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On the Move: A Mixed-Methods Study to Examine the Impact of Kinesthetic Learning Tables on Student On-Task Behavior and Academic Growth

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On the Move: A Mixed-Methods Study to Examine the Impact of Kinesthetic Learning
Tables on Student On-Task Behavior and Academic Growth

By
Natalie Boone

A Dissertation Submitted to the
Gardner-Webb University School of Education
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Education

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Approval Page

This dissertation was submitted by Natalie Boone under the direction of the persons listed below. It was submitted to the Gardner-Webb University School of Education and approved in partial fulfillment of the requirements for the degree of Doctor of Education at Gardner-Webb University.

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He gives power to the faint, and to him who has no might he increases strength. Even youths shall faint and be weary, and young men shall fall exhausted; but they who wait for the LORD shall renew their strength; they shall mount up with wings like eagles; they shall run and not be weary they shall walk and not faint. Isaiah 40:29-31

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Abstract

On the Move: A Mixed-Methods Study to Examine the Impact of Kinesthetic Learning Tables on Student On-Task Behavior and Academic Growth. Boone, Natalie, 2016: Dissertation, Gardner-Webb University, Movement/Learning/ Kinesthetic Learning/Reading/Student Behavior

Kinesthetic learning tables, which incorporate movement, are innovative alternatives to traditional desks. The tables provide movement with bicycle pedals, balance seats, ski swings, cross lateralization, and elliptical, all while students are seated or standing. It is time to investigate whether incorporating movement within the classroom could impact student behavior and academic performance.

The goal of this study was to examine the impact kinesthetic learning tables on student on-task behavior and academic growth with an emphasis on reading skills. The study considered the effectiveness of interventions implemented in one first-grade and one fourth-grade classroom based on current research on brain-based learning as it applies to education. The focus was primarily on the processes within the program, concentrating on the impact kinesthetic learning tables had on measures of reading skills as well as the impact kinesthetic learning tables had on student classroom on-task behaviors. The study incorporated a variety of data collection methods, both qualitative and quantitative, including behavior observations, monitoring of reading grades, and teacher interviews with focus groups.

A major conclusion that can be drawn from this study was that kinesthetic learning tables have a greater impact on fourth-grade students. There was a statistically significant impact on fourth-grade reading scores as well as on-task student behaviors in the fourth grade. Additional results of this study are explored and recommendations for future research are presented.

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Chapter 1: Introduction

Background to the Study

Legislation surrounding education has shifted in the past quarter century creating new demands on teachers (Ivory, 2011). Before our very eyes, teaching in America is undergoing a revolution. Recent federal mandates have placed an increased importance on student performance as determined by academic achievement tests. Thus, school districts have begun altering their curricula to better provide students with the necessary means to improve their test performance (Hillman et al., 2009). Three major trends have now converged to bring a momentous change to education: (1) the adoption of the Common Core State Standards; (2) the growth and development of the teacher evaluation system in some states; and (3) changing lifestyles and use of technology resulting in continuing or increasing prevalence of sedentary behaviors in individuals of all ages.

First, with the adoption of the Common Core State Standards, North Carolina for the first time has a clear picture of the kinds of skills students should have when they leave high school. The role of the new Common Core State Standards is to ensure that all students are able to be successful in an economy and society that is changing at a remarkable pace and that will continue to do so throughout their lifetimes (Conley, 2014). The adoption of the Common Core Standards is the biggest pedagogical change to education since John Dewey, with more depth, increased life skills, enhanced rigor, more emphasis on technology, changes to speaking and listening skills, and sophisticated critical thinking skills (Murray, n.d.). The Common Core State Standards allow educators to share a common language about what they want students to learn, and they enable development of high-quality materials that address the standards (Conley, 2014). Students need to know how to perform the critical reading necessary to process the

staggering amount of print and digital information required to thrive at this game called life. Students must understand cause and effect and transfer knowledge from one subject area to another throughout their educational day. One of the most important goals of the Common Core State Standards is to provide the knowledge and skills necessary to succeed in college, career, and life (Conley, 2014).

Second, the growth and development of the teacher evaluation system have placed stringent accountability on all North Carolina teachers. These accountability systems have wielded enormous pressure on school leaders and educators to meet rising expectations to prepare students to be well equipped to lead the nation in the years to come (Sledge & Pazey, 2013). Some models of teacher evaluations are used to measure the contribution of a teacher or school on student learning. It is called the value-added measurement. The measurement is completed by taking the difference in student performance on a statewide assessment from 1 year to the next and then accounting for other factors that show impact on the learning process (Colestock, 2014). The factors are specific to student, classroom, and school characteristics that are shown to impact student learning. Darling-Hammond (2012) described the importance of teacher quality, saying, “Educators know—and research confirms—that every aspect of school reform depends for its success on highly skilled teachers and principals, especially when the expectations of schools and the diversity of the student body increase” (p. 8). Weisberg, Sexton, Mulhern, and Keeling (2009) recommended the design and implementation of a comprehensive performance evaluation system that fairly, accurately, and credibly differentiates teachers based on their effectiveness in promoting student achievement. The teacher evaluation systems have moved into the forefront of educational reform with a vast discussion on how to develop and make the evaluation fair and reliable.

Third, ever-changing lifestyles and use of technology have led to a continuing or even increasing prevalence of sedentary behaviors in individuals of all ages with arguably the most negative outcomes in children and adolescents (Vaynman & Gomez-Pinilla, 2006). According to research conducted by Owen, Sparling, Healy, and Dunstan (2010) with the Mayo Clinic, sedentary behavior can be defined as sitting, lying down, and expending very little energy. The number of obese and overweight children has rapidly risen. One contributor to these climbing rates is the prevalence of technology and media that promotes sedentary behavior (Fuller, 2015). The role of technology in childhood obesity is not just a matter of speculation. More than 40 studies have been conducted on the matter, and many indicate that the availability of technology contributes to a sedentary lifestyle and weight gain in children (Cespedes, 2011). A Canadian study conducted in 2003 and published in the *International Journal of Obesity* linked 7- to 11-year-old children's television and computer use to a significantly increased risk of being overweight or obese. The study found that children who spent 3 or more hours a day in front of technology had between a 17% and 44% increase of risk of being overweight or a 10% to 61% increase risk of obesity (Cespedes, 2013).

Secretary of Education Arne Duncan voiced the same concerns in an interview with CNN's Soledad O'Brien when he indicated, "America's education system is basically a 19th century model that is not preparing enough students to be successful in the 21st century economy, leaving over two million unfilled, high-wage and high-skilled jobs" (Holmes, 2012, para. 4). Technology improves educational opportunities by enabling educators and students to overcome barriers of distance and by enhancing the content of instructional materials. Students often enjoy working on computers; so when used in the classroom, the computers can create a new excitement about learning among

the students. In a 21st century world, education is no longer just a pathway to opportunity and success—it is a prerequisite.

These new changes are due in part to The Race to the Top (n.d.) initiative. The White House website offers the summary of President Obama’s initiative, stating,

Race to the Top marks a historic moment in American education; this initiative offers bold incentives to states willing to spur systemic reform to improve teaching and learning in America’s schools. Systems that simultaneously pursue systemic change and innovation have the best chance of dramatically improving teaching quality and instructional delivery. (Race to the Top, n.d., para 1).

The rigor of curriculum and the demands placed on both the teachers and the students are dramatically increased with the Common Core State Standards. Learning by doing is generally considered the most effective way to learn (Lombardi, 2007). All of this means that students are shouldering more responsibility for their own learning and are expected to develop the kind of critical thinking skills—not just rote knowledge—required for “real-world” success. As a result, advocates of student-centered learning say it provides superior preparation for both college and career (Richmond, 2014). “The goal: a stronger connection between academic learning and the kind of real-world experience that advocates say can translate into postsecondary success” (Richmond, 2014, para.7).

Statement of the Problem

With the paradigm shifts and demands on performance of schools, administrators are beginning to cut recess and physical education in order to allow for more instructional time for teachers (McCary, 2007). The one most detrimental barrier to learning and recalling information may be a teacher’s deliberate attempt to stop students from moving (Jensen, 2002). These changes have a dual effect on human behavior: People move less

and sit more. From an evolutionary perspective, humans were designed to move—to locomote and engage in all manner of manual labor throughout the day (Owen, Sparling, Healy, & Dunstan, 2010). The recent shift from a physically demanding life to one with few physical challenges has been sudden, occurring during a tiny fraction of human existence (Owen et al., 2010).

As the late arts educator Elliot Eisner reminded us, we learn about the world through our senses, drawing information in through our bodies to feed our understanding of the world (Blatt-Gross, 2015). As adults, we have the option to get up and fidget, answer phone calls, move to the back of the room, and doodle while in meetings; but we do not give this option to the students. Physically and mentally, we as humans are not well suited for sitting still and focusing on a task for an extended period of time (Wells, 2012).

Our brains require stimulation and connection to survive and thrive. Thus, teachers need to supply students with a chance for social interactions in the classroom. A stimulating environment creates more connections in the brain. Teachers must take advantage of the windows of opportunity that occur in children between the ages of 2 and 11 by providing an enriched and challenging educational environment (Starr, 1999). School-aged children regularly spend 30% of their waking hours at school. Therefore, school furniture is used extensively during a vital period of human physical development (Ramadan, 2011). Students need to be able to move, wiggle, talk, and collaborate throughout the day. Society today is in constant motion, and our brain is designed to help us survive in society by moving. The same is true for school. If the purpose of the brain is to help the body survive in the real world and in the real world people actually move, these brains must achieve that purpose in school (Tate, 2007).

Purpose of the Study

The purpose of the study was to examine the impact kinesthetic learning tables (KLTs) have on student behavior and academic growth with an emphasis on reading skills. This study assessed the effectiveness of interventions implemented in one first-grade and one fourth-grade classroom based on current research on brain-based learning as it applies to education. These learning tables, which incorporate movement, are an innovative alternative to traditional desks. KLTs provide a workout with bicycle pedals, balance seats, ski swings, cross lateralization, and elliptical; all while seated or standing. Blaydes (personal communication, May 17, 2013) mentioned brain research showing that when students move and are or become active while they are learning, this actually helps them retain information. It helps them stay focused and engaged.

Conceptual Base

The time is here to advocate for change in the schools. Keeping children active, engaged, and healthy in the environment where they spend the majority of their waking hours should be a top priority for all educators. Fiore (2014) emphasized that every day there is a new article highlighting research which shows how bad sitting for long periods of time is, not only for productivity but for overall health. All this downtime is so unhealthy that it has initiated a new area of medical study called inactivity physiology, which explores the effects of our increasingly butt-bound, tech-driven lives, as well as a deadly new epidemic researchers have dubbed sitting disease (Yeager, 2009). The less the body moves, the less blood sugar the body uses; research shows that for every 2 hours spent on one's backside per day, the chance of contracting diabetes goes up by 7% (Yeager, 2009). The risk for heart disease goes up, too, because enzymes that keep blood fats in check are inactive. One is also more prone to depression: With less blood flow,

fewer feel-good hormones are circulating to the brain (Yeager, 2009). Teachers and schools have the opportunity to make an enormous impact on the lives of their students by incorporating some movement into the classroom.

Movement is essential to the human body. Movement was here long before exercise. We as humans were designed to be movers: hunting and gathering, dancing around the fire, walking, climbing, running, jumping, crawling, rolling, working, lifting, fighting, and swimming. The history of human movement shows its importance to existence. Movement helps promote a positive learning atmosphere in which students are alert, engaged, focused, and excited to learn. While movement activities in class clearly have benefits for all students, these activities may be especially beneficial to kinesthetic learners whose learning needs are often neglected as the traditional classroom frequently caters instead to their auditory and visual peers. Movement is a vital aspect of the ability to cognitively function. Movement is important because it helps develop neural connections and actually builds the brain (Dennison & Dennison, 1994).

Movement plays an important role in the learning process. Movement not only helps with procedural memory, but it also assists with reading, gets more glucose and blood to the brain; changes the mood of the brain; and provides tons of fun during learning (Tate, 2011). If we create fun learning environments, students are likely to hold on to that learning longer. Using movement in the class can increase student motivation, engagement, and attention (Wells, 2012). Sitting for long periods of time actually works against the ability of students to learn effectively. “As students remain stationary, blood begins to pool in the buttocks and legs, creating a depression of brain attention, function, and learning capability” (J. Blaydes, personal communication, May 17, 2013). As facilitators of learning and designers of the learning environment, it is important that

teachers realize the multiple benefits of infusing movement into academic instruction.

According to Kuczala and McCall (2011), from the brain-oriented perspective, there are six critical reasons to add more movement in the classroom. They include

- The brain is attracted to novelty and is preprogrammed to notice differences. Therefore, using creative and innovative strategies that infuse movement into instruction allows the brain to stay connected for longer periods of time.
- The brain wants the body to move. The brain is stimulated and naturally learns through the movement of its own body. Using movement to teach content creates a very natural and efficient way to learn.
- The brain is a social organ that needs to interact with people. At varying levels, we are all social creatures and crave human engagement and attention. Interactive, cooperative experiences provide the brain with an optimal environment to flourish socially as well as intellectually. Movement activities encourage cooperative learning experiences.
- Learning is primarily an emotional process. When the individual cares about what is being taught, the brain remembers and retrieves information more effectively. We are our emotions; they practically run our lives. Experiential movement is a productive way to create a positive, fun, and engaging classroom environment that enhances the learning process.
- The brain operates from concrete experience. Exposing the brain to “hands-on” learning experiences is critical to memory and retrieval. The brain prefers active, not passive, learning. The more student movements

are aligned and connected to instruction, the more profound the learning process.

- The brain is always trying to create a reason for learning. Movement creates increased brain connectivity, which enhances higher-level problem solving and critical thinking skills. (Kuczala & McCall, 2011, para. 2)

The paradigm of the still, quiet classroom with neatly aligned desks unfortunately requires that some students spend a great deal of energy complying with physical restraints rather than learning (Blatt-Gross, 2015). Legislation challenges educators to provide students with the least restrictive learning environment. As the role of the school is to promote student learning through neural stimulation, extensive physical inactivity seems counterproductive. Paying attention and listening during lectures, meetings, or conversations can be challenging at times for all of us (Kercood & Banda, 2012).

Students need the opportunity to fidget, wiggle, and move while learning (J. Blaydes, personal communication, May 17, 2013). As facilitators of learning, teachers must see that all learning needs of students are met; this includes not being restricted to remaining still (Wells, 2012). Traditional schooling methods, involving long periods of time in which students are passive and seated, are not conducive to student physical needs (Wells, 2012). The brain is much more activated by movement than by seatwork, which increases fatigue and reduces concentration. What makes humans move is also what makes humans think. As the brain and body begin to work together to process motor sequences and patterns such as rolling over, crawling, walking, and jumping, the brain creates the pathways used for processing sequences in reading and math (J. Blaydes, personal communication, April 14, 2012). We must not forget that children have bodies as well as brains, and the two are intricately connected. Educators must find ways to

build those connections in the classroom.

Research Questions

The research questions for this study were organized around the purpose of the case study. The focus was primarily on the processes within the program. Therefore, the research questions that guided the study were

1. What impact do KLTs have on measures of reading skills as measured by mClass?
2. What impact do KLTs have on student on-task behaviors?

Professional Significance of the Problem

School administration is under pressure to increase student scores on standardized tests and to improve learning potential in light of all the new demands placed on education (Danielson, 2007). This is a huge task for any school district. Today's students are increasingly less active. Students are spending more time in front of computers, both at home and at school, than they are outside. It is time to investigate whether incorporating movement within the context of the school environment could partially satisfy the children's need for physical activity as well as impact classroom behavior and academic performance. Implementation of KLTs could help school districts increase both the student academic achievement levels and their physical activity levels using one process.

According to Stanford Educational Leadership Institute (Darling-Hammond, LaPointe, Meyerson, Orr, & Cohen, 2007), school and district leaders are much more than building managers. They have the leverage to improve the school as an organization through developing structures that support high-quality teaching and learning, growing, and developing the capacity of faculty to truly meet the needs of students and

implementing reform strategies that lead to improved student outcomes. It is important to determine if dynamic seating options such as KLTs have any impact on student behaviors and reading scores as a measure of academic performance. The information gained from this study will help when teachers and administrators consider classroom furniture options for schools.

