. Advocates of brain-based education support enriched educational environments that allow teachers to employ multiple and diverse strategies for presenting content to students (Jensen, 2005, 2008, 2009).

Brain Gym®, a registered trademark by Brain Gym International/ Educational Kinesiology Foundation, uses simple body movements to integrate the functions of the brain, and activates students' bodly-kinesthetic intelligence (Dennison &

Dennison, 2007). One solution to help close the achievement gap is to use movement techniques based on the idea that movement enables students to integrate functions of the brain. The Brain Gym® program integrates both mind and body through the use of kinesthetic movements. Brain Gym® is aligned with the practices of brain-based education (Dennison & Dennison, 2007).

Purpose of the Study

The purpose of the study was to determine if using a series of kinesthetic movements would improve the reading achievement of Grade 3 Hispanic and African American students. I postulated that kinesthetic movements could provide a viable solution for activating brain function and improving reading achievement. To accomplish this task, I identified a series of five Brain Gym® movements (described in Chapter 3) to test the effectiveness of performing the movements as a means of improving reading in a group of third grade Hispanic and African American students. I identified third grade struggling readers for the study through the universal screener used as part of Tier I and Tier II of RTI, described in Chapter 3, in five elementary schools from an urban North Texas district. The tiers were used to identify the groupings for students whose differing needs can be met with more intensive instructional approaches. Students targeted for RTI were identified as reading below the third grade reading level. The third grade students were chosen for this study as third grade was the first grade level tested with the Texas Assessment of Knowledge and Skills (TAKS).

Research Questions

The following research questions were used to guide this research study:

1. To what extent, if any, do kinesthetic movements increase the reading achievement of low SES Hispanic and African American third grade students?
2. To what extent, if any, do kinesthetic movements increase the reading achievement of low SES Hispanic third grade students?
3. To what extent, if any, do kinesthetic movements increase the reading achievement of low SES African-American third grade students?
4. To what extent, if any, do kinesthetic movements increase the reading achievement of low SES male third grade students?
5. To what extent, if any, do kinesthetic movements increase the reading achievement of low SES female third grade students?

Significance of the Study

Administrators have removed all or most motor learning activities from the school curriculum due to a more academic emphasis on increasing test scores. In fact, many educators have removed any activity considered non-academic from the curriculum. These non-academic activities have included the physical components of learning, visual, auditory, fine motor and postural skills essential for learning to take place (Cain et al., 2008). The creators of the Brain Gym® movements claim the enhancement of cognitive processing and whole brain learning prepares students to learn (Brain Gym International, 2011; Dennison & Dennison, 2007; Hannaford, 2005). In addition, Brain Gym® contains multiple movements purported to help school-aged students in reading, writing, and math (Hannaford, 2005; Jensen, 2009; Maguire, 2000).

The creators of Brain Gym®, Dennison and Dennison (1994), argue that “movement is the door to learning” (p. 5) and involves the building of skills used in classrooms and work places. Thus, learning happens through both the movement of muscles and intellectual skills (Hannaford, 2005). Movement improves students' performance and attitudes about the learning process (Ratey & Hagerman, 2008; Sousa, 2006). Brain Gym® represents a holistic approach that promotes whole brain learning through movement (Dennison & Dennison, 2007; Hannaford, 2005) and purports to bridge the gap between mind and body.

If the daily application of kinesthetic movements were to enhance students' reading achievement, then it might also influence future curriculum development and also inform the literature about uses for Brain Gym® in attempting to influence reading achievement of Hispanic and African American K-12 students. If the power of movement raises the Hispanic and African American students' reading achievement scores (Hannaford, 2005), then the use of these movements might have extensive applications for closing the gaps in performance experiences between minorities and White students.

Definition of Terms

Achievement gap. In education, this gap refers to the disparity in academic performance between groups of students. The term most often represents the troubling performance gaps between African American and Hispanic students and their non-Hispanic, White peers (U.S. Department of Education, 2007).

African American. This term for race refers to a person having origins in any of the Black racial groups of Africa (Aud et al., 2011).

At-risk student. Refers to students in prekindergarten, kindergarten, or Grades 1, 2, or 3, who did not perform satisfactorily on a readiness test or assessment instrument administered during the current year and who is LEP (TEA, 2010).

Brain Gym® movements. This commercial program of kinesthetic movements is designed to stimulate a flow of information restoring the innate ability to learn and function with curiosity and joy (Dennison & Dennison, 2007).

Brain-based education. This type of education requires the engagement of strategies based on principles derived from an understanding of the brain (Jensen, 2008b).

Hispanic or Latino. This term for race refers to a person of Cuban, Mexican, Puerto Rican, South or Central American, Spanish culture or origin (Aud et al., 2011).

Limited English proficient. LEP refers to students whose primary or home language is other than English and who need special language assistance to participate effectively in school programs (U.S. Department of Education, 2007).

Reading achievement. Students should know how to and be able to comprehend text, and demonstrate reading ability through performance on assessments (NAEP, 2009). In Texas, reading achievement was measured by the TAKS reading assessment (TEA, 2004).

Response to intervention. Known as RTI (U. S. Department of Education, 2007), this is the practice of meeting the academic and behavior needs of all students through a variety of services. These services should contain the three key elements: (a) high quality instruction and scientific research-based tiered interventions aligned with individual student need, (b) frequent monitoring of student progress to make results-based academic and/or behavioral decisions, (c) application of student response data to important educational decisions (e.g., placement, intervention, curriculum, and instructional goals and methodologies).

Tier I. Teachers use high quality core instruction aligned with the TEKS in which about 80% or more are successful. This tier is the crucial foundation of the RTI instructional model (U.S. Department of Education, 2007).

Tier II. Students are identified for individual or small group intervention in addition to core class instruction. This level includes scientific research-based programs, strategies, and procedures designed and employed to supplement, enhance, and support Tier I activities. District established standard protocol matches appropriate intervention strategies to specific student needs. Tier II addresses the needs of approximately 10% to 15% of the RTI-identified students (U.S. Department of Education, 2007).

Tier III. Students identified for this level of RTI have not responded adequately to Tiers I and II and receive specific custom-design individual or small group instruction. Tier III uses problem-solving models beyond the instruction used in Tier II. This level of intervention is aimed at those students who are identified at-risk academically or behaviorally and are in need of intensive intervention. Tier III addresses the needs of approximately 5% to 10% of the RTI-identified students (U.S. Department of Education, 2007).

Title I school. These are schools in which at least 35% of the students in the school attendance are from low-income families, or at least 35% of the enrolled students are from low-income families eligible to receive Federal Title I funds. This status is most frequently measured determined by the percent of students eligible to receive free and reduced-price lunch (NCLB, 2002).

Universal screener. As an initial assessment of knowledge and skills, which enables the identification of students struggling or lacking specific knowledge or skills in a given area (U.S. Department of Education, 2007).

White. This term for race refers to a person having origins in any of the original peoples of Europe, North Africa, or the Middle East (Aud et al., 2011).

Summary

This chapter provided the background of the study, the problem, purpose of the study, the research questions, significance of the study and key terms. The solution to help close the achievement gap involved the use of techniques based on the principles and practices of brain-based education. Chapter 2 presents the literature reviewed for informing the quasi-experimental study.

CHAPTER 2

REVIEW OF THE LITERATURE

Reading in the 21st century demands that all students develop high levels of literacy in reading achievement. To close the achievement gap, students must be taught to read and read well, especially at-risk minorities namely Hispanic and African American students (MacDonald & Figueredo, 2010; Mandara, 2009; Short et al., 2008; Walker-Dalhouse & Risko, 2009). The purpose of this current study was to determine if using a series of kinesthetic movements improved the reading achievement of Grade 3 Hispanic and African American students to help close the academic reading achievement gap. The kinesthetic movements studied were developed for the Brain Gym® program, which is a registered trademark by Brain Gym International/ Educational Kinesiology Foundation. To understand the components of the research, the literature review sections include (a) basic reading skills, (b) brain-based education, (c) physical activity and cognition, (d) physical fitness and learning, (e) Brain Gym® studies, (f) RTI.

Reading Skills

Whether teaching reading is by early identification (Boscardin et al., 2008; Cooke et al., 2010; MacDonald & Figueredo, 2010), by teaching phonics (Denton & Al Otaiba, 2011), by teaching fluency (Al Otaiba et al., 2009; Ming & Dukes, 2008; O'Conner et al., 2010; Rasinski, 2003a, 2003b; Rasinski et al., 2009; Rasinski et al., 2011; Soriano et al., 2011; Welsh, 2006), by teaching content vocabulary (Duff et al., 2008; Ogle & Correa-Kovtun, 2010), or by teaching comprehension (Turner, 2010), the need is prevelant. Marie Clay (1998) addressed the challenge of literacy improvement in the following manner:

> The challenge of literacy improvement is fine-tuning programs that are already satisfactory to better results. To ensure that by the age of nine no children have fallen dangerously behind their peers in literacy development, special attention must be paid to the preschool years, the preparatory class at school entry, the first two years of literacy instruction, and early interventions that provide catch-up experiencies. From the ages of eight to eleven, some children do not become able to read and write more difficult texts, not only because of different levels of comptence but also because of uneveness and weaknesses in some aspects of their literacy processing. Differentiated instruction would help to develop different strengths on different kinds of literacy tasks. When you are doing a job like literacy teaching well, it is hard to think about doing it even better. (p. 197)

Helping students learn to read and read well is an important role for early childhood educators and for American society (Clay, 1998; Cooke et al., 2010).

According to Pennington (2010), a basic understanding of grammar is fundamental for higher levels of communication, for standardized tests such as high school graduation tests, and for national tests such as the SAT which echoes the present study need for students learning to read well. Pennington investigated the use of kinesthetic movement as a vehicle by which to teach grammar to high school students. The participants in Pennington's study included 277 secondary students enrolled in college preparation level English courses. The students in the study were from Grades 9 through 11 and were assigned to classes by compterized random selection. Participants averaged from 14 to 18 years of age and were from middle class backgrounds. The students were 66% Caucasian, 16% Hispanic, 10% African American, and 8% Other.

Pennington (2010) used Holt, Rienhart, and Winston's (1996) *Elements of Writing: Language Skills* textbook to teach grammar to the students. Two similar tests derived from the textbook were used for the pretests and the posttests. A 40-question survey was distributed to the students to collect their different attitudes and perceptions, demographic data (gender and ethnicity), athletic involvement, musical inclination, other highly kinesthetic activity involvements, academic preferences, and general preferences. For qualitative data, the instructors kept brief logs of the grammar lessons they taught. The data included the dates for each of the 15 specific lessons and brief descriptions of each of the 15 minutes lessons (Pennington, 2010).

The control and the treatment groups both received the same amount of lessons (Pennington, 2010). The treatment group experienced kinesthetic activities related to grammar during the designated 15-minute timeframe. Pennington (2010) based these activities on her personal experiences in the classroom, advice from other educators, and online resources. The control group received traditional grammar lessons during the same 15-minute timeframe. The lessons were completed within five weeks after which both groups received a posttest and competed the surveys. The pretests and posttests consisted of 50 questions in length and were made up of four sections: parts of speech, complements, verbal phrases, and sentence types. Cronbach's alpha reliability test showed the reliability of the pretest to be .715 and of the posttest to be .739 (Pennington, 2010). Scores from the pretests and posttests were analyzed statistically using independent and dependent sample *t*-tests.

The results showed no significant difference between the control and treatment groups regarding changes in students' grammar test scores. However, the kinesthetic group appeared to be the most popular and to be more enjoyed by the students as compared to the control group which received solely grammar lessons. This was just one among many efforts to identify effective programs and practices to help students learn to read (Allington, 2009; Blackowicz et al., 2010; Brown, 2009). Brain-based learning represents one of these efforts.

Understanding Brain-based Education

Progress in neuroscience over the past several decades has led to better understanding of how the brain functions as students learn (Alferink & Farmer-Dougan, 2010). Through advances in neuroscience, a better understanding of how neurons and neurotransmitters operate has been generated, and data showing correlations between between brain activity and academic tasks have provided distinct clues into how students learn (Alferink & Farmer-Dougan, 2010). Advances in the understanding of neurons in general, and glial cells in particular, have occurred in recent decades. The understanding of neurotransmitters and synaptic transmission has occurred through advances in neuroscience. However, Alferink and Farmer-Dougan (2010) defended neuroscientists' lack of knowledge about how or whether the number of neurons has a relationship with the ablity to learn or intelligence. The relationship between the "quality" of the brain, determined by the number of neurons to the scope of what students can learn or how they should learn, remains unknown. According to Alferink and Farmer-Dougan (2010), recent neuroscience evidence has supported traditional teaching methods. Those methods include repetition and elaborative rehearsal and mastery but not open-ended or problem solving approaches. Concerning memory, the formation of memories through neural consolidation shows greater results when students have a number of short learning sessions distributed over a discrete period of time instead of having one long single session for ensuring long term learning (Alferink & Farmer-Dougan, 2010). The implications for educators based on these neuroscience findings include understanding how best practices may be changing to improve both students' learning and brain functioning. This implication has led to current theories concerning brain-based education regardless of whether or not they have been grounded in neuroscience.

Brain-based education is best understood by three words: engagement, strategies, and principles (Jensen, 2008a). Brain-based education is the engagement of strategies based on principles derived from an understanding of the brain as it is involved in everything students do, think, and feel. Brain-based learning requires a multidisciplinary approach. Multiple disciplines bind assessment, the school environment, and instruction into a collaborative program. One affects the other, and all of these affect students' brain development. Brain-based educators teach to various learning styles throughout the course of instruction (Jensen, 2010; Sousa, 2006). Examples of teaching to learning styles, though not extensive, include the use of hands-on and kinesthetic activities (Rule, Dockstader, & Stewart, 2006), movement (Peebles, 2007), music (Kreeft, 2006), and dance (Giguere, 2006). Brain research has been stimulated, in part, by growing concerns about the academic success, health, safety, and well-being statuses of students in America (Jensen, 2009).

Many have viewed the brain simply as a single organ, part of a larger neurological system, which controls the body. Singer (2008) argued that the different parts of the brain control different functions, particularly as these functions relate to learning. Brain research has opened avenues that allow for understanding how the brain controls students' gross motor activities. Furthermore, the results of brain research clearly define the necessary interconnectivity of the brain between mind and body for deep learning to take place. Learning involves the building of skills. Skills are used in classrooms and work places, and skills of all types happen through the coordination and movement of muscles as well as the use of intellect (Hannaford, 2005).

For a great many years, the educational and scientific communities did not agree on a relationship between thinking and movement (Jensen, 2009, 2010; Sousa, 2006). Jensen (2008a) argued for no separation of brain, mind, body, feelings, social contacts, or their respective environments and for no separating the role of the brain and its influence on student performance on state-level assessments. Jensen (2010) suggested that academic skills have a brain system that overlaps with social skills. These are evident in the areas of awareness and attention. The primary factors that interact, mitigate, or support the academic operating system are basically relationships, socialization, and social status which play a part in the motivation, decision making, and cognition needed for everyday success.

Many changes in the conceptualization of the learning process have occurred based on advances in neuroscience. In the final two decades of the 20th century, technology paved the way for a paradigm shift regarding the ways people think, live, and learn. Brain scans through magnetic resonance imaging (MRI), positron emission tomography (PET), and electroencephalogram (EEG) have offered new ways to understand and see inside the brain while it is thinking (Jensen, 2008; Sousa, 2006).

Scientists have analyzed the brain while patients perform tasks and undergo alternative states of consciousness, representing events thought to be impossible prior to those technological inventions. Neuroscience has enabled discoveries and astounding insights about the brain and how people learn and function (Jensen, 2008b).

Learning is what the human brain does best (Jensen, 2008a). Neural plasticity is an intrinsic, beneficial characteristic of the nervous system establishing both the ability to learn and the ability to adapt in response to damage that occurs in the body, in essence the ability to relearn lost information and skills (Hannaford 2005; Jensen, 2009). Changes in the brain occur as it rewires itself via new stimulation, experience, and behavior, an activity known as synaptic pruning. In synaptic pruning, the neurological regulatory process facilitates a productive change in neural structure by reducing the overall number of neurons or connections. One link from neuroscience to education occurs from physical movement to learning (Hannaford, 2005; Jensen, 2008b).

