

UNION UNIVERSITY
SCHOOL OF EDUCATION

We hereby recommend that the Dissertation by
Lakeva S. Barnes

The Effects of Gender-Based Instructional Strategies
On the Achievement of Seventh-Grade Boys in Single-Gender
Reading Classes and Seventh-Grade Girls in Single-Gender Math Classes

Be accepted in partial fulfillment of the requirements for the Degree of
Doctor of Education
In Educational Leadership

Teri Evans, Ed.D., Program Director (Date)

Dissertation Committee

Patti Ray, Ed.D., Chairperson (Date)

Gwen Neal, Ed.D. (Date)

Carrie Steakley, Ed.D. (Date)

STATEMENT OF PERMISSION TO USE

In presenting this dissertation in partial fulfillment of the requirements for the Doctor of Education Degree at Union University, I agree that the Library shall make it available to borrowers under rules of the Library. Brief quotations from this dissertation are allowable without special permission, provided that accurate acknowledgment of the source is made.

Permission for extensive quotation from or reproduction of this dissertation may be granted by my research chair or, in her absence, by the Head of Interlibrary Services when, in the opinion of either, the proposed use of the material is for scholarly purposes. Any copying or use of the material in this dissertation for financial gain shall not be allowed without my written permission.

Signature _____

Date _____

The Effects of Gender-Based Instructional Strategies
On the Achievement of Seventh-Grade Boys in Single-Gender Reading Classes
and Seventh-Grade Girls in Single-Gender Math Classes

A Dissertation
Submitted in Partial Fulfillment of the Requirements for the
Doctor of Education Degree
Union University

Lakeva S. Barnes

May 2017

ProQuest Number: 10629703

All rights reserved

INFORMATION TO ALL USERS

The quality of this reproduction is dependent upon the quality of the copy submitted.

In the unlikely event that the author did not send a complete manuscript and there are missing pages, these will be noted. Also, if material had to be removed, a note will indicate the deletion.



ProQuest 10629703

Published by ProQuest LLC (2017). Copyright of the Dissertation is held by the Author.

All rights reserved.

This work is protected against unauthorized copying under Title 17, United States Code
Microform Edition © ProQuest LLC.

ProQuest LLC.
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106 – 1346

Dedication

This dissertation is dedicated to my Lord and Savior Jesus Christ for empowering me to think, write, and to create in ways that I never thought I could.

This dissertation is also dedicated to my loving family: Wilford, my husband of 16 years, Deovontee, my parents, Deborah and Gaston, and my aunts, Barbara and Phyllis. Thank you for your encouragement and support through seven years of school.

Philippians 4:13

I can do all things through Christ who strengthens me.

ACKNOWLEDGMENTS

I would like to express my deepest gratitude to my dissertation committee, Dr. Patti Ray (Chair), Dr. Gwen Neal, and Dr. Carrie Steakley, for their prayers, guidance, and encouragement throughout the dissertation process.

I would also like to thank the Union University (Germantown) librarian, Shirley Harris, for taking the time to help me find the best resources for my study.

Special thanks to Dr. Matthew Holmes for statistics support.

My deepest gratitude goes to Dr. Stephen Marvin for introducing me to the work of Dr. Michael Gurian of the Gurian Institute.

ABSTRACT

This study examined the relationship between the reading achievement of seventh-grade boys in single-gender classes at a Tennessee charter school on the ANET (Achievement Assessment) who implemented fidgets and movement breaks compared to boys and girls who did not. Fidgets can be described as manipulatives that students can twist, turn, or squeeze during instruction to help maintain focus. This study also examined the relationship between the math achievement of seventh-grade girls in single-gender classes at a Tennessee charter school on the ANET assessment in 2016 that used process grading and mathematical written expression compared to girls and boys who did not. A paired-samples *t*-test was conducted to compare the fall preassessment achievement scores of males and females in seventh-grade single-gender reading classes and the winter postassessment achievement scores of males and females in seventh-grade single-gender math classes after receiving gender-based instructional strategies. A one-way analysis of variance was also conducted to examine the effect of implementing written expression and process grading with girls in a seventh-grade single-gender math class to girls and boys in seventh-grade single-gender math classes with no treatment. The ANCOVA was conducted to compare the effects of using fidgets and movement breaks with boys in a seventh-grade single-gender reading class to girls and boys in seventh-grade single-gender reading classes with no treatment. The findings of

this study did not support the use of the gender-based strategies as having an effect on the achievement of seventh-grade boys in reading and seventh-grade girls in math in single-gender classes.

TABLE OF CONTENTS

CHAPTER	PAGE
1. INTRODUCTION	1
Problem Statement	2
Purpose	3
Research Questions	4
2. REVIEW OF LITERATURE	5
Differences in the Brain	5
Differences in How Males and Females Approach Literacy	17
Differences in How Males and Females Approach Numeracy	20
Gender Stereotyping.....	23
History of Single-Sex Education	28
Advantages of Single-Sex Education	30
Effectiveness of Single-Sex Education.....	33
Gender-Based Instructional Training for Teachers.....	40
Implementation of Single-Sex Instruction	51
Chapter Summary.....	55

3. METHODOLOGY	57
Participants	61
Instrumentation	62
Procedures	63
Measurement	67
Data Analysis	70
Limitations	72
4. RESULTS	74
Data and Statistical Results	75
Summary	81
5. CONCLUSIONS AND DISCUSSION	82
Conclusions	82
Recommendations	83
Implications	86
Discussion	88
Closing Summary	93
REFERENCES	94

CHAPTER 1

INTRODUCTION

The implementation of single-gender classes and schools, sometimes referred to as gender-based classes, single-sex education, or single-sex classes, is a growing trend in U.S. education as a means of responding to the need for education reform. Historically, single-sex programs have been popular among independent schools, day schools, and boarding schools (Gurian, Stevens, & Daniels, 2009b). Changes were made to the Title IX regulations in 2006 by the U.S. Department of Education, which expanded the opportunities for public schools to legally provide the single-sex instruction option (Gurian et al., 2009b).

Single-sex classes and schools have been emerging around the country, as educators have become more aware of the differences in how boys and girls learn. Although Title IX no longer prohibits the implementation of single-sex schools and classes in the public arena, there are stipulations to which public schools must adhere, Document 34 CFR Part 106 (B) gives schools permission to separate students by gender if doing so will meet the particular, identified educational needs of its students (Gurian et al., 2009b). Placing students in classes based on gender is the embarkation of a much broader initiative to close the achievement gap between boy and girls in reading, math, and science. Research is much needed on the impact of teacher development and the

success of single-sex instruction. Closing the achievement gap between girls and boys is directly effected by how well teachers implement gender-based strategies in the single-sex and coed classroom. However, implementation of gender-based instructional strategies must be coupled with an in-depth understanding of the structural and functional innate differences of students' brains (Gurian et al., 2009a).

Problem Statement

Traditional classroom practices in language arts tend to favor the learning styles of some girls, which primarily focuses on reading, writing, listening, and speaking. This is what Dr. Michael Gurian (2016) calls “systemic thinking” or created systems, where there was no consideration of gender or nature. For this reason the school systems underserve certain populations. Often many boys are victims because of the physiological and psychological structures of how the male brain functions do not lend themselves to the traditional way in which language skills are acquired (Gurian & Stevens, 2011). Likewise, in math some girls are at a disadvantage because of what Gurian and Stevens (2011) called the “male-brain classroom” (p. 298) where the male teacher instructs students based on how their brain understands it.

Recent strategy-based research has indicated that use of gender-friendly reading and writing strategies have helped to foster improved achievement among some male students in the language arts classroom (Gurian et al., 2009b). Gurian and Stevens (2011) also reported that many middle and high

school math teachers have had training in how to help female students reach equal status in math and science.

Merely placing students in single-sex classes may not be a completely effective means of meeting the literacy and numeracy demands of some girls and boys. Slota (2011); Pahlke, Hyde, and Allison (2014) both reported no substantial differences in the performance of students homogeneously grouped compared to student that were heterogeneously grouped. Providing teachers with sound and appropriate training for meeting the needs of boys and girls in the single-sex setting can possibly aid in fostering the achievement of some students (Gurian et al., 2009a).

Purpose

The purpose of this study was to examine the relationship between the achievement of seventh-grade boys in single-gender reading classes and seventh-grade girls in single-gender math classes at a Tennessee charter school in 2016 and the implementation of gender-based strategies. This study attempted to determine whether or not the use of gender-based strategies had an impact on student achievement on the ANet (Achievement Network) math and reading assessments. This study also attempted to examine whether the use of gender-based strategies would help to narrow or close the gender achievement gap between girls and boys in seventh-grade reading and math.

Research Questions

1. Is there a statistically significant difference between the achievement of boys in a seventh-grade single-gender reading class who used fidgets and movement breaks and boys in a seventh-grade single-gender reading class who did not use fidgets and movement breaks?
2. Is there a statistically significant difference between the achievement of girls in a seventh-grade single-gender math class in which written expression and process grading were used and girls in a seventh-grade single-gender math class in which written expression and process grading were not used?
3. Is there a statistically significant difference between the mathematics achievement scores for girls in seventh-grade single-gender classes, in which gender based strategies were implemented, girls in seventh-grade single-gender classes, in which gender based strategies were not implemented, and boys in seventh-grade single-gender classes, in which gender based strategies were not implemented?
4. Is there a statistically significant difference between the reading achievement scores for boys in seventh-grade single-gender classes, in which gender based strategies were implemented, boys in seventh-grade single-gender classes, in which gender based strategies were not implemented, and girls in seventh-grade single-gender classes, in which gender based strategies were not implemented?

CHAPTER 2

REVIEW OF LITERATURE

Placing students in classes based on gender is the embarkation of a much broader initiative. More research is needed on the impact of teacher development and the success of single-sex instruction. Closing the achievement gap between girls and boys in reading and mathematics is directly effected by how well teachers implement gender-based strategies in the single-sex and coed classroom. However, implementation of gender-based instructional strategies must be coupled with an in-depth understanding of the structural and functional innate differences of students' brains.

Differences in the Brain

Gender differences in the brain begin soon after conception when the fetus receives an X chromosome from both parents, which sets the fetus on a path of becoming female, or when the child receives an X from one parent and a Y from another, which sends the fetus on its way to becoming male. The child's body and brain are developing based on their gender (Gurian, Stevens, & King, 2008). In Chapter One of *Boys and Girls Learn Differently: A Guide for Teachers and Parents*, Michael Gurian and Kathy Stevens (2011) reported a brief history of why the male and female brains are different. Gurian stated that evolutionist believed that the brains were different for the purposes of dividing tasks. He

further stated that if you do not believe in evolution, the brain differences could be accepted as the way God made us.

The difference in gender roles was reported as being necessary for human survival. Gurian and Stevens (2011) further reported that until about 10,000 years ago, when the world became more agricultural, humans were hunter-gatherers. Males were responsible for hunting for food, which was a very spatial activity, and protecting their families and land, which was a very aggressive occupation. Females were responsible for gathering roots and other vegetation and taking care of the children, which were sensory and verbal occupations. Because the female was responsible for the care of the children, Gurian and Stevens (2009b) reported that females had to hear, see, and use all the senses and multitask to provide the keen brain development and nurturing the children needed. The male focused on the single task of providing and protecting. Gurian and Stevens (2011) reported that men worked in large groups to build structures, while women worked inside arranging and managing the habitats in which they dwelled. Women worked in smaller groups and verbalized as they worked in dyads and triads.

In *Why Gender Matters*, Dr. Leonard Sax (2005), psychologist, family physician, and founder of the National Association for Single-Sex Public Education, focused primarily on why gender was an important factor to be considered. Sax reported that early researchers believed that differences in gender were due to cultural influences created and reinforced by parents. He

further stated that the educational system influenced educators and parents to believe that girls and boys should be educated in the same way in all subjects at the same time. According to Sax, it was believed that differences in how boys and girls learned were due to societal influences and not biological differences.

Sax (2005) reported landmark research showing that in the late 1800s neurologists Charles Edouard Brown-Se'quard and Henry Charlton Bastian discovered that a male who suffered a stroke on his left side lost language function. There was no evidence during that time of how the same type of stroke affected women. More modern research reported by Sax revealed autonomic (i.e., nervous system) sex differences in how the male and female brains were organized. Sax further reported that the male brain was compartmentalized, whereas the female brain was globalized.

Research completed on female and male stroke victims revealed that males who suffered a stroke in the left hemisphere of the brain experienced a drop in verbal IQ at around 20% (e.g., from 111.5 to 88.7); men who suffered a stroke in the right hemisphere of the brain experienced virtually no drop in verbal IQ (Sax, 2005). Sax (2005) also reported much different results for women. Women who suffered a stroke in the left hemisphere of their brain experienced a 9% drop in verbal IQ (e.g., 113.9 to 103.6). Similarly, women who suffered a stroke in the right hemisphere of the brain showed results similar to the left side an 11% drop in verbal IQ (e.g., 113.9 to 101.0). Language can be acquired on

both the left and right hemispheres of a female brain, but this is not true for males (Gurian, 2002).

Sax (2005) continued to report that there were intrinsic differences in the male and female brain. The brain tissue of males and females are inherently different from birth. Sax further reported research completed by 14 neuroscientists from three well-known universities: University of California, University of Michigan, and Stanford University. The neuroscientists found that there were significant differences in the manifestation of protein found on the X and Y chromosome of men versus women. In men many areas of the brain were rich in proteins, which was coded by the Y chromosome. Sax reported that this finding was not present in the women's brain tissue. Sax further reported that the opposite was found in women. The areas of the female brain were rich in protein, which was coded by the X chromosome. The X chromosome was absent from the male brain tissue.

Sax (2005) reported further research where the 14 scientists were given 30 samples of brain tissue collected from various individuals. The sex of the individuals from which the specimens were taken was not revealed to the scientists. Based on the manifestation of proteins on the brain tissue, the 14 scientists were able to identify the sex of each sample. Sax concluded that these findings further supported the idea of genetic differences in the male and female brain.

Sax (2005) also reported that many of his psychology professors promoted the notion that boys and girls were the same at birth, which meant nurturing played a vital role in what makes a boy a boy and a girl a girl. However, Gurian (1996) reported that nurture alone was not what made a boy a boy and a girl a girl. He further stated that there were biological factors that affected what we are and how society approaches us. Gurian and Stevens (2004) also reported that schools failed to structurally and functionally acknowledge the gender needs of some students. Sax (2005) concluded that the fact that many refused to recognize the substantial developmental differences in boys and girls had been a detriment to children for over 30 years.