In order for administrators, teachers, and students to invest precious time and money in a unique technique, data must support the efficacy of the effort and provide insight into the components of the program that contribute to its success. Paramount significance of this study and findings include recommendations for KLTs in other school districts and classrooms. Additionally, if the program yields positive results, there is opportunity for the program to be replicated, potentially enhancing the learning of an even broader group of students. If student reading scores and behaviors improve as a result of participating in this program, what are the factors in the learning and instructional environment which lead students to become more engaged with their learning and advance their educational outcomes?

Overview of the Methodology

In this study, the researcher examined whether the implementation of KLTs affected the reading scores and on-task behaviors of students in first- and fourth-grade classrooms respectively. The study incorporated a variety of data collection methods, both qualitative and quantitative, to measure how implementing KLTs in those classrooms affected student academic achievement and classroom on-task behavior. Data were collected through behavior observations, monitoring of reading grades using mClass assessments, teacher interviews with focus groups, and classroom observations. The students in this study were current learners in each grade level studied. A mixed-methods

research model was used. Research included the collection and analysis of quantitative and qualitative data through the use of numbers and statistics from numerous formal and informal assessments as well as content analysis from surveys and documents designed to answer the research questions. While the quantitative approach was predominantly employed with the focus on reading scores, qualitative inquiry related to teacher survey questions and student behavior charts was also utilized. It was the goal of the researcher to enrich reading skills and behavior data with data provided by teacher classroom observations.

Definition of Key Terms

Authentic learning. Real-life learning.

Brain research. How the brain learns as it relates to education and what researchers have determined from scientific studies on how the brain works.

Common Core State Standards. A set of high-quality academic standards in mathematics and English language arts/literacy.

DIBELS. Dynamic indicators of basic early literacy skills are a set of procedures and measures for assessing the acquisition of early literacy skills in kindergarten through sixth grade.

Exercise. Repetitive and planned physical activity with the goal of maintaining or improving physical fitness.

Kinesthetic learning tables (KLTs). Innovative tables that incorporate movement stations instead of desk and chair.

mClass. Observational reading assessment software for K-6.

Motivation. The desire to do things.

Movement. An act of changing physical location.

Neurotransmitters. Chemicals that transmit signals from a neuron to a target cell across the synapse.

Physical activity. Any bodily movement produced by skeletal muscles that results in energy expenditure.

Physical education. A planned, sequenced program of instruction that helps students develop the knowledge, attitude, motor skills, and self-management needed to adopt and maintain a physical active lifestyle.

Play. How young children physically explore their environment to facilitate language, creativity, and social skills.

Recess. Unstructured playtime where children have choices and they can release energy and stress.

Race to the Top. A grant given by the U.S. Department of Education to spur and reward innovations and reforms to education.

Teacher evaluation system. A defined set of standards used as a way of measuring the effectiveness of teachers in an education system.

Text reading and comprehension (TRC). An individually administered assessment using leveled readers from a book set to determine a student's instructional reading level with the mClass reading system.

Delimitations of the Study

The researcher acknowledged limitations of the study. Studies suggest a 3-5 year time frame for implementation of any brain-based research (Biller 2002). Due to this research, the time constraint will not be sufficient to validate the results of this study. The important concept of this study was to implement the latest in brain research through KLTs to differentiate for more students to become successful readers who enjoy school.

All data from this study, including successes and failures of the brain research that supports it, were assessed on a monthly basis and shared in a grade group meeting after school.

All students come from different backgrounds and enter school with different ability levels. The fact that all students learn differently and in different time frames also impacted the results of the study. The way each teacher implements the interventions also places limits on the study.

Assumptions

The researcher acknowledges assumptions made in the study. One assumption was that all students are exposed to the same learning process even when their environments are different. Another assumption was that all teachers implemented mClass with fidelity.

Organization of the Dissertation

The study is organized into five chapters. Chapter 1 presents a nationally scaled problem of the new demands placed on education that impact the academic scores of students. The chapter presents a study proposing to look at the impact of kinesthetic classrooms on reading scores and behaviors. This introduction includes the research questions that guide the study. Chapter 2 presents a review of literature corresponding to the themes within the research questions. The methodology for this study is discussed in Chapter 3. The data, findings, results, and analysis are presented in Chapter 4. A full summary of the research study and recommendations for consideration are found in Chapter 5.

Chapter 2: Literature Review

Overview

This chapter is organized around the themes represented in the research questions which include (a) movement and brain function (b) movement and behavior, (c) furniture and behavior, (d) movement and academics, (e) furniture and academics, (g) dynamic classroom furniture options and design, and (h) history of KLTs.

Movement and Brain Function

Exercise improves learning on three levels: first, it optimizes the mindset to improve alertness, attention, and motivation; second, it prepares and encourages nerve cells to bind to one another which is the cellular basis for logging new information; and third, it spurs the development of new nerve cells from stem cells in the hippocampus (Ratey & Hagerman, 2008).

In their informative book, Ratey and Hagerman (2008) said, “In addition to priming our state of mind, exercise influences learning directly, at the cellular level, improving the brain’s potential to log in and process new information” (p. 35). While movement increases cognitive function, it also enables students to concentrate better, because movement assists students in ridding their bodies of kinesthetic energy (Sousa, 2006). Amazingly, the part of the brain that processes movement is the same part of the brain that processes learning (Jensen, 1998).

Learning style theorists (Gardner, 1983; Marzano, 2007; McCarthy, 1990; Sternberg & Grigorenko, 2000) and educational consultants (Jensen, 1998; Sousa, 2006; Wolfe, 2001) have concluded there are some instructional strategies that, by their very nature, result in long-term retention. Exercise brings the brain and the body into biobalance, creating a better learning state for the student (Blaydes, 2010). Aerobic

activity releases endorphins, the class of neurotransmitters that relax the body into a state of cortical alertness and reduce the symptoms of depression. Because physical movement increases the energy of students, it enhances their engagement (Marzano, 2007). Movement enhances circulation as well, so individual neurons can get more oxygen and nutrients. According to Bright (2008), moving helps children focus on complicated mental tasks that require them to store and process information. Movement plays a vital role in the learning process.

Emerging evidence from neuroscience suggests that regular physical activity promotes the growth of new brain cells, stimulates the formation of blood vessels in the brain, and enhances the synaptic activity or communication among brain cells (Hillman, Erickson, & Kramer, 2008). It may spur the production of nerve growth factor which boosts brain function. Movement combines mind, body, and emotion, ensuring that learning is meaningful and will be retained (Jensen, 2003). Learning experiences must make sense in order for the brain to allow more information to settle into existing patterns.

Exercise not only fuels the brain with oxygen, but it also feeds its neurotrophins to increase the number of connections between neurons (Jensen, 1998). More neurotransmitters are released, more endorphins are released, and more neural networks are developed with movement (Jensen, 1998). It is this connection between neurons that creates learning and memory. Movement is a vital aspect of the brain's ability to cognitively function. Gross motor repetitive movements can stimulate the production of dopamine, a mood enhancing neurotransmitter. As students become active, their energy levels go up and provide their brains with oxygen-rich blood needed for highest performance (Jensen, 1998).

Procedural memory is one of the strongest memory systems in the brain and is accessed when the body is involved while one is learning (Tate, 2003). Movement not only helps with procedural memory; but it also assists with reading, gets more glucose and blood to the brain, changes the mood of the brain, and makes learning fun (Tate, 2011). Sensory components of balance, coordination, spatial awareness, directionality, and visual capabilities are developed as the child engages in movement activities such as rolling, creeping, crawling, spinning, twirling, bouncing, balancing, walking, jumping, juggling, and supporting their own weight in space (J. Blaydes, personal communication, May 17, 2013). When students perform cross-lateral activities through locomotor movement patterns, the brain and body midlines cross to integrate and organize the hemispheres of the brain. This makes the brain more alert and energized for learning.

According to Blaydes (personal communication, April 14, 2012), crossing the midline integrates brain hemispheres to enable the brain to better organize itself. Cross-lateral movements are those in which arms and legs cross over from one side of the body to the other. The left side of the brain controls the right side of the body, and the right side of the brain controls the left side. Both sides are forced to communicate when arms and legs cross over. The visual abilities needed for eye tracking in reading are strengthened through moving about in space with or without equipment crossing the brain and body midlines.

The vestibular and cerebellar systems are the first systems to mature in the brain. These two work closely with the reticular activation system that is located at the top of the brain stem and is critical to our attention system (J. Blaydes, personal communication, June 29, 2014). These systems interact to ensure balance, turn thinking into action, and coordinate moves. Balance improves reading capacity. Physical education and activities

that stimulate inner ear motion, like rolling, jumping, and spinning, are necessary to lay the foundation for learning (Blaydes, 2001). Proper development, enrichment, and remediation of these systems are critical to a child's ability to learn. The body's vestibular system interacts with the cerebellum to control balance, coordination, and spatial awareness (J. Blaydes, personal communication, April 14, 2012). These systems turn thinking into action and facilitate the student's ability to place words and letters on a page. To move forward, educators must admit that a one-size-fits-all model of education is doomed to fail the majority of students and teachers.

Research shows that when children have recess, they gain more focus on the task, become less fidgety, show improved attention and memory, and learn to resolve conflicts (Adams, 2011). Gardner (1983) declared one of his eight multiple intelligences as the bodily kinesthetic multiple intelligence. If physical education is cut from schools, one eighth of human intelligence is eliminated. Physical education is one of the few disciplines that incorporate most of the eight identified intelligences simultaneously.

An average of half an hour of recess per day has been cut out of the school day in the majority of elementary schools following the implementation of No Child Left Behind (Center for Public Education, 2008). Movement triggers the release of a number of neurotransmitters and hormones, including dopamine, serotonin, adrenaline, and endorphins which cause students to feel happy and excited (Jensen, 2000). Requiring students to move can help engage even typically reluctant and disinterested learners (Honigsfeld & Dunn, 2009). Unfortunately, adding physical activity to the school day can be difficult due to the competing priorities, budget concerns, and lack of time reported by teachers and administrators (Center on Education Policy, 2011).

Movement and Behavior

Many factors influence student performance in school and on standardized tests; one significant influence on academic achievement is student on-task behavior and attention (Frazier, Youngstrom, Glutting, & Watkins, 2007). Researchers have discovered that the brain responds to the motions of the body and vice versa (Tompson et al., 2005). Movement helps promote a positive learning atmosphere in which students are alert, engaged, focused, and excited to learn. Movement engages students both physically and mentally and by so doing helps reduce the amount of off-task behavior (Helgeson, 2011). Biologically, all people are built to move, and increased amounts of sitting seem to counter this premise. Research findings support the idea that movement in the form of standing or walking is critical to maintaining wellness, through everything from fewer repetitive motion injuries to reduced weight, fostering greater concentration and engagement and boosting productivity (Amick et al., 2003). The ability to pay attention increases when given the opportunity to move (Kilbourne, 2009). The increase of arousal and the decline in physical fatigue that comes from movement helps students focus their attention on the task at hand (Jensen, 2000).

A study conducted in North Carolina evaluated the effects of a 12-week classroom-based program, which gave students 10-minute breaks daily for organized physical activity. On average, the activity breaks increased on-task behavior by 8% in kindergarten through fifth-grade students involved in the study. Among those who tended to be the least focused in class, their behavior was improved by 20% due to the breaks (Mahar et al., 2006). Attention and the ability to inhibit distracters, both of which contribute to on-task behavior, have been shown to improve after an acute bout of physical activity in children (Drollette, Shishido, Pontifex, & Hillman, 2012).

Sylwester (1995) said movement facilitates cognition. He said the reason humans have the brains they have is so they will move. He also pointed out that a central mission of the brain is to intelligently navigate its environment. Therefore, learning must include movement concepts and skills. Aerobic activity not only increases blood flow to the brain, but also speeds recall and reasoning skills (Etnier et al., 1999). When there is a brain-body connection, memory is enhanced (Tate, 2003).

Some researchers have proposed that difficulties processing sensory input could be the root of some behavioral and attention problems within the classroom (Polatajko & Cantin, 2010). Scholars estimate that 13% of children within the general education classrooms demonstrate difficulties processing sensory information (Ahn, Miller, Milberger, & McIntosh, 2004) and that those difficulties can manifest as behavioral concerns, attention deficits, and decreased social skills. Sensory processing theorists believe proprioceptive and vestibular input is as beneficial to learning as visual and auditory input (Polcyn & Bissell, 2005). Their view is that children are not allowed sufficient opportunities to move at school.

Furniture and Behavior

The purpose of the brain is to help the body survive in the real world, and in the real world people actually move. It therefore follows that brains should be used for that purpose in school (Tate, 2007). Brains require stimulation and connection to survive and thrive. Requiring students to move can help engage even those typically reluctant, disinterested learners (Honigsfeld & Dunn, 2009). Thus, teachers need to supply students with a chance for social interactions in the classroom. A stimulating environment creates more connections in the brain. Teachers must take advantage of the windows of opportunity that occur in children between the ages of 2 and 11 by providing an enriched

and challenging educational environment.

Students need to be able to move, wiggle, talk, and collaborate throughout the day. If society today is in constant motion and the brain is designed to help survive in society by moving, then motion at school seems essential. The key to productive work is healthy motion, even while seated. Pedals under the desk, rubber bands around the chair feet, or anything that can make the body be in motion are important for optimal productivity. The benefits of changing postures throughout the day include improved focus, engagement, and wellness. Poor sitting, too much sitting, and poorly designed seating can contribute to worker discomfort, health problems, and low productivity (Movement in the Workplace, n.d.)

Since sedentary behavior is an independent risk factor for increased rates of illness (Church, Craig, Katzmarzyk, & Bouchard, 2009), the result can mean fewer hours lost to sick workers. The increasingly sedentary nature of work and its impact on health and productivity indicators demand the promotion of physical activity within the workplace (Pronk & Kottke, 2009). A clear culture shift educates the workers on the benefits of increased movement, providing strong and visible management support for these changes; and including consistent and regular reminders encouraging employees to move can be very effective. The sedentary nature of our culture and society is deeply rooted. Barr-Anderson, AuYoung, Whitt-Glover, Glenn, and Yancey, (2011) found that introducing short bouts of physical activity into workplace practices increased data entry, speed, and accuracy.

Standing desks are now used in hundreds of schools nationwide. Mark Benden, research professor of classroom ergonomics, at Texas A&M, examined the impact of these desks in a 2011 study of four central Texas fourth-grade classrooms (Benden,

Congleton, & Fink, 2011). When asked, teachers in this study all said that the standing desks had a positive impact on student behavior.

Movement and Academics

Emerging brain science research supports the link between movement and physical activity and increased academic performance. As schools everywhere strive to improve the academic performance of their students, many have cut physical education and recess periods to leave more time for classroom instruction. However, studies show that students who participate in daily physical education exhibit better attendance, a more positive attitude toward school, and superior academic performance (National Association for Sport and Physical Education & Council of Physical Education for Children [NASPE], 2001). Physically active youth are more likely to have better grades and test scores than their inactive counterparts (Trost & Van, 2009). When students are active, their energy levels go up and their brains are provided with oxygen-rich blood needed for highest performance (Jensen, 1998). Oxygen and glucose feed the brain so the brain is ready to learn at the maximum level.

Hillman et al. (2009) found that preadolescents performed significantly better when reading comprehension tests followed exercise periods as opposed to when they followed periods of rest. Physical activity can support and improve connections between neurons, enabling more effective neural communication, which is essential for learning (Helgeson, 2011). Increasing the activity level of students helps the brain prepare for learning. Research has shown that exercise provides more oxygen-rich blood, which nourishes the brain. There is limited research supporting the notion that test scores go up by keeping students in the classroom longer, but there are numerous studies that show the benefits of recess for children. When children have recess, they gain more focus on the

task, become less fidgety, improve attention and memory, and learn to resolve conflicts (Adams, 2011).