Brain research is important to the educational paradigm of the 21st century. Brain research findings can help educators more effectively teach students while incorporating research findings from empirical studies, such as those addressing social conditions, stress, nutrition, environments, exercise, and the brain (Jensen, 2008b). Neuroscientists have found that during the process of development, the brain is affected by dramatic and specific environmental conditions that could impact the brain's intricate circuitry. In addition, unpredictable stressors impair the brain's capacity for learning by affecting not only learning but also health and behavior (Jensen, 2010).

With fewer than 50% of K-12 students in the United States experiencing a daily physical education class, students need alternative methods for movement and for stimulating the brain (Dennison & Dennison, 2007). According to Stephens, Kinnison, and Proctor (2012), effective instructional experiences that include physical activity are critical for optimal brain development. Through innovated brain research, strong links between physical education and cognition have been generated (Brown & Parsons, 2008; Chomitz et al., 2009; Ratey & Hagerman, 2008).

Physical Activity and Cognition

For many years, scientists viewed the brain as somewhat inflexible and mostly subject to genetic predispositions. Recently, the brain has been shown to be quite adaptable (Jensen, 2010). Environmental influences may be more significant to brain development than hereditary factors. These influences have considerable implications for educators and may directly affect the pedagogical strategies used in the classroom (Jensen, 2010). Educators cannot ignore the implications of brain-based research in the educational environment. A multitude of diverse factors, one of which is movement, affects cognitive development in K-12 students (Wilmes, Harrington, Kohler-Evans, & Sumpter, 2008).

Many school administrators have reduced the inclusion of physical activities in the school day due to time constraints created by pressure to increase students' high stakes test scores (Cain et al., 2008; Stephens et al., 2012). Even at the preschool level, educators have become so focused on benchmarks, data, and accountability that teachers have shifted away from using sponateneous, imaginative play (Emslie & Rober, 2009; Ginsberg, 2007). Educators have reduced or eliminated recess to ensure students have extra time in reading instruction (Emslie & Rober, 2009; Ginsberg, 2007).

On the other hand, exercise helps shape the muscles, heart, lungs, and bones (Chomitz et al., 2009; Ratey & Hagerman, 2008; Reynolds & Nicolson, 2006). Physical activity increases the production of new brain cells and increases brain mass (Pereira et al., 2007). Physical activity strengthens the basal ganglia, cerebellum, and the corpus callosum, all of which represent critical areas for brain effectiveness (Jensen, 2010). The cerebellum houses the cognitive processes of memory, attention, and organization of information. Not only does the cerebellum help in organizing the flow of thoughts, but it also helps with physical movement coordination (Strick, Dum, & Fiez, 2009). Exercise fuels the brain by increasing the flow of oxygen with high-nutrient food and neurotropins to enhance growth and greater connections between neurons (Jensen, 2005). Importantly, exercise triggers the release of the brain-derived neurotropic factor dopamine (Hannaford, 2005). Dopamine enhances cognition by boosting the ability of neurons to communicate with one another. This evidence based on neuroimaging has directly linked neuroscience and learning. The likelihood of a link between classroom instruction and physical fitness needs consideration to determine the most effective ways to teach students (Willis, 2007).

Tomporowski, Davis, Miller, and Naglieri (2008) stated that systematic exercise programs might actually enhance the development of specific types of mental processing known to be important to students meeting the challenges they encounter in academics as well as throughout their lifespans. They concluded students' mental functioning increases due to exercise training when tasks involve executive functions. Executive functions occur when performing goal-directed actions. Even simple exercise training programs represent important methods for enhancing aspects of students' mental functioning as well as social and cognitive development. The impact of physical activity on students' physical health as well as on their mental functions and psychological well-being was found to be highly important (Tomporowski et al., 2008).

Physical Fitness and Learning

Learning occurs as a part of physical fitness. Coe, Pivarknik, Womack, Reeves, and Malina (2006) determined the effect of physical education class enrollment and physical activity on academic achievement in a study of 214 sixth grade students. The students were randomly assigned to physical education classes in either the first or second semester. The students received 30-minute blocks of physical activity ranging from light to vigorous. Academic achievement was assessed using the students' grades in four core classes and scores on standardized tests. Results indicated similar grades regardless of whether the students were in first or second semester of physical education. However, higher grades were associated with vigorous physical activity.

Similarly, Castelli, Hillman, Buck, and Erwin (2007) examined the relationship between physical fitness and academic achievement of 259 third and fifth grade students who were overweight in four Illinois public schools. Two of the schools were considered academically effective with 76.3% of the students meeting standards in mathematics and reading. In addition, 24.3% of the students in these same two schools received free or reduced-price lunch. For the students from the other two schools, 46.2% met the standard for mathematics, and 40.6% met the standard for reading, with 66% of the students receiving free or reduced-price lunch. The ethnic distribution of the students in the study was 78% Caucasian, 12% African American, 5% Asian, 3% Hispanic, and 2% other. The measures for the participants included five components of a physical fitness test and two content areas of the Illinois Standard Achievement Test.

Castelli et al. found physical fitness to be related to higher academic achievement in reading and mathematics in the third and fifth grade students, regardless of student SES.

Jensen (2009) suggested that in order for brain mass to increase and brain function to become more effective as part of learning, people must engage in totally new activities. Jensen encouraged school administrators to plan programs with specific motor activities. Such motor activities include cross-lateral movements requiring the arm and leg to cross over from one side of the body to the other, bilateral movements requiring climbing, and unilateral movements requiring reaching. Jensen argued that these motor activity requirements along with the integration of physical activities across the curriculum are highly beneficial for the brain. Jensen stated that kinesthetic activities lead to learning in academic classes and lead students to use the whole brain.

According to Howe and Freedson (2008), reporting on behalf of the President's Council on Fitness and Sports, all K-12 students need 30 minutes of physical movement a day to stimulate the brain, because sensory motor integration is fundamental for academic achievement. In Texas, schools must provide at least 135 minutes of moderate or vigorous structured physical activity per week for elementary students and at least 30 minutes per day in junior high school (National Association for Sport and Physical Education and the American Heart Association, 2010).

Carlson et al. (2008) employed a multistage longitudinal study with a probability sample design of a nationally representative group of 5,316 students in kindergarten who were followed through the fifth grade. The direct academic achievement measures were scores for mathematics and reading. Data were analyzed at five time points: fall and spring of kindergarten, spring of first grade, spring of third grade, and spring of fifth grade. The measures included the number of times during the week and minutes per day that students participated in physical education. Experimental groups were categorized into three levels of physical activity: (a) low, which incorporated from 0 to 35 minutes per week; (b) medium, with 36 to 69 minutes per week; and (c) high with 70 to 300 minutes per week. Students took standardized mathematics and reading tests to determine if physical education participation increased academic performance. Item Response Theory (IRT) and scale scores were calculated for each student. IRT scale scores represented estimates of the number of items students would have answered correctly. Family income was categorized into four groups, and the student's race/ethnicity and mother's educational level were used in the data analysis (Carlson et al., 2008).

Carlson et al. (2008) used multivariate linear regression models to test the longitudinal association between physical activity and the Item Response Theory (IRT) scale scores for both mathematics and reading. Data were stratified by gender. The sample was 52.1% girls, 11.1% Hispanic, and 8.7% African American. The results revealed some academic benefit and no negative effects from physical activity. Significant differences by gender were found. No association between physical activity and academic achievement was found for boys in reading or mathematics, partly due to the boys being generally more fit than girls. This finding may help explain the noted benefit of physical education on academic achievement in girls but not in boys (Carlson et al., 2008).

Carson et al. (2008) observed that teachers reported the most common amount of exposure students had to physical education was one to two times per week. The most common durations reported were 16 to 30 minutes for kindergarten and first grade, and 31 to 60 minutes in the third through fifth grades. There was no mention of how much time second graders spent in physical education. However, Carson et al. implemented an intervention of one hour per day of physical education and showed a positive effect on academic scores for both boys and girls compared to 40 minutes per week. Carson et al. revealed that girls gained a larger advantage than boys in academic scores with the addition of five hours per week of physical education. Therefore, Carson et al. concluded that more time in physical education helps students perform better academically and should be promoted for its many benefits including eliminating the fear of it negatively affecting academic achievement.

Even though Carson et al. (2008) reported that girls who spent more time in physical education exhibited a small benefit academic benefit for mathematics and reading and no benefit was observed for boys, their findings supported those from previous studies. Essentially, Carson et al. confirmed that time spent in physical education did not harm academic achievement. The fear that spending more time in physical education may affect academics negatively may not be a legitimate reason for reducing or even eliminating physical education programs (Carson et al., 2008).

Dills, Morgan, and Rotthoff (2011) reported on using the same sample as Carson et al. (2008). When controlling for a variety of student, classroom, and school characteristics, neither recess nor physical education (PE) showed any statistically significant or economically significant impact on student learning (Dills et al., 2011). Dills et al. reported that increasing recess by an additional minute per week led to increases in the mean for reading. The largest effect reported was on reading in kindergarten, while other effects showed negative results. Adding one minute per week of PE increased the gain in math by one standard deviation (Dills et al., 2011). This finding supported Carson et al.'s (2008) findings, by showing that changing the time spent in recess and PE is unlikely to affect student test scores. Further, PE may represent productive time for learning as the students may be better able to concentrate due to their opportunities for physical activity (Dills et al., 2011).

Physical activity, an important component of everyday life, occurs in many forms during the early childhood years through jumping, running, and tumbling that seem to come naturally but are not performed at proficient levels (Goodway & Branta, 2003). During early childhood years, students learn mainly through movement and physical manipulation of objects (Piaget, 1964). Physical activity serves the purpose of stimulating physiological development, creating functional motor abilities, and organizing the brain for subsequent cognitive processing in the physical, social-emotional, and cognitive domains of learning (Bloom, 1956). In early childhood, physical activity stimulates growth by supporting normal bone and muscle development as well as cognition.

Goodway and Branta (2003) reported on the benefits of a Motor Skill Intervention (MSI) program with disadvantaged preschool students. The participants in the study included 31 four-year-old African American students enrolled in an urban preschool program. The control group included 28 African American 4-year-olds identified as disadvantaged or at-risk. The participants were screened with the Test of Gross Motor Development (TGMD, 1985), an objective preschool readiness test assessing cognitive, affective, and psychomotor objectives to determine the need for intervention services. The MSI group received 24 lessons during a 12-week period with each lesson lasting 45 minutes in length. The sessions were composed of a rotation of activities including hopping, galloping, jumping, ball bouncing, striking, kicking, catching, and throwing.

The control group received typical preschool day activities including free play, centers, circle time, directed play in centers, table work, and snack time. There were no organized physical activities for the control group, and free play and recess were left up to the control group teacher's discretion.

Goodway and Branta (2003) used two separate 2 x 2 analyses of variance (ANOVAs) with repeated measures to assess the influence of the motor skill intervention program on locomotor skills and object control development. They found no significant differences between the two groups prior to intervention. Locomotor skills were 15% for the MSI group and 26% for the control. Object control skills were 17% for the MSI group and 18% for the control group. Post intervention locomotor skills for the MSI group increased from 10.32 to 20.03, which translated into raw scores ranging from 15% to 80%. For the control group, the object control scores increased from 11.61 to 13.54, indicating the same raw score of 26% at both pre and post intervention measurements. The object control skill results in the MSI group improved from 3.07 to 12.77, with the raw score ranging from 17% to 80%. The control group improved from 3.14 to 7.29, with the raw score ranging from 18% to 24% (Goodway & Branta, 2003).

The control group demonstrated significant changes from the pretest to posttest, but the MSI group yielded significantly higher post intervention results than the control group (Goodway & Branta, 2003). Consequently, the MSI group increased in all skills with 10 of 12 skills improving by at least one criterion element of form. Goodway and Branta (2003) demonstrated that disadvantaged students benefit from 12 weeks of motor skill intervention. Based on their results, daily physical activity in the preschool years or early childhood is not performed at proficient levels, and intervention yields positive results for students' physical abilities.

Robinson and Goodway (2009) studied 117 African American preschoolers from two Head Start centers located in a large urban Midwestern city. One center was used for the intervention, and one center was used for the control group. The two 9-week instructional interventions involved 18 sessions with each lesson being 30 minutes in length and targeting preschoolers who were at-risk of developmental delays and in poor health. The intervention group was randomly assigned to a low autonomy intervention group (n = 38). The mastery motivational climate group (n = 39) was the control group. There were no significant age differences between the groups. All participants were videotaped performing the two trials of six skills composed of catch, dribble, kick, overhand throw, strike, and underhand roll. All skills were part of the Test of Gross Motor Development Second Edition (TGMD-2, 2000), a well validated criterion and norm referenced standardized test.

The comparison group received 30 minutes of unstructured free play that did not involve any teacher direction for 9 weeks (Robinson & Goodway, 2009). The unstructured free play totaled 18 sessions. The object control intervention occurred over the same 9 weeks, but these students experienced 18 motor skill sessions. The participants in the low autonomy group followed the guidance of the teacher. The participants received 12 minutes of instruction for two skills on each day of instruction. In total, the participants from both groups received a total of 432 minutes of instruction or free play. The mastery motivational climate group received identical instructional approach as the low autonomy group, with the exception that they navigated independently through the activity stations where they chose the amount of time they spent, the skill, and the difficulty of the activity. Posttest data were collected the week following the 9-week intervention, and retention tests were completed on the object control performance. Robinson and Goodway (2009) employed an ANOVA with repeated measures to examine the influence of the motor skill intervention on the low autonomy and mastery motivational climate groups. The ANOVA revealed significant main effects for the time, treatment, and treatment-by-time interactions. In regard to the treatment-by-time interaction, 73% of the pretest to retention changes in the students' scores were attributed to the skill instructional time. Before the start of the intervention, simple main-effects tests revealed no statistically significant differences for the groups. After the intervention and retention test, significant differences were found in the groups' TGMD-2 scores. Paired sample *t* tests from the pretest to retention test revealed significant improvements in the students' TGMD-2 scores for both the low autonomy and mastery motivational climate groups, but no differences were present from pretest to retention between the groups. Based on the literature (e.g., Goodway & Branta, 2003), the hypothesis was that both the low autonomy and mastery motivational climate instructional climates resulted in more proficient TGMD-2 scores compared to the participants in the comparision group. Robinson and Goodway (2009) revealed significant motor development gains regardless of instructional climate. Such gains, said Clark (2007), allow students to function fully and independently in their environments and contribute to students' cognitive, social, motor, and physical development.

Chomitz et al. (2009) found a relationship between physical fitness and academic achievement using a sample of diverse urban public school students. A total of 1,841 students in Grades 4 through 8 were assessed using the Massachusetts Comprehensive Assessment System (MCAS) achievement tests, as well as fitness and body mass index (BMI), during a one-year timeframe. To assess the association between the fitness and the MCAS test and to evaluate the strength of the association between fitness achievement and the odds of passing the math and English sections of the MCAS, Chomitz et al. used bivariate correlation, multivariate regression analysis, chi-square tests, and ANOVA. Measures used for the study were academic, fitness, weight, and socio demographic (i.e., race/ethnicity and SES). Sixty-five percent of the students were non-White, including 284 Hispanic and 784 African American students. Forty-five percent of the students were from low income households. Almost 40% of the students were either overweight or at-risk of being overweight. Statistically significant differences between groups were observed for gender ($p < .05$), ethnicity ($p < .05$), SES ($p < .001$), and weight status ($p < .001$). Overall, 72% passed the math test, and 89% passed the English test and 3.6 out of 5 of the fitness tests. These findings contributed to a growing body of evidence indicating a significant positive relationship between physical fitness and student academic achievement (Chomitz et al., 2009).