As reported by Gurian (2002), refusal to recognize the developmental differences in boys' and girls' brains was probably due to the fact that early psychology students did not have access to neurobiological evidence to support their theory. Their main focus was the psyche and not the structure of the brain (Gurian, 2002). With the advancement of the *magnetic resonance imaging* (MRI), images of the internal structure of the brain can be captured (Sousa, 2014). With *positron emission tomography* (PET) and *single photon emission computed tomography* (SPECT) scanning technology, scientists and doctors get a more precise view of the human brain (Gurian, 2002). Gurian et al. (2009b) and Sousa (2014) further reported that neuroscientists are now able to view the working brain in action. Sousa (2014) also reported that scientists are able to view the structure and function of the "living brain" (p. 2) using the computerized axial

(CAT), electroencephalography (EEG), magneto encephalography (MEG), functional magnetic resonance imaging (fMRI), and functional magnetic resonance spectroscopy (fMRS).

Sax (2005) reported that researchers at Virginia Tech observed the brain activity of 508 normal children---224 girls and 284 boys from 2 months to 16 years of age. The researchers found that the areas of the brain that involved language and fine motor skills matures around six years earlier in girls than in boys, and the area of the brain involving spatial ; and targeting matures around four years earlier in boys than girls. The researchers concluded that sections of the brain involving language, fine motor skills, spatial memory, and getting along with others matures in a different order, time, and rate in boys compared to girls.

Gurian and Stevens (2011) reported functional differences in how boys' and girls' brains use cells and blood activity. He reported that the PET and MRI show differences in blood flow and neurotransmission. He stated that boys tend to use the right hemisphere more; girls tend to use the left. Boys tend to process emotional experiences in the lower brain limbic system (where fight-or-flight responses are stored); girls tend to process emotive information in the upper brain (where complex thought occur). Sax (2005) reported that over 70 years ago the development of the "fight or flight" (pp. 68-69) theory was as a result of the research study of psychologist Walter Cannon on the hormonal responses of animals to stress and confrontation. Because he did not want to deal with the hormonal fluctuations of female animals, he only studied the male animals.

Gurian and Stevens (2011) further reported that the PET scans and MRIs had started to reveal that sensory information burdened with emotional experiences comes into the female limbic system quickly to the upper part of the brain where thinking occurs. The male brain on the other hand moves emotionally stressful information to the lower part of the limbic system (that is, the amygdala) and the brain stem. Sax (2005) further reported that some males' senses become sharper and they feel excited because the sympathetic part of the brain is energized by adrenaline, which causes the male to have sharper senses and a feeling of excitement.

Because of these reported differences, some boys and girls process crises differently. Some females talk about the situation and reach out for help because more of their activity moves up to the hemispheres of the brain that verbalize and reason over the crisis. Sax (2005) also reported that some female responses are influenced by the parasympathetic, (p. 69) which operates using acetylcholine, which can cause nausea, dizziness, or a sickening feeling. Some girls may experience an inability to communicate their feelings with the right words.

Gurian and Stevens (2011) also reported that some males' response to crisis short-circuits intellectual and academic learning because their ability to process the crisis situation takes longer and involves less reasoning. This is because some males are more occupied in the lower part of the brain rather than the upper part where reasoning and learning occurs. Sousa (2011) reported in

How the Brain Learns, that the hypothalamus, found in the lower part of the limbic system, controls the release of hormones and balances numerous body functions, including sleep, body temperature, food intake, and liquid intake. If these systems are not balanced, it can be difficult for students to focus on processing cognitively on academic subject matter (Sousa, 2011).

Sousa (2011) also reported that the amygdala, which is attached to the hippocampus, where long-term memory is stored, plays an important role in encoding emotional messages. The emotion associated with a memory is recalled when the memory is recalled. The relationship between the hippocampus and the amygdala establishes long-term memory. Teachers must be made aware of the fact that in order to permanently affect how much content students remember, the lesson must connect to the emotional components of the brain in a positive way.

Gurian (2016) stated that the gender differences in the brain are confirmed throughout the world and show no significant differences between cultures. He further stated that gender differences in the brain are cross-cultural (Gurian, 2016), meaning that culture does affect gender role, attire, and expression, but those aspects of gender only affect some aspects of a child's learning.

The structural and functional differences between the male and female brain have a tremendous impact on how boys and girls learn (Gurian, 1996). Gurian and Stevens (2011) reported that the male brain is about 10% larger than the female brain, but the smaller female brain has a larger corpus callosum.

Gurian and Stevens (2011) and Senn (2012) reported the corpus callosum, the wires that connect the right and left hemispheres and control communication between the two, as being about 20% larger in the female brain. Gurian and Stevens (2011) further reported that the corpus callosum is more condensed in the female brain and is comprised of more neural connections between hemispheres. Because the corpus callosum is more dense in the female brain, the female is able to process more information between the left and right hemispheres at a more rapid pace (Gurian & Stevens, 2011). Sousa (2014) reported that these cerebral areas are activated during reading in both boys and girls.

Gurian (1996) explained that the larger corpus callosum, the nerves connecting the left and right hemispheres of the brain, is directly correlated to the female's ability to sometimes perform better in reading. Gurian continued to explain that the reading process requires students to rapidly shift between the left and right hemispheres of the brain. Gurian also stated that the single-sex option is a good one for boys whose brains are not as verbal as girls. In the single-sex male class, boys can learn to self-manage and feel safe working with others who understand them "instinctively" (Gurian, 1996, p. 210).

According to Gurian and Stevens (2011), the density of the corpus callosum allows the female to connect language and emotion processing centers more effectively. Gurian and Stevens (2011) further reported that the male language processing is more centralized in the left hemisphere of the brain. In

the classroom, this means the female has access to more words than the male and has the ability to more effectively communicate emotions (Gurian & Stevens, 2011). In the classroom, Gurian reported that some girls use words as they learn, whereas some boys work in silence. During cooperative groups, some girls tend to use more words than boys, with the exception of attention-seeking males. Gurian and Stevens (2011) also reported that some girls prefer more concrete explanations and some males find “coded language” (p. 46) more engaging. Sousa (2014) later reported that there is debate among scientists about what the difference in the density of the corpus callosum really means. Some support that the differences have an impact on how male and female adults connect with language.

Senn (2012) reported that the male brain is required to do more than what it is developmentally capable of in the early childhood stages. Sax (2005) reported that the kindergarten objectives are not developmentally relevant for some male kindergarten students. Sax (2007a) also stated that timing plays a huge factor in educating students. Jabor, Kungu, Machtmes, Buntat, and Nordin (2011) claimed that delaying the entry of some students into school as a attempt to enhance achievement was ineffectual based on empirical studies that showed that some childrens’ academic progress actually declined compared to their younger peers and continued to decline as they progressed through school.

Sax (2005) expressed that today's kindergarten is much different from kindergarten 30 years ago, but Sax (2007b) added that boys' brains have not developed any faster than they did 30 years ago. The curriculum for kindergarten today is the first-grade curriculum of 30 years ago. The goal today is for 5-year olds to reason, apply simple numerical concepts, and begin to read and write. Sax (2007b) further expressed that placing a 5-year-old in that type of learning environment poses a problem, because some 5-year-old boys do not possess the fine motor skills to effectively write the letters of the alphabet. Sousa (2011) reported that brain cells deplete oxygen and glucose for energy. The brain depletes more energy when performing a difficult task. A sufficient amount of oxygen and glucose must be in the brain in order for the brain to complete a difficult task. An insufficient amount of oxygen and glucose can cause slothfulness and inactivity (Sousa, 2011). Sax further explained that being a good teacher is not enough when the students are not developmentally prepared.

Learning to read and write is not as challenging for some girls as it is for some boys. Although some boys typically perform well once they gain the reading and writing skills necessary for academic success, the process can sometimes prove frustrating for some males because of a developmental delay in comparison to some girls. The frustration experienced in early childhood can sometimes result in a negative attitude about language acquisition (Gurian & Stevens, 2011). Gurian and Stevens (2011) further reported that because literacy is foundational to acquiring knowledge in other academic areas, gender gaps are

sometimes present in elementary school and even persevere throughout middle and high school.

According to Gurian (1996), during the developmental stages of a fetal brain, the female brain tends to develop faster than the male brain. The left hemisphere of the brain, which controls language, communication, and thinking, forms later than the right hemisphere of the brain, which controls spatial relationships. Gurian and Stevens (2003) further reported due to a developmental delay in boys, the corpus callosum fibers are not ready to connect the left and right hemispheres of the brain because cells do not yet exist in the left hemisphere. This causes the fibers to have to connect to areas within the right hemisphere. Senn (2012) reported these parts of the right hemisphere as the temporal lobe, which produces strong spatial relationships, measurement, and map reading in the male brain. This explains why some males are more likely to use objects like blocks to explore how they use space (Gurian, 1996).

Sax (2005) reported a more subtle difference in brain development between boys and girls. The parts of the brain that control language and fine motor skills reach maturation 6 years earlier in a female. The parts of the brain that influence spatial memory reach maturation 4 years earlier in a male. Sax further reported that it was concluded that the areas of the brain that dealt with language, spatial memory, fine motor coordination, and people skills do not develop in the same order, time, and degree in girls compared to boys.

Gurian (1996) reported an experiment completed by Dr. Rubin Gur at the University of Pennsylvania, where he used brain scan equipment to generate computer photographs of the brain in action. During the study, when boys and girls were asked to complete a task requiring the use of manipulatives and how they were used in space, the right hemisphere of the male brain lit up with intensity. A significantly less amount of the left hemisphere showed intensity in the male brain during the experiment. However, the female brain showed an equal amount of intensity in both hemispheres of the brain. Gurian, Stevens, and King (2006) later reported that children naturally gravitate to activities that cause their brains to experience the greatest personal stimulation. According to Gurian, this experience differs between some girls and boys. Gurian admonished educators to consider how the male and female brains learn and design instruction that provides the necessary stimuli for students to become successful.

Differences in How Males and Females Approach Literacy

Researchers have been able to use technologies to examine how different the brain functions are when engaged in certain activities, including reading and math. Scientist discovered that beginning readers use different cerebral passageways while reading than proficient readers do. Struggling readers and average readers use different regions of the brain to decode written text. The brain of the struggling reader requires more energy to complete the task, which makes the struggling reader work much harder than the average reader (Sousa, 2014).

In an international study that examined the gender differences in how boys and girls navigated through online reading versus printed text, Wu (2014) found that girls had better knowledge of metacognitive skills, such as navigation strategies, how to implement the strategies, and when to implement the strategies. However, the gender gap between boys' and girls' approaches to electronic reading was narrower in most countries. Wu also found that girls with superior knowledge of metacognitive techniques also demonstrated excellent navigation skills. This dominance demonstrated by some girls led to superior reading abilities.

Gurian (2016) stated that because of the systemic verbal linguistic platform from which learning occurs, some males struggle because of the need for spatial stimulants to awaken the verbal center of the brain. Movement breaks, squeezing a stress ball, or pulling something apart and putting it back together while learning helps to stimulate the right side of the male brain (Gurian, 2016). Males understand their world best when they are provided the opportunity to physically explore it (Loeper, 2014). As a society, we must reevaluate the long-term goals for a viable life among males with what we know about gender differences (Jackson & Hilliard, 2013). Williams (2004) felt that boys who demonstrated a disinterest in literacy in the classroom may be avid magazine or comic book readers outside the classroom. This form of literacy is not always viewed as meaningful by teachers and may be ignored, to the detriment of both the student and teacher. Welldon (2005), a school librarian attempted to reduce

the gender gap in reading at her school by starting the Cool Guys Reading Club. To appeal the boys' competitive nature, boys would come to the club meetings and engage in discussion around one book. Each boy would then answer a comprehension question about the book. As the questions became more difficult boys could earn different color belts similar to how karate students advance. To test their research skills, boys were asked to find books in the library by various authors that they had not read. Because many of the boys had never ventured to access books from the shelf, this provided exposure to new authors.

Bozack (2011) reported research proposing a change in teaching practices across curriculums, such as making available student choice in reading materials, including options beyond print. In *Boys' Hidden Literacies: The Critical Need for the Visual*, Jennifer Rowsell and Maureen Kendrick (2013) stated that "language is privileged, and it is assumed that whatever can be thought or felt can best be expressed through language" (p. 587). Rowsell's article addressed boys' conceptual understandings of how images could be used as a means of allowing boys to express their understanding in the literacy classroom.

Dr. Gurian (2016) stated that these strategies aid in males' retention of information because their main focus is not words. Movement is an especially effective strategy for connecting the brain and body. When movement is strategically a part of classroom instruction, the brain is completely activated and the learning process begins (Hannaford, 1995). Gurian (2016) also reported that chemicals and cells in the body are stimulated during the learning process when

students are moving. When some boys learn and move simultaneously, learning is secured in the body through "procedural memory" (Gurian, Stevens & King, 2008, p.17; King & Gurian, 2006b).

In a study completed by Scheiber, Reynolds, Hajovsky, & Kaufman (2015) where gender differences in reading, writing, and math were investigated, they reported a narrow advantage for females in reading that spanned across girls age 6-21. "There was a statistically significant main effect of gender on reading, controlling for parent education" (Scheiber et al, 2015, p. 342). Males and females did not differ in math achievement, according to Scheiber et al., (2015).

Differences in How Males and Females Approach Numeracy

Gurian and Stevens (2011) reported some male students as having an advantage over some girls when it came to doing mental calculations because of the spatial structure of the male brain. Some girls tended to perform better using manipulatives and objects to make the problem-solving process more authentic in nature. Gurian also reported some males as being more skilled in deductive reasoning, whereas some females tended to favor inductive reasoning. Males preferred theoretical arguments and meaningful debates about abstract ideas. Females who possess this talent are sometimes considered "bridge-brain" (p. 45) females. These are females who possess almost the same qualities of both male and female brains (Gurian & Stevens, 2011).

In a study completed by Leaper, Farkas, & Brown (2012), girls' motivation in math was associated with math support from mothers. Math achievement among some girls was reported as being higher when mothers demonstrated positive views of their children's math abilities. It was further reported that although parent support helped to enhance motivation in math, peer support was equally as important for female students. During identity exploration, having the support of peers in small STEM (science, technology, and mathematics) programs can help girls further develop their interest in a domain that is perceived as a male-dominated field of study (Leaper et al., 2012). On the other hand, some girls can have negative influences over their female peers' perceptions of math. For example, James (2009) shared a story of a female student (Sue) who was in her Pre-Algebra class one year. Sue loved math and solved extra math problems for fun. The next school year Sue was in Ms. James's Algebra class and befriended another female student in the class who stated that math was unnecessary. She asked if Sue agreed and Sue agreed with the student. Ms. James reported that from that time forward, Sue's attention to math declined and she lost her spark for math.