A Canadian study examined the effects on 546 elementary students' academic performance of 1 additional hour of physical education per day. Students in Grades 2 to 6 who received additional physical education earned better grades in French, math, English, and science than the students who received the standard amount of physical education per week (Shephard, 1996).

A longitudinal study by the Centers for Disease Control and Prevention followed two national samples involving 5,316 students from kindergarten through fifth grade. Girls who participated in physical education for 70 or more minutes per week had significantly higher achievement scores in math and reading than girls who were enrolled in physical education for 35 or fewer minutes per week (Carlson et al., 2008).

An analysis of fitness testing results from more than 800,000 students in California revealed a significant positive correlation between physical fitness, achievement, and performance on state achievement tests in reading and mathematics (Grissom, 2005). Exercise brings the brain and the body into balance, creating a better learning state for the student (Blaydes, 2010). Balance improves reading capacity. Physical education and activities that stimulate inner ear motion like rolling, jumping, and spinning are necessary to lay the foundation for learning (Blaydes, 2001).

On average, half an hour of recess per day has been cut out of the school day in the majority of elementary schools following the implementation of No Child Left Behind (Center for Public Education, 2008). Unfortunately, adding physical activity to the school day can be difficult due to competing priorities, budget concerns, and lack of time reported by teachers and administrators (Center on Education Policy, 2011).

Physical activity exerts a stimulating influence on the entire brain that keeps it functioning at an optimal level. When students are actively engaged in experiences with content, they stand a much better chance of learning and remembering what they need to know (Tate, 2003). Active learning is an approach to instruction in which students engage the material they study through reading, writing, talking, listening, and reflecting. Students and their learning needs are at the center of active learning.

A major finding of a study in Massachusetts indicated that the students who received more hours of physical activity scored significantly higher on the English language arts (ELA) test (Tremarche, Robinson, & Graham, 2007). Students in this study were all fourth-grade students in two different schools and were given the Massachusetts Comprehensive Assessment System (MCAS) standardized test in two areas, ELA and math. Students in two schools used for this study received different amounts of physical education time throughout the year. Those in one school received twice the physical education time as those in the other school. The findings showed that the students receiving the most physical education scored significantly higher on their ELA assessment but not on their math assessments.

Another study performed in Texas evaluated students and their academic relation to physical fitness scores. It was notable that all five fitness tests had a positive, linear association with academic test scores, and no variable had a non-significant association (Van Dusen, Kelder, Kohl, Ranjit, & Perry, 2011). The results demonstrated that each additional unit of cardiovascular fitness was associated with increased the Texas Assessment of Knowledge and Skills (TAKS) performance. Physical activity improves general circulation, increases blood flow to the brain, and raises the levels of norepinephrine and endorphins. Student health and fitness levels are highly correlated

with academic results.

Castelli, Hillman, Buck, and Erwin (2007) observed a positive relation between fitness and standardized achievement test performance in mathematics and reading for third-grade and fifth-grade children. Coe, Pivarnik, Womack, Reeves, and Malina (2006) administered a 3-day physical activity recall survey to sixth-grade children and observed academic performance in four core classes. They found increased performance in core academic classes for those children who reported vigorous physical activity outside of school relative to those who reported no physical activity outside of school.

Physical exercise of various intensities and durations can enhance cognition across the lifespan of humans (Cotman & Berchtold, 2002). Trudeau and Shephard (2010) identified physiological influences, such as greater arousal and enhanced levels of neurotrophins, which stimulate neural connections in the hippocampus, the learning center of the brain.

Aerobic activity not only increases blood flow to the brain but also speeds recall and reasoning skills (Etnier et al., 1999). With increased blood flow through movement, blood travels to the brain at greater rates and feeds the essential nutrients, oxygen, and glucose it needs to function at its best.

Research indicates that physical activity enhances brain function and produces many cognitive and physiological benefits (Diamond & Hopson 1998; Hannaford, 1995; Jensen, 1998; Sylwester, 1995). The academic mission of a school may be better served by providing more physical activity opportunities for its students.

Furniture and Academics

Elementary school classrooms serve as the main context for learning and development during childhood. The main function of school furniture is to support the

child when writing, drawing, and watching the teacher (Exner & Wingrat, 2005). In a perfect world, the physical environment of a classroom would promote learning, enhance academic achievement, and facilitate appropriate behavior in and between students.

Taylor (2009) referred to the physical environment of the classroom as the silent curriculum, meaning the environmental design of a classroom has the power to facilitate and enhance the learning process in ways similar to that of the overt curriculum.

Movement has a therapeutic effect on the brain and the body (Tate, 2007).

Classroom furniture should be designed to allow movement, because localized muscle fatigue and pain can result from poor posture and in limited blood supply to muscles for learning (Legg, Trevelyan, Carpentier, & Fuchs, 2003). Diamond and Hopson (1998) conducted research focused on enriched environments derived from play and supported the importance of play in early brain development. Critical motor development sets the stage for brain processes used later for decoding and problem solving, which is a strong argument for daily physical education starting in kindergarten.

Classrooms should conform to the most enlightening ideas of collaboration, flexibility, and meaningful learning through design, construction, and decoration. All equipment should advance the school's program and goals. According to Mandal (1984), classroom furniture is typically not designed to fit school children proportionately. Children who are uncomfortable in their seats may demonstrate behaviors such as rocking, fidgeting, and other position changes to try to alleviate their discomfort. These children may seem disruptive and inattentive; when, in fact, they are merely attempting to cope with an uncomfortable or ill-fitting chair.

Learners in a positive, joyful environment are likely to experience enhanced learning, memory, and self-esteem (Jensen, 2008). Because of motivation's powerful

influence in literacy learning, teachers are more interested than ever in understanding the relationships between motivation and achievement and in learning how to help all students achieve the goal of becoming effective, lifelong learners. A challenging environment forces the brain to flex its thinking muscles (Jensen, 2008). Classrooms should be multisensory environments. Even so, studies show that students who participate in daily physical education exhibit better attendance, a more positive attitude toward school, and superior academic performance (NASPE, 2001).

Dynamic Classroom Furniture Options and Design

Previous research has found that increased attention and work completion is associated with the use of controlled movement or dynamic seating options (Pfeiffer, Henry, Miller, & Witherell, 2008). While movement activities in class clearly have benefits for all students, they may be especially beneficial to kinesthetic learners whose learning needs are often neglected in the traditional classroom which frequently preferences auditory and visual learners. Kinesthetic learners use their senses and body awareness to discover, explore, and understand new information (J. Blaydes, personal communication, June 29, 2014).

Schilling, Washington, Billingsley, and Deitz, (2003) found attention to task, in-seat behavior, and writing legibly increased when three children with attention deficit hyperactivity disorder (ADHD) used therapy balls. This same study showed that improvement in seating behavior was evident for all of the participants when using therapy balls for seating.

Pfeiffer et al. (2008) found that second-grade students with attention difficulties achieved increased attention while using the Disc-O® seat cushion, thus increasing

attention to time on task. Significantly lower scores on the subsections of the Behavior Rating Inventory of Executive Function (BRIEF) suggest that attention to task may improve when using this cushion.

Ivory (2011) examined the effect of Zuma® chairs, Disc-O® seat cushions, and the standing desk with FootFidget® on attention, work neatness, and work completion in 19 second-grade students. The Sensory Processing Measure (SPM) was used to identify sensory deficits in the participants. Students periodically completed a rubric designed to measure the dependent variables after lessons, which generated data on their perception of the effect of the different dynamic seating options.

Kennedy (2004) made valid points when he spoke about classroom furniture evolving to embrace the different ways students learn; classroom furniture also must change. The relationship between the student and the classroom environment needs to be better understood in order to promote academic performance for all students (Hemmingsson & Borrell, 2001). The furniture in each classroom should function to facilitate learning while allowing the appropriate level of participation without distractions (Cotton, O'Connell, Palmer, & Rutland, 2002). School furniture should provide a stress-free and comfortable workplace for all children (Wong & Chung, 2007).

Stability balls have been suggested as a way to increase focus and attention while improving academic achievement (Schilling et al., 2003). According to Ratey and Hagerman (2010), this improvement seems to result from the tiny movements kids make while balancing. Those small movements stimulate their brains which helps them to focus. The incorporation of movement can meet the needs of kinesthetic learners and allow other students the opportunity to get a break from the traditional “desk centered seating” style found in the majority of classrooms (Beaudoin & Johnston, 2011).

Combining movement and increasing blood flow should result in the ability to stay on task throughout the day and thus increase academic learning. A study performed at the Mayo Clinic by Owen et al. (2010) focused on improving learning and reducing obesity by making children more active. Those researchers found that the ability to move around more while sitting made the students more attentive. Researchers believed that a child who sits on a ball chair is able to direct natural kinesthetic energy and need for movement in a positive way, because the child has to constantly move on that chair in order to maintain balance. Ball chairs channel students' physical energy in a positive way and help them to focus better on the task at hand.

Stability ball seats give children tactile stimulation while they are working on balance, helping their brains to learn (Pytel, 2007). The benefits of stability balls are described by Bob Nellis of the Mayo Clinic, who conducted a study on the benefits of chairless classrooms and said, "Kids move around, they are supposed to be active" (Pytel, 2007, p. 10). His study showed that students with attention problems could focus better using the exercise balls for chairs in their classrooms. What is more, children in the classrooms who require extra movement could do so quietly without disturbing other students (Pytel, 2007, p. 10).

In another study, Fedewa and Erwin (2011) identified how stability balls affected on-task and in-seat behavior for students with attention and hyperactivity concern. These researchers conducted the largest, most systematic investigation of stability ball use, measuring changes in attention in 76 students in four general education classrooms as well as in-seat and on-task behavior of eight specific students. The study was done over the course of 12 weeks and used momentary time sampling (MTS) to observe eight students. At the end of a 2-week implementation period, observers recorded a decrease in

hyperactivity and an improvement in attention. Also, they found that eight children in fourth and fifth grades had increased on-task and in-seat behaviors while using therapy balls. The results of the study showed that the in-seat average went from 45% to 94%; and on-task behavior went from 10% to 80% (Fedewa & Erwin, 2011). Sitting on a ball provides students with tactile stimulation and the opportunity to actively work on their balance, which increases blood flow and ultimately improves concentration levels.

People commonly experience times while reading when they struggle to remember they have read. They tend to wiggle in their chairs, doodle, and do various other activities in order to keep themselves focused on what they are reading. The use of stability balls as chairs in classrooms has been shown to help improve focus during class for some students. It allows students to move and wiggle while working on an assignment such as reading a book. Some teachers have opted to seat the students in their classrooms on stability balls rather than chairs to help those students stay on task. In theory, the use of stability balls will help students to focus on what they are reading and, therefore, improve their reading comprehension.

Dynamic seating options alter the amount of sensory feedback received by a child by allowing movement while seated or standing at a desk. Sensory processing is the way the nervous system mediates the interaction between a person and the environment, which means sensory processing is fundamental to participation in occupation (Roley & Jacobs, 2009). Similarly, in a study on the effects of using stress balls in the classroom, Stalvey and Brasell (2006) found a significant decrease in the number of student distractions during instruction time when students were permitted to manipulate a stress ball.

A significant opportunity exists for maximizing learning opportunities and

creating meaningful experiences by rethinking the classroom experience (Miller-Kuhaneck, Henry, Glennon, & Mu, 2007). Dynamic classroom furniture options allow freedom of movement and increased range of motion for students while they are learning and working. The design of the classroom is imperative to the learning process for children. The design of learning spaces should increase levels of engagement, foster active learning and teaching, and support the learning goals of higher education institutions. Comfortable spaces that reflect the outside world must be created in classrooms and in education. “The traditional classroom chair pushes the sitter’s weight straight down, increasing pressure on the lower back and forcing the student to sit on the chair and not in it” (Jensen, Dabney, Markowitz, & Selsor, 2006, p. 3). Teachers and students must be able to easily move, as learning needs change throughout the day. Children need to talk to one another and collaborate with each other to make meaning of their learning. Rows of desks make such collaboration difficult.

Every classroom space looks different and should be designed with the same goals in mind: collaboration, flexibility, and meaningful learning. In the real world, the body is not confined to a wooden or metal desk 5-6 hours a day. Instead it is allowed to sit, stand, bend, flex, recline and lie down. This is not so in most classrooms. As teachers transformed their roles into facilitators of learning, they found that standing in front of the classroom or lecturing was no longer prudent. “As long as students do not infringe on the rights of their peers, they should be offered flexible seating options” (Tate, 2007, p. 56). Teachers need to be able to accept the movement from the students and allow this to happen throughout the day. Children should have choices as they are faced with constant challenges and decisions. One of those choices should be how they sit and learn. Flexible or choice seating arrangements can make for a more relaxed

environment for learning.

History of KLTs

According to Pinney (personal communication, January 24, 2014), the idea for these KLTs started when a young teacher from the southeastern part of the United States asked a company to create a balance desk for her. That is when the company, Kids Fit, realized they had many of the same ideas. They knew they could create rooms that combined learning with a physical activity component. When they determined that simply moving the physical activities into the “traditional” classroom could accelerate learning, they began to design these new learning tables. Kids Fit combined the knowledge gained over their previous 14 years with a determination to use the same movements from children exercise equipment into learning stations or tables. They took this knowledge and modified the movements and mechanics to fit the classroom environment.

When the idea began, it was mainly to get movement added in the classroom; not exercise, just movement. The problem they addressed was that people were either not paying attention or they simply did not know how to implement the scientific evidence that movement could create an optimal learning environment for children. So Kids Fit decided to set some parameters for how to develop this crazy idea of letting kids move in their seats. The parameters were set as follows: The design needed to be unobtrusive to the entire classroom experience; it needed to be quiet and easy to implement for teachers; and it needed to be safe for children. Thus, the “less is more” factor came into play (Pinney, personal communication, January 24, 2014). The idea was to have as few adjustments as possible for both teachers and students. It is also known that behavioral problem children often need to move and release energy, so it was important to have a

few stations where students could release larger amounts of energy without being loud or bothersome. These were the first thoughts that went into the design process of these KLTs.

Later, Kids Fit found that teachers could very easily use the equipment to create a “spark” effect, as discussed in Ratey and Hagerman’s (2008) research to increase heart rate and blood flow in the students, thus increasing their brain’s fuel for learning. It was never a goal of the company to make a significant impact on obesity in children; clearly, they understood that some movement was better than none. However, health benefits became apparent when studies like one from Benden, Blake, Wendel, and Huber (2011) showed, “children burn 17% more calories just standing at their desk versus sitting or that sitting has the same impact as smoking if done excessively” (p. 1434). Pinney (personal communication, January 24, 2014) said,

Well all you have to do is the math; seven percent more calories (+more with movement) multiplied times five school days per week times 30 school weeks - that equals a huge change in a child’s health after just one year - now multiply that by 12 school years! Now KidsFit believes they can make an impact on obesity.

Kids Fit used Computer Aided Design (CAD) software, to rapidly change design and analyze movement using two forms of computer software, Soliworks and Motion Study. This process allowed them to see exactly how the proposed equipment would move before they ever started building a table. Further, these programs enabled the testing of table designs and analysis of each motion for biomechanical efficiencies right on the computer screen. Kids Fit also looked at other designers in the market and talked to users about their advantages and disadvantages, which helped them perfect their own table

design.

Kinesthetic tables can be therapeutic because they activate postural muscle control resulting in better hand control. They improve visual skills for improved focusing, tracking, and scanning. Kinesthetic tables stimulate the vestibular sense for better balance reactions and alertness. They also stimulate proprioception for better muscle control and force of movement. Another benefit is that these tables coordinate the two sides of the body for improved midline orientations. Positive results come in the form of improved posture and balance, better handwriting, fewer distractions, more body awareness, and better attention and focus during the day (Capell, 2012).