In the past, educators assessed the domains of learning as separate entities. Those domains are (a) cognitive representing mental skills, (b) affective representing feelings or emotions, and (c) psychomotor representing kinesthetic and spatial skills (Bloom, 1956). However, the three learning domains are intrinsically woven in such a way that one enhances the other. Childhood development can be positively enhanced via physical education when applying Bloom’s domains to students in elementary school grades. Even though the positive effect of physical activity on the cognitive, social, and physical development of young students is generally acknowledged, little emphasis on ensuring appropriate physical educational experiences with the early childhood curriculum has occurred nationally (Stork & Sanders, 2008). The following subsections address the curricula implications of physical educational experiences including

ExerLearning® (a registered trademark of invenTEAM, LLC), dance and learning, and Brain Gym® and learning.

ExerLearning®

Physical activity is not an option for humans. It is necessary for the brain to learn and function at its best. The wiring, the circulation, the connection between mind and body are very real. The brain contains one hundred billion neurons that communicate with one another through hundreds of different chemicals. Physical activity can enhance the availability and delivery of those chemicals. Harnessing technology for activity is the ExerLearning® solution (Staiano & Calvert, 2011).

ExerLearning® is a rhythmic and aerobic balance of activities added to the regular learning day (Staiano & Calvert, 2011). Hillman and Castelli (2009) determined that physical education classes, recess periods, and after school exercise programs provided students with academic benefits. Staiano and Calvert (2011) suggested that physical activity may increase students' cognitive control, that is, the ability to pay attention, and may result in better performance on academic achievement tests.

In Hillman and Castelli's (2009) study, the participants included 20 nine-year old students comprised of 8 girls and 12 boys. In the first part of the study, students performed a series of stimulus discrimination tests known as flanker tasks and a series of stimulus-discrimination tests for assessing their inhibitory control to resist doing one thing to do the needed activity at an appropriate time. The first group of students was tested following a 20-minute resting period over one day. The other group of students was tested after a 20-minute walk on a treadmill. While the students were walking on the treadmill, they were wore an electrode cap to measure their brain's electrical activity.

Results from that portion of the study demonstrated that the students performed better on the flanker task after an acute bout of walking for 20 minutes (Hillman & Castelli, 2009). The students were able to attend better, that is, able to block out distractions (noise) and act on appropriate stimulus even when the environment was noisy by essentially being able to tune out the noise. To see how exercise would translate to the classroom environment, the students took an academic achievement test that measured reading, spelling, and math. As before, Hillman and Castelli (2009) found better results following exercise. Interestingly, the largest effect found was for reading comprehension. Hillman and Castelli found that the increase in reading comprehension equated to almost a full grade level. The effect of exercise on achievement was not only statistically significant but also meaningful. However, since walking on a treadmill is not something that students really do and not a valid form of exercise for them, Hillman and Castelli (2009) worked on an ongoing project involving treadmill walking at the same intensity as a Wii Fit® exercise which more closely represents the way K-12 students really do exercise. Wii Fit® is a video exercise game so popular that as of the spring of 2009, 18.22 million copies of the game had been sold.

Hillman and Castelli (2009) suggested that daily school-wide assemblies contain a brief stint of physical activity. They suggested using an intranet or internal TV channels to broadcast activities to be completed within each classroom. Further suggestions included scheduling daily outdoor activities as well as offering formal physical education at the rate of 150 minutes per week at the elementary level and 225 minutes at the secondary level (Howe & Freedson, 2008). Lastly, Hillman and Castelli suggested that classroom teachers integrate physical activities into the learning. Based on the above evidence, ExerLearning® is beneficial for young K-12 students and likely so for older students. ExerLearning delivers, through the integration of technology, games, and movement-inducing fitness, learning opportunities for students in Grades K through 12 (Hillman & Castelli, 2009).

Ratey and Hagerman (2008) commented in *Spark* that the objective of Project Zero Hour was to generate innovative opportunities for students needing to improve their literacy skills. The idea was to determine whether working out before school offered performance boosts in reading ability and other subjects. Project Zero Hour was an educational experiment in a Chicago school conducted by physical education teachers producing not only the fittest but also some of the smartest kids in the nation (Ratey & Hagerman, 2008). Ratey and Hagerman believed in the notion supported by emerging research that physical activity sparks biological changes that bind brain cells to each other enabling the brain to learn. The more neuroscientists discover about the effects of physical activity on the brain, the clearer the role of exercise becomes. Stimulus concerning student readiness creates an environment by which students are ready, able, and willing to learn. Students in the experiment demonstrated a 17% higher rate of increase in reading and comprehension than their counterparts who were not involved in the experiment (Ratey & Hagerman, 2008). These findings suggested the need to consider the influence of specific movement types such as dance on learning.

Dance and Learning

Giguere (2006) showed a connection between the ways K-12 students think, reason, and problem solving in language arts and dance. Giguere suggested that the overlaps in cognition might be a good starting point for using dance in the design of elementary curricula. Giguere conducted an intervention study to test this hypothesis. The first part of the study included 100 fifth grade students who participated in a series of three dance classes with an even distribution of boys and girls. Each 45-minute class consisted of warm-up, stretching, and large locomotor movements through which the students learned the sequencing of the movements. Directions for the activities were open-ended so the students could form their own interpretations in a variety of ways. The final section of the class consisted of group choreography based on a poem. Three different poems were used that progressed from literal to abstract over the three day study.

The second part of the study consisted of interviews of the students (Giguere, 2006). Parental permissions were obtained in accordance with the Institutional Review Board guidelines. The interviews were conducted with two groups of students and consisted of two parts that were focused on the students' experiences with creating poetry and dance movements. The student-interview conversations were graphically organized into maps. Giguere (2006) concluded that the choreographic process had a critical role in the scholastic benefits of dance. She suggested that 21st century dance can reunite body and mind and encouraged dance researchers and educators consider not only the body's role in learning but also the mind's role in motion.

Skoning (2008) included the benefits of using creative movement and dance in the classroom as teaching tools. These tools are geared to produce increased student understanding of content along with classroom behavior. By integrating movement and dance in the classroom, teachers can meet the needs of a variety of learning types, especially the students who have kinesthetic learning styles (Skoning, 2008). Skoning integrated creative movement with literature instruction for 27 students, nine of whom had learning and cognitive disabilities. The students showed increased comprehension of characters, plots, and overall story lines of the novels they read. Skoning suggested that educators "need to push [them]selves to think of creative ways to meet state and national learning standards and the many ways that children demonstrate their intelligence and understanding" (p. 9). Brown and Parsons (2008) echoed this research by showing that brain function while learning to dance demonstrates that both hemispheres of the brain are actively engaged.

Brain Gym® and Learning

Current philosophy about teaching students to read includes applying research establishing the relationship between the mind and body and the importance of movement in learning (Bobo, 2009; Brown & Parsons, 2008; Cain et al., 2008; Chomitz et al., 2009; Pennington, 2010). However, few examples of movement-based activities surfaced to show its application to reading in the elementary school setting. Despite the growing popularity of brain-based research, much of the evidence for brain development has not been used for educational measures (Fischer, 2009). One contemporary approach to the use of movement for brain activation engages kinesthetic stimuli and activities in promoting reading skill building in students. Kinesthetic movements applied via the Brain Gym® program represent this approach (Dennison & Dennison, 2007).

Brain Gym® is a program with unique movements and processes that was developed by Dennison and Dennison (1994). This program began through extensive study in education, psychology, and neuroscience. Brain Gym® is a holistic approach that promotes whole brain learning through movement (Dennison & Dennison, 2007; Hannaford, 2005). Brain Gym® bridges the gap between mind and body, through the use of simple movements to stimulate brain function necessary for learning (Dennison &

Dennison, 1994, 2007; Hannaford, 2005). This program is based on the idea that learning problems are caused when different sections of the brain and body do not work together in a coordinated manner. This lack of connection blocks the ability to learn. In an effort to overcome this learning block, this program uses a variety of simple movements intended to improve the integration of specific brain functions and body movements (Dennison & Dennison, 1994, 2007).

Brain Gym® is a process of re-educating the mind and body (Dennison & Dennison, 1994, 2007). Stress, which is encountered daily, inhibits these connections (Dennison & Dennison, 1994). Movement improves K-12 student performance and attitudes about the learning process (Dennison & Dennison, 2007). Students gain efficient connections across the neural pathways located throughout the brain (Dennison & Dennison, 1994). With success, learning is easier and more efficient. Therefore, Brain Gym® movements stimulate the flow of information along these networks, restoring the child's innate ability to learn and function with curiosity and joy (Brain Gym International, 2011).

Dennison and Dennison (2007) describe human brain function in terms of three dimensions: *laterality*, *focus*, and *centering*. First, the laterality dimension pertains to the coordination between the left and right sides of the brain, especially in the midfield where the brain's two sides must integrate. Laterality dimension development is necessary for reading, writing, listening, speaking, and the ability to move and think (Dennison & Dennison, 1994, 2007). Second, the focus dimension involves the ability to coordinate between the back and front areas of the brain (Dennison & Dennison, 1994, 2007). Focus affects comprehension, or the ability to blend context and details into a full personal meaning and to understand new information in terms of previous experiences. Such disorders as attention deficit disorder and attention deficit hyperactivity disorder have been related to the inability to focus (U.S. Department of Education, 2003).

The final dimension of centering is the coordination between the top and bottom structures of the brain. Centering enables integrating emotion with rational thought. Stress, again, can disturb centering and equilibrium (Dennison & Dennison, 1994, 2007). Brain Gym® can help mitigate the deleterious effects of general and developmental stress and can be used to build the neuronal pathways to improve access to each of the two hemispheres of the brain. With centering, students feel more grounded and organized (Dennison & Dennison, 1994, 2007).

Brain Gym® is a movement-based educational experience. Its curriculum consists of a series of movements, processes, programs, materials, and educational philosophy purposefully used to activate the brain while promoting neurological re-patterning and facilitating whole-brain learning (Dennison & Dennison, 1994, 2007). Brain Gym® uses 26 simple activities representing naturally occurring movements, usually observed during the first years of childhood as part of learning to coordinate eyes, ears, hands, and whole bodies (Dennison & Dennison, 2007).

Five Brain Gym® movements can be used for the specific function of maximizing student readiness for learning. The movements include the *cross crawl*, *lazy 8s*, the *thinking cap*, the *owl*, and *hook-ups*. The cross crawl and the lazy 8s are midline movements that support the cross-motor patterns that develop binocular vision, binaural hearing, and two-handed coordination in the midfield where thoughts and movements are organized to perform academic skills, such as reading, writing, spelling, and arithmetic.

The thinking cap is an energy exercise that helps to reestablish the neural pathways between the brain and the rest of the body. Hook-ups is part of the deepening attitudes movements that activate the vestibular system as well as the neocortex and prefrontal cortex. Deepening attitudes movements are designed to return energy to the center of the body and restore electrical energy within the reasoning centers. The owl is one component of the lengthening activities. Lengthening activities give the brain information about where the human body is within space and about how the body moves through space. This type of movement releases tension and promotes a sense of readiness to participate in the activities of the present situation or environment (Dennison & Dennison, 2007).

Brain Gym® has been endorsed by the education department of the United Kingdom (UK). It is used in private schools throughout the US. The program has been used in 80 countries around the globe, and the books and training manuals have been translated into 40 languages (Dennison & Dennison, 2007; Hannaford, 2005).

Brain Gym® Studies

Numerous articles have been written concerning the use of the Brain Gym® program (Carpenter, 2005; Dodson, 2006; Peterson, 2005). Brain Gym International (2011) reported that a wide range of skills which include reading, writing, spelling, mathematics, attention, memory, and fine motor and postural skills have been measured in pilot studies of the curriculum. Although most of the published studies are only published in the official Brain Gym® Journal, a few were published as doctoral papers and delineate both the positive and negative effects of Brain Gym® on reading (Hyatt, 2007; Myhra, 2009; Nussabaum, 2010; Walker, 2008).

Through the incorporation of Brain Gym® and Project SOL (Save Our Learners), many teachers in various districts have seen benefits in Texas schools. Carpenter (2005) indicated that the students who had participated in Brain Gym® demonstrated improved reading scores on the Texas Proficiency Reading Inventory (TPRI) from the 2004-2005 school year over those who did not experience the program. English as a second language (ESL) learners made such significant gains that they were able to exit the ESL program (Carpenter, 2005). Other notable results using Brain Gym® include the reduction of office referrals in pre-K classrooms, which went from 19 per month to zero (Carpenter, 2005). Special education students who used Brain Gym® daily made at least one year of progress toward reaching grade level performance (Carpenter, 2005). Finally, two elementary school teachers had been using Brain Gym® and decided to use it with high school students who were failing (Carpenter, 2005). After only three weeks of using the exercises, students went from failing to passing and were able to pass the state standards test. Some students reported that they were able to achieve AB honor roll status (Carpenter, 2005). No statistical results were presented. Only qualitative findings were reported.

Peterson (2005) indicated that the reading test results of students involved in a Brain Gym® program from both the 2001-2002 and the 2002-2003 school years improved. Students mentored by senior citizens showed significant improvement in reading skills. The study included 51 students in Grades K through 5 who were paired with senior citizen mentors trained to facilitate the Brain Gym® exercises. The students and mentors met regularly to work not only on the exercises but also on their relationships. The measures used to determine pre and post interventions for reading included behavior problems, self-esteem, and reports taken from parents, teachers, and the students themselves. The effects of the intervention showed the students passed the reading tests at grade level (Peterson, 2005).

Dodson (2006) used 30 Grade 4 inclusion classroom students to determine the effects of Brain Gym®. Fifteen of the students were labeled exceptional educational students. Of the remaining 15 students, six were in the high average learning range meaning that they were the lowest of the high performing students. The last nine students were in the class due to being labeled as high at-risk status. The Gates-MacGinitie Reading Test was administered as a pretest-posttest measure for all of the students. The reading pretest results were reported in August to range from reading levels at Grade 1.9 to 6.8. After using the Brain Gym® exercises, the April reading posttest results resulted in an increase in the posttest reading levels from Grade 2.4 to 10.5 (Dodson, 2006). Dodson (2006) reported that the students' scores increased, and that most of the students developed a love for reading.

Walker (2008) conducted a quantitative quasi-experimental nonequivalent control group design study and examined the oral reading fluency and numeracy scores of third grade students who participated in a classroom-based movement program. The purpose was to determine any relationship between oral reading fluency and numeracy scores and the five kinesthetic movements. One group of students received 10 days of guided movement activities for 15 minutes each school day, while the control group received regular classroom instruction each school day. Brain Gym® movements were combined with play activities. A pretest and posttest were used to measure the third graders' oral reading fluency and numeracy scores (Walker, 2008). Walker found that the movement program intervention had a statistically significant positive effect on student achievement in literacy and numeracy.

Myhra (2009) determined the effect a sensory integration program had on the academic performance of preschool students identified for receiving special education services. Ten students ranging from 3 to 5 years old participated in the study. Findings from the study revealed that participation in Stimulating Maturity through Accelerated Readiness Training and Brain Gym® activities had a positive effect on the students' fine motor manipulation and writing, cognitive matching and counting, language naming and comprehension, and gross motor object and body movements.

Hyatt (2007) reviewed the theoretical bases and research findings upon which Dennison and Dennison (1994, 2007) claimed that movement activities enhance learning. Hyatt also questioned the validity of the Brain Gym® activities being founded on scientific research based practices. Hyatt commented that Dennison and Dennison failed to support the Brain Gym® crawling, drawing, tracing symbols in the air, yawning, and drinking water activities with research. Hyatt further suggested that none of the Brain Gym® movements that supposedly facilitate academic learning actually include the academic piece of instruction. Rather, Hyatt argued that the purpose of the Brain Gym® movements was to get the child ready to learn.

Hyatt (2007) added that none of the movements included an assessment to determine which of the three dimensions of the brain mentioned earlier require attention and which movements would be more appropriate for which corresponding dimension. Regarding neurological re-patterning, Hyatt remarked that a major foundational assumption of Brain Gym® is based on a theory of repatterning that has been disproven by numerous sources. Furthermore, to date, the idea of neural re-patterning has not met the rigors of scientific research (Hyatt, 2007).

Hyatt (2007) criticized the flaws in the teacher's edition of Brain Gym®. Hyatt reviewed the published studies regarding Brain Gym® and found that only a few were actually peer reviewed with the rest appearing only in the *Brain Gym Journal*. Hyatt concluded that educators and educational training institutes must avoid using practices and programs (such as Brain Gym®) with no substantive theoretical research base with students in the hope of improving a learning problem. Hyatt challenged educators to take the time to critically review instructional programs, in this case Brain Gym®, and select only programs with sound, objective research support.