Gurian and Stevens (2011) also reported how a teacher placed girls who lacked confidence in math in cooperative groups with girls who had more confidence in math and how the strategy helped to develop their leadership and full participation in math skills. As the girls developed more confidence over time, the groupings were eliminated. Anthony Rucker, a male math teacher, reported

using a strategy he called *showcasing girls*. He communicated that he was well aware of the biases girls experience in coed math classes. He purposed to call on girls an appropriate number of times and allowed them to play more of a leadership role in the classroom. James (2009) also indicated that having girls work in teams to play math games could help to build their confidence if started early. She suggested a gradual release for older girls who may not have the confidence to solve problems quickly.

In *Teaching the Female Brain: How Girls Learn Math and Science*, Abigail Norfleet James (2009), stated that girls need to be made aware that they are not limited to biology when it comes to learning. She further stated that girls need strategic math instruction that focuses on the ways in which females apply and conceptualize numbers. One teacher noted that variety is key because of the rapid changes in the adolescent brain and the many advantages and disadvantages of girls and boys. James stated that many girls feel that they are not suited for math. Teachers can play a vital role in helping girls learn how to do math based on the way they learn. In addition, (Anjum, 2015) because of the cognitive factors associated with mathematics, teachers should place greater emphasis on understanding the terminology involved because it empowers students to communicate their understanding while problem solving.

Gender Stereotyping

In a report completed by David Kommer, *Boys and Girls Together: A Case for Creating Gender-Friendly Middle School Classrooms*, Kommer (2006) asked, "Are boys and girls treated differently from one another?" "Should boys and girls be treated differently?" (p. 2). Kommer (2006) further reported that in 1992, the American Association of University Women (AAUW) reported the needs of girls were not being met in schools by not prompting them in an effort to guide them to the correct answers when they gave the wrong answer to a question. Boys were called on more often or they just responded to questions without being called upon, leaving girls sitting in silence.

It was also reported that girls were not encouraged to enroll in math courses. As a result, girls were not as successful as boys in math achievement. Because of these findings, the AAUW focused attention on educational equity (Kommer, 2006). In light of the study, many teachers began to reflect upon their teaching practices. As a result, girls began to make gains in math. In a different study that examined to what degree teachers' beliefs about the achievement of children kindergarten through sixth grade influenced the development of children's interest in math concluded that there was no association between gender and teacher's beliefs and development of children's interest in math, K. Upadaya at the University of Helsinki and J. S. Eccles at the University of California in 2014 concluded that there was no association between gender and teacher's beliefs and children's math interest. This study also reported that

teachers believed that boys had better math abilities, but no difference was found in the performances of boys and girls.

Kommer (2006) further found that boys had become victims of the educational system. He asked the following questions of many educators:

1. Who is more likely to drop out of high school?
2. Who is more likely to be sent to the principal's office for a disciplinary referral?
3. Who is more likely to be suspended or expelled?
4. Who is more likely to be identified as student needing special education?
5. Who is more likely to need reading intervention?

Kommer found that the answer to all of the above questions was "boys," which was very discouraging for some boys.

In addition, Bonny L. Hartley and Robbie M. Sutton (2013) completed a study that examined whether and when children develop negative stereotypes about male students' academic performance compared to girls'. They found that boys' academic performance was hindered by the fact that they were expected to achieve lower than the girls. However, girls' achievement was not positively affected by the fact that the expectation was for them to perform higher than the boys (Hartley & Sutton, 2013). Further study was completed to determine whether boys' achievement would improve if they were expected to perform as well as girls. Hartley found that boys' performance could be reversed by setting a

higher expectation for them academically. This strategy has tremendous implications for boys' academic performance.

In a qualitative study titled, "Girls Have More of an Educational Brain," by Monique M. Jethwani (2015), 35 Black high school freshman (18 boys and 17 girls) in Bermuda participated in a study to understand why Black boys had a higher dropout rate than Black girls. Both boys and girls were interviewed to identify the variations in the students' school experiences that might explain the gap in educational success (Jethwani, 2015). One-on-one interviews were used to explore students' academic goals, their discipline history, and how they perceived the support they received academically, socially, and emotionally in school.

Many of the male students reported that girls were educationally adapted and devoted (Jethwani, 2015). One male student stated that he didn't believe that teachers thought that boys would pass at the same rate as girls. His reasoning was based on a science class where information was presented about the differences in the male and female brains. He learned that the male and female brains develop differently. He concluded that girls were therefore wired to outperform boys in school. More than one third of males and females in the study agreed that boys were not as serious about their studies as girls, and that boys were more likely to play in class (Jethwani, 2015).

Silvia Galdi, Mara Cadinu, and Carlo Tomasetto (2014) sought to employ measures to demonstrate that automatic associations consistent with a negative “in-group” (p. 251) stereotype might lead to stereotype-induced underperformance. Galdi et al. (2014) reported that students must be aware of a stereotype in order to be affected by a stereotype threat. It was further reported that gender identity activation hindered math performance in some girls (Galdi et al., 2014). Galdi further stated that students’ personal negative perceptions about abilities of their gender could serve as a means of being susceptible to stereotype threat.

In a study titled, “Examining Gender Differences in Ability Group Placement at the Onset of Schooling: The Role of Skills, Behaviors, and Teacher Evaluations” (Catsambis, Mulkey, Buttaro, Steelman, & Koch, 2012) gender differences were investigated for ability group placement for reading. The focus was on the large gender differences in reading group placement because of data showing boys falling much lower than girls in literacy skills. In spite of ongoing opposition over the practice of ability grouping, a large percentage of students in the United States are homogeneously arranged by educators as early as kindergarten (Catsambis et al., 2012). Educators who adhere to these stereotypes may be less prone to adapt their instruction to aid students in their achievement in these areas (Riley, 2014).

Catsambis et al. (2012) reported that grouping students by ability at the early onset of schooling further promotes achievement in students in the higher reading groups, but diminishes the achievement in students in the lower reading groups. They found that boys were underrepresented in the high reading groups and overrepresented in the low reading groups. High reading group placement was based on boys' low reading performance at the entry of kindergarten, but the low reading group placement of boys was not limited to the reading test scores. It also included teacher evaluations and teacher evaluations of student approaches to learning (Catsambis et al., 2012). The placement of boys and girls did not take into account the developmental differences in how boys and girls acquire or use language.

Catsambis et al. (2012) further reported that gender differences in boys' and girls' achievement in reading as measured by assessment scores did not completely clarify why boys were overrepresented in low reading groups. Catsambis et al. (2012) stated that gender stereotyping in teacher evaluations of boys may have led to boys being placed in the lower reading groups. Catsambis et al. (2012) also stated that "gender-stereotyped expectations" (p. 9) from educators are limited when students enter as highlevel readers. Because teachers' main criteria for placement is how well students perform on an entry-level assessment, high performers are judged as having the skill set to meet teacher expectations.

A study was completed in UP, India, to examine the relationship between mathematics achievement and reading comprehension and gender difference in mathematics achievement of children in upper primary grades (Anjum, 2015). Data was analyzed using mean, standard deviation, & *t* test, which found significant difference in the reading comprehension and math achievement of boys and girls. There was also a significant positive correlation between the reading comprehension and math achievement of students in upper primary grades (Anjum, 2015). Anjum (2015) stated that the idea of reading comprehension serving as a prerequisite for learning math or positively affecting math achievement was a growing trend. Anjum was also of the opinion that girls' interest in reading and having a reading teacher of the same gender is why girls outperform boys in reading.

History of Single-Sex Education

In the early history of American education, girls were not afforded the same educational opportunities as boys. Single-sex classes were common throughout the 19th century and into the early years of the 20th century (Spielhagen, 2008). Coeducational high schools developed during the Progressive Era by the disciples of John Dewey. The goal was to provide students with courses that suited their needs. Feminists were in full support of such reform because of some of the discriminatory incidents against women that had previously occurred (Spielhagen, 2008). Spielhagen also reported that

throughout the 20th century, a greater number of female students took advanced mathematics and science courses and eventually enrolled in college.

According to Gurian et al (2009b), gender-based classes in public schools were once limited to physical education and sex education classes. This changed in 1975 when legislation outlawed separating boys and girls in physical education classes to prevent inequities in the distribution of provisions and equipment for female athletic departments (Spielhagen, 2008). Schools that were not under federal regulations, including: independent, parochial and day schools, continued to have single-sex classes. Huffman (2012) reported that single-sex schools performed better than coeducational schools on tests completed by 16-year old girls 20% to 13% in 1974. There was no significant difference in the boys' scores at age 16.

In 2002, the No Child Left Behind (NCLB) legislation was amended to allow schools to experiment with single-sex classes in an effort to reform education and improve student outcomes (Hughes, 2007). To aid schools that received federal funding in the transition process from a traditional coeducational structure to a single-sex structure, Senators Kay Bailey Hutchison and Hillary Rodham-Clinton sponsored a provision to provide schools with the direction needed to establish single-sex classes (Hughes, 2007; Sax, 2005). Since their amendment passed, single-sex schools received incentive grants through the U.S. Senate as a part of NCLB. These provisions were in an effort to provide parents with educational options that would meet the needs and interest of

students (Hughes, 2007). October 2006 brought about another change in education related to gender-based instruction. Under President George Bush's administration, the U.S. Department of Education amended Title IX by expanding gender-based instruction options to all public schools (Gurian et al., 2009a; Huffman, 2012).

Advantages of Single-Sex Education

Because of the structural and functional differences of the male and female brain as reported by Gurian (1996), Gurian et al (2009b), Gurian and Stevens (2011) and Sax (2005), many males and females would benefit greatly from single-sex instruction if teachers were to develop strategies to enforce curriculum that converge on best practices for how boys and girls learn. Separating adolescent boys from girls can aid in narrowing their focus from the socialization aspects of school to the academic (Hughes, 2007). The coeducational setting often lends itself to students becoming easily distracted by one another. Students frequently view their peers as an audience for which they perform to the "detriment" (p. 9) of their academic progress (Hughes, 2007). In coed settings some boys feel they have to excerpt their masculinity (Gurian and Stevens, 2005). Pahlke et al. (2014) argued that girls are intimidated by boys in coed classrooms, especially in what Gurian and Stevens (2011) describes as the male-brain classroom. Gurian et al (2009b) stated that single-sex classes could be a way to create more gregarious boy and girl classrooms. For example, Hughes (2007) reported improved participation among females in the all-girl

classrooms because of the absence of inhibiting factors boys sometimes pose. Data collected from parents, teachers, and students revealed that females felt more comfortable taking a leadership role and participating in the math class when placed in a single-gender environment (Simon, 2013). Gurian and Stevens (2011) specifically reported that there have been many reports of how girls improved in only-girls schools and classes in the areas of math and science.

Likewise, Hughes (2007) reported boys as being free to express emotions and read poetry without giggling when separated from girls. Similar improvements have been reported about boys in reading, writing, and behavior management. The research of Hughes (2007) and Gurian and Stevens (2005 & 2011) suggested that placing students in gender-specific classes at the middle school level has very often curtailed discipline and learning problems. This is most true for girls in all-girl classes. Because of subtle gender stereotypes in the coed setting, girls tend to shy away from participating in math or science classes because boys tend to dominate in those subjects (Sax, 2005).

Sax (2005) further reported that societal stereotypes was why some girls were sometimes reluctant to enroll or participate in courses and activities that were viewed as masculine in nature, such as, playing the trumpet in the school band, and some boys sometimes shied away from participating in courses and activities that were stereotypically viewed as feminine in nature or "a threat to their masculinity" (Merisuo-Storm, 2006, p.114), such as playing the flute.

Gender-specific schools and classes can possibly eliminate gender stereotypes

(Sax, 2005). Sax further reported how boys who attended the gender-specific schools benefited because they were no longer intimidated. Sax found that some of the most athletic males in the school were able to excel in art, music, foreign language, and literature courses. Sax also suggested that girls reportedly excelled in computer science and physics courses while attending an all-girls' school.

However, Hughes (2007) reported that some have argued that separating students by gender is a violation of the *Brown v. Board of Education* ruling of 1954, "separate is inherently unequal" (p. 7). Disputants contend that separating students by gender is the same as separating them by race. But Hughes stated that single-gender classes are optional, whereas, non-Whites did not have a choice. The separation was not based on any efforts to improve the academic performance of non-White students. Hughes also reported the specific advantages for disadvantaged and minority students. Families with unlimited resources have historically had the choice to enroll their children in private single-sex schools. By providing public schools the option to implement single-sex instruction, poor and disadvantaged students can benefit from a single-sex education.

Huffman (2012) reported that the U.S. Department of Education contracted with the RMC Corporation in 2008 to complete a limited study that included the benefits of single-sex schools. The study included observations as well as surveys completed by teachers, parents, students, and administrators.

Compared to the traditional coeducational schools, single-sex schools showed an increase in positive interrelationships, decrease in disruptive behaviors, and an increased sense of citizenry. Academically, there was more effort and completion of homework in the single-sex schools and a heightened level of respect for teachers.

Effectiveness of Single-Sex Education

Spielhagen (2008) reported that evaluating effectiveness of gender-based instruction can prove to be difficult because of the many variables that must be examined, such as changes in curriculum and teacher buy-in. Spielhagen stated that although measuring the effectiveness of gender-based instruction on a single factor can be difficult, narrowing it down to separation by gender can assist in the process of evaluating outcomes. However, simply placing boys and girls in separate classrooms or separate schools is not automatically better (Huffman, 2012; Sax, 2006). Separating students by gender alone accomplishes minimal results (Sax, 2006).

In a 2011 research study completed by Max McFarland, Annastashia M. Benson, and Barry McFarland at the University of Nebraska, a sample of fifth-grade students from a Midwestern Public Elementary School participated in a study to determine the following:

1. Do students in gender-specific classrooms perform better than those students in traditional classrooms on achievement scores?

- 1a. Do students in the boy-only classroom perform better than students in the girl only classroom?
- 1b. Do students in the boy-only classroom perform better than male students in the traditional classroom?
- 1c. Do students in the girl-only classroom perform better than female students in the traditional classroom?
2. Do students who have participated in gender-specific classrooms after the initial year perform better on achievement tests compared to those individuals who participated in gender-specific classrooms during the first year of implementation?