“Each child has interactive intellectual, physical, emotional, social and moral systems that require a good balance to achieve maximum overall performance” (Pinney, personal communication, January 24, 2014). Kinesthetic classrooms successfully enhance teaching and learning environments to develop all of these systems. Different children need various levels of movement. For some children, standing is enough to help them focus; while the troubled child can be helped dramatically when allowed to listen or to read at a walker desk. Plus, when the opportunity of movement is added in the classroom, variety becomes essential. Three basic human motor movements—rolling, crawling or walking, and jumping—directly correspond with the ways information travels in the brain; that is, side to side across the corpus callosum, back to front across the motor cortex, and up and down from the bottom to the top of the brain (J. Blaydes, personal communication, 2013). Kinesthetic classrooms help schools to stimulate these motor patterns and continue building the framework for a broad scope of learning.

The body’s motor, balance, and vestibular systems must develop with sufficient strength and variation for the brain mechanisms to effectively process information (J.

Blaydes, personal communication, 2013). The brain of a child who has had only a limited or narrow range of movement experiences may have an underdeveloped information processing function, and that child will struggle to learn. The goal of KLTs is to provide the movements needed to help students learn better.

Chapter 3: Methodology

Introduction

A clear relationship between movement in the classroom and academic gains and student behavior was made clear through the literature review. This chapter includes a review of the methodology for the study. The chapter discloses the methods, type of study, data collection processes, data analysis processes, and information so that the study's replication is possible. Two research questions served as the foci of the study.

1. What impact do KLTs have on measures of reading skills as measured by mClass?
2. What impact do KLTs have on student on-task behaviors?

Restatement of the Problem

The one most detrimental barrier to learning and recalling information may be a teacher's deliberate attempt to stop students from moving (Jensen, 2003). These changes have a dual effect on human behavior: People move less and sit more. From an evolutionary perspective, humans were designed to move—to locomote and engage in all manner of manual labor throughout the day (Owen et al., 2010). The recent shift from a physically demanding life to one with few physical challenges has been sudden, occurring during a tiny fraction of human existence (Owen et al., 2010). As adults, we have the option to get up and fidget, answer phone calls, move to the back of the room, and doodle while in meetings; but we do not give this option to the students. Physically and mentally, we as humans are not well suited for sitting still and focusing on a task for an extended period of time (Wells, 2012).

Research Design and Approach

The researcher conducted a mixed-method study to determine whether the

implementation of KLTs impacts student reading scores and student in-class behaviors. The research took place over a 6-week period and was followed by semi-structured focus-group interviews with the participating teachers.

Mixed-method research is formally defined as “the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts, or language in a single study” (Johnson & Onwuegbuzie, 2004, p. 17). Researchers introduced the concept of triangulation in the late 1970s. Denizen and Lincoln (2003) defined triangulation as “the combination of methodologies in the study of the same phenomenon” (Johnson, Onwuegbuzie, & Turner, 2007, p. 112). Denizen and Lincoln identified several types of triangulation which involve the use of both quantitative and qualitative approaches. This study was bound by time, place, and activity in which the researcher collected detailed information using a variety of data collection processes over the specified time period.

The goal of the mixed-method approach is to draw from the strengths of both approach paradigms and to minimize their weaknesses. The strengths of this study lie in the combined use of quantitative and qualitative research methods. Quantitative research provides quantifiable data from which patterns can emerge, while qualitative research facilitates sociological data collections. Combining quantitative with qualitative data broadens data types to form a comprehensive picture of the observed patterns. When researchers combine and increase the number of strategies used within a study, the scope and depth of the project are increased, resulting in a more complete picture of human behavior and experience (Morse, 2003).

While the quantitative approach was predominantly employed, with the focus of reading scores from mClass, qualitative inquiry related to teacher interviews and student

behavior observations were also utilized. It was the goal of the researcher to enrich reading skills and behavior data with data provided by the teacher interviews. The interview with the participating teachers was used to gain insight into their perspectives about the use of KLTs.

Population

The rural county where the study occurred is primarily an agricultural and manufacturing county with considerable support for local and small businesses. The largest employer in the county is a paper manufacturing and packaging plant that was established in 1909. The second largest employer is the school system, and the local hospital follows as the third leading employer. The county has expanding tourist facilities which have seen slow but steady growth over the last 30 years. The county population has grown about 20% over that time, and four towns have incorporated. The people are inviting and show a great sense of community.

According to the United States Census Bureau (Newsroom Archive, 2011), the county's population of approximately 58,855 and its 553 square mile radius make it the third largest county in the state. The racial makeup of the county is 96.6% White, 1.3% African American, 0.6% Native American/Alaska Natives, 0.4% Asian, 3.4% Hispanic/Latino Origin. One percent of the population reported being of two or more races.

The county is home to 125 church congregations; 73% of the population is affiliated with a religious congregation. The top three religious affiliations are Southern Baptist, United Methodist, and Catholic. The percentages are 66% Southern Baptist, 19% United Methodist, and 2.5% Catholic.

According to the National Center for Educational Statistics (2012), for the 2011-

2012 fiscal year, the participating district consisted of 16 schools, nine elementary schools (prekindergarten through Grade 5), three middle schools (Grades 6-8), two high schools (Grades 9-12), one alternative school high school (Grades 9-12), and one early college high school. The student population was 7,813, and there were 546 classroom teachers. The student-teacher ratio was 14:1. The exceptional education population consisted of 151 English Language Learners and 1,196 students with individualized education plans (IEPs) which document disabilities.

All county elementary students may receive the benefits of the federally funded Title I program; as per national guidelines, over 35% of the students qualify for free or reduced lunch prices, thereby making all students eligible.

Sample

Gravetter and Wallnau (2008) defined a sample as a “set of individuals selected from a population usually intended to represent the population in a research study” (p. 4). Two teachers from the district were chosen to implement KLTs in their classrooms. The school-based administrator completed a nomination form; a teacher interview process was then conducted to choose the teachers to implement KLTs. The two teachers are housed at two different elementary schools in the county. The study took place in those two schools. All staff members from the two schools were exposed to brain research professional development and strategies to impact students in the classroom.

The researcher selected the sample county while working as part of the county administration team when the KLTs were put into place. Since then, the researcher has departed from the county administration; so potential bias from the researcher has now been reduced. Creswell (2003) described this as a convenience sampling in which the selection was made by accessibility or easy availability. The administrator on site placed

the students from both locations on class lists, and all students in both grades had an equal chance of being placed in the classrooms with KLTs.

Class A was made up of 10 boys and 10 girls. One child had an IEP (learning disability: reading and math and OT); and two children had speech IEPs. This class had four children who began first grade below grade level and had Personalized Education Plans (PEPs). Three children had an attention problems but were not addressed ADHD with medication. Two other children in the class took medication for ADHD, and one child took medication for oppositional defiance disorder. All take their medication at home. Although most of the children had a good home life, many had broken or split homes. The teacher had been teaching for 7 years. This was her seventh year at this school and in first grade. Teacher A has her Bachelor's degree in elementary education Grades K-6.

Class B consisted of 19 students, 11 girls and 8 boys. Nine students had reading PEPs, and five students had math PEPs. Two English as Second Language (ESL) students were in the class as were three students with IEPs and three with 504 accommodations. Also, Academically and Intellectually Gifted (AIG) services were provided to five students in reading and/or math. Teacher B had been teaching for 21 years. She taught both fifth and third grade in Newport, Tennessee, prior to moving to North Carolina. She taught fifth grade at School B for 4 years; and at the time of this study, she was teaching fourth grade. She began her teaching career as a departmentalized language arts teacher for 12 years and then became a self-contained classroom teacher for the remaining 8 years. Teacher B was named Teacher of the Year in 2012 for School B.

Materials

The reading materials used in this study include all the components of mClass with the major focus on the reading levels. All reading materials used during this study were from the state-adopted reading curriculum and are correlated with the State Common Core standards. They were used with all students in the study. Microsoft Excel and SPSS were used to organize data and to create charts and graphs to display the data.

The reading assessment software used in this study is mClass Reading 3D by Amplify, which utilizes a running record to diagnose reading comprehension in Grades K-5. This program serves as the district's test for reading levels and was used as the pre and postreading levels for this study. The district testing schedule was followed by all students and teachers involved in the study. DIBELS is described as a set of procedures and measures for assessing the acquisition of early literacy skills from kindergarten through sixth grade. These measures were specifically designed to assess the "Big 5" of literacy; namely phonemic awareness, phonic skills, fluency, vocabulary, and comprehension. They are designed to be short fluency measures used to regularly monitor the development of early literacy and early reading skills (Amplify, 2014a). The measures are all linked to each other, psychometrically and theoretically, and all have been found to be good predictors of students' later reading proficiency. This study focused on the reading levels determined by the mClass Reading 3D system. The mClass Reading 3D solution is the only validated, research-based assessment that combines quick indications of early skill development with deep observations of student interactions with authentic texts (Amplify, 2014a). This solution integrates the predictive power of the DIBELS assessment and the strength of TRC.

Upon approval to conduct the research, the researcher met with each participating

teacher; and with the use of Appendix A, the initial invitation to participate, classroom observations were conducted weekly throughout the study. Observations were conducted at different time intervals during the week to get a better picture of a whole student day. The behavioral observations were conducted using MTS, in which every 30 seconds, the observer coded the students' behavior on the basis of several behavioral classifications of on-task behavior (Fedewa & Erwin, 2011). Those behavior classifications include listening to the teacher, talking with the teacher to get clarification, group work with peers, independent seat work, and off-task behavior. The MTS form is shown in Appendix B.

Teacher interviews were conducted at the conclusion of the study observation period and discussed what teachers observed during their classroom time. Teacher input is very important to this study, because they are the ones who see the most change in their students both individually and as a group. The interviews occurred in a focus group, the protocol of which is outlined in Appendix C.

Data Collection

This 6-week study occurred during the 2015-2016 academic calendar year. Standardized test scores from the mClass system were analyzed for the purpose of tracking academic gains in reading scores. The tests were given at the beginning of the school year and then at the end of the school year, in accordance with the county testing calendar. The scores were compared to determine whether a statistically significant impact on the reading levels of students in the kinesthetic classrooms exists compared with those in regular classrooms.

Upon approval to conduct the study using the initial invitation to participate in the study (Appendix A), the researcher conducted teacher interviews and classroom

observations. The researcher utilized the MTS observation form (Appendix B) while conducting random classroom observations of student behavior. The observer carried a stopwatch to mark the 30-second time intervals and recorded her observations at the end of each interval on worksheets designated for each child participant. The MTS at 30-second intervals process was selected, because it has been shown to reduce the number of false positives for duration events. Observations made using this methodology have been shown to be valid and reliable across multiple observers (Rapp, Colby-Dirksen, Michalski, Carroll, & Lindenberg, 2008).

Semi-structured, in-depth interviews were conducted based on a topic guide (Appendix C) and explored in detail each teacher's views and experiences using KLTs. The sessions were audio recorded at each participant's school and with each participant's permission (Appendix D). The interview topic guide included the following prompts to elicit participant views and experiences: (a) What kinds of professional development have you received in movement in the classroom; (b) What other types of activity or movement in the classroom do you use in your planning; (c) Tell me about how you handle the transition from desks to learning tables for your students; (d) When do you notice students moving more during class; (e) Which students do the most movement throughout the day; (f) Do your students have assigned seats or do you allow them to choose which table to use; (g) What other ways do you see these tables either benefiting or harming your instructional day; (h) Have you noticed any differences in student behavior through the use of the tables; and (i) Is there anything else you would like to share with me about the tables that you think is important for this study?

These interviews provided insight into student behaviors and how they interacted

with the tables from the teacher's perspective. The researcher organized the data by question in order to look across the board and see any consistencies and differences in the responses. Connections, relationships, themes, and patterns were also analyzed based on the responses to the questions.

Threats to Validity

The researcher made every effort to set aside preconceived ideas to derive study results that are accurate and free from prejudices. However, bias on the part of the researcher could have been expected due to her own interest in KLTs.

Every effort was made to ensure internal validity and accuracy. Internal threats to validity include (a) the extent to which each student participates in the kinesthetic classroom, (b) the teaching style of the teachers involved, (c) the time required to perform the test and observations, and (d) the physical and academic makeup of the classes. External validity may not be generalized due to the size of the sample.

The students in the classes did not know why the researcher was in the room, limiting the Hawthorne Effect. The Hawthorne effect refers to the tendency of some people to work harder and perform better when they are participants in an experiment (Cherry, 2015). Individuals may have changed their behavior due to the attention they were receiving from the researcher rather than because of the learning tables. The researcher made every effort to limit this effect through using a random observation schedule.

Data Organization and Analysis

After the study, a measure of analysis of covariance (ANCOVA) was used to find any statistically significant differences in reading scores between the group with KLTs and the group without KLTs (NKLT). Student reading scores from the beginning of the

year (BOY) were controlled. The mean, standard deviation (SD), t value, and p value were all reported for this test.

The Excel program was used to show the percentage of difference between on-task and off-task student behaviors based on the observation data. The results were displayed in Excel spreadsheets, graphs, charts, and through narrative passages. Measures of central tendency were used in this study to demonstrate how participants were responding to the interventions in place. Descriptive statistics were also used to show the percentages of on-task and off-task behavior for each grade level and classroom. Inferential statistics were used to determine whether patterns observed and recorded were related to chance or were due in part to the study interventions.

Qualitative data analysis is primarily an inductive process of organizing data into categories and identifying patterns and relationships among those categories. Inductive analysis is the process in which researchers synthesize and make meaning from the data, starting with specific data and ending with categories and patterns (McMillan & Schumacher, 2010). The process of qualitative analysis for this study involved six steps (Creswell, 2003). The first step was to transcribe the teacher interviews. The second step was to read the line-by-line transcripts to ensure they all made sense. The third step was a coding process, whereby codes were written in paper margins and later organized into categories in an Excel spreadsheet using terms from the actual language of the participants. In step four, the codes were used to develop larger themes and patterns. In step five, the researcher decided how the themes should be represented in the qualitative section of the results. This study uses narrative passages and quotes from the teacher interviews as evidence of themes to represent the findings. In step six, the researcher interpreted the data. During this step, meaning from the qualitative data was connected to

the literature reviewed on movement, academic success, and on-task behavior.

Trustworthiness

The trustworthiness of a qualitative study can be influenced by the credibility of the researcher (Merriam, 2009). Researchers must take steps to demonstrate that findings arise from the data and not their own biases. Here, steps must be taken to help guarantee as much as possible that the work's findings are the result of the experiences and ideas of the interviewees, rather than the characteristics and preferences of the researcher (Shenton, 2004).

The researcher ensured prolonged engagement, as the research was conducted over a 6-week span. Persistent observations were ensured by constantly observing and recording data in the same manner. Every effort was made by the researcher to keep an open mind while conducting research to allow a diversity of interpretations for the data. Given the qualitative nature of the study, transferability is limited; but another researcher could conduct a similar study.

Summary

The area of movement in the classroom is one of the most recent areas of research in brain-based learning. The use of dynamic seating options is also highly researched in schools. The use of quick, simple, task-specific movements benefits every learner (Bransford, Brown, & Cocking, 2000). The results from this study will inform the school district if there is a significant impact of KLTs on student behavior and academic achievement scores, setting the stage for future studies of learning table implementation. The methods will look comprehensively at the impact of KLTs as defined by the two research questions, thus informing and creating recommendations for stakeholders.

Chapter 4: Results

Introduction

This chapter presents the major findings in the study. The purpose of this mixed-method study was to examine the impact that KLTs have on student on-task behavior and academic growth with an emphasis on reading skills. The study included data from researcher observations using the momentary time sample form which served as the on-task behavior observation instrument. Teacher interviews were also part of the data collected for this study. These interviews were used to gain insight into the classroom from the teachers' perspective. Reading data over the past 2 years were also used to determine if there are any trends in academic growth in the rooms with KLTs. This chapter includes a description of the participants, research tools used, data analyses, and a summary of the findings.

The researcher set out to investigate the following questions using the data collected, the Excel program, and IBM SPSS 21 to interpret the data: What impact do KLTs have on measures of reading skills? What impact do KLTs have on student on-task behaviors? Each of these research questions was aligned to specific data sources for this study.