Response to Intervention (RTI)

RTI, under the umbrella of the IDEIA, requires scientifically based interventions be used to target students' areas of specific need when those areas become apparent. The IDEIA (2004) encouraged states to use a process based on students' responses to research-based interventions to determine if the students had specific learning disabilities and to provide additional supports. RTI is a coordinated comprehensive multi-tier early detection, prevention, and intervention system (U.S. Department of Education, 2007). RTI enables educators to identify students as at-risk and ensures the reduction of inappropriate referrals to special education for low income minority students experiencing inadequate classroom instruction.

The multi-tiered RTI model has three levels of support: (a) class-wide group instruction in their general education setting for Tier I, (b) targeted or remedial intervention for Tier II, and (c) intensive individual interventions for Tier III. Tier I is the primary intervention level and can be used with all students. Highly qualified scientific research-based instruction is used in the general education setting as part of Tier I. Tier

II is the secondary intervention given to students through specialized small group instruction. Tier II identified students tend to be at-risk for academic and behavorial problems. Tier III is the most intensive level of intervention and includes specialized individualized instruction and targeted behavioral supports for students with intensive needs (U.S. Department of Education, 2007). The RTI process has been integrated into school improvement plans throughout the United States and Canada. RTI promotes efforts to improve all students' academic achievement (Shores, 2009). All RTI models include progress monitoring as a critical component to pinpoint students' specific areas of difficulty while keeping close track of students' progress and documenting that underachievement has not resulted from lack of appropriate instruction.

Nussabaum (2010) evaluated the Dennison and Dennison's (1994) Brain Gym® movements for RTI Tier I uses with at-risk students' academic performance measured by TAKS Reading, TAKS Math, and BASC-II. A total of 364 East Texas students from second through sixth grade participated in the study. Results from the study indicated the students displayed statistically significant gains in reading and math after receiving Brain Gym® as a Tier I RTI academic intervention. Similarly, students who received Brain Gym® as a general education classroom management strategy demonstrated statistically significant improvements away from maladaptive behaviors including aggression, hyperactivity, inattention, depression, and anxiety (Nussabaum, 2010).

While there are many RTI models, states may select the RTI model deemed most appropriate to the characteristics of the particular state. Once a state agency has adopted criteria for determining eligibility for a learning disability, the local education agencies must use the state adopted criteria (U.S. Department of Education, 2007). For the purpose of this research, the state of Texas RTI model for the participating district was used to target the students for participation and to ensure they experienced reading underachievement.

Summary

As shown in Chapter 2, movement and exercise can help students attain improved academic achievement in various content areas. Brain-based education priniciples influence the use of kinesthetic movements outlined in the Brain Gym® program. Brain-based movements can enhance cognitive skills and improve academic learning as well as provide a foundation for an active lifestyle. By incorporating mind, body, and brain-based education through movements student reading achievement can be improved (Dennison & Dennison, 2007) and might lead to increasing the reading achievement of Hispanic and African American third grade students. Chapter 3 provides the methodology and procedures for conducting this quasi-experimental study.

CHAPTER 3

METHODOLOGY

This chapter conveys information about participants, variables, measurement instruments, research assistants (RAs), data collection procedures, and data analysis. It also addresses the qualifications of the three research assistants and me. The chapter ends with a summary.

Hispanic and African American students lag behind their White counterparts in literacy achievement gap (Aud et al., 2011; National Association for the Education of Young Children, 2011). Literacy is the key to academic success. Though making strides, Hispanic and African American students perform below their White counterparts (Aud et al., 2011; National Assessment of Educational Progress [NAEP], 2009; Snyder & Dillow, 2011; TEA, 2009, 2010). This study was designed to determine if using a series of kinesthetic movements would improve reading achievement for Grade 3 Hispanic and African American students. The research design was a quasi-experimental pretest-posttest comparison group design (Gall, Gall, & Borg, 2006). To achieve the study's purpose, I investigated the effects of kinesthetic movements with the following research questions.

1. To what extent, if any, do kinesthetic movements increase the reading achievement of low socioeconomic status (SES) Hispanic and African American third grade students?
2. To what extent, if any, do kinesthetic movements increase the reading achievement of low SES Hispanic third grade students?
3. To what extent, if any, do kinesthetic movements increase the reading achievement of low SES African-American third grade students?

4. To what extent, if any, do kinesthetic movements increase the reading achievement of low SES male third grade students?
5. To what extent, if any, do kinesthetic movements increase the reading achievement of low SES female third grade students?

Participants

This research project focused on Grade 3 students from four elementary schools receiving Title I funding in an urban school district in North Texas. The sample was selected based the criteria of SES and eligibility for receiving free or reduced-price lunch. All four schools had similar student populations.

The district is comprised of 63,385 students of which 25,112 (40%) were Hispanic, 15,207 (24%) African American, 18,216 (29%) White, 4,596 (7%), Asian/Pacific Islander, and 254 (.4%) Native American. Of the total student population for the district, 37,900 (60%) were economically disadvantaged and eligible for free or reduced-price lunch, and 14,742 (23%) were considered limited English proficient (LEP). For this study, only Hispanic and African American third grade students were included.

Grade 3 participants assigned to the treatment and control groups were selected based on placement in Tier I or Tier II of response to intervention (RTI). No Tier III third grade students were included in the study, as they received intense one-on-one intervention. The participants in the study from the four schools originally totaled 76. Nine students represented attrition from the study with seven withdrawing from school before the study ended and with two being absent on the posttest date. The final sample included 67 participants. The participants included Hispanic (n = 48) and

African American (n = 19) students identified as low performing and at-risk of failure through the RTI process. These students also received Tier I or Tier II interventions. The four schools participating in the study were denoted as S1, S2, S3, and S4. Table 1 provides the participant frequencies by ethnicity and gender.

Table 1

S1, S2, S3, and S4 Student Demographics

School	Hispanic	African American	Male	Female
S1	10	6	8	8
S2	12	7	10	9
S3	14	2	12	4
S4	12	4	13	3

S1 had the largest population of students at 1,023, with Hispanics representing 73%, African American 22%, and White and other ethnicities 5%. Grade 3 students at S1 numbered 99, of which 63% of the African American students met the 2010 TAKS reading standard, and 69% of the Hispanic students met the standard. Sixty-nine percent of the third grade students were LEP. Third grade S1 participants included 10 Hispanic students (5 males and 5 females) and 6 African American participants (3 males and 3 females).

S2's total population was 981 students, of which 19% were African American, Hispanic 68%, and White and other ethnicities 13%. The Grade 3 students at S2 totaled 124, of which 56% were African American. Of the 124 students, 85% were LEP.

Third grade S2 participants included 12 Hispanic students (7 males and 5 females) and 7 African American participants (3 males and 4 females).

S3's total population was 865 students, of which 8% were African American, 85% were Hispanic, and 7% were White and other ethnicities. All Grade 3 students at S3 totaled 109; 60% were African Americans who met the reading standard; and 73% of Hispanic students met the reading standard. Additionally, 68% of the third grade students were LEP. Third grade S3 participants included 14 Hispanic participants (10 males and 4 females), 2 African American male participants, and no African American female participants.

S4's total student population was 806 students, of which 12% were African American, 78% were Hispanic, and 10% were White and other. The Grade 3 students at S4 totaled 108; of the total, 60% of the African American students met the reading standard with 77% of the Hispanic students meeting the reading standard. Additionally, 81% of the third grade students were LEP. Third grade S4 participants included 12 Hispanic students (9 males and 3 females), 4 African American male participants, and no African American female participants. All the students whether in the experimental group or control group, due to the nature of their placement in RTI, participated in additional small group instruction as part of their regular school day instruction and not as part of the study.

Experimental Group

Students eligible for participation met the criteria of being in third grade, at-risk, Hispanic or African American, of low SES, and RTI-identified for either a Tier I or Tier II level intervention. Participation was contingent on parental consent for each student.

Upon the receipt of parental consent forms from the eligible students, the two groups were formed.

The research assistants and I administered a 30-day, five minutes per day series of specifically targeted movements to the students of the experimental group. At the time of the intervention, I held a Master's degree as do all of the RAs. One RA holds an earned doctorate. See Table 2 for this information.

Table 2

Research Assistants' Demographics

RA	Gender	Ethnicity	Content Area	Years of Experience	Education	Student *n*
A	Female	White	Reading	18	M.Ed., Reading Ed.D., Curriculum/ Instruction-Supervision	16
B	Female	Hispanic	Reading	15	M.Ed., Early Childhood	19
C	Female	Hispanic	Reading	13	M.Ed., Reading	16
D	Female	White	Reading	27	Masters (unknown)	16

To qualify to teach Brain Gym® movements, I completed a 24-hour course in Brain Gym® 101 taught by a certified Educational Kinesiology Foundation Brain Gym® instructor. I provided the three research assistants one extensive four-hour training session about the movements and the specifics of each movement prior to the onset of the study. During this training, they practiced every aspect of the kinesthetic movement intervention and the test administration. The RAs were given the specific times and places during which the interventions were to take place and were provided with copies of the pretests and posttests. The intervention was conducted at each of the four respective schools in a standardized format. The selection of the school gym ensured that the experimental group received the intervention away from the control group and reduced the number of external validity errors influencing the study (Gall et al., 2006).

Control Group

The control group students did not receive the Brain Gym® movement intervention but instead received the regular reading instruction by the general education teacher. The control group was administered both the pretest and posttest.

Independent Variables

The students' demographic variables were ethnicity, SES, and gender, and they were selected from schools identified as the most eligible by the TEA Academic Excellence Indicator System (AEIS; TEA, 2009). Kinesthetic Brain Gym® movements were the only intervention used. Those movements were the cross crawl, the lazy 8s, the thinking cap, the hook up, and the owl. These movements were performed in sequential order. The movements are discussed below.

The cross crawl movement crosses the midline of the body as the participant alternately moves one arm and the opposite leg then the other arm and the opposite leg in slow movements. By touching the right elbow to the left knee the large areas of both brain hemispheres are activated simultaneously, which facilitates balance nerve activation across the corpus callosum. This activity makes communication between the two hemispheres faster and more integrated, thus producing high-level thinking. When this movement is done slowly, it requires fine motor involvement and balance which allows the student to activate the vestibular system and the frontal lobes of the brain consciously. This slow movement lasts for the duration of one minute followed by the next movement, lazy 8s.

Lazy 8s involves holding one thumb at eye level and drawing a large 8 lying on its side in the air in front of the face in midfield while moving counterclockwise up and over and around and completing the 8 by moving the thumb clockwise on the right side. This activity is done three times. Then, the student switches hands and moves that thumb in the same pattern three times. Finally, the student holds both thumbs close together and follows the pattern three more times. Lazy 8s establish the necessary rhythm and flow for good hand-eye coordination. The three sections of this slow movement are done three times each and last for one minute.

The thinking cap is done while gently “unrolling” the ears, several times from top to bottom. The thinking cap movement is designed to wake up the whole system of hearing mechanisms and assists with memory. The simple act of physically stimulating the tactile receptors in the outer ear activates the ear. This movement is done very slowly for the total time of one minute and is followed by the hook-up.

The hook-up is done while the participant crosses his or her ankles. Next, arms are extended in front of the body while crossing one wrist (on the same side as the top ankle) over the other, and the movements are completed by interlacing the fingers and drawing the clasped hands up and toward the chest. The participant holds this position for one minute while breathing slowly with eyes closed and the tip of the tongue on the roof of the mouth. This movement is followed by the owl.

The owl requires the student to grasp the top of one shoulder with the opposite hand and squeeze the muscle firmly. Slowly, the student turns his or her head to look back over that shoulder and opens the chest. The student continues to squeeze the muscle while turning his or her head to look over the other shoulder, making a “hooting” noise while opening the chest again. The student then hoots again while dropping the chin to the chest and allowing the muscles to relax. The owl is done with the same hand positioning three or more times for a total of 30 seconds and is repeated with the other hand squeezing the opposite shoulder and doing the same steps mentioned for a total of 30 more seconds (Dennison & Dennison, 2007).

The total time to do the five mentioned movements with the experimental group was five minutes per day and resulted in a total intervention time of 150 minutes during the 30-day timeframe for the study. At the end of the daily intervention time, the students were returned to their respective classrooms to receive daily instruction by the classroom teacher. The control group did not receive any of the Brain Gym® movements.

Dependent Variable

Reading raw scores for each participant in the experimental and control groups were pretest and posttest for the released Texas Assessment of Knowledge and Skills (TAKS) English and Spanish versions (TEA, 2004; see Appendices F and G for excerpts). The TAKS test year of 2004 was chosen because the same reading passages were available in both English and Spanish. The 2004 TAKS test represented the last year in which the test was translated using parallel passages. The TAKS was designed to measure the extent to which students learned and could apply the defined knowledge and skills at each tested grade level in accordance to the state's curriculum requirements (TEA, 2011). TAKS reading test performance standards were established according to the Texas Essential Knowledge and Skills (TEKS). The test development process included educator input to develop items thought to be appropriate and valid measures of the objectives, regular educator review, revisions to all the proposed test items before field testing, and second educator review of data and items after field testing.

The TAKS was used to assess students in four reading categories. The first category is basic understanding with a total of 15 questions that tests subsets of reading through word identification, reading in a variety of texts, reading vocabulary development, and reading comprehension. The second category is applying knowledge of literary elements with a total of seven questions to test subsets of reading text structures and literary concepts. The third category is using strategies to analyze with six total questions with subsets of reading comprehension, text structures, and literary concepts. The fourth category is applying critical thinking skills with a total of eight questions and subsets of reading comprehension and literary response. The test contains 36 questions to assess four objectives that correlate with the standards for the state of Texas. A raw score of 23 out of 36 indicates that the student meets the standard established through the state's TEKS. The raw scores from the released TAKS 2004 version were used as the measure of student reading performance.

Data Collection Procedure

Prior to the commencement of the study, letters were sent to the principals of the four participating schools requesting their consent and participation. Upon receiving approval from the school district and the cooperating schools, I arranged a schedule for data collection in each of the participation sites. After receiving permission to conduct the study, the three RAs (described in the previous section) were contacted at their respective elementary schools. The assistants were trained (as described previously) to deliver instruction with the Brain Gym® movements program to the treatment group.

After the informed consents were collected, each participant was assigned an identification number to ensure confidentiality. The participants' identifying numbers were placed in one container, pulled one at a time, and placed in the experimental group to insure random selection. The participants selected by random drawing were placed into the experimental group, and the remaining students were assigned to the control group.

After the sample was assigned to each of the two groups using the identification numbers, a t-chart was made with column headings labeled Control Group and Experimental Group. Each respective RA took even numbers of strips alternating between the two labeled columns until all had been used up. They opened the strips of paper and wrote down the student numbers corresponding to each group. Data collection occurred in three phases: Phase I (pre-assessment), Phase II (intervention), Phase III (post-assessment).

Phase I: Pre-assessment

Students' reading scores from the previous year were gathered. The third grade RTI documentation from the universal screener identified the students as being in Tier I or Tier II. Therefore, existing school documentation and data from AEIS report allowed for generating the student participants. Prior to administering the pretest, permission to conduct the study was obtained from the four participating school principals (see Appendix A).

The administration of the TAKS reading test for all the participants in the study was done in two sittings. The students were administered the pretest by their corresponding RAs. The students were given as much time as they needed to complete the test in a similar fashion as they would take the test under actual TAKS test conditions. After the pretest administration, the RAs placed them in a sealed envelope, and returned them to me for scoring and analysis. Identical testing and test processing procedures were used for the posttest. Actual test taking times were not used for measurement.

Phase II: Intervention

The RAs and I conducted a 30-day series of movements with the treatment group students daily for five minutes each school day. The five-minute sessions consisted of the five Brain Gym® (or kinesthetic) movements described earlier and were conducted by pulling out the experimental group of students at the beginning of the school day and engaging them in the Brain Gym® movements in their respective school gymnasiums. Each of the four schools had a different amount of students for the Brain Gym® movement pull-out sessions. The intervention did not interfere with regular daily content instruction, as specified by participating principals.