The participating students took science, social studies, and writing in a coed setting, but were separated by gender for their math and reading classes. The instrument used to collect student data was the Measure of Academic Progress (MAP). A two-way analysis of variance (ANOVA) was used to determine whether there was a significant difference between the Rasch Unit (RIT) achievement scores of boys and girls in reading and math. The mean spring RIT score for 17 boys in the single-gender reading class was 202.82 compared to the mean spring RIT score of 207.00 from the eight boys in a traditional reading class. The mean spring RIT score for 15 girls in the single-gender class was 205.47 compared to the mean spring RIT score of 200.75 from the eight girls in the traditional class. This research further substantiated the fact that reading instruction in a single-gender environment does not improve the

achievement of male students. A single-gender environment must be coupled with the implementation of brain-based instructional strategies (McFarland et al., 2011).

After examining the effects of single-gender classroom activities on the achievement of fifth-grade boys and girls in a public school, Erik P. Chaussee (2012), also found that there was no significant difference in the achievement of boys and girls between a first-quarter preassessment and a fourth-quarter postassessment. (Chaussee, 2012) further reported that single-gender classes had a limited impact on student achievement. Sax (2006) also reported that in order for student achievement to improve in the single-sex classroom, teachers must be keenly aware of the physiological and functional differences of the brains of boys and girls. James (2009) stated that teachers who understand the primary cognitive differences between genders are more equipped to structure lessons for all students.

In an attempt to familiarize herself with the effectiveness of single-sex instruction, Spielhagen (2008) made use of two statistical tools: standardized test scores of sixth and seventh grade students in a small urban middle school in Hudson Valley, New York and surveys of teachers, students, and parents. Single-sex classes were strictly voluntary and parents were notified by mail that the option existed. Parents could opt out by sending a written letter to the school. More than 75% of parents chose to enroll their children in the single-sex classes.

The survey results of the students revealed that they generally were in agreement with their parents' choice to place them in single-sex classes and had some input in the decision-making process, so for the most part, the students in the single-sex classes wanted to be there.

Spielhagen (2008) resolved that merely analyzing standardized test scores would not adequately depict the overall achievement of students in this setting, so he surveyed teachers and parents about their perceptions of students' performance and achievement. The parent perspective provided information based on the developmental changes of students. The teachers' perspective provided information in light of the content challenges and the differences observed in students based on teachers' experience with middle school students over time.

Spielhagen (2008) further reported comparing the Terra Nova scores of students in the first-year single-gender program to the students from the previous year when students were in coed classes. Gains were observed in both the single-gender and the coed data sets. Spielhagen also reported that the gains were more evident in the sixth-grade. In the first year of the study all sixth-grade students showed significant gains on the Terra Nova test compared to their fifth-grade scores. In all academic areas sixth-graders mean scores averaged percentile gains of 2%. As noted by Spielhagen, there were no declines in any subject area whether students were in single-gender or coed classes. Two questions arose from the analysis of student data: Did the change and

implementation of the curriculum have an impact on student achievement? Did having the option to choose whether to be in a single-gender or coed class have an impact on students' motivation to learn?

Spielhagen's (2008) report of how well seventh graders performed was not desirable. Students in seventh-grade were not as compliant as sixth graders when it came to single-gender classes. Spielhagen reported seventh-grade percentile gains in only three academic areas: language, language mechanics, and math, and there was no change in vocabulary, math computation, and math concepts.

Spielhagen (2008) reported returning to the school after 3 years of the single-sex instructional program to exam the Terra Nova test scores of students during fifth, sixth, and seventh. Because of an apparent change in the demographics of the school due to normal changes in community, the data sample was narrowed down to students who had been at the school all 3 years. Spielhagen further reported that a more significant change in the data sample made it quite difficult to attribute what makes a program effective. According to Spielhagen, students who earned high-test scores were enrolled in honors math courses that were mixed gender because the school could not offer two honors math courses. Because the higher achieving students were removed from the data sample, scores were affected.

Despite the challenges faced by the changes in the data sample, Spielhagen (2008) reported gains for all students in reading. In math there was a decline in scores in the single-sex classes, but an increase in the mixed classes, especially among the girls. Spielhagen stated that was a contradiction of the popular belief that girls do not perform as well in math among boys. Spielhagen concluded that the increase in math scores among the mixed-gender classes was due to the honors classes offered.

Spielhagen (2008) further reported that the students in the single-gender classes made the most gains in language, whereas students in the mixed classes declined by 10 percentile points, with the greatest decline among boys. There were gains overall on the Terra Nova test, except among boys in the mixed-gender classes. Girls in the mixed gender classes showed no change from fifth to seventh grades. Spielhagen noted that based on the test results, single-gender instructional arrangements worked for some students. There were significant gains over time in reading and language arts in the single-sex classes. The decline in language arts scores in the mixed-gender classes should be reviewed more closely.

In "Single-Sex Classrooms Are Succeeding," Gurian et al. (2009a) reported information about the positive effects of single-gender instruction from schools across the country. Renee Parker, principal of Hope High School in Hope, Arkansas, worked with ninth and tenth grade boys who were struggling with the transition to high school. After reviewing the data, Parker found that

approximately 12% of students, primarily males, had failed all courses in the fall semester. In an effort to assist those struggling students make the transition, Parker and her colleagues researched gender-based instructional strategies and attended professional development to prepare to help the students. Hope High School piloted single-sex classes in the ninth grade classes.

Gurian et al (2009a) reported that a year later there were no ninth-grade students who had failed all four courses. Discipline and attendance had improved. Gurian and Stevens (2011) further indicated some effective gender-based strategies used by many teachers in the middle school classrooms. Separating students by gender while working in cooperative groups to complete a task or project proved to be beneficial to many middle school teachers. One teacher reported that there were fewer discipline referrals among boys.

Another teacher reported successfully using stress balls and quick tension-release techniques with middle school boys. Boys were allowed to use stress balls while talking to the teacher about their problems, which aided in their ability to actually express themselves more effectively. She also allowed the boys to draw while they talked as a means of giving them something to do as they spoke. Gurian and Stevens (2011) reported how another teacher allowed boys to rip paper or hit a pillow as a means of releasing their testosterone. Sax (2006) admonished educators to incorporate best practices for the all-girl classrooms and the all-boy classrooms.

Gender-Based Instructional Training for Teachers

Although teachers play a pivotal role in advocating for equitable instructional practices, many do not enter the profession equipped to teach in a way that meets the diverse needs of students (Sandholtz & Sandholtz, 2010). King, Gurian, and Stevens (2010) reported that a number of teachers were expressing the need for professional development focusing on instructing boys. Effectively training teachers in how male and female brains function in the learning environment is essential to the successful implementation of a single-sex program in any school or district. Educators must be aware that the structure of the learning environment must be conducive to the way boys and girls learn (Hughes, 2007; Strain, 2013).

Huffman (2012) similarly reported that teacher training played a significant role in the success of a single-sex program. Summer training including professional development focused on best practices in terms of the knowledge and skills are needed to implement effective movement in the classroom (Sevimli-Celik & Johnson, 2013). Spielhagen (2011) indicated the need for teachers to receive support and feedback from school leaders throughout the school year to insure the fidelity of the single-gender initiative.

David A. Sousa (2014) reiterated in his book *How the Brain Learns to Read* that the more knowledgeable teachers are about how the brain learns to read, the more equipped teachers will be to select appropriate strategies that will result in the success of students. For example, in a study titled, "Impact of

Reading Strategy Use on Girls' and Boys' Achievement," researchers Bouchamma, Poulin, and Ruel (2014) focused on how reading strategies differed from one gender to the other and if the differences could predict each individual's performance in school. Bouchamma et al. (2014) stated that strategies are elements of a group of significant skills vital to learning to read, which is why receiving specific instruction on how to use the strategies could possibly enhance comprehension. This study used data from a sample of ($N = 20,094$; 49.1% male) 13-year-olds from every province in Canada that completed the Pan-Canadian Assessment Program Reading Assessment, developed by the Council of Ministries Education (CMEC).

Bouchamma et al. (2014) reported that almost all of the answers analyzed from Question Number 2 of the sixth section of the student questionnaire revealed significant differences in gender in relation to which strategy students chose, with the exception of the strategies using etymology to determine meaning from the text. Bouchamma's findings also indicated that girls used strategies such as striving to comprehend as many words as possible, rereading areas of the text they found challenging, highlighting, note-taking, or summarizing with greater usage than boys. Many other gender contrasts were found regarding read aloud, using context clues, prior knowledge, considering the central idea of the text, viewing charts and graphics, soliciting help, using resources, and finding a quiet place to read (Bouchamma et al., 2014).

Bouchamma et al. (2014) reported that the results revealed that there were five strategies that may have played a significant role in the achievement of boys. Boys were reported as using prior knowledge to connect to new knowledge. Boys also considered the central idea of the text in order to make meaning, they reread sections they may have found challenging, and adjusted their reading speed based on the level of difficulty of the text they were reading. Basically, this study identified gender differences with regard to the use of a variety of reading strategies and determined which strategies may have contributed to the achievement of girls and boys in reading.

Teachers must also learn the various strategies for how to instruct boys and girls separately (Gurian et al., 2009b), as well as when to use different teaching techniques with coed classes (Hughes, 2007). Meeting the various needs of both genders in the same setting would prove to be quite challenging for educators. Hughes (2007) strongly advocated the single-sex option because the teacher could more effectively concentrate on the needs of each sex and propel students to reach their full potential. For example, boys typically need more space from which to work as compared with girls (Gurian & Stevens, 2011). This is why boys do not prefer working in cooperative groups to the extent that girls do. When teachers are not aware of the need for some boys to have additional physical space it can cause many teachers to label boys as rude, impolite, or out of control. Gurian and Stevens (2011) claimed that boys are often

spatial learners and that the use of a vast amount of space is how boys typically process information. The space is also beneficial for boys to move around.

According to Gurian and Stevens (2011), movement helps boys manage and excerpt impulsive behavior. Gurian further reported that when it came to spatial intelligence, some boys tended to experience more processing, which can be perceived as either positive or negative. The positive is they are actively learning when they move because they are stimulating their own spatial ability through movement, which increases right hemisphere development. The perceived disadvantage is that some boys are all over the place and invading the space of others because they have not learned to manage their impulses, especially in the early grade levels. Additionally, King et al. (2010) stated that movement helps boys stay out of the "*neural rest (boredom) state*" (p. 40). King et al. (2010) further reported that, since movement strengthens brain activity, girls could also benefit. Knowledge of this information can aid teachers as they plan and execute their classroom setup, thus fostering academic achievement in students (Hughes, 2007).

Gurian et al. (2009b) advised educators to complete the teacher training prior to implementation of a single-sex education program in a school or district. The expected results may not be achieved if a teacher who has not been trained before being placed in a classroom of all boys or girls. That type of experience can prove to be overpowering. Gurian and Stevens (2011) further noted that research showed that the most successful introduction of single-gender

instruction was those who provided educators with effective professional development on how to understand how to “translate theory into action in the classroom” (p. 215). Gurian and Stevens (2009b) also stated that failure to provide such training has resulted in unsuccessful gender-based academic programs. According to Spielhagen (2008), because teachers’ perceptions about the differences between boys and girls play a key role in the expectations set by teachers, training is essential. Spielhagen also noted that when teachers engage in actively implementing strategies in the single-sex classroom, the body of research continues to expand.

Sax (2005) reported that girls and boys have different expectations from their teachers. The teacher-student dynamic can be based on gender. Because girls sometimes express a need to bond with their teachers, they expect teachers to be on their side and to develop their talents. According to Sax, girls are teacher pleasers. They want the teacher to see them in a positive light. Girls will sometimes feel that they have let their teacher down if they make a failing grade. Girls are also more likely than boys to ask for help from their teacher. Sax further reported that girls will persevere through a challenging assignment because of their teacher, whereas boys are more concerned about whether or not the assignment relates to their personal interest.

Teachers need to be aware of the differences in the educational preferences of boys and girls in order to best prepare and execute instruction as well as respond to issues that may arise between teacher and student (Sax,

2005). Sax (2005) reported that some teachers noted more success with girls when they were eager to support female students and use a less confrontational approach. According to Sax (2005), the aggressive approach to handling girls impairs their learning, but mild stress can sometimes improve learning in boys because it improves the growth of neural connections in the male hippocampus while it hinders growth in the female hippocampus. This ties back into the fact that boys perform better on timed multiple-choice assessments due to the stress factor.

As a foundation for understanding how boys and girls learn, teachers must understand girls are more comfortable working in cooperative groups and reporting information verbally (Gurian & Stevens, 2011). Gurian and Stevens (2011) further reported that girls' strong oral skills are due to their primary focus on relationships and communication. Spielhagen (2008) noted that girls prefer including the arts (e.g., music, drama, and dance) in their work, prefer assignments that involve reading, and view a failure on an assignment as a personal failure (Spielhagen, 2008). Gurian et al. (2009b) also reported that teachers should help girls understand that mistakes will be made and that they should view them as learning opportunities.

On the other hand, boys tend to be competitive in their approach to academics and because their primary focus tends to often relate to their pursuit of power. Boys prefer math, when completed on the board (Gurian & Stevens, 2011), as well as science, when compared to reading and writing. Likewise, boys

do not typically prefer verbal expression. This is why Gurian et al. (2009b) suggested that teachers help boys find their oral and written language through graphic organizers and art. Merisuo-Storm (2006) further explained that teachers and school districts' perceptions of quality reading materials many times is not preferred by male students.

Merisuo-Storm (2006) further reported that parents and teachers find it quite difficult to motivate a reluctant boy to read. In order to develop male interest in reading, teachers must broaden their horizons and consider using book series, books based on films, specialty magazines, comics, and cartoons. Merisuo-Storm stated that once you genuinely strike a boy's interest in reading, he can be exposed to more advanced texts.

When it comes to planning writing task for boys, teachers should consider the personal interest of boys and/or allow them to use the computer to draft their writing (Merisuo-Storm, 2006). Merisuo-Storm (2006) suggested fostering positive attitudes about writing early, because some students' view of writing declines as they advance through school because the skills necessary to be an effective writer requires effort.

Some girls often prefer a more concrete approach to math by way of manipulatives and objects. Assessments administered to boys should typically be quick multiple-choice formats, and they do not typically view failure as an overall failure of self (Spielhagen, 2008). Middle school girls and boys experience chemical changes of which teachers should be aware. The generation of

estrogen in girls increases concentration. In middle school boys, testosterone promotes aggression, fidgeting, and movement (Gurian & Stevens, 2011).

Senn (2012) further reported that the structure of the male brain suggests the need for movement because the male brain produces less serotonin than the female brain. According to Senn, this increases fidgeting in males. Hughes (2007) further reported that movement happens naturally in boys when they are in a closed space. Gurian and Stevens (2011) suggested that teachers create movement breaks during the learning process to reduce impulsive behavior in boys and stimulate the brain to process information. Senn further reported that frequent opportunities to move could help increase the communication between the right and left hemispheres of the male brain and therefore enhance the male students' ability to learn. A great number of male students was diagnosed as having a hyperactivity disorder when in fact they just needed to move in order to process information in classroom.