The research findings this chapter reports are based on analysis of data from semi-structured interviews, school district resources, and the researcher's observations within the buildings. During in-depth teacher interviews, study participants described their perceptions and experiences before and after the kinesthetic tables were implemented as well as discussing their use of findings to improve student success in school with regard to these tables.

Table 1 shows the crosswalk between the research questions of this study and the

data source for analysis.

Table 1

Crosswalk of Research Questions and Data Sources

Research Question	Observation	Teacher Interviews	mClass Scores
What impact do KLTs have on measures of reading skills as measured by mClass?			X
What impact do KLTs have on student on-task behaviors?	X	X	

Participants

The participants in this study were two first-grade classrooms and two fourth-grade classrooms in the XYZ Public Schools System of Western North Carolina. Upon approval to conduct the study, the researcher was on the staff in the county in which this study took place, which made it convenient to perform the research. Since then, the researcher is no longer a part of the county staff, thus the bias from the researcher has now been reduced. Creswell (2003) described this as a convenience sampling whereas the selection was made by accessibility or easy availability.

Two classrooms were used per grade level: one with the implementation of KLTs and the other a traditional classroom. School-based administrators nominated the teachers used for this study, then the teachers were interviewed to optimize placement of the tables. The tables need to be housed with a teacher who can handle noise and constant movement in their classrooms. The administrator on site placed the students at both locations on class lists, and all students in both grades had an equal chance of being

placed in the classrooms with KLTs. The focus of the study was on the two classrooms with KLTs, and the other two classrooms were used for comparison data only.

The first-grade class with KLTs, Class A, was made up of 10 boys and 10 girls. One child had an IEP (learning disability: reading and math and OT) and two children had speech IEPs. This class had four children who began first grade below grade level and had PEPs. Three children had an attention problem but were not addressed ADHD with medication. Two other children in the class took medication for ADHD, and one child took medication for oppositional defiance disorder.

Teacher A had been teaching for seven years, all at this school and all in first grade. Teacher A had her Bachelor's degree in elementary education Grades K-6 and had just recently received her National Board Teaching Certification.

The fourth-grade classroom with KLTs, Class B, consisted of 19 students: 11 girls and eight boys. Nine students had reading PEPs, and five had math PEPs. Two ESL students were in the class, as were three students with IEPs and three with 504s. The North Carolina Department of Public Instruction 504 Plan was developed to ensure that a child who has a disability identified under the law and is attending an elementary or secondary educational institution receives accommodations to ensure both academic success and access to the learning environment. Finally, AIG services were provided to five students in reading and/or math.

Teacher B had been teaching for 21 years. She taught both fifth and third grades in Newport, Tennessee, prior to moving to North Carolina. She had taught fifth grade at School B for 4 years and was then teaching fourth grade. She began her teaching career as a departmentalized language arts teacher, which she did for 12 years. She then became a self-contained classroom teacher for another 8 years. Teacher B was named Teacher of

the Year in 2012 for School B.

Data Collection/Research Tools

Systematic behavioral observation data were documented using the MTS observation form (Appendix B) to observe student on-task behaviors. The direction of the student's gaze, engagement in class, focus on teacher given assignments, or listening and following teacher directions determined time on task. Observers carried a stopwatch to record the 30-second time intervals and marked their observations on the designated form. The design was chosen because MTS at 30-seconds has been shown to reduce the number of false positives for duration events (Rapp et al., 2008). In effect, the MTS interval would serve to make the observations more valid and representative of the child's behavior throughout the observation period. The observer visited each classroom seven times, for a total of 28 days of observations. During that time, the observer randomly chose two students to observe on-task behaviors for 5-minute time frame durations and recorded the observed behavior every 30-seconds. The observation process was repeated in each classroom for a total of 40 minutes of observation per visit, giving the observer 56 individual observations per classroom for a total of 224 student observations. The researcher spent 18 hours and 40 minutes of observation time in the classrooms. To carry out the MTS, the observer noted whether the observed students were on-task or off-task. To calculate the percentage of on-task behavior, the researcher took the on-task marks and divided them by the total observation marks, which gave an average on-task behavior. The same process was completed for off-task behaviors for each classroom and the findings were analyzed by gender. The data were then analyzed and the corresponding results were reported.

Teacher interviews were conducted at the conclusion of the observation period.

The two classroom teachers with KLTs participated in the interview process. A designated list of questions prompted great discussion, and it became more like a small focus group than an interview. The interview process took approximately 1 hour and 30 minutes. The interview was recorded then transcribed by the researcher. The researcher had an outside person review the transcript for accuracy.

The mClass data used for this study were collections of the four classrooms in the study over the past 2 years. They were chosen to identify trends in achievement. The focus of the mClass data was the TRC section.

The TRC measure is based on an assessment approach developed by Marie Clay, author of *An Observation Survey of Early Literacy Achievement* (1993). TRC is a running record assessment of reading performance (alternately known as a reading record) that allows teachers to evaluate a student's foundational skills, which are necessary to become a fluent reader, and the ability to apply those skills to increasingly complex texts. TRC assesses oral reading accuracy and comprehension using a set of calibrated benchmark books. Using TRC, a teacher determines each student's instructional reading level at three benchmark administration periods during the school year and monitors student reading performance between those periods. (Amplify, 2014b, p. 1)

Data Analysis

Descriptive statistics were reported for the total group as well as for each specific classroom in the study. The statistics were analyzed by gender for the observation instrument. The primary dependent variable was on-task behavior. Similar to Clare, Jenson, and Kehle (2000), on-task behavior was defined by whether the student was oriented toward the teacher or the assigned task and was performing the assigned activity.

For the student to be considered on-task in the instructional lesson, he/she had to be responding to the teacher's prompt or instruction by, (a) choral or vocal responding, (b) answering verbally to a teacher directed question, (c) raising a hand, (d) writing, (e) looking at the teacher, (f) working with another student on teacher-assigned activity, or (e) reading. The student was considered off-task when he or she did not meet the definition of being on-task. Examples of off-task behavior included the student leaving a seat without permission, looking away from the teacher or instructional materials, not complying with teacher requests, or putting a head down on the desk with his/her eyes closed.

Data and Findings for Research Question 1

Research Question 1: What impact do KLTs have on measures of reading skills as measured by mClass?

Using software IBM SPSS 21, an ANCOVA was conducted to determine if there is a statistically significant difference in end-of-year (EOY) reading scores over the past 2 years between the groups with KLTs and the groups without KLTs when controlling their scores in the BOY, for first grade and fourth grade respectively.

Table 2 displays the TRC cut points used in the mClass assessment system. A TRC is used to determine each student's instructional reading level at two benchmark administration periods during the school year. TRC categorizes students in a system that describes overall reading ability and indicates the need for further instructional intervention (Amplify, 2014b). Students in first grade should be on a level C or D to be considered proficient at the BOY administration time and then progress to an I at the EOY administration to be considered proficient. Table 2 demonstrates the BOY and EOY cut points that are necessary to be considered proficient or above proficient for each

grade in elementary school.

Table 2

TRC Cut Points for BOY and EOY Reading Scores

Grade	Time of Year	Proficient	Above Proficient
K	BOY	RB	A and above
K	EOY	C to D	E and above
1	BOY	C to D	E and above
1	EOY	I	J and above
2	BOY	I	J and above
2	EOY	L to M	N and above
3	BOY	L to M	N and above
3	EOY	O to P	Q and above
4	BOY	O to P	Q and above
4	EOY	R to S	T and above
5	BOY	R to S	T and above
5	EOY	U to V	W and above

Table 3 shows the mean scores for the EOY reading level scores for the two first-grade classrooms used in this study. The mean EOY reading level score for the first grade classroom with KLTs was 9.83 (SD=2.7), which is equal to a TRC reading level of between an I and a J. The mean EOY reading level score for the first-grade classroom without KLTs was 10.23 (SD=2.3), equating to a TRC reading level of between a J and a K. To be considered on grade level for first grade, students need to be reading between a J and K on the TRC level.

Table 3

Descriptive Statistics for First Grade

Group	Mean	SD	N
With KLTs	9.83	2.710	36
Without KLTs	10.23	2.327	35
Total	10.03	2.518	71

Table 4 shows the EOY reading level scores for the first-grade classroom with KLTs with Teacher A. The average reading level was 9, which is equivalent to an I. At the end of the first grade, students should be reading on level I to be considered proficient. This shows the average of all students were on an I, which is considered proficient. There were a total of four students in the 2-year data that ended the year on the proficient level and 23 students who were above a J, which is considered above proficient. This were a total of 27 of the 36 students (75%) to be either proficient or above proficient at the EOY reading level. The table shows the average growth in reading for each year, five growth points were seen in year 1 and three growth points in year 2. This shows that the growth points over the past 2 school years average was a four point growth in reading levels. It was during the first year that the tables were implemented, and the greatest gain was reported. The BOY was taken with a traditional classroom set up and then KLTs were implemented. Approximately four months after implementation of KLTs, the EOY reading scores were collected. Table 4 shows the growth over the past 2 years in this first-grade classroom.

Table 4

Two-Year TRC Scores for First-Grade Class with KLTs

Student	BOY	EOY	Level of Growth
Year 1 KLTs			
1	F	L	6
2	E	J	5
3	D	J	6
4	J	M	3
5	D	K	7
6	I	N	2
7	H	M	5
8	D	I	5
9	<PC	B	1
10	E	J	5
11	D	K	7
12	E	J	5
13	D	J	6
14	G	L	5
15	D	J	6
16	E	L	7
17	RB	H	7
18	E	J	5
19	E	H	3
20	D	J	6
Average Growth			5
Year 2 KLTs			
1	D	G	3
2	E	I	4
3	E	I	4
4	B	E	3
5	F	I	3
6	E	K	6
7	F	L	6
8	F	K	5
9	E	F	1
10	I	J	1
11	D	F	2
12	H	L	4
13	I	L	3
14	G	M	6
15	RB	D	3
16	F	M	7
Average Growth			3

Table 5 shows the EOY reading level scores for the first-grade classroom without KLTs. The average reading level was 10, which is equivalent to a J. At the end of the first grade, students should be reading on level I to be considered proficient. This shows the average of all students were on a J, which is considered above proficient. There were a total of five students in the 2-year data that ended the year on the proficient level, and 22 students who were above a J, which was considered above proficient. This was a total of 27 of 35 students (77%) to be either proficient or above proficient at the EOY reading level. The table shows the average growth in reading for each year, 5.9 growth points were seen in year 1 and 5.3 growth points in year 2. This shows that the growth point average over the past 2 school years was a 5.6 in reading levels. It was during the first year that the tables were implemented, and the greatest gain was seen. The BOY and EOY were taken with a traditional classroom setup with this classroom as they are used for comparison data.

Table 5

Two-Year TRC Scores for First-Grade Class without KLTs

Student	BOY	EOY	Level of Growth
Year 1			
1	F	K	5
2	E	K	6
3	E	N	9
4	H	M	5
5	E	K	6
6	E	M	8
7	E	J	5
8	D	H	4
9	D	M	9
10	E	G	2
11	D	I	5
12	D	I	5
13	D	K	7
14	RB	H	7
15	F	L	6
16	D	F	2
17	F	L	6
18	E	N	9
Average Growth			5.9
Year 2			
1	E	I	4
2	F	L	6
3	E	K	6
4	F	M	7
5	D	I	5
6	E	J	5
7	RB	H	7
8	E	J	5
9	E	K	6
10	D	I	5
11	E	L	7
12	H	M	5
13	D	H	4
14	D	J	6
15	E	J	5
16	RB	E	4
17	B	F	4
Average Growth			5.3

Tables 4 and 5 show the average scores from the BOY and EOY reading levels across a 2-year time span. The first-grade classroom without KLTs showed an average of 5.6 levels of growth in TRC reading levels across the 2-year span, which was an increase of 1.6 levels over the first-grade classroom with KLTs. The students in the classroom without KLTs average EOY was a J, or above proficient as opposed to those with KLTs, which was an I, which was considered proficient.

In this study, the effects of KLTs on reading achievement were examined by comparing the EOY reading TRC scores in four different classrooms after controlling the effects of the BOY reading TRC scores.

Consequently, an ANCOVA was conducted to explore whether there were any significant differences on EOY reading level scores between the two different learning groups when adjusted for the covariate BOY reading level scores. The significance level used in this study was $\alpha=.05$. The interaction effect between classroom design and EOY was assessed to rule out the violation of regression homogeneity assumption before assessing the effects of classroom design methods on EOY reading achievement while controlling for BOY reading achievement. Below are the ANCOVA results for the first-grade participants for this study.

Table 6 reports the interaction effect between group, which was classroom design and BOY reading level scores were not statistically significant: $F(1, 67)=.207, p=.650$.

Table 6

Tests between Subject Effects for First-Grade Interaction

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	230.049	3	76.683	24.020	.000	.518
Intercept	228.618	1	228.618	71.612	.000	.517
Group	.507	1	.507	.159	.692	.002
Total_BOY	211.948	1	211.948	66.390	.000	.498
Group*Total_BOY	.662	1	.662	.207	.650	.003
Error	213.895	67	3.192			
Total	7584.000	71				
Corrected Total	443.944	70				

Note. R squared=.518 (Adjusted R Squared=.497).

From Table 7, since $p=.309$, the null hypothesis is rejected due to the equal error variance of the dependent variable between the two groups; that is, the assumption of the homogeneity of variance was held. The Levene's test determines if the two conditions have about the same or different amounts of variability between scores.

Table 7

Levene's Test of Equality of Error Variances

F	df1	df2	Sig.
1.052	1	69	.309

Note. Tests the null hypothesis that the error variance of the dependent variable is equal across groups. A. Design: intercept + Group+ Total_BOY *Total_BOY.

A final ANCOVA, represented in Table 8, without interaction indicates there was a statistically significant difference on EOY reading level scores between the first-grade classroom with KLTs and the first-grade classroom without KLTs when controlling the covariate BOY reading levels, $F(1,68)=5.680$, $p=.020$. Due to the adjusted mean for KLTs ($M=9.525$) being smaller than that of without KLTs ($M=10.545$), there was a

statistically significant decrease on EOY reading scores between the first-grade classroom with KLTs and the first-grade classroom without KLTs.

Table 8

Tests between Subject Effects for First Grade – Without Interaction

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	229.387	2	114.693	36.350	.000	.517
Intercept	248.126	1	248.126	78.639	.000	.536
Group	17.922	1	17.922	5.680	.020	.077
Total_BOY	226.614	1	226.614	71.821	.000	.514
Error	214.557	68	3.155			
Total	7584.00	71				
Corrected Total	443.944	70				

Note. R squared=.517 (Adjusted R Squared=.5027).

The study consists of two different grade levels in hopes to show the impact across the elementary grade level spans. The following data were collected for the fourth-grade classrooms involved in the study. Table 9 shows the mean scores for the EOY reading level scores for the fourth grade. The mean of reading level score for the fourth grade with KLTs was 18.92 (SD=2.3) for EOY, which was equal to a TRC reading level of between an R and an S as the EOY score. The mean reading level score for the fourth grade without KLTs was 18.32 (SD=2.7) for EOY. This equates to a TRC reading level of between an R and S. To be considered on grade level for fourth grade, students need to be reading between an R and S on the TRC level.

Table 9

Descriptive Statistics for Fourth-Grade Participants

Group	Mean	Std. Deviation	N
With KLTs	18.91	2.353	34
Without KLTs	18.32	2.760	34
Total	18.62	2.563	68

Table 10 displays the EOY reading level scores for the fourth-grade classroom with KLTs in the classroom of Teacher B. The average reading level was 18.93, which was equivalent to an S. At the end of the fourth grade, students should be reading on a level R or S to be considered proficient. This shows the average of all students were on an S, which was considered proficient. There were a total of 14 students in the 2-year data that ended the year on the proficient level; and 16 students who were above a T, which is considered above proficient. This was a total of 30 of the 34 students (88%) to be considered either proficient or above proficient at the EOY reading level. The table shows the average growth in reading for each year; 3.59 growth points was seen in year 1 and 3.65 growth points in year 2. This shows that the growth point average over the past 2 school years was a 3.62 in reading levels. It was during the first year that the tables were implemented and the greatest gain was noticed. The BOY was taken with a traditional classroom set up and then KLTs were implemented. Approximately four months after implementation of KLTs, the EOY reading scores were collected. Table 10 shows the growth over the past 2 years in this fourth-grade classroom.