Participants received the intervention at a pull-out session at the beginning of the school day after morning announcements were made at each of the four schools. The intervention was administered from 8:20 a.m. to 8:30 a.m. The period allowed the intervention to take place and travel time between the classroom and the school gym. Each intervention session lasted approximately five minutes and totaled 150 minutes of intervention over the 30-day intervention period. Each of the five movements was performed for about one minute at the pull-out sessions.

During the daily five-minute sessions, the RAs and I observed students' practice of the Brain Gym® movements and corrected any deviations from the Brain Gym® movement protocol until the movements were mastered (Dennison & Dennison, 1994). There is no set standard in the research protocol that determines the number, combination, duration, or frequency of the kinesthetic movements necessary when used for research purposes (Dennison & Dennison, 1994). Dennison and Dennison (2004) reported that researchers would be free to determine the number and frequency of Brain Gym® movements to use. However, Dennison and Dennison specified how each movement might enhance individual ability. Researchers were also free to select the Brain Gym® movement that seemed most useful for research purposes. For this study, participating principals were concerned that instructional time would be compromised, which became the determining factor for restricting the movements to five minutes daily.

Phase III: Post-assessment

Upon the completion of the 30-day intervention, the RAs and I administered the posttest assessment to the experimental and control groups. The entire TAKS reading test was used in both the pretest and the posttest assessment. (See Appendices F and G for excerpts.) The types of questions following each passage were comprehensive in nature.

Data Analysis

A series of mixed between-within subjects analysis of variance (ANOVA) tests were used to control for the problem of obtaining different pretest scores (Pallant, 2007). The pretest-posttest design required awareness of pre-existing differences between the experimental and control groups, particularly in the case of each student having an equal chance of being randomly selected for the treatment group (Castillo, 2009). In the mixed between-within subjects ANOVA, the change from pretest to posttest within the control group and the change from pretest to posttest within the treatment group (analyzed via the time by condition effect) were compared to each other. Because of the intervention, I controlled for students' SES and ethnicity conditions between groups.

The chi-square (χ^2) procedure was used to analyze the distributions of the independent variables (gender, ethnicity, SES, program, school, and condition) before conducting the statistical tests regarding the research questions. The mixed between-within subjects ANOVA was used to determine differences between students' pre-posttest scores (Pallant, 2007). To determine statistical significance, the *apriori* α value has to be less than .05.

Assumption Check for Normality

I evaluated the normality of the dependent variable (TAKS reading scores) using the histogram, skewness statistic, and kurtosis statistic. The dependent variable of the raw TAKS reading score was assessed for normality based on the rule of thumb by Hair, Tatum, and Anderson (2009) in which the normality of an interval variable is evaluated based on the standardized *z* scores for skewness and kurtosis and could be expressed in the formulas of $Z_{skewness} = \frac{Skewness}{\sqrt{\frac{6}{N}}}$ and $Z_{kurtosis} = \frac{Kurtosis}{\sqrt{\frac{24}{N}}}$ in which *N* is the sample size. If the calculated $Z_{skewness}$ and $Z_{kurtosis}$ were in the range of ±1.96, the data were normally distributed at the .05 level, or if the calculated $Z_{skewness}$ and $Z_{kurtosis}$ were in the range of ±2.58, the data were normally distributed at the .01 level. As the sample size in the present study was relatively small, I used the less liberal ±2.58 criterion.

Summary

I addressed the effects of kinesthetic movement intervention as a possible intervention for increasing Hispanic and African American third grade students' reading achievement. The dependent variable was represented through the students' scores on the TAKS reading pretest and posttest. The 2 x 2 mixed between-within subjects ANOVAs were used to determine differences between students' pretest and posttest reading achievement scores. The intervention for this study consisted of a 30-day series of kinesthetic (Brain Gym®) movements conducted for five minutes a school day in a slow and deliberate manner with a treatment group of Grade 3 students. Students (n = 67) in four public elementary schools from a large urban, Texas independent school district participated in the 30-day quasi-experimental study. Four highly trained interventionists helped implement the daily intervention.

CHAPTER 4

RESULTS

The purpose of the quasi-experimental study was to determine if using a series of kinesthetic movements improves the reading achievement of Grade 3 Hispanic and African American students. I derived the dependent variable data for each participant in the experimental and control groups from pretest and posttest raw scores for the released version of the 2004 Texas Assessment of Knowledge and Skills (TAKS) English and Spanish reading (TEA, 2004). I chose the 2004 TAKS reading test because the same reading passages were available in both English and Spanish. The 2004 TAKS test represented the last year in which the test was translated using parallel passages. To obtain statistical significance for any test used for analyzing the data, the *apriori* α value required the obtained *p* value to be smaller than .05. This chapter addresses the descriptive analysis, preliminary screening procedures, descriptive statistics, and the research question results.

Preliminary Screening Procedures

All of the participants in the study were third grade students from low socioeconomic status (SES) meaning they either received free or reduced lunch at school. The students' demographic variables were ethnicity (African American and Hispanic), SES, and gender (male and female).

Missing Value Patterns

Initially, 76 participants were recruited to participate in the study. Two participants moved, four withdrew, two missed the pretest, and one missed the posttest. The attrition resulted in 67 participants.

The cross tabulation with chi-square (χ^2) procedures was used to determine whether the nonparticipating students and participants with missing data were significantly different from the participants with complete data. Table 3 reveals that nonparticipating students and participants with missing data were not significantly different in terms of gender, ethnicity, SES, program, school, and experimental versus control group status (a.k.a., condition). Therefore, the groups were treated as equivalent.

Table 3

Pearson χ^2 Results for the Cross Tabulations Comparing Between Incomplete and Complete Participant Data (n = 76)

Variable	χ^2	*df*	*p*
Gender	1.98	1	.159
Ethnicity	1.65	1	.199
SES	1.93	1	.165
Program	2.28	2	.319
School	5.21	3	.157
Condition	2.48	1	.115

Checking for Univariate Normality

According to Kline (2005), skew indices (i.e., skewness statistic with standard error [SE]) above 2.58 indicate non-normality. (For detailed explanation, see data analysis section of Chapter 3.) Kurtosis indices (i.e., kurtosis statistic with SE) between 10 and 20 also indicate non-normality. As seen in Table 4, none of the variables were remarkably skewed, and none showed high kurtosis indices.

Table 4

Skewness and Kurtosis Statistics for the Dependent Variables (n *= 67)*

Variable	Skewness	Kurtosis
Pretest Score	.80	.08
Posttest Score	.39	-.58

Note. *SE* for skewness statistic = .29. *SE* for kurtosis statistic = .58.

Univariate normality was confirmed by visually inspecting the histograms. Additionally, no evidence of outliers in the distribution of scores was observed when reviewing the histograms. I judged both the pretest and posttest distributions to be normal. Figures 1 and 2 depict the distributions for the pretest and posttest scores.

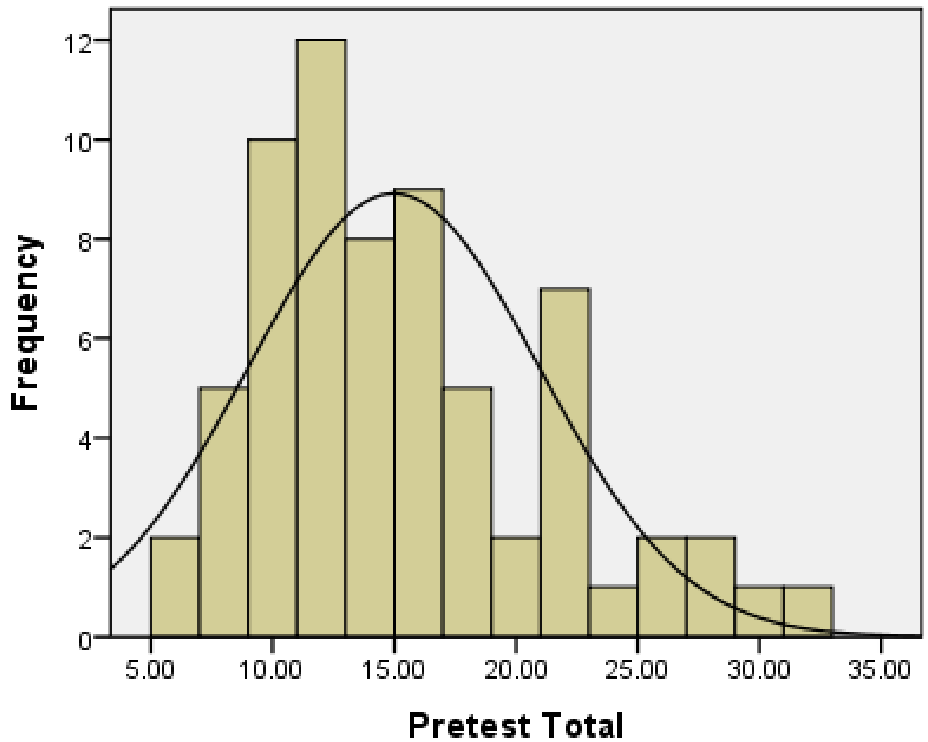

Figure 1. Score distribution for pretest total score.

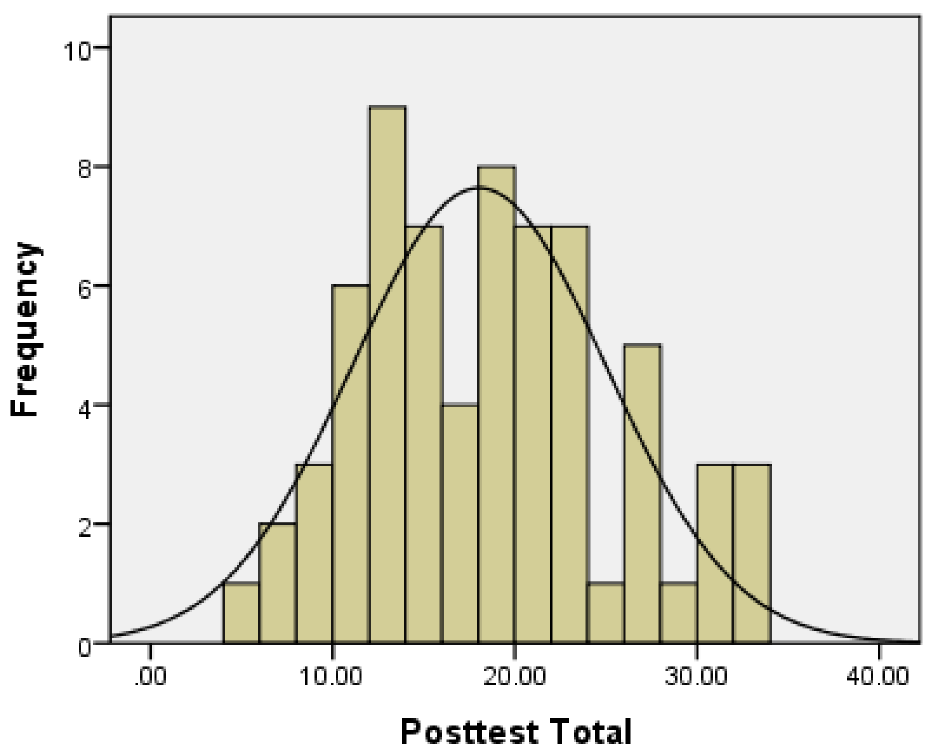

Figure 2. Score distribution for posttest total score.

Descriptive Statistics

All variables included in the data were described with frequency of occurrence and measures of central tendency and dispersion (mean and standard deviation) as appropriate for the variable. The demographic variables are presented first and followed by the descriptive statistics for the dependent variable.

Demographic Variables

The demographic variables included the four schools (S1, S2, S3, and S4) and the participating students' characteristics.

Schools. As shown in Table 5, a slightly greater percentage of the control group participants were from S2. A slightly smaller percentage of the control participants were from S4. The percentage of participants in the experimental group was similar across schools.

Table 5

*Frequencies of Control and Experimental Group Participation by School (*n *= 67)*

	Control (*n* = 31)		Experimental (*n* = 36)	
School	*n*	%	*n*	%
S1	8	25.8	8	22.2
S2	10	32.3	9	25.0
S3	7	22.6	9	25.0
S4	6	19.4	10	27.8

Students. The frequencies and percentages for the demographic variables within gender are displayed in Table 6. More females (65.2%) than males participated. There were more Hispanic females (70.8%) and males (72.1%) than African American males and females. In addition, more males were in the ESL program (44.2%) than in the bilingual (27.9%) and regular (27.9%) programs. More females were in the regular program (29.2%) than in the bilingual (20.0%) and ESL (20.8%) programs. More males (74.4%) than females (70.8%) received free lunch. Fewer males were from S1 (18.6%) than from the other three schools, and fewer females were from S4 (12.5%) than from the other three schools. More females (58.3%) were in the experimental than in the control group. Fewer males passed the TAKS (41.9%) than did not pass the TAKS (46.5%); however, more females passed the TAKS (62.5%) than did not pass the TAKS (25.0%). Females experienced slightly fewer interventions (24) than males (43).

Research Questions

To answer the five research questions, I conducted a 2 x 2 mixed between-within subjects analysis of variance (ANOVA) was used to compare pretest and posttest scores (i.e., between and within subjects; Pallant, 2007). The between-subjects variable was represented by the intervention (i.e., experimental vs. control group). The within-subjects variable was time (i.e., pretest vs. posttest score). In the mixed between-within subjects ANOVA, the change from pretest to posttest within the control group and the treatment group (analyzed via the time by condition effect) are compared to each other.

Table 6

*Frequencies and Percentages for the Students' Demographic Variables (*n *= 67)*

	Male		Female	
Variable	*n*	%	*n*	%
Ethnicity				
Hispanic	31	72.1	17	70.8
African American	12	27.9	7	29.2
Program				
Bilingual	12	27.9	12	20.0
ESL	19	44.2	5	20.8
Regular	12	27.9	7	29.2
SES				
Free Lunch	32	74.4	17	70.8
Reduced Lunch	11	25.6	7	29.2
School				
S1	8	18.6	8	33.3
S2	10	23.3	9	37.5
S3	12	27.9	4	16.7
S4	13	30.2	3	12.5
Condition				
Control	21	48.8	10	41.7
Experimental	22	51.2	14	58.3
TAKS Status				
Did Not Pass	20	46.5	6	25.0
No Score	2	4.7	2	8.3
Passed	18	41.9	15	62.5
Commended	3	7.0	1	4.2
Total Interventions				
1	24	55.8	12	40.0
2	17	39.5	8	33.3
3	2	4.7	4	16.7

Descriptive Statistics for the Dependent Variable

Table 7 presents the means and standard deviations for the pretest and posttest scores.

Table 7

*Descriptive Statistics for the Dependent Variable (*n *= 67)*

	Pretest			Posttest		
Variable	Range	*M*	*SD*	Range	*M*	*SD*
Total Score	6 - 31	14.97	5.99	5 - 33	18.03	6.99

Research Question 1

The first research question was: To what extent, if any, do kinesthetic movements increase the reading achievement of low SES Hispanic and African American third grade students? I analyzed data from pre and posttests to determine if there were significant differences were tested in reading achievement test scores between low SES Hispanic and African American third grade students experiencing the kinesthetic movements versus the control group. I conducted the 2 x 2 mixed between-within subjects ANOVA procedure. The between subjects variable was the intervention (i.e., experimental vs. control group). The within subjects variable was time which was what both groups had in common between the pretest and posttest administrations (Pallant, 2007).

Assumptions. The assumption of equality of variance for the pretest means was fulfilled, F (1, 65) = .55, p = .460. Similarly, the assumption of equality of variance for the posttest means was fulfilled, F (1, 65) = .03, p = .862. In addition, the assumption of equality of covariances was fulfilled, F (3, 3029786) = .13, p = .945. The variables met all the assumptions necessary for the between-within subjects ANOVA.