Sax (2006) reported a study completed by Florida University graduate student Janel Caine. Sax further reported that Caine wanted to test the hypothesis that music therapy would help to relax premature babies, improve their appetites, and in turn cause them to experience growth at a faster rate. Caine used 52 premature babies for her research; each set of 26 mixed gender babies was matched in weight and age. She played music for one set of 26 and did not play music for the other 26. On average, the babies who received the music therapy grew more rapidly, had fewer medical issues, and were released

from the hospital 5 days earlier than the babies who did not receive therapy. Caine's findings also showed the results by gender (Sax, 2006). The premature girl babies who received music therapy were released 9.5 days earlier than the girl babies who did not receive therapy, but the boy babies who received therapy did not leave any earlier than the boy babies who did not receive therapy. Sax concluded that the boy babies did not hear the music as well as the girl babies.

Teachers often times misdiagnose some male students with (ADD) in the early childhood years because it appears that they are not listening or paying attention during instructional time (Gurian & Stevens, 2011; Sax, 2005; & Senn, 2012). Gurian and Stevens (2011) stated teachers sometimes "misdiagnose male students with ADHD, ADD, and other learning disorders" (p. 61) due to a lack of understanding of how their brains operate, how to create boy-centered classrooms or their disadvantages in the traditional learning environment. To help to reduce the misdiagnosis of Attention-Deficit Disorder (ADD), Attention-Deficit Hyperactivity Disorder (ADHD), and other behavioral challenges among male students, educators should consider the single-gender option (Piechura-Couture, Heins, & Tichenor, 2013). Gurian and Stevens also indicated that boys become bored more readily than girls and struggle with managing their boredom because they require varying stimulants to maintain their attention, whereas some girls are more able to self-manage boredom. Boredom has a detrimental impact on learning because students mentally check

out and may even misbehave in class; as a result, they are labeled as a behavior problem.

There are reported gender differences in boys' and girls' senses of smell, hearing, touch, taste, and smell. Sensory information enters the brain and the process of understanding the experience takes place. The classroom experience enters the brain through students' senses. The male and female sensory experiences are different; therefore, the approach to education must take that fact into account (James, 2007). Sax reported that a female teacher's soft voice is normal for the female students, but the male students are falling asleep. Gurian and Stevens (2011) reported that some girls are better listeners than boys, hear more of what is spoken, and are "more receptive to the plethora of details in a lecture or conversation" (p. 46). Gurian stated that some boys tend to hear less and require clear evidence to support the claims of his teachers or peers.

James (2007) reported the structure of boys' and girls' ears are similar, but the cochlea, inside the ear shows differences in boys and girls. The cochlea is where sound energy is transformed into neural energy. The cochlea in boys is longer than in girls, which causes boys to respond to sound later than girls. According to Bonomo (2010), girls hear better if the frequencies are above 2 kHz. Bonomo also reported that girls' hearing is more acute than boys in the 1000-1400 Hz range, which is necessary for skillful speech distinctions. The differences in how boys and girls hear increase as they age. As girls get older

they perceive a loud voice as yelling and they think the teacher is angry. It is not that they are not interested in the content being presented, according to Senn (2012), but the male students are struggling to hear. Other times, teachers may observe boys as being louder than girls in a coed setting.

Senn (2012) explained that a males' perception of his voice is different from what the female teacher hears. Gurian and Stevens (2011) suggested teachers use a louder voice when teaching boys. Gurian and Stevens (2011) and Sax (2005) further stated that teachers should try to place boys close to the front of the classroom. Gurian also suggested teachers arrange the room so that each student has the same opportunity to hear.

It was suggested that teachers use signals in the classroom to gain the attention of boys or to give directives, because some boys' best sense is vision. After teachers repeat information of instructions numerous times, some boys no longer hear the information. James (2007) referred to the process of becoming less sensitive to sound as "adaptation" (p. 21). An example of living near a train was given and how the sound is loud at first, but over time you no longer notice it (Hoyt, 2016).

Even with a broad knowledge of how boys and girls learn and a repertoire of strategies for both genders, no strategy is error proof, according to Spielhagen (2008). Gender is not the only factor that must be taken into consideration when planning lessons for boys' and girls' classes.

Implementation of Single-Sex Instruction

Strain (2013) suggested a productive approach to the implementation of single-gender classes would be to measure the way in which single-gender instruction is executed. Approaches to implementing a single-sex instructional environment should be differentiated to meet the needs of each district and school. No two districts or schools are the same; therefore, the approach to how to implement a single-sex program must be strategically designed based on the needs of the students (Gurian et al., 2009b). Some schools are strictly single sex, whereas others have coed classes with single-sex classes in math, science, and reading only. Others implement single-sex classes in certain grades.

In "Gender-Friendly Schools", by King, Gurian, and Stevens (2010), Wamsley Elementary School principal Desha Bierbaum decided to address the 2007 achievement gap between boys and girls by creating a more gender-friendly environment for all students. After personally availing herself to information about best practices for how boys and girls learn, Bierbaum advised second-grade teacher, Diane, to allow the boys to stand and move around during the lesson to reduce fidgeting and allow boys to process the information. Several teachers admitted not being as aware of strategies that would be useful with male students and would benefit greatly from professional development that would sharpen their awareness. In a 2014 research study by Jaimie McMullen (University of Limerick), Pamela Kulinna (Arizona State University), and Donette Cothran (Indiana University) that examined teachers' perceptions of using activity

breaks in the classroom, teachers reported being more likely to implement movement in their classrooms if the activities were (a) simple to adopt, (b) aligned to their teaching skills and beliefs, (c) noticeably beneficial; and (d) “beneficial to make teachers innovative in their educational practices” (McMullen, Kulinna, & Cothran, 2014, p. 513).

In response to teachers’ concerns and willingness to meet the needs of students, Bierbaum wrote and received a grant to provide teachers with online courses, summer training, and on-site professional development and coaching on gender-based instruction (King et al., 2010). This initiative proved to be a huge success. King et al. (2010) reported Wamsley was removed from the Adequate Yearly Progress (AYP) watch list because of improvements in student performance.

Gurian et al (2009b) reported in *Successful Single-Sex Classrooms* how one Atlanta, Georgia, public school district decided to convert a struggling middle school into two single-gender academies. The all-boy school was the B.E.S.T. Academy at Benjamin Carson and the all-girl school was the Coretta Scott King Young Women’s Leadership Academy. Gurian further reported that the primary focus of the boys’ academy was on literacy. The goal was to close the achievement gap in reading, because they understood that the students’ reading abilities would affect their performance across content areas in high school and even into college. The primary focus of the girls’ academy was on technology. Promethean boards were used in math and science courses. Other forms of

technology, such as, thin client computers, digital cameras, iPods for broadcasting, and LCD projectors were also utilized. As a result, Gurian et al (2009a) reported that students exceeded the projected 25% gains by 51%.

Another example of how single-sex classes were implemented was reported by Gurian et al. (2009b) when Jo Anne Rodkey, principal of Woodward Avenue Elementary School in DeLand, Florida, began a single-sex class experiment in her school where teachers could opt in. The purpose of the experiment was to provide effective instruction for boys who were falling behind the girls in reading. According to Gurian et al. (2009b), Rodkey took responsibility for training the teachers, sending them to professional development to gain knowledge about instructing separate gender classes, and providing them with the most current research about gender learning differences.

The teachers had the option to teach in single-gender classes under the condition that they were intentional in their approach to teaching and learning and used brain-based strategies designed specifically for gender learning differences (Gurian et al., 2009b). Gurian et al. (2009b) reported that the program was a success and that now the school has gender classes that boys and girls are showing significant gains. Gurian et al. (2009b) also reported that although the focus was not on behavior, there was a reduction in office referrals.

Teachers must keep in mind that the overall success of any single-gender education initiative must be methodically planned based on the needs of the students.

Gurian et al. (2008) suggested placing teachers who enjoy and understand how girls learn in an all girls classroom and placing teachers who enjoy and understand how boys learn in an all boys classroom. Gurian et al. (2006) reported how Douglass Elementary School realized that their classrooms were conducive to the way girls learn because of the verbal emotive, sitting in a chair, note-taking, listening, and multitasking abilities. Boys' innate impulsiveness, single-task oriented, spatial-kinesthetic style, and physical aggression were perceived negatively by teachers.

Gurian et al. (2006) further reported that to create a more boy-friendly environment, Douglass Elementary increased opportunities for experimentation and kinesthetic learning by allowing boys to create a sentence across the floor using cards rather than having them to complete a worksheet, and teachers used story-boards to aid male students in the writing process by allowing them to create images of what they read before writing about it. Gurian et al. (2006) also reported that when the boys used the images to write it prompted the brain to connect with the words. This is how spatial-visual representations were used in literacy. Boys also had the privilege of choices of what to read and write about in Mrs. Vance's class.

Gurian et al. (2006) further reported that Mrs. Vance was able to use the action and heroism themes of the text to teach characterization. To improve boys' grades, Douglass Elementary required parent signatures on homework assignments. Any homework without a signature required an explanation from

the parent. This policy helped to improve Todd's grades from D's to B's. Gurian et al. (2006) further reported how Mrs. Holsted allowed students to work in gendered groupings using materials of their own choosing, which helped them to retain the content better. Overall, because of Douglass Elementary School's commitment to implementing brain-based practices in the classroom, students experienced significant improvement in learning.

Chapter Summary

In response to a need for education reform, many schools and districts around the country implemented single-sex education programs following the amendment to Title IX, which afforded public schools the opportunity to implement single-sex schools and classes under the condition that it would benefit students (Huffman, 2012). As a result, schools and school districts began to create single-sex classes and schools (Gurian & Stevens, 2009b).

Many schools started with a single grade level. Some split two low-performing schools into two different schools, separating the genders (Gurian et al., 2009b). Although many schools and districts took the opportunity to implement gender-based programs in their schools and districts by selecting what many administrators identified as the best teachers and training based on how boys and girls learned, (Gurian et al., 2009b) there was limited information about the correlation between the fidelity of strategy implementation and student achievement. Gurian and Stevens (2011) further reported that without ongoing professional development, many single-sex programs failed.

In order for strategic planning to occur, teachers must have first received a clear understanding of the science of the human brain in its function and development, and according to Gurian et al. (2006), they must fully understand how much more difficult it is for boys compared to girls in the traditional learning environment. Sousa (2014) stated that good lesson plans, years of experience, and the hope that what is taught will be understood and retained is not enough to bring about the expected success of students. The hope can only be realized when teachers actively use the brain-based training they are provided to design lessons that change the human brain in ways that produce positive student outcomes. In *Boys and Girls Learn: Differently Action Guide for Teachers*, Gurian and Ballew (2003) stated that teachers make students aware of the different approaches to learning in order to build on their strengths, as well as, appropriately compensate for their weaknesses.

Once administrators and teachers have been made aware of what is necessary to create what King et al. (2010) considered gender-friendly schools, they must be willing to follow through and do whatever it takes to meet the academic needs of both genders by implementing with fidelity the brain-based strategies that could foster the achievement of all students.

CHAPTER 3

METHODOLOGY

The purpose of this study was to examine the relationship between the achievement of seventh-grade boys in single-gender reading classes at a Tennessee charter school in 2016 and the implementation of fidgets and movement breaks. Fidgets can be described as small gadgets or manipulatives that students can twist, turn, rub, or squeeze during instruction to help maintain focus. There are commercial fidgets, such as Boinks, that allow students to slide a marble back and forth through a small tube made of plastic netting. There are household items that also can be used as fidgets, such as large buttons, satin fabric squares, smooth rocks, action figures, rubber bands, or any small handheld items that students can safely manipulate in their hands.

Movement breaks are opportunities for students to move before, during, or after instruction by moving in their seats, standing near their seats, or moving about the room. Some movements help to stimulate the right and left hemispheres of the brain, while others could actually be embedded in the instruction, such as the “think-pair-share” or the *Teach Like a Champion* “turn & talk” (Lemov, 2015) strategy where students work in pairs to brainstorm ideas and share information concerning a concept, story, or idea.

This study also examined the relationship between the achievement of seventh-grade girls in single-gender math classes at a Tennessee charter school in 2016 and the implementation of grading the process and mathematical written expression. Because females approach math from a language standpoint by attempting to make sense of the problems using the left hemisphere of the brain, the language center, James (2009) suggested that math teachers provide female students the opportunity to explain how they derived their answers using written expression. According to James, girls focus on mastery rather than performance, therefore some girls would also benefit from having their math work graded based on whether or not they used the correct method to solve the problem. This study attempted to determine whether or not the use of fidgets and movement breaks in reading, process grading and written expression in math have an impact on student achievement using scores from the (ANET) Assessment.

In addition, this study examined if there was a significant difference between seventh-grade boys who implemented fidgets and movement breaks in reading, seventh-grade boys who did not implement fidgets and movement breaks, and seventh-grade girls who did not implement fidgets and movement breaks to determine if the use of gender-based strategies could possibly aid in the narrowing of the achievement gap between girls and boys in seventh-grade reading. It also examined if there was a significant difference between seventh-grade girls who used written expression and process grading in math, seventh-

grade girls who did not implement written expression and process grading, and seventh-grade boys who did not implement written expression and process grading to determine if the use of gender-based strategies could possibly aid in the narrowing of the achievement gap between girls and boys in seventh-grade math.

The implementation of single-sex classes and schools, sometimes referred to as gender-based classes, single-sex education, or single-gender classes, is a growing trend in U.S. education as a means of responding to the need for education reform. Historically, single-sex programs have been popular among independent schools, day schools, and boarding schools (Gurian et al., 2009b). Changes were made to the Title IX regulations in 2006 by the U.S. Department of Education, which expanded the opportunities for public schools to legally provide the single-sex instruction option (Gurian et al., 2009b).

Single-sex classes and schools have been emerging around the country, as educators have become more aware of the differences in how boys and girls learn. Although Title IX no longer prohibits the implementation of single-sex schools and classes in the public arena, there are stipulations to which public schools must adhere, Document 34 CFR Part 106 (B) gives schools permission to separate students by gender if doing so will meet the particular, identified educational needs of its students (Gurian et al, 2009b).

Approaches to implementing a single-sex instructional environment should be differentiated to meet the needs of each district and school. No two districts or

schools are the same; therefore, the approach to how to implement a single-sex program must be strategically designed based on the needs of the students (Gurian et al., 2009b). Some schools are strictly single sex, whereas others have coed classes with single-sex classes in math, science, and reading only. Others implement single-sex classes in certain grades.