Table 10

Two-Year TRC Scores for Fourth-Grade Class with KLTs

Student	BOY	EOY	Growth Points between BOY and EOY
Year 1			
1	M	O	2
2	L	N	2
3	N	S	5
4	P	S	3
5	N	T	6
6	O	T	5
7	S	U	2
8	P	S	3
9	P	S	3
10	P	T	4
11	M	Q	4
12	P	U	5
13	N	R	4
14	Q	T	3
15	Q	R	1
16	P	T	4
17	P	U	5
Average Growth			3.59
Year 2			
1	P	P	0
2	K	R	7
3	R	S	1
4	P	R	2
5	Q	U	4
6	R	U	3
7	S	U	2
8	C	J	6
9	O	T	5
10	O	U	6
11	M	R	5
12	O	R	3
13	L	R	6
14	Q	U	4
15	T	U	1
16	Q	S	2
17	P	U	5
Average Growth			3.65

Table 11 displays the EOY reading level scores for the fourth-grade classroom without KLTs. The average reading level was 18.32, which is equivalent to an R. At the end of the fourth grade, students should be reading on level R or S to be considered proficient. This shows the average of all students were on an R, which was considered proficient. There were a total of 13 students in the 2-year data that ended the year on the proficient level and 12 students who were above a T, which was considered above proficient. This was a total of 25 of the 34 students (73%) to be either proficient or above proficient at the EOY reading level. The table shows the average growth in reading for each year; 3.18 growth points was seen in year 1 and 2.35 growth points in year 2. This shows that the growth point average over the past 2 school years was a 2.76 in reading levels. The BOY and EOY were taken with a traditional classroom setup because this class is used for comparison data. Table 11 shows the growth over the past 2 years in this fourth-grade classroom.

Table 11

Two-Year TRC Scores for Fourth-Grade Class without KLTs

Student	BOY	EOY	Growth Points between BOY and EOY
Year 1			
1	R	U	3
2	P	U	5
3	P	R	2
4	S	U	2
5	S	U	2
6	R	U	3
7	N	R	4
8	H	L	4
9	Q	S	2
10	O	S	4
11	I	L	3
12	P	S	3
13	I	O	6
14	P	R	2
15	S	U	2
16	N	Q	3
17	O	S	4
Average Growth			3.18
Year 2			
1	R	R	0
2	M	P	3
3	P	U	5
4	L	P	4
5	P	R	2
6	Q	U	4
7	R	R	0
8	Q	U	4
9	P	R	2
10	L	M	1
11	Q	S	2
12	R	S	1
13	R	S	1
14	M	N	1
15	Q	U	4
16	Q	U	4
17	M	U	2
Average Growth			2.35

To further support the study, Tables 10 and 11 show the two classrooms' average reading scores from the BOY and EOY data over a 2-year time span. The classroom with KLTs showed a 3.62 level growth in reading levels, resulting in an increase of .86 reading levels over the classroom without the tables. On average the students with KLTs increased about one level more than those without the tables in the fourth grade. The use of KLTs could be one possible reason for the higher increase in reading levels.

Similarly, the researcher was trying to assess the effects of KLTs on reading achievement by comparing the EOY reading TRC scores in different classroom setups when adjusting the covariate BOY reading TRC scores. An ANCOVA was employed in this study to determine whether there are any significant differences on EOY reading level scores between the two different means of learning groups after controlling the effects of BOY reading level scores. The interaction effect between classroom organization group and EOY must be assessed to rule out the violation of regression homogeneity assumption before the effects of classroom organization methods on EOY reading achievement controlling for BOY reading achievement can be assessed. Below are the ANCOVA results for fourth-grade participants in this study.

From Table 12, the interaction effect between group with KLTs and BOY was determined. The interaction is not statistically significant: $F(1, 64)=3.128, p=.082$. Consequently, the main effect of the implementation of KLTs on EOY reading level scores was assessed.

Table 12

Tests between Subject Effects for Fourth Grade – Interaction

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	323.751	3	107.917	59.383	.000	.736
Intercept	123.259	1	123.259	67.825	.000	.515
Group	8.564	1	8.564	4.712	.034	.069
Total_BOY	314.481	1	314.481	173.048	.000	.730
Group*Total_BOY	5.685	1	5.685	3.128	.082	.047
Error	116.308	64	1.817			
Total	24010.000	68				
Corrected Total	440.059	67				

Note. R squared=.736 (Adjusted R Squared=.723).

From Table 13, since $p=.613$, the researcher failed to reject the null hypothesis that there are equal error variance of the dependent variable between the two groups; that is, the assumption of the homogeneity of variance is held.

Table 13

Levene's Test of Equality of Error Variances for Fourth Grade

F	df1	df2	Sig.
.259	1	66	.613

Note. Tests the null hypothesis that the error variance of the dependent variable is equal across groups. A. Design: intercept + Group+ Total_BOY *Total_BOY

A final ANCOVA, represented in Table 14, without interaction indicates there was a statistically significant difference on EOY reading level scores between the fourth-grade classroom with KLTs and the fourth-grade classroom without KLTs when controlling the covariate BOY reading levels, $F(1, 65)=5.246$, $P=.025$. Due to the adjusted mean for KLTs ($M=18.998$) being larger than that of without KLTs ($M=18.237$),

there was statistically significant improvement on EOY reading level scores between the fourth-grade classroom with KLTs and the fourth-grade classroom without KLTs when adjusted the covariate.

Table 14

Tests between Subject Effects for Fourth Grade – Without Interaction

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	318.066	2	159.033	84.736	.000	.723
Intercept	125.441	1	125.441	66.837	.000	.507
Total_BOY	312.184	1	312.184	166.338	.000	.719
Group	9.846	1	9.846	5.246	.025	.075
Error	121.993	65	1.877			
Total	24010.000	68				
Corrected Total	440.059	67				

Note. R squared=.723 (Adjusted R Squared=.714).

Data and Findings for Research Question 2

Research Question 2: What impact do KLTs have on student on-task behaviors?

The researcher used the MTS observation form to collect on-task behaviors of students in four different classrooms. The data were collected in the same manner with each visit to the classrooms. The teacher interviews were also used to answer Research Question 1.

The Excel program was used to show the percentage difference between on-task and off-task student behaviors based on the observation data. The results are displayed in Excel spreadsheets, graphs, charts, and through narrative passages. Measures of central tendency were used in this study to give an idea of how participants responded to the interventions in place. Descriptive statistics are used to show the percentages of on-task and off-task behaviors for each grade level and classroom.

A summary of percentages of student classroom behaviors, specifically student

on-task and off-task behaviors, is represented in Table 15. The on-task percentage for fourth graders with the implementation of KLTs is 94%, which is 14% greater than those without KLTs. First graders showed no difference in percentages of on-task behavior either with or without KLTs when compared to classes on the same grade, with 78% respectively being on-task. The average overall increase in on-task behavior is 7% when the KLT classrooms are compared to those without KLTs not taking into account the grade levels. The greatest difference is shown in fourth-grade students.

Table 15

Summary of Percentages of Classroom Behavior

Class	On-Task	Off-Task
Fourth-Grade With KLTs	94%	6%
Fourth-Grade Without KLTs	80%	20%
First-Grade With KLTs	78%	22%
First-Grade Without KLTs	78%	22%

Figure 1 displays the comparison of on-task behaviors for fourth-grade students in this study. The figure shows that the percentage of students who were on-task was at 94% for those who were in the classroom with KLTs in the fourth grade. The average on-task behavior for the nonkinesthetic learning table classroom in the fourth grade was 80%, resulting in a 14% increase of on-task student behaviors with the use of KLTs in the fourth grade.

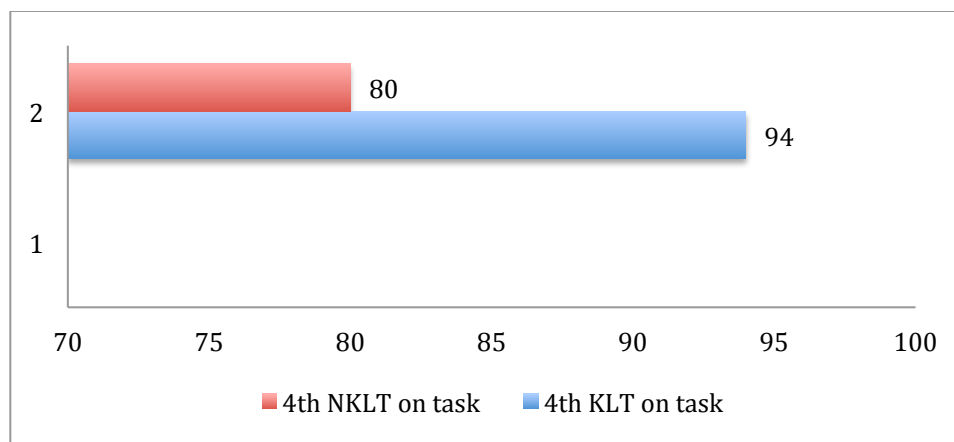


Figure 1. *Comparison of Percentages of On-Task Behaviors in the Fourth Grade.*

Teacher interviews were conducted in order to get a deeper look into what happens in the classroom when the researcher is not in the room observing. The teachers interact with these tables and students on a daily basis.

Interviewer: When do you notice students moving more during class?

Teacher B: I notice more movement during math and more peddling when the students are listening (or not) listening to instruction.

Interviewer: What do you mean (or not) listening?

Teacher B: The tables usually tell on the students for me. If they are listening intently then the movement is slow and steady, when they are “pretending to listen” the movement is fast and rapid. I notice this same behavior when they are silent reading. It really is amazing to watch.

Teacher B, the fourth-grade classroom teacher, reported that after having the tables for 2 years she can tell if students are really working or just pretending to work.

Figure 2 displays the comparison of on-task behaviors categorized by male students in the fourth-grade classrooms. The male students in the kinesthetic classroom

had an average of 95% on-task behaviors during the times they were observed in this study resulting in a 19% increase in on-task behaviors when compared to the classroom without KLTs.

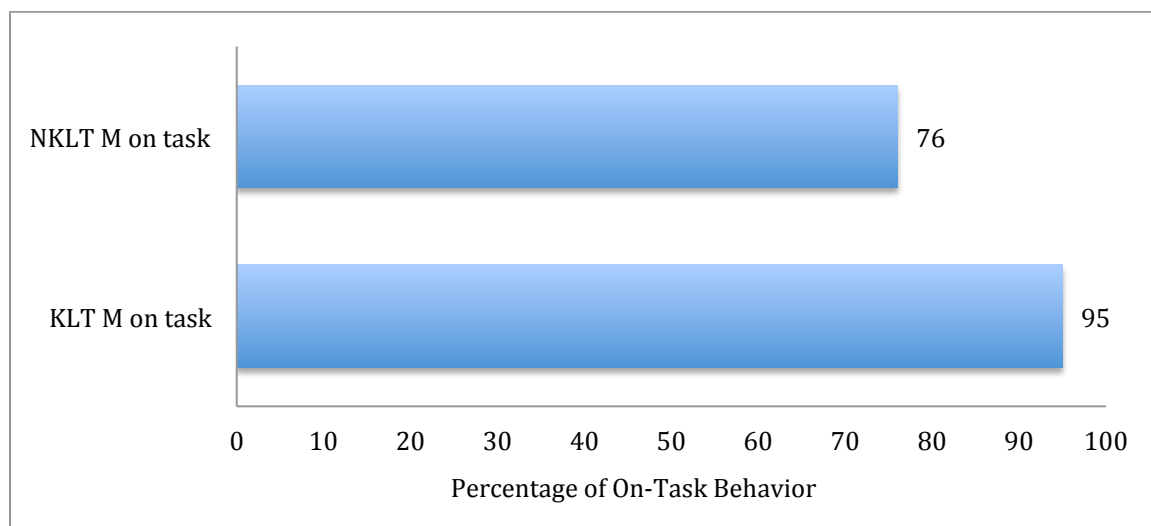


Figure 2. *Comparison of On-Task Behaviors in Fourth-Grade Male Students.*

To dig further, the research on male student on-task behavior was examined through the interview results from the following question.

Interviewer: Which students do the most movement throughout the day?

Teacher B: Some students with behavior issues have been sent to my room to work independently. They seem to be on-task and calmer. Most of the students with the behavior issues have been boys this year. In years past I have seen a good combination, but this year it's mostly the boys. When they hit these tables, their whole demeanor changes, and they begin to calm down and focus better.

The behaviors analyzed by male gender show an increase in on-task behavior; and according to the teacher interview, the behaviors were apparent not only in her regular students but also with those students who are sent to her room to use the tables as

calming mechanisms from other classes.

Figure 3 shows the comparison of on-task behavior categorized to only the female students in the fourth-grade classrooms. The female students in the kinesthetic classroom had an average of 92% on-task behaviors during the times they were observed in this study. This was an 8% increase in on-task behaviors when compared to the classroom without KLTs.

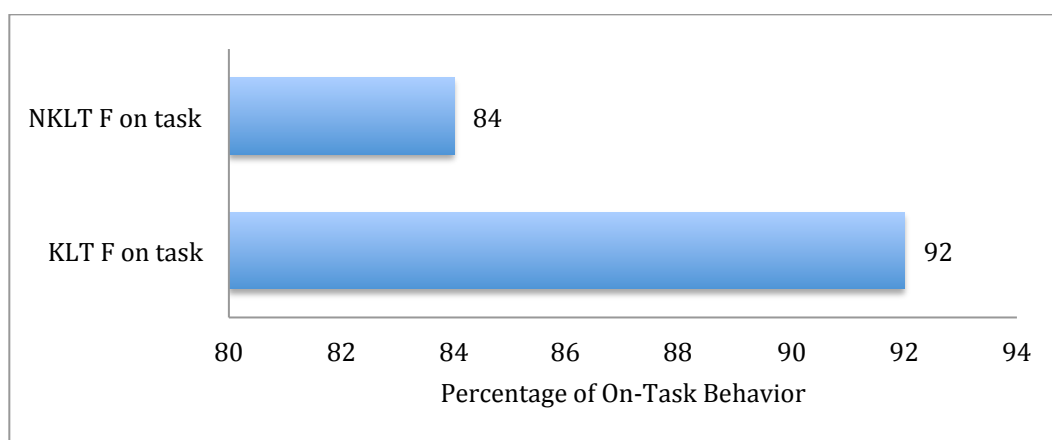


Figure 3. *Comparison of On-Task Behavior in Fourth-Grade Female Students.*

The following was taken from the interview session with the classroom teacher in fourth grade to get more input on student movement in particular situations.

Interviewer: Which students do the most movement throughout the day?

Teacher B: I have witnessed a calming effect with two autistic students. Their anxiety levels decreased during independent work. Children that require lots of stimulation move more. One student that had been homeschooled prior to 4th grade moved continuously. She was evaluated prior to entering public school. I can't remember her diagnosis, but she would not have been as successful without the stimulation she received from the movement. She scored 5s on both tests and

had never been tested and was not on grade level prior to entering school. Some students with behavior issues have been sent to my room to work independently.

They seem to be on task and calmer.

The teacher spoke highly of the use of the tables on students who were not accustomed to the norms of public education. There were apparent differences from the use of the tables that she had observed and reported.

Similarly, the research was repeated in the first-grade classrooms to give a perspective of the tables' impact in lower elementary grades. The style of teaching in first grade was somewhat different from fourth grade due to the developmental level and learning capacity of students. The following results were gathered from the MTS observations as well as teacher interviews in first grade.

Figure 4 shows the comparison of on-task behaviors for students in the first-grade classrooms. The table displays that the percentage of on-task students was at 78% for both samples of students who were observed in this study.