Results. The means for the pretest and posttest total scores between the control and experimental groups are displayed in Table 8. The mixed between-within subjects ANOVA findings in Table 9 revealed that reading achievement scores increased across time, within the participant groups F (1, 65) = 19.52, p = .001. The change in reading achievement scores across time did not differ significantly between the control and experimental groups, F (1, 65) = .48, p = .491, from the pretest to the posttest.

Table 8

Means and Standard Deviations for Reading Achievement Across Time as a Function of the Brain Gym® Intervention

	Pretest		Posttest		
Group	*M*	*SD*	*M*	*SD*	Mean Difference
Control	14.35	5.69	17.94	6.92	3.59
Experimental	15.50	6.28	18.11	7.15	2.61

Table 9

*Mixed Between-within Subjects ANOVA Results for Reading Achievement Across Time as a Function of the Intervention (*n *= 67)*

Source	*df*	*F*	*p*
Between Subjects			
Condition	1	.21	.649
Error	65		
Within Subjects			
Time	1	19.52	.000*
Time x Condition	1	.48	.491
Error	65		

Note. * Denotes significance at less than the .01 level.

Research Question 2

The second research question was: To what extent, if any do kinesthetic movements increase the reading achievement of low SES Hispanic third grade students? I analyzed data from pre and posttests to determine if there were significant differences in reading achievement test scores between low SES Hispanic third grade students who experienced the kinesthetic movements versus the control group. I conducted a 2 x 2 mixed between-within subjects ANOVA procedure. The between subjects variable was the intervention (i.e., experimental vs. control group). The within subjects variable was time which was what both groups had in common between the pretest and posttest administrations (Pallant, 2007).

Assumptions. The assumption of equality of variance for the pretest means was fulfilled, F (1, 46) = .27, p = .603. Similarly, the assumption of equality of variance for the posttest means was fulfilled, F (1, 46) = .16, p = .694. In addition, the assumption of equality of covariances was fulfilled, F (3, 499628) = .10, p = .962. The variables met all assumptions necessary for the between-within subjects ANOVA.

Results. The mixed between-within subjects ANOVA findings in Table 11 shows the reading achievement pretest and posttest scores increased across time (F (1, 46) = 14.33, p = .001). The change in reading achievement scores across time approached statistical significance between the control and experimental groups but did not achieve it (F (1, 46) = 3.14, p = .083). An increase from pretest to posttest was indicated for both the control and experimental groups across time. As shown in Table 10, reading achievement scores improved within the control group from pretest (M = 14.43, SD = 6.13) to posttest (M = 18.52, SD = 7.23). Reading achievement scores were similar within the experimental group from pretest (M = 17.36, SD = 6.31) to posttest (M =

18.84, *SD* = 7.55). However, the pattern of scores indicated that the kinesthetic movement intervention did not improve reading achievement scores on the released 2004 TAKS test. Instead, students who were not exposed to the intervention (i.e., the students in the control group) improved at the same rate as the experimental group. Therefore, the intervention did not result in higher reading achievement scores for Hispanic third grade students.

Table 10

Means and Standard Deviations for Reading Achievement Across Time as a Function of the Brain Gym® Intervention Within the Hispanic Sample

	Pretest		Posttest		
Group	*M*	*SD*	*M*	*SD*	Mean Difference
Control	14.43	6.13	18.52	7.23	4.09
Experimental	17.36	6.31	18.84	7.55	1.48

Table 11

*Mixed Between-within Subjects ANOVA Results for Reading Achievement Across Time as a Function of the Brain Gym® Intervention Within the Hispanic Sample (*n *= 48)*

Source	*df*	*F*	*p*
Between Subjects			
Condition	1	.78	.381
Error	46		
Within Subjects			
Time	1	14.33	.000*
Time x Condition	1	3.14	.083
Error	46		

Note. * Denotes significance at less than the .01 level.

The means for the pretest and posttest total scores of the control and experimental groups consisting of Hispanic students are shown in Figure 3. The pretest and posttest lines for the two groups' scores were not parallel. This observation suggested the possibility of interaction, even though the statistical results depicted none.

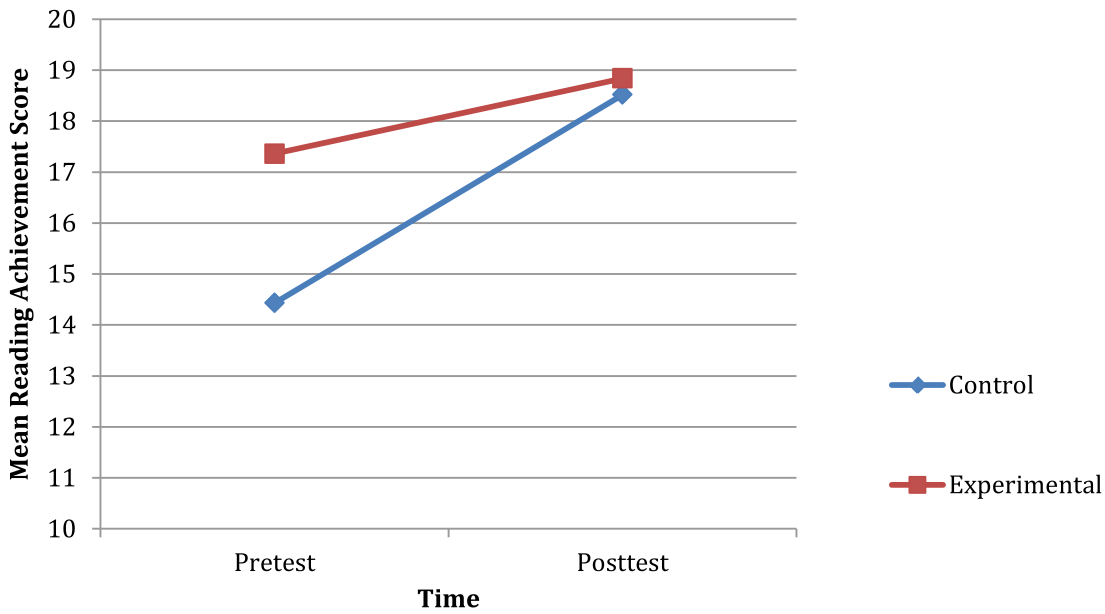

Figure 3. Mean reading achievement scores across time were higher for the control group than for the experimental group.

Research Question 3

The third research question was: To what extent, if any, do kinesthetic movements increase the reading achievement of low SES African American third grade students? I analyzed data from pre and posttests to determine if there were significant differences in reading achievement test scores between low SES African American third grade students who experienced the kinesthetic movements versus the control group. I conducted a 2 x 2 mixed between-within subjects ANOVA procedure. The between subjects variable was the intervention (i.e., experimental vs. control group). The within subjects variable was time which was what both groups had in common between the pretest and posttest administrations (Pallant, 2007).

Assumptions. The assumption of equality of variance for the pretest means was fulfilled, F (1, 17) = .74, p = .402. Similarly, the assumption of equality of variance for the posttest means was fulfilled, F (1, 17) = .29, p = .600. In addition, the assumption of equality of covariances was fulfilled, F (3, 16700) = .20, p = .894. The variables met all assumptions necessary for the between-with subjects ANOVA.

Results. The means for the pretest and posttest scores between the control and experimental groups consisting of only the African American students are presented in Table 12. The mixed between-within subjects ANOVA findings in Table 13 revealed that reading achievement test scores increased across time, F (1, 17) = 5.21, p = .036. This finding was significant since the obtained p = .036 was greater than the apriori $\alpha <$ .05. The change in reading achievement scores across time did not differ significantly between control and experimental groups, F (1, 17) = .91, p = .353. The kinesthetic movements did not result in an increase the reading achievement scores of African American third grade students.

Table 12

Means and Standard Deviations for Reading Achievement Across Time as a Function of the Brain Gym® Intervention Within the African American Sample

	Pretest		Posttest		
Group	*M*	*SD*	*M*	*SD*	Mean Difference
Control	14.35	5.69	17.94	6.92	3.59
Experimental	15.50	6.28	18.11	7.15	2.61

Table 13

*Mixed Between-within Subjects ANOVA Results for Reading Achievement Across Time as a Function of the Brain Gym® Intervention Within the African American Sample (*n *= 19)*

Source	*df*	*F*	*p*
Between Subjects			
Condition	1	.54	.474
Error	17		
Within Subjects			
Time	1	5.21	.036*
Time x Condition	1	0.91	.353
Error	17		

Note. * Denotes significance at less than the .05 level.

Research Question 4

The fourth research question was: To what extent, if any, do kinesthetic movements increase the reading achievement of low SES male third grade students? I analyzed data from pre and posttests to determine if there were significant differences in reading achievement test scores between low SES male third grade students who experienced the kinesthetic movements versus the control group. I conducted a 2 x 2 mixed between-within subjects ANOVA procedure. The between subjects variable was the intervention (i.e., experimental vs. control group). The within subjects variable was time which was what both groups had in common between the pretest and posttest administrations (Pallant, 2007).

Assumptions. The assumption of equality of variance for the pretest means was fulfilled, $F(1, 41) = .01$, $p = .922$. Similarly, the assumption of equality of variance for the posttest means was fulfilled, $F(1, 41) = .00$, $p = .975$. In addition, the assumption of equality of covariances was fulfilled, $F(3, 326984) = .36$, $p = .783$. The variables met all the assumptions necessary for the between-within subjects ANOVA.

Results. The means for the pretest and posttest scores between the control and experimental groups for only the male students are presented in Table 14. The mixed between-within subjects ANOVA findings in Table 15 revealed that reading achievement scores increased across time, $F(1, 41) = 9.89$, $p = .003$. The change in reading achievement scores across time did not differ significantly between the control and experimental groups, $F(1, 41) = .00$, $p = .982$. Therefore, the kinesthetic movements did not result in increased reading achievement scores for the male third grade students.

Table 14

Means and Standard Deviations for Reading Achievement Across Time as a Function of the Brain Gym® Intervention Within the Sample of Males

	Pretest		Posttest		
Group	*M*	*SD*	*M*	*SD*	Mean Difference
Control	14.67	6.27	17.71	8.10	3.04
Experimental	14.41	6.51	17.50	8.04	3.09

Table 15

*Mixed Between-within Subjects ANOVA Results for Reading Achievement Across Time as a Function of the Brain Gym® Intervention Within the Sample of Males (*n *= 43)*

Source	*df*	*F*	*p*
Between Subjects			
Condition	1	.01	.096
Error	41		
Within Subjects			
Time	1	9.89	.003*
Time x Condition	1	0.00	.982
Error	41		

Note. * Denotes significance at less than the .01 level.

Research Question 5

The fifth research question was: To what extent, if any, do kinesthetic movements increase the reading achievement of low SES female third grade students? I analyzed data from pre and posttests to determine if there were significant differences in reading achievement test scores of low SES female third grade students who experienced the kinesthetic movement treatment versus the control group. I conducted a 2 x 2 mixed between-within subjects ANOVA procedure. The between subjects variable was the intervention (i.e., experimental vs. control group). The within subjects variable was time which was what both groups have in common between the pretest and posttest administrations (Pallant, 2007).

Assumptions. The assumption of equality of variance for the pretest means was fulfilled, F (1, 22) = .52, p = .478. Similarly, the assumption of equality of variance for the posttest means was fulfilled, *F* (1, 22) = .53, *p* = .475. In addition, the assumption of equality of covariances was fulfilled, *F* (3, 25756) = 1.50, *p* = .214. The variables met all assumptions necessary for the between-within subjects ANOVA.

Results. The means and standard deviations for the pretest and posttest scores between the control and experimental groups consisted of only females and are presented in Table 16. The mixed between-within subjects ANOVA findings in Table 17 revealed that reading achievement scores increased across time, *F* (1, 22) = 13.27, *p* = .001. The change in reading achievement scores across time did not differ significantly between control and experimental groups, *F* (1, 22) = 2.49, *p* = .129. Therefore, the kinesthetic movements did not result in the reading achievement scores of female third grade students.

Table 16

Means and Standard Deviations for Reading Achievement Across Time as a Function of the Brain Gym® Intervention Within the Sample of Females

	Pretest		Posttest		
Group	*M*	*SD*	*M*	*SD*	Mean Difference
Control	13.70	4.45	18.40	3.66	4.70
Experimental	17.21	5.69	19.07	5.64	1.86

Table 17

*Mixed Between-within Subjects ANOVA Results for Reading Achievement Across Time as a Function of the Brain Gym® Intervention Within the Sample of Females (*n *= 24)*

Source	*df*	*F*	*p*
Between Subjects			
Condition	1	1.22	.282
Error	22		
Within Subjects			
Time	1	13.27	.001*
Time x Condition	1	2.49	.129
Error	22		

Note. * indicates significance at .01 level.

CHAPTER 5

SUMMARY, DISCUSSION, AND RECOMMENDATIONS

Summary and Discussion

The purpose of the quasi-experimental study was to determine if using a series of kinesthetic movements improves the reading achievement of Grade 3 Hispanic and African American students. One brain-based kinesthetic movement strategy is Brain Gym®, a registered trademark by Brain Gym International/Educational Kinesiology Foundation. It offers a series of 26 kinesthetic movements that are purported to help school-age students in reading, writing, and mathematics (Dennison & Dennison, 2007; Hannaford, 2005). This study included the use of five of the Brain Gym® kinesthetic movements, the Cross Crawl, Lazy 8s, Thinking Cap, Hook-ups, and Owl. The pretest-posttest research design allowed for gathering data regarding male and female Hispanic and African American Grade 3 students who were at-risk and from low SES status from a large urban North Texas School District. The students' ethnicities, socioeconomic status (SES), gender, and scores from a released 2004 TAKS Reading test represented the variables investigated. All analyses were conducted with the 2 x 2 mixed between-within subjects analysis of variance (ANOVA) to determine significant differences between the means of the pretest and posttest scores. Each research question was addressed separately.

Research Question 1

The first research question was: To what extent, if any, do kinesthetic movements increase the reading achievement of low SES Hispanic and African American third grade students? Data revealed that the means from the pretest and posttest reading achievement scores of all participating Hispanic and African American students increased across time (p = .001). However, the reading scores did not differ significantly (p = .491) between the control and experimental groups. These findings indicated that kinesthetic movements did not help improve student reading achievement.

Research Question 2

The second research question was: To what extent, if any do kinesthetic movements increase the reading achievement of low SES Hispanic third grade students? Data revealed that the pretest and posttest scores for all Hispanic students increased (p = .001) across time. The reading scores showed no difference from the control and experimental groups across time and condition (p = .083) for Hispanic students. Reading achievement did improve within the control group, and the reading scores were similar with the experimental group. Kinesthetic movements did not help increase reading scores and failed to represent a good intervention to use due to the findings.

Research Question 3

The third research question was: To what extent, if any, do kinesthetic movements increase the reading achievement of low SES African American third grade students? Data revealed that using the kinesthetic intervention did not differ significantly (p = .353) from pretest to posttest across time between the control and experimental groups. While reading achievement did increase across time (p = .036) for all African American students, the intervention did not yield significant changes. The implication of this finding for educators is that kinesthetic movements do not represent a viable solution for improving student reading achievement.

Research Question 4

The fourth research question was: To what extent, if any, do kinesthetic movements increase the reading achievement of low SES male third grade students? The finding showed that the reading achievement did increase across time (p = .003) for all male students. However, the change did not differ significantly (p = .982) between the control and experimental groups for the male third grade students. This finding indicates that kinesthetic movements do not represent a good intervention for increasing student reading achievement.

Research Question 5

The fifth research question was: To what extent, if any, do kinesthetic movements increase the reading achievement of low SES female third grade students? As with the previous four research questions, the data from this analysis revealed that reading scores increased across time (p = .001) for all female students. The change did not differ significantly (p = .129) between the control and experimental groups for the female third grade students.