Traditional classroom practices in language arts tend to favor the learning styles of some girls, which primarily focus on reading, writing, listening, and speaking. Often many boys are at a disadvantage because the physiological and psychological structures of how the male brain functions do not lend themselves to the traditional way in which language skills are acquired (Gurian & Stevens, 2011). Likewise, in math some girls are at a disadvantage because of the "male-brain classroom" (Gurian & Stevens, 2011, p. 298). Strategy-based research indicated that use of gender-friendly reading and writing strategies has helped to foster improved achievement among some male students in the language arts classroom (Gurian et al., 2009a). Gurian and Stevens (2011) also reported that many middle and high school math teachers have had training in how to help female students reach equal status in math and science as well.

Research is needed on the impact of teacher development and the success of single-sex instruction. Closing the achievement gap between girls and boys is directly affected by how well teachers implement gender-based strategies in single-sex and coed classrooms. However, implementation of gender-based instructional strategies, such as movement breaks for boys in

literacy and written expression in math for girls (James, 2009), must be coupled with an in-depth understanding of the structural and functional innate differences of students' brains (Gurian et al., 2009b).

Recent strategy-based research has indicated that use of gender-friendly reading and writing strategies has helped to foster improved achievement among some male students in the language arts classroom (Gurian et al., 2009a). Gurian and Stevens (2011) reported that many middle and high school math teachers have had training in how to help female students reach equal status in math and science.

Participants

This study took place at a local charter school in Shelby County, Tennessee, comprised of approximately 450 boys and girls Grades 6-8. Each grade level had one section or team of teachers and students. This study only included students in four classes: two seventh-grade all-male reading classes (60) and two seventh-grade all-female math classes (60). The population did not include students with Individualized Education Programs (IEP) or 504's due to the possible lurking variables that could affect the data. A federal law called the Individuals With Disabilities Education Act (IDEA) requires that public schools create an IEP for every child receiving special education services. Kids from ages 3 through high school graduation or a maximum age of 22 (whichever comes first) may be eligible for an IEP. The IEP is meant to address each child's

unique learning issues and include specific educational goals. It is a legally binding document. The school must provide everything it promises in the IEP.

The 504 plan falls under Section 504 of the Rehabilitation Act of 1973. This is the part of the federal civil rights law that prohibits discrimination against public school students with disabilities. That includes students with learning and attention issues who meet certain criteria. Much like an IEP, a 504 plan can help students with learning and attention issues learn and participate in the general education curriculum. A 504 plan outlines how a child's specific needs are met with accommodations, modifications, and other services.

The Tennessee charter school where the study took place opened in 2008 with gender-based classes and offered gender classes through 2014-2015, but a new administration chose to implement coed classes for the 2015-2016 school year. The current administration decided to return to the single-gender instructional option for grades 7 and 8 for the 2016-2017 school year.

Instrumentation

The instrument used to measure student achievement was the ANET assessments for English Language Arts and Mathematics. The ANET assessments measured the achievement of students for selected common core reading and math standards covered during the 8-week study. The pre- and postassessments measured achievement for the same math and reading standards to determine students' achievement for those skills.

A seventh-grade reading preassessment from the ANET assessment question bank was created and administered September 2016 to collect baseline data from the seventh-grade students participating in the study. The numeracy coach created the seventh-grade mathematics preassessment from the ANET assessment question bank to be administered in September of 2016 in order to collect baseline data for the seventh-grade students participating in the study. After the administration of the seventh-grade reading and math preassessments, the teachers implemented the gender-based learning strategies in their classrooms for 8 weeks. The ANET assessment was administered in November as a postassessment to collect data for student performance in seventh-grade reading and mathematics after the implementation of the specified gender-based learning strategies.

Procedures

This was an experimental case study that examined the relationship between female students' achievement (dependent variable) in seventh-grade math and the use of written expression and grading the mathematics process (independent variables). The study also examined the relationship between male students' achievement (dependent variable) in seventh-grade reading and the use of fidgets and movement breaks (independent variables).

The study began after receiving formal approval from the Institutional Review Board (IRB) of Union University in Jackson, Tennessee. After this permission was received, all consent and assent forms were issued. After

obtaining assent and consent forms from school officials, teachers, parents, and students, the researcher completed a random drawing to determine which classes would function as the experimental groups and the control groups for reading and math. Assent was given by 33 boys and 37 girls to complete the study at a Tennessee local charter school.

Professional development was provided in September 2016 for the seventh-grade reading and math teachers. Both teachers were given information about how the left hemisphere of the female brain that controls language, communication, and thinking matures 6 years earlier compared to boys and how the right hemisphere of the male brain that influences spatial memory matures 4 years earlier as compared to girls. Both teachers received training focused on how the physiological and psychological differences in the brain development of boys and girls affect literacy and numeracy acquisition.

The seventh-grade math teacher participating in the study received professional development on how to approach numeracy with some girls based on the structural design of the female brain. This training included the use of written expression, which allowed girls to use the left hemisphere of the brain in their approach to mathematical concepts and it also included grading the process rather than merely determining if girls had the right or wrong answer. Because some girls are teacher pleasers, they spent more time solving math problems in an effort to get the exact answer, although they may have followed the proper steps and possibly misunderstood one aspect of the process. Grading the

process reduces the stress level some girls experience while striving to correctly solve problems because they have a chance to receive partial credit for some aspects of the process. The math teacher was instructed to allow the girls in the experimental group to write justifications for their answers and to grade their work based on how well they followed the steps necessary to solve problems, rather than checking for right or wrong answers only.

The seventh-grade reading teacher participating in the study received professional development on how to approach literacy with some boys based on the structure of their brains. The training for reading included the use of commercial and self-created fidgets and a variety of movement breaks that could be used in the reading classroom to aid male students in reducing disruptive behavior and/or a lack of focus. Boys in the seventh-grade experimental group received fidgets while reading, writing, or speaking. The boys' experimental group was allowed movement breaks after an extended amount of time of sitting, listening, or once the teacher noticed students were getting restless. Both the reading and math teachers had the opportunity to practice the use of the strategies for their subject area during the training session. Fidgets were provided throughout the training, as well as movement breaks.

Pre- and postassessments for both seventh-grade reading and math were created in ANET by using the question bank and administered to the participating seventh-grade students. Participating students responded to 10 multiple-choice questions that assessed three to five common core standards in reading and

math that were covered in the school's reading and math curriculum during the first marking period of the 2016-2017 school year. Because the assessments needed to be coded for confidentiality purposes, students took the test on paper. For the purpose of this study, students were assigned a code that was handwritten on the assessment by the researcher (example: 1B - 60B). The students who gave consent had an assessment that was coded in black, but the students who did not give consent received an assessment coded in red.

A cluster sampling was created from two seventh-grade female math classes and two seventh-grade male reading classes. A simple random drawing determined which classes would be considered Class 1B – 30B (male experimental group), 31B - 60B (male control group), 1G – 30G (female experimental group), and 31G - 60G (female control group). The reading teacher was given the 1B – 60B preassessments, and the math teacher was given the 1G – 60G assessments to be administered in order to obtain baseline data from students in reading and math.

The teachers created seating charts for testing purposes for both the experimental groups and the control groups so that students could receive the same code when taking the pre- and postassessments. The seventh-grade teachers administered the preassessment in September 2016, after which, the reading teacher began implementation of the fidgets and movement breaks with the male experimental group. The seventh-grade math teacher began implementation of the written expression and process grading with the female

experimental group. Fidelity checks were completed over an 8-week period of time by the dean of instruction and the researcher to measure the level of implementation of the specified strategies. Fidelity checks consisted of basically determining if the strategies were used or not.

Postassessments were created 4 weeks into the study from the ANET question bank in preparation for administering the test at the end the 8-week period. Both teachers were asked to discontinue the use of the strategies once the postassessment data was retrieved. The preassessment data was retrieved from the safe. The codes on the pre- and postassessments were matched to ensure that pre- and postassessment data were collected for all participants prior to creating a data set. Both the pre- and postassessment data were placed in the safe until the researcher was prepared to run the paired-samples *t* test and a one-way analysis of variance ANCOVA in SPSS.

Measurement

Data from the seventh-grade reading and math pre- and postassessments were analyzed using a paired-samples *t* test, also known as the repeated measures *t* test. The paired-samples *t* test were used to examine whether there was a statistically significant difference in students' achievement on the ANET preassessment compared to the ANET postassessment after students used specific gender-based strategies. A one-way analysis of variance (ANCOVA) was used to determine if there was a statistically significant difference between gender and gender-based strategies in math for girls and reading for boys.

This study sought answers to the following research questions:

1. Is there a statistically significant difference between the achievement of boys in a seventh-grade single-gender reading class who used fidgets and movement breaks and boys in a seventh-grade single-gender reading class who do not use fidgets and movement breaks?

H₀: There is no statistically significant difference in the achievement of boys in the seventh-grade single-gender reading class that used fidgets and movement breaks compared to those who did not.

H₁: There is a statistically significant difference in the achievement of boys in the seventh-grade single-gender reading class that used fidgets and movement breaks compared to those who did not.

2. Is there a statistically significant difference between the achievement of girls in a seventh-grade single-gender math class where written expression and process grading is used and girls in a seventh-grade single-gender math class where written expression and process grading were not used?

H₀: There is no statistically significant difference in the achievement of girls in the seventh-grade single-gender math class that used writing and process grading compared to those who did not.

H₁: There is a statistically significant difference in the achievement of girls in the seventh-grade single-gender math class that used writing and process grading compared to those who did not.

3. Is there a statistically significant difference between the mathematics achievement scores for girls in seventh-grade single-gender classes, in which gender based strategies were implemented, girls in seventh-grade single-gender classes, in which gender based strategies were not implemented, and boys in seventh-grade single-gender classes, in which gender based strategies were not implemented?

H₀: There is no significant effect of the written expression and process grading on the math achievement scores controlling for gender .

H₁: There is a significant effect of the written expression and process grading on the math achievement scores controlling for gender.

4. Is there a statistically significant difference between the reading achievement scores for boys in seventh-grade single-gender classes, in which gender based strategies were implemented, boys in seventh-grade single-gender classes, in which gender based strategies were not implemented, and girls in seventh-grade single-gender classes, in which gender based strategies were not implemented?

H₀: There is no significant effect of the written expression and process grading on the math achievement scores controlling for gender.

H₁: There is a significant effect of the written expression and process grading on the math achievement scores controlling for gender.

Data Analysis

The research design used for this study was an experimental case study that examined the relationship between the dependent variable, student achievement in math and reading, and the independent variables, the type of class, single-gender boys and single-gender girls, and strategies, fidgets/movement breaks and written expression/process grading. The instrument that was used was the ANET assessment. It was designed as a benchmark assessment to measure student achievement in math and language arts at the end of each quarterly term. For the purpose of this study, the quarterly benchmark assessment was not used, but rather, the ANET test bank was used to design reading and math assessments for specific Tennessee Common Core standards.

A paired-samples t-test was run in SPSS comparing the preassessment scores of male students in a single-gender seventh-grade reading class at a local charter school in Memphis, Tennessee, which did not use fidgets and movement breaks for the postassessment scores of male students in a single-gender seventh-grade reading class at a local charter school in Memphis, Tennessee, who did use fidgets and movement breaks. A paired-samples t-test was run in

SPSS comparing the preassessment scores of female students in a single-gender seventh-grade math class at a local charter school in Memphis, Tennessee, who did not use written expression and process grading to the postassessment scores of female students in a single-gender seventh-grade reading class at a local charter school in Memphis, Tennessee, who did use written expression and process grading. The dependent variables were the reading and math ANET scores. The independent variables were gender and class.

The differences between the male students who used fidgets and movement breaks were compared to the male students who did not use fidgets and movement breaks to determine whether the use of fidgets and movement breaks had an effect on the reading achievement of males on the ANET assessment. The differences between the female students who used written expression and process grading were also compared to the female students who did not use written expression and process grading to determine whether the use of written expression and process grading had an effect on the math achievement of females on the ANET assessment.

In addition, an ANCOVA was run in SPSS to examine the differences between the reading pre- and postassessment achievement scores of seventh-grade male students in a single-gender reading class who implemented fidgets and movement breaks to seventh-grade male students who did not implement fidgets and movement breaks, and female students who did not implement

fidgets and movement breaks in single-gender reading classes. The dependent variables were the reading achievement scores, while the independent variables were gender (1 = boys), groups (1= boys w/treatment, 2 = boys no treatment, 3 = girls no treatment). An ANCOVA was also run to examine the differences between the math pre- and postassessment achievement scores of seventh-grade female students in a single-gender math class who implemented written expression and process grading to seventh-grade male students who did not implement written expression and process grading, and female students who did not implement written expression and process grading in single-gender math classes. The dependent variables were the math achievement scores, while the independent variables were groups (1 = girls w/treatment, 2 = girls no treatment, 3 = boys no treatment).

Limitations

This study contributed to the field of education, but did not address the issue of closing the achievement gap between seventh-grade boys and girls in single-gender math and reading classes. There were a number of other variables that may have affected student achievement scores in this study beyond gender, class composition, and gender-based strategies. Classrooms compared were comprised of students with a diversity of ability levels in both reading and math, sample sizes were limited due to over 50% of seventh-grade students and parents not providing assent or consent to participate in the study, the movement

breaks in the all-boys single-gender reading class were limited to allowing male students to go to the restroom one at a time, and the written expression in the all-girls single-gender math class was limited to girls justifying their answers in writing, but there was no conferring between teacher and students around misconceptions. Ongoing training for teachers was not completed due to scheduling conflicts. The students did not take the testing seriously because a high-stakes test, such as Measures of Academic Progress (MAP), was not used.

CHAPTER 4

RESULTS

This chapter presents the findings and analysis of the data to address the research questions and the hypotheses. The primary purpose of this study was to examine seventh-grade male single-gender reading classes and seventh-grade female single-gender math classes to determine how and to what extent specific gender-based instructional strategies influenced boys' reading achievement and girls' math achievement.

The research questions were considered in this research study and are answered in this chapter. The current study sought to determine whether students in single-gender math and reading classes who received gender-based instruction performed better on the ANET assessment compared to students in single-gender math and reading classes who did not receive gender-based instruction. The data analyzed includes (a) the reading achievement data of males who used fidgets and movement breaks, (b) the reading achievement data of males and females who did not use fidgets and movement breaks, (3) the math achievement data of females who used written expression and process grading, and (4) the math achievement data of males and females who did not use written expression and process grading. The data analysis determined whether student achievement was impacted by whether strategies were or were

not used. The statistics were disaggregated and compiled, and they are presented in the tables that follow.