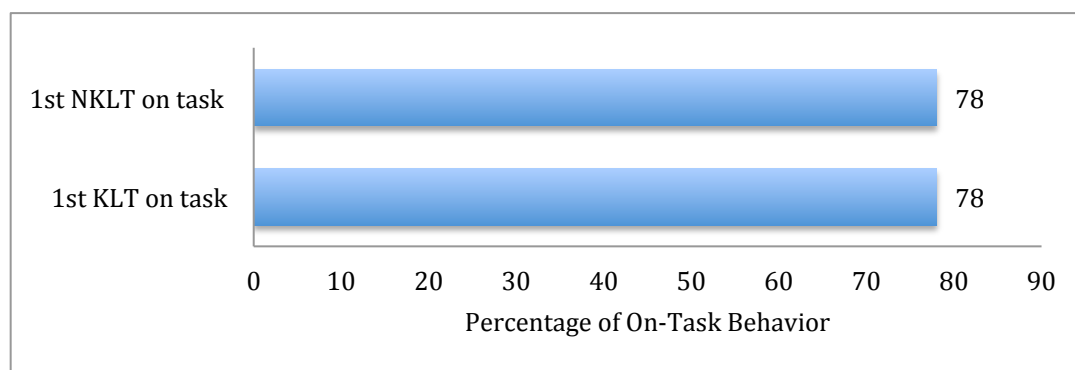


Figure 4. *Comparison of Percentages of On-Task Behaviors in First Grade.*

First grade is another world where students are encouraged to move most of the time despite the tables. Both groups of first graders were given the chance to wiggle and

move around during most observation days despite the classroom arrangement. Both first-grade teachers used in this study implemented movement on a regular basis for this age group. When interviewing the first-grade teacher, differences were noted among her students as explained below.

Interviewer: When do you notice students moving more during class?

Teacher A: I notice the most movement during work time. They seem to move freely as they are working such as writing or doing classwork. I have noticed the most stopping of the movement during heavy thinking periods and then once they have figured out what they are doing or working on they get back quickly to spinning, wiggling and rocking on the seats. In reading group I have noticed that while I am talking and teaching they seem to stop movement and listen, but then as they are whisper reading they pedal at a regular pace.

Interviewer: Which students do the most movement throughout the day?

Teacher A: Usually my most active, energetic students move more frequently. Some students need to sit and twist, others need to sit on their knees and twist and then some choose to pedal. This is up to them where they like to sit and choose to sit. All the kids seem to find the seat that they like best. I have many students with attention problems or ADHD – these students seem to be my most active kids on the chairs. Also, this year I have noticed that my students with learning disabilities seem to constantly move on the chairs throughout the day.

Teacher A reported that she had seen a difference in the movement of her students based on student need and subject being taught.

Figure 5 presents the comparison of on-task behavior categorized for only the male students in the first-grade classrooms. The male students in the kinesthetic

classroom had an average of 69% on-task behaviors during the times they were observed. This was 8% decrease in on-task behaviors when compared to the classroom without KLTs.

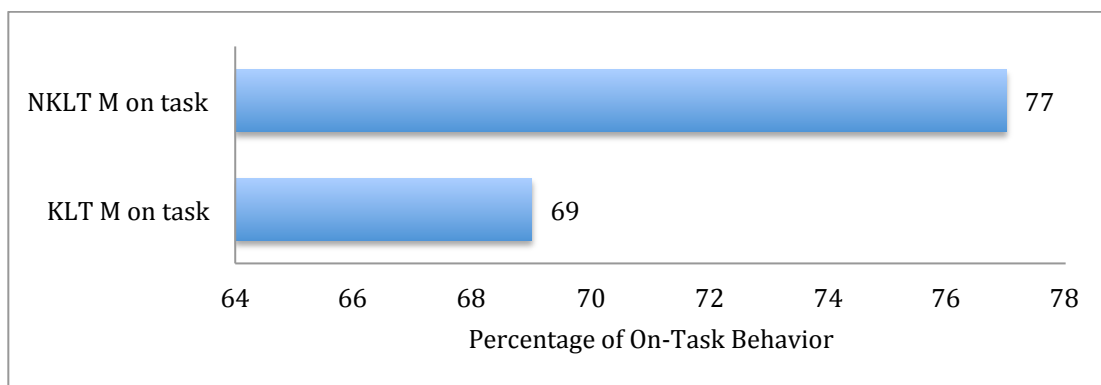


Figure 5. *Comparison of On-Task Behavior in Male Students in First Grade.*

Figure 6 presents the comparison of on-task behavior categorized to only the female students in the first-grade classrooms. The female students in the kinesthetic classroom had an average of 87% on-task behaviors during the times they were observed. This was a 9% increase in on-task behaviors when compared to the classroom without KLTs.

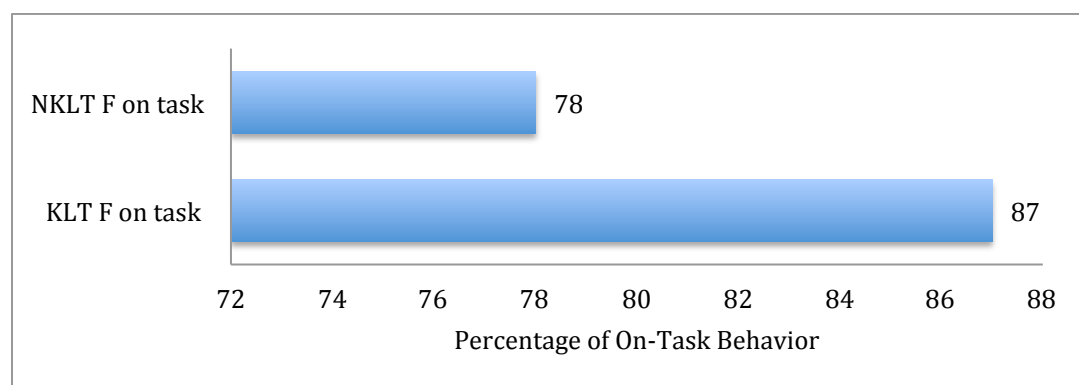


Figure 6. *Comparison of On-Task Behavior in Female Students in First Grade.*

More data were gathered with the teacher interviews, consequently allowing the

researcher to focus on some trends that appeared in the research. It was important to get the insight of the classroom teachers, because they were the ones who were in the classes with the students and the tables on a daily basis. They provided a better understanding as to the impact the tables had in their classrooms during the year, outside of the research observation window. Three major themes came out of the teacher interviews.

Theme 1: Teachers report more focus from their students in their classrooms as well as more on-task behaviors.

Interviewer: What other ways do you see these tables either benefiting or harming your instructional day?

Teacher A: For the most part they do not bother me or my instruction in any way. The students seem to learn well while moving and focus better on the task they are working on. I especially love the pedals in reading groups, I feel like they help the students while they are reading.

Teacher B: Kicking and spinning pedals are the only negatives I have encountered. They do this when they are not engaged or they are off-task. There are many benefits. Students have mentioned they become more focused during reading, organizational skills improve due to lack of a desk to lose items, a sense of community has developed within the classroom, and the design of the seat provides the student a working position. They do not have the opportunity to lean back in non-working position. Several behavioral issues are non-existent due to the stimulation and movement they receive.

Both teachers agreed with the fact that they could tell and see a difference in their students' behaviors with these tables. They informed the researcher that the students seem to focus more and stay on task better with the tables than without the use of the

tables. Students using the tables in other ways was also reported and that these two teachers were okay with students just being human and wanting to try new things.

Theme 2: Teachers report that students display less distracting behaviors therefore having more in-seat time.

Interviewer: Have you noticed any differences in student behavior through the use of the tables?

Teacher A: I have not noticed any major differences in behavior. This could be due to their age. Six and seven year olds are energetic at all times of the day. Especially this group, they are wigglers. They do seem to stay seated longer periods of time.

Teacher B: I notice the lack of inappropriate contact between students. (Irritating each other by touching, picking or wandering aimlessly) they remain in their seat more often. They are more cooperative with each other, and the desire to stand while working is often visible, and they are on task more often.

The decrease of picking and touching and increase in remaining in their seats could lead to the increase in on-task behavior. Teacher B described some interesting ideas with the use of these tables, including the lack of inappropriate touching as well as being able to watch and see when the students are really working or just pretending to work.

Amazingly, the observer witnessed this while doing classroom observations. It was remarkable to see that when the students were listening to the teacher talk, the pedals were going pretty quick and steady; then the teacher played a video and all but two students quit pedaling and focused on the video. The two students who were still pedaling were doing so very slowly and steadily. At the end of class, the teacher said that those two young boys who continued moving had ADHD.

Theme 3: The teachers believe that the tables have helped increased overall scores and performance in their classrooms.

Interviewer: Is there anything else you would like to share with me about the tables that you think is important for this study?

Teacher A: I cannot think of anything else that would be helpful to you, sorry.

Well, maybe one thing. I can tell they have better sustained read to self time now that the tables are implemented. This group of students is especially young developmentally but these tables have helped them to be able to complete assignments and read longer.

Teacher B: I think my test scores are impacted tremendously. We have achieved high- test scores and high growth in both tested areas. I think it would be interesting to compare my growth with tables implemented and prior to implementation. After one student retook her test, 100% of my 20 students scored either a 4 or 5 on Reading EOG, and 18 of 20 scored either a 4 or 5 for math EOG. One student scored a 3 in math.

Both teachers spoke that they believe their students were increasing in overall performance. These teachers were in the classrooms and could see more gains than this research study lends to us.

Summary of Findings

Two major findings emerged from the analyses of data. The purpose of this study was to determine the impact KLTs have on student on-task behaviors. Based on the findings using the on-task behavior observations, teacher interviews, and mClass data, KLTs had the greatest overall impact on the fourth-grade classroom.

The first major finding is the mClass data showing that the fourth-grade

classroom with KLTs showed a statistically significant increase in reading achievement over its counterparts without KLTs. The first-grade class data indicate there is a statistically significant decrease in reading achievements on EOY between with KLTs and without KLTs.

The second major finding was the impact that KLTs have on student on-task behavior in elementary schools. The analysis of the impact of movement using KLTs on student on-task behavior revealed some promising results. This study indicated that the fourth-grade class that had KLTs had a 14% higher on-task rate than the fourth-grade class without the learning tables. The study also showed that there was absolutely no difference in the on-task rate for the first graders with or without the learning tables.

Thus, the results indicate that the movement intervention of KLTs had a significant impact on the fourth-grade on-task behavior and very little to no effect on the first-grade on-task behavior. This is supported by the themes that came about after in-depth teacher interviews. This could be a result of the way the schools are set up. In second grade, the students usually transition from center learning to more desk and chair learning. The demands get higher and harder for second graders. Most first graders are allowed to move all day anyway and thus the tables may not have such a big effect on this group. The fourth graders showed a large increase in on-task behavior, and this could result from the implementation of the learning tables allowing students to move while they learn.

Data collected through surveys, teacher interviews, and mClass scores were used to answer the research questions. Data analysis and interview excerpts were presented and summarized in this chapter. The chapter concluded with a summary of the major findings brought forth through the data for this research. Chapter 5 provides

interpretation of the findings, implications for change, and recommendations for future studies.

Chapter 5: Summary, Conclusion, and Recommendations

Introduction

This study was used to determine the acute impact that KLTs had on student on-task behaviors as well as to identify any trends in academic growth with a focus on reading scores. The study determined that movement can promote more on-task behaviors in older elementary students, thus increasing learning opportunities. Across decades of research, time-on-task is positively associated with academic achievement. Studies examining the use of therapy balls, a different type of dynamic furniture in the classroom, support that therapy ball seating may facilitate engagement and in-seat behavior creating opportunities for effective instruction (Schilling & Schwartz, 2004; Schilling et al., 2003). This study also demonstrated that the use of KLTs resulted in increased on-task behavior, which has the potential to improve classroom performance and facilitate learning.

The purpose of this mixed-method study was to determine the impact that KLTs had on student on-task behaviors in first and fourth graders in XYZ County Schools. The overarching goal was to deliver research-based KLT strategies to elementary school students, to determine if these tables aided in an increase of on-task behaviors, and to see if they led to any trends in academic growth. These specific tables were manufactured by KidsFit Incorporated and are designed to allow a student to move while learning.

The research questions were answered by using MTS observations, teacher interviews, and statistical analyses on mClass reading scores. The data were collected by the same methods for all four classrooms, but the focus is on the impact in the two classrooms using KLTs. Decreased attention to task has been identified as interfering with learning in the elementary school setting (Williams & Schillenberger, 1996).

Interpretations of the Findings

The data gathered from this study were used to investigate the impact of educational KLTs on student on-task behaviors and academic growth in reading between two first-grade classrooms and two fourth-grade classrooms. An important consideration is the developmental level of the participants studied; most previous studies exploring the effect of stability ball use on educational variables focused on elementary-grade students as young as preschool (Schilling & Schwartz, 2004) and as old as fifth grade (Fedewa & Erwin, 2011). The use of stability balls is a different type of dynamic classroom furniture, and the results could be used in comparison with this study.

Movement engages students both physically and mentally and thereby helps reduce the amount of off-task behavior (Helgeson, 2011). The average difference between the two fourth-grade classrooms on-task behaviors was 14% and two first-grade classrooms on-task behaviors were 0%. Similar findings were reported by other researchers in their studies. Helgeson (2011) found that movement helps promote a positive learning atmosphere in which students are alert, engaged, focused, and excited to learn. The increase of on-task behaviors in fourth grade by 14% indicates that the results of this specific study are similar to the study Helgeson conducted.

The fourth-grade classroom with KLTs revealed the greatest increase in on-task behaviors throughout the entirety of the study, with a 14% increase. When the data were analyzed by gender, the fourth graders with KLTs still demonstrated the greatest on-task percentage increase. Male students in the fourth-grade classroom with KLTs showed an average of 95% on-task behavior, which is 19% more on-task time than their counterparts in the nonkinesthetic classroom. Female students showed an increase of 8% between the kinesthetic and nonkinesthetic classrooms, going from 84% to 92% on-task when using

KLTs.

The first-grade classrooms showed 0% change in on-task behavior overall between the kinesthetic and nonkinesthetic classrooms, with 78% on-task behaviors observed during the entirety of the study. There are differences that appear once the data are analyzed by gender. Male students in the first grade showed an 8% decrease in on-task behavior in the kinesthetic learning classroom, going from 77% on-task in the nonkinesthetic classroom to 69% on-task in the kinesthetic learning table classroom; KLTs had a negative impact on the on-task behaviors in male students in the first grade. Examining the female students in the first-grade classrooms, the nonkinesthetic room female students' on-task behaviors were 78% on-task; and the kinesthetic classroom female students' on-task behaviors were 87%, indicating an increase of on-task behaviors in female first-grade students by 9%.

The greatest impact in on-task behaviors was in the fourth-grade classroom with KLTs. This could be due in part to the nature of work required of fourth-grade students as well as their maturity and developmental rates. The fourth-grade students have better control of their bodies but are typically expected to be sitting in desks and chairs all day with little movement. With the use of the tables, these students are given the opportunity to move while learning, whereas first graders are constantly moving between centers, circle time, carpet time, and teacher time. It is more natural for movement to occur in a first-grade classroom based on their curriculum demands, attention spans, and developmental levels. This could be a reason why little impact was shown in the first-grade classrooms in student on-task behaviors.

The study findings are similar to those of Pfeiffer et al. (2008), who found that second-grade students with attention difficulties had increased attention while using the

Disc-O® seat cushion, thus increasing attention to time-on-task. Second grade is when the biggest changes occur in the demands of education. Thus, the study indicates that the most impact can happen in the upper elementary grades, as shown in this study with fourth graders.

Comparing the average on-task percentage for all classrooms involved in the study, the results indicate there is an average increase of on-task behavior of 7%. Both first- and fourth-grade classrooms with KLTs had an 86% on task average as opposed to the 79% on-task average from both first- and fourth-grade classrooms without KLTs. Overall, the students using KLTs had higher levels of on-task behavior than those who were sitting in traditional classroom arrangements.