Discussion of the Findings

The academic achievement emphasis in 21st century education demands that students be taught how to read and how to develop high levels of reading achievement (No Child Left Behind Act of 2001 [NCLB], 2002). However, at-risk minorities, especially Hispanic and African American students, continue to lag behind their White counterparts in reading, and the achievement gap continues (MacDonald & Figueredo, 2010; Mandara, 2009; National Assessment of Educational Progress [NAEP], 2011; Short et al., 2008; Walker-Dalhouse & Risko, 2009). This gap creates national interest from school district leaders and teachers who find themselves trying to teach students with learning difficulties how to read (Deshler & Hock, 2009; Goodwin & Ahn, 2010; Pinnell & Fountas, 2009). Students who struggle with reading problems are easily identifiable through response to intervention (RTI). In an effort to raise achievement scores, the RTI process has been integrated into school improvement plans throughout the United States and Canada (Shores, 2009). Students with reading difficulties are then placed into the three tier intervention system, and specific plans are created to address the needs of the identified student.

In the search to prevent and improve reading difficulties, brain-based education has encouraged educators to find kinesthetic means to help students learn to read (Jensen, 2010; Pinnell & Fountas, 2009). Movement and exercise have been reported to positively impact learning, mainly in girls (Carlson et al., 2008). Chomitz et al. (2009) found a relationship between physical fitness and academic achievement. Dills et al. (2011) echoed the effect that increasing time in recess or in physical education class increased students' reading scores. Goodway and Branta (2003) reported on the benefits of motor skill intervention with disadvantaged preschool students. Robinson and Goodway (2009) reported similar results with disadvantaged preschool age African American students. Movement seemed to be the key to academic achievement. With these studies in mind, I conducted this quasi-experimental study. Even though the students' reading scores increased over time, there was no difference found between the two group scores. The intervention appeared to have no effect on reading achievement.

The results of this study did not support the findings of the other studies of the effectiveness of kinesthetic activities in helping children learn to read (Carpenter, 2005; Dodson, 2006; Myhra, 2009; Nussabaum, 2010; Peterson, 2005; Walker, 2008). Hyatt

(2007) reviewed studies using Brain Gym® movements in a learning environment and did not find any significance, even though the Brain Gym® program developers Dennison and Dennison (2007) have claimed its effectiveness with students experiencing particular challenges, such as ADHD, dyslexia, special needs, attention disorders, stress, and behaviors. Hyatt (2007) warned educators to avoid using practices and programs, such as Brain Gym®, with no substantive theoretical research base in the hope of improving a learning problem.

Research on the positive benefits of exercise and physical activity on academic achievement led me to believe in a greater relationship between cognition and physical activity. Results of the study indicate that although students made reading achievement gains, the gains were not statistically significant as measured by the 2004 TAKS reading assessment. However, instead of using slow and deliberate movements, I recommend implementing vigorous exercise that lasts longer than five minutes to help stimulate students' brains. A longer intervention period, over a longer period of time may have yielded different results as in studies from Myhra (2009), Nussabaum (2010), and Walker (2008). Furthermore, the released 2004 TAKS instrument may not have been sensitive enough to measure changes and should have been used in conjunction with other interventions. The findings of this study might conflict with other researchers' findings due to its limitations, which are dicussed in the next section.

Contributions and Limitations

A strength of this study was the research design. This design was quasi-experimental and represented an effort to improve RTI within the school setting. The findings add to the body of literature (see Myhra, 2009; Nussabaum, 2010; Walker,

2008) concerning Brain Gym® and RTI as opposed to the studies found only in the Brain Gym® Journal. I had theorized that the group engaging in Brain Gym® movements would demonstrate higher reading academic achievement as compared to the control group. Given the results of this study, Brain Gym® movements did not show significant improvement as a movement oriented brain based strategy for increasing student reading achievement.

The findings of this study limit generalizations from the data. The Brain Gym® movements were used five minutes, once a day for a period of 30 days. Perhaps, due to time constraints from the participating schools, not enough of the Brain Gym® movements were used each day, and the five movements might need to be combined with other reading interventions. Five minutes of movement daily was too limiting. A longer period of intervention such as a full semester might yield the positive results seen in other studies.

In addition, the reading assessment instrument might not have been sensitive enough to measure changes from pretest to posttest for such a short-term intervention. Another limitation may be that the movements from the Brain Gym® program do not meet the criteria of evidence-based practice for use with RTI and thus do not lead to increases in reading achievement scores. These findings and limitations lead to the following recommendations for practice and research and a conclusion for the study.

Implications

In the large urban district, the low SES third grade African American and Hispanic students in this research struggled with low reading achievement. However, they did not show significant gains in reading achievement despite the daily use of the five Brain Gym® movements. The Brain Gym® movements did not appear to be an effective intervention to help close the reading achievement gap for the low SES third grade African American and Hispanic students.

The following represent what I view as implications for school districts that consider activity-based interventions to increase school achievement:

- Short periods of time using deliberate and slow physical movement may not improve reading achievement and may not be appropriate for use with public school students.
- More daily PE which involves vigorous activity to energize the students and activate brain functioning needs to be implemented in schools.
- The initial cost involved in training instructors for programs such as Brain Gym® can be somewhat expensive. School districts should look to their personnel for designing district specific vigorous activity interventions.

The following represent the implications for future researchers:

- A kinesthetic movement intervention study with a longer period of time dedicated to daily intervention that includes more vigorous physical activity may be necessary.
- Longitudinal studies to discern the long term outcomes of using kinesthetic movements over lengthier intervention periods and using more movements are needed.
- Studies using combinations of physical interventions and evidence-based reading interventions to study reading achievement may provide practices that are more effective.

APPENDIX A

INTRODUCTORY LETTER TO PRINCIPALS

To: Principal
[redacted] Elementary
Dear M[redacted],
My name is Edelmira Sánchez a doctoral student at the University of North Texas, Denton Texas; Department of Teacher Education and Administration. At the present time I am in the midst of writing my proposal for dissertation requirements. My research is on kinesthetic movements specifically taken from a program known as the Educational Kinesiology Foundation/Brain Gym® International that was developed by Dr. Paul and Gail Dennison.
The research study is targeting students with low academic achievement in Reading, from five elementary schools in the Arlington Independent School District. The purpose of my study is to determine the effectiveness of using five movements daily for a period of 70 days, from the above mentioned program in reading achievement.
I am looking at working with 100 students, 20 each from the five area schools, which would include 10 students in a control group and 10 in the experimental group. The study is to take place from September to December 2010. Released TAKS tests will serve as the pre and posttests. At your campus I am requesting help from Dr. Jan Cowman, one of your instructional facilitators, in order to gather data for the study. Thereby, the reason for writing this letter is ask for your participation in my research study. If you so choose to do so, permission from Dr. Carter is in process.
I await your prompt response, as your participation would become an integral part of my proposal process.
Sincerely,
Edelmira Sánchez
Instructional Facilitator
[redacted] Elementary
2900 [redacted]
[redacted], Texas 7[redacted]

esanche1@[redacted].net

Major Professor:
George Morrison
University of North Texas
Department of Teacher Education and Administration
George.Morrison@unt.edu

APPENDIX B

INTRODUCTORY LETTER TO PARENTS: ENGLISH

Dear Parent/Guardian of ____,
Please allow me to introduce myself, my name is Edelmira Sánchez and I am a doctoral student at the University of North Texas, Denton Texas; Department of Teacher Education and Administration. I am conducting research on kinesthetic (learning/exploring) movements (exercises), specifically five types of movements daily over a period of 40 days and its result on reading achievement.* Your child is being asked to participate as part of this campus. Half of the children who participate will have a chance of doing the exercises and the other half will not do them. The estimated daily time for each student is to be five minutes of exercises after morning announcements. Student participation is from October until November, 2010. At the end of this trial period there I will be available to explain to the parent/guardian of the participants from the *control* group your child's reading improvements and answer any questions you may have.

A permission form with more detail is being included with this letter. Thank you for your consideration of this endeavor to assist improving one of your child's most valuable assets in life….reading!

Sincerely,

Edelmira Sánchez
Instructional Facilitator/Key Investigator
[redacted] Elementary
2900 [redacted]
[redacted], Texas 7[redacted]
esanche1@[redacted].net

Major Professor/Principal Investigator
George Morrison
University of North Texas
Department of Teacher Education and Administration
George.Morrison@unt.edu

*The idea being researched with the students is taken from a program known as the **Educational Kinesiology Foundation/Brain Gym® International** developed by Dr. Paul and Gail Dennison.

APPENDIX C

INTRODUCTORY LETTER TO PARENTS: SPANISH

Estimado Padre/guardián de ____.
Mi nombre es Edelmira Sánchez. Soy una estudiante trabajando en mi doctorado en la Universidad de North Texas; Departamento de Educación para Maestros e Administración. Al presente estoy escribiendo la propuesta para los requisitos de tesina.

El estudio es en específicamente cinco movimientos (ejercicios), que serán conducidos diario por 40 días y los resultados en la academia de lectura.* Se le está pidiendo permiso para que su niño/a participe como parte de esta escuela. La mitad de niños que serán voluntarios, harán los movimientos y la otra mitad no los harán.

El tiempo estimado para hacer los movimientos diarios es cinco minutos después de los anuncios del día. Su participación será de octubre hasta noviembre del 2010. Al final del estudio estaré disponible para explicarle a los padres/guardianes del grupo controlado los resultados y contestar preguntas que tenga.
Una forma para su permiso y con más detalles es incluida con esta carta.
Sinceramente,
Edelmira Sánchez

Instructional Facilitator/Key Personnel
[redacted] Elementary
[redacted]
[redacted], Texas 7[redacted]

esanche1@[redacted].net

Major Professor/Principal Investigator:
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*La idea para el estudio es basada sobre un programa conocido como **Educacional Kinesiología Fundación/Brain Gym® International** fundado por el Dr. Paul and Gail Dennison.

APPENDIX D

APPROVED INFORMED CONSENT AND ASSENT: ENGLISH

University of North Texas Institutional Review Board

Informed Consent Form

Before agreeing to your child's participation in this research study, it is important that you read and understand the following explanation of the purpose, benefits and risks of the study and how it will be conducted.

Title of Study: The Effects of Brain Gym® Movements on the Reading Achievement of Third Grade Students.

Principal Investigator: George Morrison, University of North Texas (UNT) Department of Teacher Education and Administration.

Key Personnel: Edelmira Sánchez, University of North Texas

Purpose of the Study: You are being asked to allow your child to participate in a research study which involves doing physical movements daily in an effort to see if by doing so will increase his/her reading achievement as indicated by the Texas Assessment of Knowledge and Skills (TAKS). Half of the children who volunteer to participate will do movements and the other half, will not.

Study Procedures: Your child will be asked to take a released 2004 TAKS test in October and thereafter do a series of five movements by a trained person, that may or may not be his/her classroom teacher that will take about five minutes daily of your child's time. He/she will take a released test in November, and the results will be compared to determine growth.

Foreseeable Risks: No foreseeable risks are involved in this study.

Benefits to the Subjects or Others: We expect the project to benefit your child by helping increase TAKS test scores in reading.

Procedures for Maintaining Confidentiality of Research Records: In order to maintain confidentiality, your child's name will not be used. A number will be assigned to your child at the beginning of the study and no names will be disclosed at any time during the research. Only the Key personnel will know the names and number assigned to your child, but will not disclose that information to anyone else. The confidentiality of your child's individual information will be maintained in any publications or presentations regarding this study.

Questions about the Study: If you have any questions about the study, you may contact __*Edelmira Sánchez*_______ at telephone number [redacted], or *George Morrison*, Department of Teacher Education and Administration at telephone number 940-565-4476.

Review for the Protection of Participants: This research study has been reviewed and approved by the UNT Institutional Review Board (IRB). The UNT

Page **1** of **3**

IRB can be contacted at (940) 565-3940 with any questions regarding the rights of research subjects.

Research Participants' Rights: Your signature below indicates that you have read or have had read to you all of the above and that you confirm all of the following:

- You understand the possible benefits and the potential risks and/or discomforts of the study.
- You understand that you do not have to allow your child to take part in this study, and your refusal to allow your child to participate or your decision to withdraw him/her from the study will involve no penalty or loss of rights or benefits. The study personnel may choose to stop your child's participation at any time.
- You understand why the study is being conducted and how it will be performed.
- You understand your rights as the parent/guardian of a research participant and you voluntarily consent to your child's participation in this study.
- You have been told you will receive a copy of this form.

____
Printed Name of Parent or Guardian

__________________________________ ____________
Signature of Parent or Guardian Date

APPROVED BY THE UNT IRB
FROM 9/17/10 TO 9/16/11

Child Assent Form

Researchers from the University of North Texas are trying to learn about how exercises help students learn to read better.

You have been asked to be a part of the study because this may help you.

This study is asking for you to help from October to November 2010.

If you decide to help in this study, you will be asked to do five easy exercises every day in the mornings after announcements. This study will take place at school, and should take about five minutes of your time.

You do not have to be in this study if you don't want to and you can quit the study at any time. No one will get mad at you if you decide you don't want to help.

If you would like to be part of this study, please sign your name below.

____

Printed Name of Child

______________________________ _________________

Signature of Child Date

APPROVED BY THE UNT IRB
FROM 9/17/10 TO 9/16/11

APPENDIX E

APPROVED INFORMED CONSENT AND ASSENT: SPANISH

Mesa Directiva Institucional de la Universidad de North Texas

Forma de Consentimiento Informado

Antes de consentir la participación de su niño/a en este estudio, es importante que usted lea e entienda la siguiente explicación del propósito y los beneficios o riesgos del estudio y como será conducido.

Título del Estudio: The Effects of Brain Gym® Movements on the Reading Achievement of Third Grade Students.

Investigador Principal: George Morrison , Universidad de North Texas (UNT) Departamento de Educación para Maestros e Administración.

Personje Clave: Edelmira Sánchez, Universidad de North Texas

Propósito del Estudio: Se le está pidiendo su permiso para que su hijo/a participe en un estudio en que se emplean movimientos físicos diario para ver si haciendo esto da como resultado aumento académico en la lectura conforme la prueba de Texas Assessment of Knowledge and Skills (TAKS). La mitad de niños que serán voluntarios, harán los movimientos y la otra mitad no los harán.

Procedimiento del Estudio: A su hijo/a se le dará una prueba de TAKS del año 2004 en octubre. Después hará una serie de cinco movimientos físicos que son dirigidos por una persona que ha sido entrenada. Puede ser la maestra u otra persona. Los movimientos físicos solo tomaran cinco minutos. Su hijo/a tomara una prueba de TAKS en noviembre y los resultados serán comparados para determinar su crecimiento académico.

Riesgo previsible: No hay riesgo previsible en este estudio.

Beneficios para los participantes u otros: Esperamos los beneficios de este proyecto que se encuentre un aumento académico en la prueba de TAKS. *La mesa directiva institucional no garantiza resultados.*

Procedimientos Para Mantener la Confidencialidad de los Archivos del Estudio: Para mantener confidencialidad, el nombre de su hijo/s no será usado. Un número se va a asignad al principio del estudio en lugar de nombres. Los nombres no serán revelados en ningún tiempo durante el estudio. Solamente la personaje clave tendrá la lista de los nombres y su asignación. La confidencialidad sobre la información de su hijo/s será mantenida en publicaciones o presentaciones de este estudio.

Preguntas Sobre el Estudio: Si usted tiene alguna pregunta sobre el estudio, puede llamar a *Edelmira Sánchez*_______ al número [redacted] o a *George Morrison*, Departamento de Educación para Maestros e Administración al número 940-565-4476.

Repaso para la Protección de los Participantes: Este estudio ha sido repasado e aprobado por la mesa Directiva Institucional de la Universidad de North Texas. Puede ser contactada al (940) 565-3940 con preguntas asegún los derechos de los participantes.

Derechos de los Participantes en el Estudio: Su firma indica que usted ha leído o le han leído todo lo indicado y lo que sigue:

- Usted entiende los beneficios posibles y los riesgos y/o incomodidades del estudio.
- Usted entiende que no necesita dar permiso para que su hijo/a participe en el estudio. No habrá castigo o pérdida de algún derecho o beneficio con su negar en hacer esto o con su decisión de retirarlo del estudio. Los personajes del estudio pueden parar la participación de su hijo/a a cualquier momento.
- Usted entiende la razón que este estudio se lleva acabo y como será conducido.
- Usted entiende sus derechos como padre/guardián de la participación en un estudio y da su permiso voluntariamente para que su hijo/a participe en este estudio.
- Se le ha dicho que recibirá una copia de esta forma.