Data and Statistical Results

There were a number of boys and girls whose scores were not included in the data due to students not taking both the reading or math pre- or postassessments. Three male students were not included in the analysis of the reading and math ANET assessments because although some students and parents gave consent and assent to participate, three male students did not take the preassessment for reading, three female students did not take the postassessment for reading, four male students did not take the preassessment for math for research questions 1 and 2. One male student and three female students did not take the reading postassessment. Three male students and three female students did not take the math postassessment for research questions 4 and 5. The data results are presented below and are organized by research question.

Research Question 1. Is there a statistically significant difference between the achievement of boys in a seventh-grade single-gender reading class who used fidgets and movement breaks and boys in a seventh-grade single-gender reading class who did not use fidgets and movement breaks?

As shown in Table 1, a paired-samples *t*-test was conducted to compare the fall preassessment achievement scores of males in a seventh-grade single-gender reading class and the winter postassessment achievement scores of

males in a seventh-grade single-gender reading class after receiving gender-based instructional strategies. There was no statistically significant difference between the mean scores for boys before the strategies ($M = 56.7$, $SD = 26.2$) and boys after the strategies ($M = 51.7$, $SD = 26.2$) conditions: $t(13) = .713$, $p = .488$. The sig. (2-tailed) value is .488. This value was greater than .05, using a 95% confidence interval. Because of this, it was concluded that there was no statistically significant difference between the mean achievement scores of males who used fidgets and movement breaks and males who did not. Therefore, the researcher failed to reject the null hypothesis.

Table 1

Seventh-Grade Boys' Mean Fall and Winter Reading Scores

Assessment Type	<i>M</i>	(<i>SD</i>)	<i>n</i>	<i>p</i> -value
Fall Preassessment	56.78	13.53	14	.488
Winter PostAssessment	51.78	22.49	14	

Research Question 2. Is there a statistically significant difference between the achievement of girls in a seventh-grade single-gender math class in which written expression and process grading were used and girls in a seventh-grade single-gender math class where written expression and process grading were not used?

As shown in Table 2, a paired-samples *t* test was conducted to compare the fall preassessment achievement scores of females in a seventh-grade single-gender math class to the winter postassessment achievement scores for females in a seventh-grade single-gender reading class after receiving gender-based instructional strategies. There was a statistically significant difference between the mean scores for girls before the strategies ($M = 23.5$, $SD = 28$) and girls after strategies ($M = 56.47$, $SD = 28$): $t(16) = -4.8$; $p = .000$. The sig. (2-tailed) value was .000. This value was less than .05. Because of this, it was concluded that there was a statistically significant difference between the mean achievement scores of females in a classroom where written expression and process grading were used compared to classrooms where they were not. Therefore, the researcher rejected the null hypothesis.

Table 2

Seventh-Grade Girl's Mean Fall and Winter Math Assessment Scores

Assessment Type	<i>M</i>	(<i>SD</i>)	<i>n</i>	<i>p</i> -value
Fall Preassessment	23.52	16.17	17	.000
Winter PostAssessment	56.47	21.19	17	

Research Question 3. Is there a statistically significant difference between the mathematics achievement scores for girls in seventh-grade single-gender classes, in which gender based strategies were implemented, girls in seventh-grade single-gender classes, in which gender based strategies were not implemented, and boys in seventh-grade single-gender classes, in which gender based strategies were not implemented?

As shown in table 3, an ANCOVA was conducted to compare the effect of implementing written expression and process grading with girls (group 1) in a seventh-grade single-gender math class to girls (group 2) who did not implement process grading and written expression, and boys (group 3) in seventh-grade single-gender math classes with no treatment. When comparing the girls (group 1) who implemented the strategy to the girls (group 2) who did not implement the strategy, there was a p -value of .596. This implies that there was no significant difference between the two groups. When comparing the girls (group 1) who implemented the strategy to the boys (group 3) who did not implement the strategy, there was a p -value of .528. This implies that there was no significant difference between the two groups. When comparing the girls (group 2) who did not implement the strategy to the boys (group 3) who did not implement the strategy, there was a p -value of .205. This implies that there was no significant difference between the three groups. Therefore, the researcher failed to reject the null hypothesis that there is no significant effect of the written expression and process grading on the math achievement scores controlling for gender.

Table 3

Effects of Fidgets & Movement Breaks in Seventh-Grade Boys' and Girls' Single Gender Math Classes

Between Groups	<i>p</i> -value
Group 1/Group 2	.596
Group 1/Group 3	.528
Group 2/Group 3	.205

Research Question 4. Is there a statistically significant difference between the reading achievement scores for boys in seventh-grade single-gender classes, in which gender based strategies were implemented, boys in seventh-grade single-gender classes, in which gender based strategies were not implemented, and girls in seventh-grade single-gender classes, in which gender based strategies were not implemented?

As shown in table 4, a one-way analysis of covariance (ANCOVA) was conducted to compare the effect of implementing fidgets and movement breaks with boys (group 1) in a seventh-grade single-gender reading class to boys (group 2) who did not implement fidgets and movement breaks, and girls (group 3) in seventh-grade single-gender math classes with no treatment. When comparing the boys (group 1) who implemented the strategy to the boys (group 2) who did not implement the strategy, there was a *p*-value of .964. This implies that there was no significant difference between the two groups. When comparing the boys (group 1) who implemented the strategy to the girls (group 3)

who did not implement the strategy, there was a p -value of .244. This implies that there was no significant difference between the two groups. When comparing the boys (group 2) who did not implement the strategy to the girls (group 3) who did not implement the strategy, there was a p -value of .193. This implies that there was no significant difference between the three groups. Therefore, the researcher failed to reject the null hypothesis that there is no significant effect of the fidgets and movement breaks on the reading achievement scores controlling for gender. Therefore, the researcher failed to reject the null hypothesis that there is no significant effect of the fidgets and movement breaks on the reading achievement scores controlling for gender.

Table 4

Effects of Written Expression and Process Grading in Seventh-Grade Boy's and Girl's Single-Gender Reading Classes

Between Groups	p -value
Group 1/Group 2	.964
Group 1/Group 3	.244
Group 2/Group 3	.193

Summary

The findings of this study showed that there was no real effect on seventh-grade male students' achievement in gender-based reading classes in regards to fidgets and movement breaks, and there was no effect on seventh-grade female students' achievement in gender-based math classes in regards to written expression and process grading. There were not enough data to support the research questions.

CHAPTER 5

CONCLUSIONS AND DISCUSSION

The purpose of this study was to examine the difference between the achievement of seventh-grade boys in single-gender reading classes and seventh-grade girls in single-gender math classes at a Tennessee charter school in 2016 and the implementation of gender-based strategies. This study attempted to determine whether or not the use of gender-based strategies had an effect on student achievement on the ANET math and reading assessments. This study also attempted to examine whether the use of gender-based strategies would help to narrow or close the gender achievement gap between girls and boys in seventh-grade reading and math.

Conclusions

The results of the study indicated the use of fidgets and movement breaks in the male single-gender reading classroom did not have an effect on achievement on the ANET assessment. It was concluded that the teachers' decision to limit students' movement to restroom breaks did not stimulate the brain in a way that would awaken the language center. As a result, the male treatment group and the male control group were in similar environments during the learning and no statistically significant difference was evident. The results of the study also indicated the use of written expression and process grading in the

female single-gender math classroom did not have an effect on achievement of on the ANET assessment. It was concluded that the preassessment data for the treatment group represented the fact that students had not received instruction for the skills prior to being assessed. As a result, after receiving instruction, the female control and treatment groups showed a statistically significant difference in performance.

Recommendations

Recommendations to the local charter school include the following:

1. Implement cross-lateral gender-based instructional strategies in seventh- and eighth-grade male single-gender reading classes. Gurian et al., (2009b) reported these activities helped to activate the neural wires between the right brain (spatial-mechanical) and the “verbal left brain” (language center).
2. As a part of small-group instruction, have struggling students write explanations for how they solved math problems that were missed on an assessment. Teachers can conference with students or reteach the skill and allow students to complete test recovery to correct the problems.
3. Provide administrators and seventh- and eighth-grade teachers with ongoing gender-based professional development about the differences in how males and females approach literacy and numeracy. This type of training can help teachers understand the science of the male and

female brains and design lessons and activities that are best suited to the way in which boys and girls learn.

4. Use high-stakes assessment results, such as; NWEA or TNReady, to examine the effect of gender-based instructional strategies.

Recommendations for future study include the following:

1. Evaluate the opinion of the male approach to acquiring language from administrators, teachers, parents, and students in order to determine the professional development necessary to aid school leaders as well as students through the process of making academic improvements. Is there a commitment to the work of addressing the literacy needs of male students in reading based on the structural and functional differences of the male brain?
2. Evaluate the opinion of the female approach to applying and conceptualizing numbers from administrators, teachers, parents, and students in order to determine the professional development necessary to aid school leaders as well as students through the process of making academic improvements. Is there a commitment to the work of addressing the numeracy needs of female students in math based on the structural and functional differences of the female brain?
3. Investigate the single-gender literacy and numeracy classroom of students who have a teacher of the opposite sex to better understand the male female brain dynamics that occur in these classrooms that

may prevent some students from fully engaging in the learning. How does having a teacher of the opposite sex affect students' ability to fully access content?

4. Monitor the behavior of students in the male single-gender reading classes where fidgets are appropriately used to measure if impulsivity and disruptive behaviors are diminished or reduced. Although the data did not support the use of fidgets as a means of improving the reading achievement of seventh-grade male students in a charter school in Memphis, Tennessee, their use may be beneficial in improving behavioral data. Is there a correlation between the use of fidgets in a male reading class and discipline referrals?
5. Students in female gender-based math classes should receive extended time to complete assessments to determine if providing more time to solve math problems will impact the achievement of female students, and measure if the additional time can narrow or close the gender gap between males and females in mathematics. According to James (2009), some girls tend to check every answer because they are more concerned about having the correct answers. This is cause for many female students not to finish a timed assessment and receive an undesirable score. Can extended time on standardized math assessments improve the achievement of some female students?

6. Because many girls struggle in what Gurian and Stevens (2011) calls the male-brain class, is there a correlation between student's achievement and the gender of the teacher?
7. What are the effects of an extended school day on the achievement of students?

Implications

As a result of the study there are implications associated with when and how to allow male students in the gender-based reading classroom to use fidgets and have movement breaks. There were different types of fidgets used in the male single-gender reading class such as stress balls, Boinks, and LEGOS. Different students have different needs. Some need to squeeze, while others need to manipulate. Because of the spatial-mechanical structure of some male students, throwing or tossing may occur. It is important for educators to be aware of the types of fidgets some students may need in order to stay focused during a lesson.

Because all male students may not need to fidget, it is important for teachers to distinguish which tools, if any, are best for their students so that all students have the opportunity to have the best learning experience based on their individual needs. This can help male students use fidgets as learning tools rather than toys. There were also suggested movement breaks such as Gotcha! (Gurian et al., 2008) where students work in pairs or in a circle group. They put their left hand, palm up, in front of their partner or person to their left. Then, they

extend their right index finger and place it in the palm of the hand of their partner or the person to their right. When the teacher says "Go!" students try to do two things simultaneously: pull their right finger away from their partner or the person on their right and try to grab the finger of their partner or the person to their left. This exercise stimulates the whole brain, which helps males avoid the neural rest state (King & Gurian, 2006a) during learning.

Likewise, in the female single-gender math class, some girls must not only use written expression to justify answers to math problems, but also have the opportunity to confer with the math teacher in order to dispel misconceptions and gain a better applicable and conceptual understanding of the process. This will provide female students the tools necessary for being successful math students and improve performance in class and on assessments.

Effectively training teachers in how male and female brains function in the learning environment is essential to the successful implementation of a single-sex program in any school or district (King et al., 2010). This is especially true for the female reading teacher instructing a male single-gender class and the male math teacher instructing a female single-gender class. Teachers tend to teach the way they learn, which can be especially frustrating in what Gurian et al. (2009b) called the male-brain math class. Each school must understand the needs of their students in order to experience success that can come from single-gender instructional practices in math and reading (Gurian et al., 2009b).

Discussion

This study examined the achievement of seventh-grade male students in single-gender reading classes that implemented fidgets and movement breaks compared to those who did not at a local charter school in Memphis, Tennessee, in the fall and winter of 2016 on the ANET assessment. The study also included the achievement of seventh-grade female students in single-gender math classes that implemented written expression and process grading compared to those who did not in a local charter school in Memphis, Tennessee, in the fall and winter of 2016 on the ANET assessment. The reading preassessment data for the study came from a sample of 30 males (14 experimental and 16 control) and 38 females (18 experimental and 20 control). The math preassessment data for the study came from a sample of 26 males (10 experimental and 16 control) and 33 females (17 experimental and 16 control). The postassessment data for reading came from 32 males (14 experimental and 18 control) and 35 females (18 experimental and 17 control). The postassessment data for math came from 30 males (13 experimental and 17 control) and 35 females (17 experimental and 18 control). Among the sampling students, there were more male participants than females for both reading and math. This supports the study completed by Jethwani (2015), where male students reported female students as being more structurally designed to perform at a higher level academically than male students, therefore, competing against them academically was of no avail.

The all-male and all-female single-gender reading and math classes (experimental and control) took both the reading and math ANET preassessments prior to the implementation of the gender-based strategies to be compared to the reading and math ANET postassessments after the implementation of the gender-based strategies. The preassessment scores for male students (experimental) were compared to the postassessment scores of male students (experimental) after the 8-week study. The male students' mean score before implementation was 56.78 as compared to 51.78 after implementation. The experimental analysis revealed that there was no statistically significant difference between the male students' achievement scores on the ANET reading assessment before using the fidgets and movement breaks as compared to after. The preassessment scores for female students (experimental) in math were compared to the postassessment scores of female students (experimental) in math after the 8-week study. The female students' mean score before implementation was 23.52 as compared to 56.47 after implementation. The experimental analysis revealed that there was a statistically significant difference between the female students' achievement scores on the ANET math assessment before using written expression and process grading as compared to after. Because there was no statistically significant difference between the postassessment math scores of girls who received treatment compared to girls who did not receive treatment, it was concluded that the results from the female math classes could be due to female students receiving

instruction around mathematical skills that were not taught prior to the preassessment.