Similarly, the EOY reading level data from the fourth-grade classroom with KLTs were compared to the data from the fourth-grade classroom without KLTs to determine the impact on academic performance. The fourth-grade classroom with the implementation of KLTs showed an average increase in TRC reading scores, on average, of 3.59 levels in year 1 and 3.65 in year 2; resulting in an overall average of 3.62 levels of reading growth each year. The fourth-grade classroom without the implementation of KLTs showed an increase of 3.18 levels in year 1 and 2.35 levels in year 2, which is an average of 2.76 levels of growth in reading scores over 2 years. This is equivalent to approximately one level less than in a kinesthetic learning classroom in the fourth grade. The data reveal that there is a statistically significant improvement in reading level scores between classrooms with KLTs and without KLTs in fourth grade.

Similar data were collected for the first-grade classrooms used in this study. The data from the study result in the implementation of KLTs having a statistically significant impact on the first graders. The first-grade classroom with the implementation of KLTs

had an average growth in year 1 of five reading levels. In year 2, the average growth was three reading levels, resulting in the average of four reading levels of growth over a 2-year time span. The first-grade classroom without the implementation of KLTs disclosed an average growth of 5.9 reading levels in year 1 and a 5.3 growth of reading levels in year 2, resulting in an overall average over a 2-year time span to be 5.6 reading levels. According to this data, the nonkinesthetic learning table classroom has shown 1.6 levels of growth more on EOY reading scores than the first-grade classroom with KLTs. Thus, the statistically significant impact is a negative impact on the first graders in this study.

This study provided qualitative data contributing to the research that KLTs have a positive impact on student on-task behaviors, especially in fourth grade. As compared to the Fedewa and Erwin (2011) study on stability ball use, the percentage of on-task behaviors went from 10% to 80%; but this study was conducted on the same set of students in different environments. This study showed an increase in on-task behaviors in fourth graders as compared to their nonkinesthetic classroom counterpart.

Limitations

As with any research design, inherent limitations must be addressed. The sample size was fairly small, with only two first-grade and two fourth-grade classrooms studied. The amount of time spent in each classroom observing students, 18 hours, was limited; time might need to be extended to thoroughly examine the effectiveness of KLTs on student on-task behavior. There was no input from the students to get their perceptions of the use of the tables. Input from students could increase the validity of the test. Other limitations for this particular study are the teacher's ability to handle and allow for movement in the classrooms.

Another limitation is the potential for subjectivity with both direct observations

and with mClass scores. In addition, a longer-term intervention may be warranted to explore whether student achievement outcomes are influenced by the use of KLTs in the classroom for a longer period. A longer study would allow time for adjusting to the changes that KLTs impose and would show more information about the on-task behavior of students for that longer period of time. A longer study would also decrease any teacher bias and could increase observer inter-rater reliability. Particular teaching styles may also have affected this study. Some teachers are generally more apt to allow movement in their classrooms.

The negative impact KLTs had in first-grade students in this study could be the result of the learning environment. Students in the first grade are prone to learning in a moving environment with a focus on centers and frequent breaks. A difference in teacher classroom management could also be the reason for the negative impact, considering the years of experience teaching first grade each first-grade teacher brings to the research. This particular group of first-grade students came in as a very low-performing group of kindergarteners and a very immature group as well. They have continued to struggle in the first grade as well with behavior and academics. All of these factors could have influenced the results of this study.

Recommendations for Further Study

Given the limitations of the small sample size, future research is needed to examine the effect of these tables. The results of this study will enhance the literature involving the use of KLTs, based on the theory that movement increases on-task behaviors. Study results indicate the potential for use of KLTs as an effective and appropriate intervention for students, especially in upper elementary school. Future research and replication of this study are needed to further validate its results.

Prior to this study, no other studies had systematically examined the use of KLTs as an intervention to increase on-task behaviors in elementary children. Although the results show that the implementation of these tables has the potential to increase on-task behavior in the classrooms, replication of this study is warranted and could be enhanced with the addition of more qualitative components. Interviews of the students would enhance this study, as would insights into parental perceptions of the use of these tables.

It would also be beneficial to know if consistent results would be obtained from differing populations and/or settings. Therefore, future research should focus on differing populations (e.g., students with varying disabilities, nondisabled students, students from different cultural groups and ethnicities) and differing settings (e.g., varied content classes, nonacademic classes, other schools, varying grade levels). Future studies should also address the effects of the intervention on the participants over longer periods of time and in multiple settings.

Further research should be targeted to gather data about individuals rather than groups. Focusing on specific students would allow for more information for teachers, administrators, and districts to determine if this intervention works best with specific students. Future studies will be needed to examine whether teachers share the same level of enthusiasm when using KLTs.

Research on students in the same grade level that allows all students the chance to be on the tables and off the tables would reveal if it truly is the tables that promote the on-task behavior. Linking movement in the classroom to math achievement would also be a good research endeavor.

Implications for Change: School Administrators

This study has immediate practical implications for implementing KLTs in school

environments. Many factors influence student performance in school and on standardized tests; one significant influence on academic achievement is student on-task behavior and attention (Frazier et al., 2007). With strict curriculums and limited time in elementary schools, administrators and teachers must creatively integrate as much time-on-task as possible for all students. The findings from this study provide guidance for education administrators and policymakers who must think about how to improve and/or maintain student on-task behaviors, thus increasing the learning opportunities. More time-on-task might result in more learning.

A primary barrier to implementing KLTs in the classroom is that teachers fear their students will not be able to settle back down into lessons or will remain too noisy or cause a distraction; the cost of implementation is acknowledged by the teachers in this study. This study suggests, however, that students are not more off-task after the use of KLTs but rather demonstrate an increase in their on-task behavior, especially in the fourth grade.

The findings of this study suggest that the use of KLTs has promising implications for increasing on-task behaviors of students in fourth grade in academic settings. An additional strength of the KLT intervention to teachers and students who may benefit from this approach is the degree of internal control the intervention affords the students. The student decides if and when to use the components of these tables. This is important because it makes this intervention more student-directed, which allows them to become responsible for managing their own behavior and thus impact their own learning.

Implications for Change: Classroom Teachers

Educators who are familiar with the time-on-task research, know their students

well, use effective classroom management techniques, and employ good teaching practices and interactive learning activities have the power to turn the learning lights on for many, many students. If teachers can implement KLTs in their classrooms, students may not only receive some health benefits, but they could also increase their learning because of improved on-task behavior. Children learn more readily if they are able to attend to tasks and absorb information. This study provides some evidence that movement in the classroom in upper elementary schools can increase the on-task percentage of students. Increasing on-task behavior can have the potential to increase overall learning. However, when it comes to increasing instructional time, it must be specific time that is curriculum-focused. One research review revealed that when coupled with good teaching methods—particularly, timely and specific feedback, attention to what a student already knows, and the active participation of the teacher—time has a significant impact on achievement (Quartarola, 1984). In order for the impact to be significant, the teaching must be specific and targeted and must involve good class management.

Another review concluded that the combination of additional time with effective teaching strategies and curricula designed to engage students is a powerful tool for enhancing academic performance (Moore & Funkhouser, 1990). In this instance, engaging students means choosing the instructional strategies and curriculum that will enhance a student's motivation to learn.

Conclusions

While studies that investigate the use of KLTs in classrooms are limited, the existing literature on the topic of movement and use of dynamic furniture suggests that KLTs are valuable tools for the learning process. The results of this study support the

hypotheses that students will be more on-task using KLTs when compared to students without the use of KLTs. While this study provides rigorous, empirical evidence of the importance of movement and its impact on student on-task behaviors, the researcher is not able to link this study to achievement because of the lack of ability to determine how the on-task time was used during instructional time.

The researcher concluded that there is a positive impact on student on-task behaviors and academic achievement in fourth graders who have access to KLTs. This means that students who used these tables made higher reading level growth on average and showed more on-task behaviors during the observation periods when compared to the students who did not use these tables. The researcher is not able to link the reading achievement to the use of the learning tables due to the other factors that influence reading achievement in students. However, the researcher can link the use of the tables with increased overall on-task behaviors in the fourth-grade students in this study.

Adding movement with KLTs is not a simple action but rather one that should be gradual, taking time to set expectations for the students. Both teachers and students have to adjust to the changes that come with these movement interventions. Once these changes have had time to become routine, it would still take time for the academic achievement and student behavior to adjust and show significant change. Despite the many limitations, this study's major finding is that KLTs have greater impact and show greater increase in on-task behavior and academic achievement in the fourth grade.

Lastly, the researcher believes that the implementation of KLTs can be a powerful tool for upper elementary students, teachers, and administrators. As a result of this study, school district personnel should realize the impact that these tables can have in their schools and make necessary changes to budgets and policies on movement. In

conclusion, students in the fourth grade with KLTs increased time-on-task in the classroom and showed an increase in reading levels higher than their counterparts without the tables. The impact was positive in the upper elementary classrooms and should help educators in future decision making.

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Appendix A

Initial Invitation to Participate

Dear _____:

My name is Natalie Boone and I am a student at Gardner-Webb University pursuing a *Doctorate of Education* in Educational Leadership. Currently, I am completing the requirements for graduation, which includes writing and defending a dissertation. My dissertation is entitled, *On the Move: A Mixed-Methods Study to Examine the Impact of Kinesthetic Learning Tables on Student Behavior and Academic Growth*. The purpose of this research study is to examine the impact that kinesthetic learning tables have on student behavior and academic growth with an emphasis on reading skills.

I have chosen to do a mixed method study. To assist in my data collection, I will need to be granted permission to observe in the classrooms that are currently using the kinesthetic learning tables. During the observation, I will be watching student behaviors during different subject areas being taught. Each student will be coded B (boy) or G (girl). No other means of identification will be used during the observation times. The observation periods will only be used to observe how much the students use the kinesthetic tables while the teacher is teaching and if it correlates to the time on task for the students.

Also, I will be comparing reading scores using mclass data to see if there is a correlation between the movements in the classroom and improved reading levels and scores. To have a good comparison, the quantitative data will be collected in all 1st and 4th grade rooms in both schools.

Lastly, I will be having focus groups with the teachers involved in the study to gain insight to what they see on a daily basis from their student's use of the kinesthetic learning tables. These focus groups will take place at least twice throughout the study.

The county, schools, teachers, and students will remain anonymous at all times. There is no need to have any identification markers for anyone who is a participant in the study.

If you have questions or concerns, please feel free to contact me at XXXXXXXXXXXX or by phone at XXXXXXXXXXXXXXXX.

Thank you:

Natalie Boone

Appendix B

Observation Form for Classroom Behaviors

Momentary Time Sampling Form

Student's Name: _____ Teacher: _____

Subject/Period: _____ Date(s): _____

Behavior Definition (in specific, observable, measurable terms)

Total Observation Time: _____ Length of each interval: _____

Date	Interval #										Total times behavior occurred (X)
B or G	1	2	3	4	5	6	7	8	9	10	
O or X											

Date	Interval #										Total times behavior occurred (X)
B or G	1	2	3	4	5	6	7	8	9	10	
O or X											

Date	Interval #										Total times behavior occurred (X)
B or G	1	2	3	4	5	6	7	8	9	10	
O or X											

Date	Interval #										Total times behavior occurred (X)
B or G	1	2	3	4	5	6	7	8	9	10	
O or X											

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Appendix C

Interview/Focus Group Protocol

SESSION INFORMATION

Time of Interview: _____
 Date of Interview: _____
 Interview Location: _____
 Interviewer: Natalie Boone
 Interviewees: _____

INTRODUCTION

Before we get started, let me take just a moment to thank you again for agreeing to visit with me and talk with me about your experiences with kinesthetic learning tables. I very much appreciate your sharing your time and thoughts with me. My doctoral dissertation research focuses on the impact that kinesthetic learning tables have on student reading scores and classroom behavior. The purpose of this research study is to examine the impact that kinesthetic learning tables have on student behavior and academic growth with an emphasis on reading skills. I'm curious if you have any questions for me about either the nature of the study or about my own background, and I'd be happy to answer those for you if you do. [Pause for questions.]

INFORMED CONSENT

So, before we begin the actual interview, I also want to make sure you've had a chance to read the informed consent form that I emailed to you some time ago. It's important to me that you understand exactly what your participation in the study involves, and the steps I will take to protect your anonymity and privacy. Do you have any questions for me about the informed consent document, or about your participation? [Pause for questions.]

[Collect signed informed consent form from participant.] _____ Signed & received

GUIDING QUESTIONS

[Begin audio recording.]

1. Why don't we get started by talking a little bit about your professional background?
2. What kinds of professional development have you received in movement in the classroom?
3. What other types of activity do you use in your planning?
4. Tell me about how you handle the transition from desks to learning tables for your students.

5. When do you notice students moving more during class?
6. Which students do the most movement throughout the day?
7. Do your students have assigned seats or do you allow them to choose which table to use?
8. What other ways to see these tables either benefiting or harming your instructional day.
9. Have you noticed any differences in student behavior through the use of the tables?
10. Is there anything else you would like to share with me about the tables that you think is important for this study?

NEXT STEPS

Over the next week or so, I'll use the audio recording from our interview today to create a written transcript of our conversation. As soon as it's ready, I'll email a copy to you. If you would, please take just a few minutes when you receive it to read through it and let me know if it looks accurate. You're also welcome to send me additional information you'd like to include if you think of details or information you'd like to add as you read it. I'll also spend some time reading through the transcript and thinking about all you shared during our discussion today. As I continue to collect more data for the study, it may be the case that I contact you to see if you would be willing to answer just a few more questions. Would that be OK?

[Pause to note participant's willingness to participate in a secondary interview.]

CLOSING

Again, thank you very much for spending time with me today and answering my questions. Your perspectives are very helpful, and I appreciate your sharing them with me. Please don't hesitate to call or email me if you have any questions about today's session or about the research itself. I'm happy to answer them for you

Appendix D

Informed Consent of Study Participants

My name is Natalie Boone and I am a student at Gardner-Webb University pursuing a *Doctorate of Education* in Educational Leadership. Currently, I am completing the requirements for graduation, which includes writing and defending a dissertation. My dissertation is entitled, *On the Move: A Mixed-Methods Study to Examine the Impact of Kinesthetic Learning Tables on Student Behavior and Academic Growth*. The purpose of this research study is to examine the impact that kinesthetic learning tables have on student behavior and academic growth with an emphasis on reading skills. Your unique experiences will enrich the quality of the research, its results, and their value to members of the education community.

Your participation in the study is completely voluntary, and you may choose to end it at any time. As a participant, you will individually complete one interview designed to gather in-depth information about your experiences with a classroom with kinesthetic learning tables. Some participants may be invited to participate in one secondary interview to further explore specific aspects that may turn up throughout the data collection process.

All interviews will be conducted at a date, time, and location of your choosing in order to protect your time and minimize any inconvenience you may experience. Interviews are expected to last approximately one hour and will be recorded to ensure accurate data collection. You may decline to answer any questions you wish and we may, upon your request, temporarily suspend audio recording if you wish to share information that you do not want recorded.

While there are no known risks to your participation, I am committed to ensuring confidentiality and protecting your privacy. The interviewer will prepare a written transcript of your recorded interview and a copy will be provided to you to check accuracy. You will be referenced by a pseudonym in the dissertation and its derivatives to protect your privacy, and I will not provide other information that might indirectly identify you. Audio recordings, transcripts, and field notes will be maintained securely and destroyed five years after the dissertation's successful defense. The dissertation will be presented to doctoral faculty at Gardner-Webb University. The dissertation and its derivatives may be published or presented in professional or academic settings.

I am happy to discuss any questions you have about the study or your role as a participant. Please contact me at XXXXXX or XXXXXXXX if you have any questions. You may also contact my dissertation chair, Dr. Karen Sumner, at XXXXX or direct questions or concerns about your role as a participant to the Gardner-Webb University Institutional Review Board at XXXXXX.

To affirm your participation in the study, please complete the following section:

1. The researcher may _____ or may not _____ create an audio recording of my interview responses for use in the study.
2. I would _____ or would not _____ like to receive a synopsis of the study's findings.

_____/_____/_____
Name Signature Date