____
Nombre de padre/guardián

______________________________ __________
Firma de padre/guardián Fecha

APPROVED BY THE UNT IRB
FROM 9/17/10 TO 9/16/11
XB

Forma de Aprobación del Nino/a

Un estudio de la Universidad de North Texas está tratando de aprender como el ejercicio ayuda a los estudiantes leer mejor.

Se te está pidiendo que ayudes en este estudio porque te puede ayudar.

Este estudio está pidiendo tu ayuda de octubre a noviembre del 2010.

Si tú decides ayudar con este estudio se te va a pedir que hagas cinco ejercicios cada mañana después de los anuncios. Este estudio será en la escuela. Tomará por lo menos cinco minutos para completar.

No tienes que ayudar con este estudio si no quieres y puedes parar a cualquier tiempo que tú quieras. Nadie se enojará contigo si no quieres ayudar.

Si tú quieres ser parte de este estudio, favor de firmar abajo.

____
Nombre de niño/a

______________________ ______________
Firma de niño/a Fecha

APPROVED BY THE UNT IRB
FROM 9/17/10 TO 9/16/11

APPENDIX F

EXCERPT OF ENGLISH VERSION OF TAKS READING ASSESSMENT

FOR GRADE 3

DIRECTIONS
Read each selection. Then read each question that follows that selection. Decide which is the best answer to each question. Mark the space for the answer you have chosen.

SAMPLE

A Rabbit Named Sticks

1 Lop-Eared Rabbit Village was on the north edge of a forest. The rabbits who lived there were called lop-eared because their ears drooped down around their faces. They were all very proud of their long, floppy ears. One young rabbit in Lop-Eared Rabbit Village was not so happy. His ears were different. They stood straight up. Everyone teased him and called him Sticks.

2 “Be proud. Your grandfather had ears just like yours,” his mother often said to him.

3 But Sticks didn’t like looking different. He wanted his ears to be long and floppy like everyone else’s.

S-1 In paragraph 1, which word helps the reader know what the word drooped means?

- ⬭ *proud*
- ⬭ *floppy*
- ⬭ *young*
- ⬭ *different*

S-2 What problem does Sticks have in this story?

- ⬭ His mother doesn’t like his straight ears.
- ⬭ He wishes that he could be more like his grandfather.
- ⬭ The other young rabbits in his village are jealous of him.
- ⬭ He wants to look like the other rabbits in his village.

STOP

The Marfa Lights

Roberto wrote the following journal entry about his visit to Marfa, Texas.

August 28, 2001

1 Mom, Dad, and I left Kerrville about 7:00 A.M. We were going to spend a few days at Big Bend National Park. Since it is such a long drive, we decided to spend the night in Marfa. After making two stops, we finally reached the town around 3:00 P.M.

2 We headed for the Thunderbird Motel to check in. The man there was very friendly. His name was Tom. He told us that we had come at a good time. The Marfa Lights Festival would be the next day. The festival is held each year near the end of summer. Tom said there would be concerts, a parade, lots of food, and games. I was glad we had stopped here. Dad said that even though we had planned to leave early the next day, we could stay for a little while.

3 We found our motel room and carried our bags inside. Dad wanted to relax before we walked around. While he and Mom rested, I read my book, *Interesting Places to Visit in Texas*.

4 I looked up *Marfa* to see what I could find out about the Marfa lights. I read that the Marfa lights are small lights that appear far off in the distance. Although they are usually white, sometimes the lights appear to be different colors. They seem to float around in the darkness and then disappear. People have seen these lights at night since 1883. There are many guesses about them. Some people say they are spaceships. Others think they are swamp gas. Still others believe they must be car headlights. No one really knows.

5 That evening we still had some time before sunset, so we went for a walk. I took a picture of downtown Marfa with the disposable camera Mom had bought me. It's the kind you throw away after the pictures are made. We stopped in a few stores as we walked

The town of Marfa, Texas

GO ON

around town. Most of the stores were selling T-shirts and postcards with pictures of the Marfa lights on them. Outside, some people were hanging blinking lights around a stage. Other people were setting up booths in the streets. Workers were shouting to one another and working around the tourists to hang signs. Everyone looked excited and in a hurry. It made me feel the same way. I was ready to see those Marfa lights!

6 After an early dinner we drove to an area about nine miles east of town where the lights can be seen on most nights. A historical marker near there tells of a rancher who saw the lights in 1883. Dad stopped the car to let me take a picture of the sign. The sun was about to set, so we quickly found a place to park.

Road sign to the Marfa lights

7 More and more cars pulled up. Many people had come to see the lights and go to the festival. We had been told that the lights would appear in the distance at the bottom of the Chinati Mountains. As the sun went down, we looked for the lights but didn't see anything. I was sitting on the hood of our car and complaining to Dad when a man walked up.

8 The man said he had heard us talking. He said he lived in Marfa. He pointed and told me to look over a fence and between two telephone poles. Then I saw the first light appear! It moved around. Then it disappeared. Another light showed up and did the same thing. I quickly got out my camera and took a picture. By now there was a big crowd of people watching the glowing, dancing lights. The lights reminded me of cotton balls bouncing around. We watched as more and more lights appeared and disappeared. Around midnight the lights finally stopped. We drove back to the motel and fell into our beds.

9 Now I've seen the lights, but I still have no idea what they are. One thing is for sure, though. Whatever they are, the lights have brought a lot of excitement to the town of Marfa.

GO ON

1 Why does Roberto most likely write this journal entry?

- To describe seeing the mysterious lights
- To tell his friends how to get to Marfa
- To sell it to a magazine
- To tell his parents what he saw

2 What is the most likely reason that Roberto takes pictures of things in Marfa?

- The man at the motel needs pictures.
- His parents tell him to take pictures.
- He wants to see whether his new camera works.
- He wants to remember what he sees.

3 When Roberto learns about the Marfa Lights Festival, he feels —

- pleased that his parents decided to stop in the town
- angry that he will miss the festival
- upset that he won't be able to take pictures of the lights
- hopeful that he will get a festival T-shirt

4 The reader can tell that the Marfa lights —

- do not move around
- have been seen by many people
- can be seen during the day
- are only white

GO ON

5 Read the list below. Then answer the following question.

Possible Causes of the Marfa Lights

- Spaceships
- Swamp gases
- ______________

Which of the following best completes the list?

- Cotton balls
- Concerts
- Car headlights
- Cameras

6 Which words from paragraph 5 help the reader know what disposable means?

- *throw away*
- *around a stage*
- *in a hurry*
- *before sunset*

7 How do Roberto's parents probably feel after driving in the car to Marfa from Kerrville?

- Satisfied
- Lost
- Pleased
- Tired

GO ON

8 The man at the motel tells Roberto that it is a good time to visit Marfa because —

- it is the only time of the year that the lights can be seen
- the town is having a festival to celebrate the lights
- the motel has a room where Roberto's family can stay for the night
- people in the town are hanging lights on a stage for a concert

9 In paragraph 3, which word helps the reader know what relax means?

- *carried*
- *found*
- *read*
- *rested*

10 When Roberto is waiting to see the Marfa lights, why does a man come to talk to him?

- To show him where to look for the lights
- To tell him stories about Marfa
- To help him find his new camera
- To give him pictures of the Marfa lights

11 How does Roberto probably feel when he sees the lights?

- Disappointed
- Clever
- Excited
- Foolish

GO ON

APPENDIX G

EXCERPT OF SPANISH VERSION OF TAKS READING ASSESSMENT

FOR GRADE 3

INSTRUCCIONES
Lee cada cuento. Luego lee cada pregunta que acompaña al cuento. Decide cuál es la mejor respuesta para cada pregunta. Marca el espacio de la respuesta que escogiste.

EJEMPLO

Palitos

1 Había una vez una villa de conejos llamada Orejas-Caídas que quedaba al norte de un bosque. A los conejos que vivían ahí les decían orejas-caídas porque tenían las orejas inclinadas completamente hacia abajo. Los conejos de esta villa estaban muy orgullosos de sus orejas largas y caídas. Pero había un conejo joven de la villa Orejas-Caídas que no se sentía muy feliz. Sus orejas eran diferentes pues las tenía paradas. Todos se burlaban de él y lo llamaban Palitos.

2 —Deberías estar orgulloso ya que tus orejas son igualitas a las que tenía tu abuelito —le decía siempre su mamá.

3 Pero a Palitos no le gustaba verse diferente. Quería que sus orejas fueran largas y caídas como las de los demás conejos de su villa.

E-1 En el párrafo 1, ¿cuál palabra ayuda al lector a saber qué significa la palabra inclinadas?

- ⬭ *orgullosos*
- ⬭ *caídas*
- ⬭ *joven*
- ⬭ *diferentes*

E-2 ¿Cuál es el problema de Palitos en el cuento?

- ⬭ A su mamá no le gustan sus orejas paradas.
- ⬭ Él desea parecerse más a su abuelito.
- ⬭ Los otros conejitos de su villa le tienen envidia.
- ⬭ Quiere parecerse a los demás conejos de su villa.

ALTO

Las luces de Marfa

Roberto escribió lo siguiente en su diario sobre su visita a Marfa, Texas.

28 de agosto de 2001

1 Mis papás y yo salimos de Kerrville como a las 7:00 de la mañana. Íbamos a pasar unos días en el Parque Nacional Big Bend. Como está muy lejos, decidimos pasar una noche en un pueblo llamado Marfa. Después de hacer dos paradas, por fin llegamos al pueblo como a las 3:00 de la tarde.

2 Fuimos al Motel Thunderbird y nos registramos. El encargado del motel era un señor muy amable que se llamaba Tom. Nos dijo que habíamos llegado muy a tiempo. El Festival de las Luces de Marfa iba a ser al día siguiente. Este festival se celebra cada año al final del verano. Tom dijo que habría conciertos, un desfile, mucha comida y juegos. ¡Qué bueno que paramos allí! Mi papá dijo que aunque había pensado que nos iríamos temprano al día siguiente, podíamos quedarnos un poco más.

3 Sacamos las maletas del carro y nos fuimos a buscar nuestro cuarto. Mi papá quería relajarse antes de caminar por los alrededores. Mientras él y mi mamá descansaban, empecé a leer un libro que se llama *Lugares interesantes de Texas*.

4 Me puse a buscar información del pueblo de Marfa para ver qué podía encontrar sobre las luces. Leí que son luces pequeñas que aparecen a lo lejos. Aunque casi siempre son blancas, a veces se ven de diferentes colores. Parece que flotan en la oscuridad y luego desaparecen. La gente ha visto estas luces por las noches desde 1883. Muchas personas han tratado de explicar qué hace que aparezcan las luces. Algunos dicen que son naves espaciales. Otros creen que tienen que ver con los gases que salen de los pantanos. Algunas personas creen que son luces de carros. Nadie sabe qué son en realidad.

El pueblo de Marfa, Texas

SIGUE

5 Esa tarde todavía quedaba un poco de tiempo antes de que anocheciera, así que fuimos a caminar. Tomé una foto del centro de Marfa con la cámara desechable que me había comprado mi mamá. Este tipo de cámara se tira a la basura después de que las fotos están listas. Nos detuvimos en varias tienditas mientras caminábamos por el pueblo. En la mayoría de las tiendas vendían camisetas y postales con fotos de las luces de Marfa. En la calle, unas personas estaban poniendo en un escenario unas luces que se prendían y se apagaban. Otras estaban poniendo puestos. Los trabajadores se gritaban unos a otros mientras colgaban letreros. Ellos hacían sus tareas en medio de la gente. Todo el mundo se veía tan emocionado y tenía tanta prisa que yo también me emocioné. ¡Yo ya quería ver esas famosas luces!

Letrero que indica el camino al mirador de las luces de Marfa

6 Cenamos temprano y luego fuimos en el carro a un lugar que queda a nueve millas del pueblo. Desde allí se pueden ver las luces casi todas las noches. Cerca del lugar nos detuvimos para leer una placa histórica que explica que un granjero vio las luces por primera vez en 1883. Yo le tomé una foto a la placa. Ya casi era de noche, así que estacionamos el carro rápidamente.

7 Empezaron a llegar más y más carros. Muchas personas habían venido para ver las luces y para ir al festival. Nos habían dicho que las luces se iban a ver a lo lejos en la parte de abajo de las montañas Chinati. Mientras el sol desaparecía, buscamos las luces, pero no vimos nada. Yo estaba sentado arriba del carro quejándome con mi papá porque no veía nada. De pronto un señor se nos acercó.

8 El señor dijo que nos había oído hablar. Nos contó que vivía en Marfa. Él señaló con el dedo y me dijo que me fijara entre dos postes de teléfono. ¡Entonces vi aparecer la primera luz! La luz se movió y luego desapareció. Luego apareció otra luz y pasó lo mismo. Agarré mi cámara rápido y le tomé una foto. Para esa hora, ya había muchas personas viendo las luces brillantes que parecían bailar. Las luces me hicieron pensar en bolitas de algodón saltando de un lado a otro. Vimos más y más luces que aparecían y desaparecían. Cuando ya casi era medianoche, las luces desaparecieron. Regresamos al motel y nos fuimos directamente a dormir.

9 Ahora ya vi las luces, pero todavía no entiendo qué son. De lo que sí estoy seguro es de que, sean lo que sean, estas luces han hecho que el pueblo de Marfa sea más interesante.

1 Lo más probable es que Roberto escribe esta información en su diario para —

- describir las luces misteriosas
- decirles a sus amigos cómo llegar a Marfa
- venderle a una revista lo que escribió
- contarles a sus papás lo que vio

2 ¿Cuál es la razón más probable de que Roberto tome fotos de las cosas que ve en Marfa?

- El encargado del motel necesita fotos.
- Sus papás le dicen que tome fotos.
- Quiere saber si su cámara nueva funciona.
- Quiere recordar lo que ve.

3 Cuando Roberto se entera del Festival de las Luces de Marfa, él se siente —

- contento de que sus padres decidieran parar en el pueblo
- enojado porque se perderá el festival
- molesto porque no podrá tomar fotos de las luces
- ilusionado de que le compren una camiseta del festival

4 ¿Qué puede concluir el lector acerca de las luces de Marfa?

- No se mueven.
- Muchas personas las han visto.
- Se pueden ver durante el día.
- Son siempre blancas.

SIGUE

5 Lee la lista que aparece abajo y contesta la pregunta que le sigue.

Posibles causas de las luces de Marfa
• Naves espaciales
• Gases de los pantanos
• ______________

¿Cuál de las siguientes respuestas completa mejor la lista?

- ⬭ Bolitas de algodón
- ⬭ Conciertos
- ⬭ Luces de carros
- ⬭ Cámaras

6 ¿Qué frase del párrafo 5 ayuda al lector a saber qué significa desechable?

- ⬭ *se tira a la basura*
- ⬭ *en un escenario*
- ⬭ *tenía tanta prisa*
- ⬭ *antes de que anocheciera*

7 Probablemente, ¿cómo se sienten los padres de Roberto después de viajar en carro desde Kerrville hasta Marfa?

- ⬭ Satisfechos
- ⬭ Perdidos
- ⬭ Contentos
- ⬭ Cansados

SIGUE

8 El encargado del motel le dice a Roberto que él y su familia llegaron muy a tiempo a Marfa porque —

- es la única época del año en que las luces se pueden ver
- habrá un festival para celebrar las luces que se ven cerca del pueblo
- el motel tiene un cuarto donde la familia de Roberto puede pasar la noche
- unas personas del pueblo están poniendo luces en un escenario para un concierto

9 En el párrafo 3, ¿qué palabra ayuda al lector a saber qué significa <u>relajarse</u>?

- *sacamos*
- *buscar*
- *leer*
- *descansaban*

10 Cuando Roberto está esperando ver las luces de Marfa, ¿para qué viene un señor a hablar con él?

- Para mostrarle dónde buscar las luces
- Para contarle historias sobre Marfa
- Para ayudarle a encontrar su cámara nueva
- Para darle fotos de las luces de Marfa

11 Probablemente, ¿cómo se siente Roberto cuando ve las luces?

- Desilusionado
- Inteligente
- Emocionado
- Tonto

SIGUE

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