The single-gender male experimental group used fidgets and movement breaks for a period of 8 weeks after the completion of preassessments, while the single-gender male control group did not. The fidgets helped to minimize impulsivity and disruptive behavior, but they did not eliminate the behaviors all altogether. The reading teacher reported male students destroying some of the fidgets and tossing them back and forth across the room at times. The movement breaks were limited to the teacher allowing male students to go to the restroom one at a time, with the exception of one student, who was allowed to walk back and forth to the trash can when necessary. This study did not demonstrate a statistically significant difference between the achievement scores of the male students who used fidgets and movement breaks and those who did not. Males who used the fidgets and movement breaks had a preassessment mean score of 51.78 compared to the male students who did not at 53.05. The female students who did not use fidgets or movement breaks had a preassessment mean score for was 57.64 in reading, which supported the literature that stated that the female brain develops language earlier than in the male, therefore, causing some females to advance in language more rapidly (Gurian & Stevens, 2011).

The single-gender female experimental group implemented written expression and process grading for a period of 8 weeks after the completion of preassessments, while the single-gender female control group did not. The

written expression helped female students to use words rather than symbols to demonstrate their understanding of math concepts, but the written information was not used to improve student performance. Female students could have benefited from ongoing consultations with the math teacher; they should have conferred to discuss justifications in order to dispel misconceptions. The process grading revealed to female students which steps they may have completed incorrectly, but there was no consultation around how to make corrections and solve problems correctly in the future. Whole-group instruction was the method used to communicate how to correct misconceptions.

This study did not demonstrate a statistically significant difference between the achievement scores of the female students who used written expression and process grading compared to those who did not. Female students who implemented written expression and process grading had a preassessment mean score of 56.47 compared to the female students who did not at 53.88. The male students who did not implement written expression and process grading had a preassessment mean score of 60.00 in math, which supported the literature that stated that the male brain develops mathematical calculation in the right hemisphere of the brain earlier than in the female, therefore, causing some males to advance in math more rapidly (Gurian & Stevens, 2011). These results demonstrate the need for more intentional planning around the use of gender-based strategies and focused and ongoing training for teachers of single-gender classes.

Educators have traditionally approached language acquisition and number sense in ways that are most familiar to the ways in which they approach literacy and numeracy. For over a decade, information has been published to better inform teaching and learning as they relate to the differences in the structural and functional differences between the brains of males and females. The purpose of this study was to address the structural and functional differences in how males approach literacy and girls approach numeracy by examining the relationship between the use of gender-based reading strategies (fidgets & movement breaks) and the achievement scores of male students on the ANET assessment. It also studied the relationship between the use of gender-based math strategies (written expression & process grading) and the achievement scores of female students on the ANET assessment. The focus on specific gender-based strategies distinguishes this study from other studies.

This study was not free from limitations. First, the study was limited to one section of seventh-grade middle school males and females at a local charter school. There was only one seventh-grade reading teacher and one seventh-grade math teacher. Each class was composed of 30 students, but only 50% of students and parents consented to participating in the study. Second, there were a number of potential variables that were not taken into consideration, such as real teacher buy-in, content knowledge, student motivation, and environmental factors that could potentially influence student outcomes.

Closing Summary

The findings of this study suggest that administrators at this local charter school in Memphis, Tennessee, should give additional attention to the specific literacy and numeracy needs of their students in order to strategically plan for gender-based instruction and provide ongoing professional development for reading and math teachers. School leaders must play an intricate part in making sure that single-gender instruction is implemented with fidelity and is progress monitored throughout the year through the use of benchmarks and other standardized testing. There must be a culture of support that resonates from school leaders and that communicates that such a program is a priority. The results of this study are not to be considered conclusive. While not disclosing all the rationale, these findings give a basis for continued discussion and interaction between educators and school leaders who separate students by gender in an effort to improve student achievement.

REFERENCES

REFERENCES

- Anjum, S. (2015). Gender difference in mathematics achievement and its relation with reading comprehension of children at upper primary stage. *Journal of Education and Practice*, 6(16), 71-76.
- Bonomo, V. (2010). Gender matters in elementary education: Research-based strategies to meet the distinctive learning needs of boys and girls. *Educational Horizons*, 88(4), 257-264.
- Bouchamma, Y., Poulin, V., & Ruel, C. (2014). Impact of reading strategy use on girls' and boys' achievement. *Reading Psychology*, 35(4), 312-331.
- Bozack, A. (2011). Motives, beliefs, and achievement in adolescent boys. *High School Journal*, 94(2), 58-76. Retrieved from <http://dx.doi.org.ezproxy.uu.edu:2048/10.1353/hsj.2011.0001>
- Catsambis, S., Mulkey, L. M., Buttaro, A., Jr., Steelman, L. C., & Koch, P. R. (2012). Examining gender differences in ability group placement at the onset of schooling: The Role of Skills, Behaviors, and Teacher Evaluations. *The Journal of Educational Research*, 105(1), 8-20.
- Chaussee, E. P. (2012). *The effects of single-gender math classroom activities on the achievement and behavior outcomes of fifth-grade girls and boys at a public elementary school* (Doctoral dissertation). Retrieved from ERICEBSCO. (ED549774)

- Galdi, S., Cadinu, M., & Tomasetto, C. (2014). The roots of stereotype threat: When automatic associations disrupt girls' math performance. *Child Development, 85*(1), 250-263.
- Gurian, M. (1996). *The wonder of boys: What parents, mentors and educators can do to shape boys into exceptional men*. New York, NY: Jeremy P. Tarcher/Putnam.
- Gurian, M. (2002). *The wonder of girls: Understanding the hidden nature of our daughters*. New York, NY: Atria Books.
- Gurian, M. (2016, March). The minds of boys and girls. Gurian Institute. In K. McPherson (Chair), *Helping Boys Thrive Summit*. Symposium conducted at the meeting of the Gurian Institute. Chandler, Az.
- Gurian, M., & Stevens, K. (2003). *Boys and girls learn differently: Action guide for teachers*. San Francisco, CA: Jossey-Bass.,
- Gurian, M., & Stevens, K. (2004). With boys and girls in mind. *Educational Leadership, 62*(3), 21-26.
- Gurian, M., & Stevens, K. (2005). *The minds of boys: Saving our sons from falling behind in school and life*. San Francisco, CA: Jossey-Bass.
- Gurian, M., & Stevens, K. (2011). *Boys and girls learn differently: A guide for teachers and parents*. San Francisco, CA: Jossey-Bass.
- Gurian, M., Stevens, K., & Daniels, P. (2009a). Single-sex classrooms are succeeding. *Educational Horizons, 87*(4), 234-245.

- Gurian, M., Stevens, K., & Daniels, P. (2009b). *Successful single-sex classrooms: A practical guide to teaching boys & girls separately*. San Francisco, CA: Gurian Institute.
- Gurian, M., Stevens, K., & King, K. (2006). *Strategies for teaching boys & girls: Elementary level*. San Francisco, CA: Jossey-Bass.
- Gurian, M., Stevens, K., & King, K. (2008). *Strategies for teaching boys & girls: Secondary level*. San Francisco, CA: Jossey-Bass.
- Hannaford, C. (1995). *Smart moves: Why learning is not all in your head*. Atlanta, GA: Great Ocean.
- Hartley, B. L., & Sutton, R. M. (2013). A stereotype threat account of boys' academic underachievement. *Child Development, 84*(5), 1716-1733.
doi: 10.1111/cdev.12079
- Hoyt, D. (2016, March). Strategies for engaging boys. In K. McPherson (Chair), *Helping Boys Thrive Summit*. Symposium conducted at the meeting of the Gurian Institute. Chandler, Az.
- Huffman, R. J., Jr. (2012). *Single-sex schools and classrooms as an effective school structure that will promote an effective learning environment, without external youth subculture distractions* (Unpublished education specialist thesis). Northern Michigan University, Marquette, MI.
- Hughes, T. A. (2007). The advantages of single-sex education. *National Forum of Educational Administration and Supervision Journal, 23*(2), 5-14.

- Jabor, Kungu, Machtmes, Buntat, & Nordin. (2011). The influence of age and gender on the students' achievement in mathematics. *Proceedings of the 2011 International Conference on Social Science and Humanity*, 94(2), 58-76.
- Jackson, B. T., & Hilliard, A. (2013). Too many boys are failing in American schools: *Contemporary Issues in Education Research*, 6(3), 311-316.
- James, A. N. (2007). *Teaching the male brain: How boys think, feel, & learn in school*. Thousand Oaks, CA: Corwin.
- James, A. N. (2009). *Teaching the female brain: How girls learn math and science*. Thousand Oaks, CA: Corwin.
- Jethwani, M. M. (2015). "Girls have more of an educational brain": A qualitative exploration of the gender gap in educational attainment among Black Bermudian adolescents. *Journal of Adolescent Research*, 30(3), 335-364.
- King, K., & Gurian, M. (2006a). The brain---His and hers. *Educational Leadership*, 64(1), 59.
- King, K., & Gurian, M. (2006b). Teaching to the minds of boys. *Educational Leadership*, 64(1), 56-58, 60-61.
- King, K., Gurian, M., & Stevens, K. (2010). Gender-friendly schools. *Educational Leadership*, 68(3), 38-42.
- Kommer, D. (2006). Boys and girls together: A case for creating gender-friendly middle-school classrooms. *Clearing House: A Journal of Educational Strategies, Issue and Idea*, 79(6), 247-251.

- Leaper, C., Farkas, T., & Brown, C. S. (2012). Adolescent girls' experiences and gender-related beliefs in relation to their motivation in math/science and English. *Journal of Youth Adolescence, 41*(3), 268-282. doi: 10.1007/s10964-011-9693-z
- Lemov, D. (2015). *Teach like a champion*. San Francisco, CA: Jossey-Bass.
- Loeper, R. (2014, Spring). Combat sports bloggers, mad scientist poets and comic scriptwriters: Engaging boys in writing on their own terms. *Afterschool Matters, (19)*, 36-43
- McFarland, M., Benson, A. M., & McFarland, B. (2011). Comparing achievement scores of students in gender specific classrooms with students in traditional classrooms. *International Journal of Psychology: A Biopsychosocial Approach, (8)*, 99-114. Retrieved from www.psyjournal.vdu.lt/wp/wp-content/uploads/2011/08/IJP_8_2011_6.pdf
- McMullen, J., Kulinna, P., & Cothran, D. (2014). Physical activity opportunities during the school day: Classroom teachers' perceptions of using activity breaks in the classroom. *Journal of Teaching in Physical Education, 33*, 511-527. doi: <http://dx.doi.org/10.1123/jtpe.2014-0062>
- Merisuo-Storm, T. (2006). Girls and boys like to read and write different texts. *Scandinavian Journal of Educational Research, 50*(2), 111-125. doi: 10.1080/00313830600576039

- Pahlke, E., Hyde, J. S., & Allison, C. M. (2014). The effects of single-sex compared with coeducational schooling on students' performance and attitudes: A meta-analysis. *Psychological Bulletin*, 140(4), 1042-1072.
- Piechura-Couture, K., Heins, E., & Tichenor, M. (2013). The boy factor: Can single-gender classes reduce the overrepresentation of boys in special education? *College Student Journal*, 47(2), 235-243.
- Riley, T. A. (2014). Boys are like puppies, girls aim to please: How teachers' gender stereotypes may influence student placement decisions and classroom teaching. *Alberta Journal of Educational Research*, 60(1), 1-21.
- Rowell, J., & Kendrick, M. (2013). Boys' hidden literacies: The critical need for the visual. *Journal of Adolescent & Adult Literacy*, 56(7), 587-599.
doi:10.1002/JAAL.184
- Sandholtz, J. H., & Sandholtz, S. H. (2010). Confronting gender issues in a novice teacher's classroom: Student and parent/teacher educator perspectives. *The New Educator*, 6(2), 118-134.
- Sax, L. (2005). *Why gender matters: What parents and teachers need to know about the emerging science of sex differences*. New York, NY: Doubleday.
- Sax, L. (2006). Six degrees of separation: What teachers need to know about the emerging science of sex differences. *Educational Horizons*, 84(3), 190-200.

- Sax, L. (2007a). The boy problem: Many boys think school is stupid and reading stinks---Is there a remedy? *School Library Journal*, 53(9), 40-43.
- Sax, L. (2007b). *Boys adrift: The five factors driving the growing epidemic of unmotivated boys and underachieving young men*. New York, NY: Basic Books.
- Scheiber, C., Reynolds, M. R., Hajovsky, D. B., & Kaufman, A. S., (2015). Gender differences in achievement in a large, nationally representative sample of children and adolescents. *Psychology in the Schools*, 52(4), 335-348. doi:10.1002/pits.21827
- Senn, N. (2012). Effective approaches to motivate and engage reluctant boys in literacy. *The Reading Teacher*. 66(3), 211-220. doi:10.1002/TRTR.01107
- Sevimli-Celik, S., & Johnson, J. E. (2013). "I need to move and so do the children." *International Education Studies*, 6(5), 1-10, doi:10.5539/ies.v6n5p1
- Simon, R. P. (2013). *Gender grouping and its initial effect in a Title I upper elementary school during the pilot year of implementation* (Unpublished doctoral dissertation). Mississippi State University, Starkville, MS.
- Slota, M. J. (2011). *Evaluating homogeneous vs. heterogeneous groupings in a k-12 setting: Do same-sex classrooms affect end-of-grade exams?* (Unpublished doctoral dissertation)? Capella University, Minneapolis, MN.
- Sousa, D. A. (2011). *How the brain learns*. Thousand Oaks, CA: Corwin.

- Sousa, D. A. (2014). *How the brain learns to read*. Thousand Oaks, CA: Corwin.
- Spielhagen, F. R. (Ed.). (2008). *Debating single-sex education: Separate and equal?* Lanham, ME: Rowman & Littlefield Education.
- Spielhagen, F.R. (Ed). (2011). "It all depends. . .": middle school teachers evaluate single-sex classes. *RMLE Online: Research in Middle Level Education*, 34(7), 1-12.
- Strain, M. (2013, October). Single-sex classes & student outcomes: Evidence from North Carolina. *Economics of Education Review*, 36, 73-87.
Retrieved from <http://dx.doi.org/10.1016/j.econedurev.2013.06.002>
- Upadyaya, K., & Eccles, J. S. (2014). How do teachers' beliefs predict children's interest in math from kindergarten to sixth grade? *Merrill-Palmer Quarterly*, 60(4), 403-430.
- Welldon, C. (2005). Addressing the gender gap in boys' reading. *Teacher Librarian*, 32(4), 44.
- Williams, B. T. (2004). Boys may be boys, but do they have to read and write that way? *Journal of Adolescent & Adult Literacy*, 47(6), 510-515.
- Wu, J.-Y. (2014). Gender differences in online reading engagement, metacognitive strategies, navigation skills and reading literacy. *Journal of Computer Assisted Learning*, 30, 252-271, doi: 10.1111/jcal.12054