The Single-Gender Classroom:

Improving Middle School Students’ Achievement in Math

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Abstract

At Joseph Case Junior High School, a school located in Swansea, Massachusetts for students in grades six through eight; there was a problematic trend in regard to student achievement in mathematics. Upon completion of an analysis of student cohort results in mathematics on the MCAS (Massachusetts Comprehensive Assessment System), there was an apparent decline in achievement for students when it comes to mathematics in their seventh grade year. More importantly, overall as a school, Joseph Case Junior High School had not met the target for AYP (Adequate Yearly Progress) in mathematics under the performance category since 2006. AYP measures student performance against specific expectations each year. The goals of this quantitative research study were to determine (a) whether single-gender classrooms for males and females in the seventh grade would be a program that would make a positive difference in the declining mathematics achievement seen in the school at this time, (b) to what extent students report being more self-confident learning in a single-gender setting for their mathematics class, (c) to what extent is there a difference between discipline referrals in the single-gender classroom and the co-educational classroom.

To support the research questions raised by this proposal, the following literature was reviewed: (1) that which explores the gender gap in mathematics achievement, (2) that which outlines biological differences between males and females, (3) that which examines the single-gender classroom and the influence on mathematics achievement at the middle school level. The underlying question guiding the study is: Will grouping students by gender for math improve their ability to pay closer attention in class and deal with fewer distractions in order to get the
most out of the class and show improvement when it comes to MCAS test scores and having an overall better grasp on the concepts at hand?

The theoretical framework for this investigation is based on social learning theory and Albert Bandura’s explanation of it which emphasizes how observing and modeling other people and their behaviors as well as attitudes and reactions to other is pertinent in the learning process. The impact that socialization has on the learning process, learning styles, and classroom behavior, are important functions of the study.

The findings of the study revealed: (a) no difference in academic achievement between the single-gender and mixed-gender classes that were relative to the purpose of the study. (b) students in both single-gender classes reported a higher level of self-concept in their math class, especially the single-gender male class, in comparison to the mixed-gender classes. (c) no difference between discipline referrals in the single-gender classrooms compared to the mixed-gender classrooms.

Some implications for further research include the fact that with proper teacher training in single-gender education, and an expansion of the study over a three year period, achievement may be raised. This is partly based on the fact that there was a significant positive difference in the level of self-concept in math class for the students that had a single-gender environment versus those students that had a mixed-gender environment for this particular school year.

Keywords: single-gender education, self-concept, social learning theory, developmental theory, math anxiety
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Table of Contents

Abstract 2

Acknowledgements 4

Table of Contents 5

Chapter 1: Problem of Practice 6

Chapter 2: Literature Review 18

Chapter 3: Research Design 39

Chapter 4: Report of Research Findings 54

Chapter 5: Discussion of Research Findings 70

References 89

Appendix A Letter to Parents 95

Appendix B Form to opt out of study 96

Appendix C NIH IRB Certificate of Completion 97

Appendix D Survey Prompt for Students 98

Appendix E Survey- Dimensions of Self-Concept 99
I. Introduction

Statement of the Problem and Significance

At Joseph Case Junior High School, a school located in Swansea, Massachusetts for students in grades six through eight; there is a problematic trend in regard to student achievement in mathematics. Upon completion of an analysis of student cohort results in mathematics on the MCAS (Massachusetts Comprehensive Assessment System), it is apparent that there is a decline in achievement for students when it comes to mathematics in their seventh grade year. More importantly, overall as a school, Joseph Case Junior High School has not met the target for AYP (Adequate Yearly Progress) in mathematics under the performance category since 2006. AYP measures student performance against specific expectations each year.

This trend of underperformance is also evident amongst other surrounding middle schools. The surrounding schools have not met the target in the performance category for several years. However, some schools have improved enough in order to reach AYP because of the fact that they have met the target under the improvement category. This was the case last year for Joseph Case Junior High School. The school met the target in the improvement category only because of the safe harbor provision. (If a school doesn’t meet the target for performance or improvement, but reduces its non-proficient students by 10%, they are considered to have made it in the improvement category). AYP reports are issued each year and show the progress schools and districts are making toward the goal of having all students reach proficiency by the year 2014. This will not be possible for many schools, such as Joseph Case Junior High School, if further interventions are not imposed on to the students.
According to Slocumb (2004) “The male brain is figured completely different from the female brain and that is rarely taken into account in personal relationships, parenting, or in the classroom” (p.13). In regard to skills necessary in math, males outperform females on spatial skills tasks such as mental rotation, spatial perception, and spatial visualization (Voyer, Voyer, & Bryden, 1995). Marilyn Vrooman, a researcher that has examined the effects of single-gender classes on reading and math achievement test scores of middle school students, believes that this topic is important as brain-based research tells us that male and female students learn differently (Vrooman, 2009).

The Massachusetts Comprehensive Assessment System (MCAS) was designed to measure the progress of students in Massachusetts in order to be in compliance with the federal No Child Left Behind Act (NCLB) of 2001. The MCAS program is used to hold schools and districts accountable, on a yearly basis, for the progress they have made toward the objective of the No Child Left Behind Act that all students be proficient in Reading and Mathematics by 2014. Joseph Case Junior High School along with many other local middle schools has not met AYP in mathematics for several years now. As the deadline date of 2014 approaches, there will be many middle schools that do not meet performance targets for mathematics. Schools and districts that do not make AYP for two or more consecutive years must follow a required course of action to improve school performance.

Low achievement in math is not just a problem for schools in Massachusetts. Statistics show that students in the United States are in fact struggling in mathematics achievement. According to Hanmer (1996), the gender gap on standardized tests has always been alarming. Regardless of background, girls do not do as well as boys on the SAT. She notes that the difference is more pronounced in mathematics, with the boys significantly outscoring the girls.
The 2009 results of the National Assessment of Educational Progress (NAEP) in math, a test given every two years to fourth graders and eighth graders nationwide, show that scores grew faster during the seven years before the federal law’s enactment (NAEP, 2009). In light of disappointing test scores, the administration along with the math department have to ask ourselves as educators if everything possible is being done to raise student achievement in mathematics. Therefore, the intervention of the single-gender classroom at the middle school level in mathematics will be an important undertaking.

**Discussion of practical and intellectual goals**

This is a study that will accomplish practical as well as intellectual goals. Speaking practically, the school is looking to change a situation in order to meet a need. The objective is to study and hopefully implement a new intervention which could make a positive difference in the declining mathematics achievement seen in the school at the current time. It is this practical goal that leads to the research questions in regard to not only achievement, but also self-confidence and student discipline. It is always the goal of an educational institution to improve on these aspects of a school community, as improving in these areas will always assist with the improvement of overall student achievement.

In this quantitative research study, there are also intellectual goals. It is important to realize that this is a study that uses a small number of individuals in which data will be analyzed. Maxwell (2005) states that intellectual goals include identifying unanticipated phenomena and influences, and generating new, grounded theories about those influences. This is something that this researcher hopes to do through analyzing two single-gender classrooms in the seventh grade, a particular place where student achievement must be raised in mathematics.
The practical and intellectual goals that have been put forth by this researcher have helped in the development of the following research questions:

**Brief summary of Research Questions**

The frameworks highlight potential differences between the two different genders and how they take in information, process the information, and communicate information. The first research question examines the notion that the students grouped together by gender will be asking questions, explaining concepts to each other, and working collaboratively in addition to instruction by the teacher.

1. To what extent will the single-gender classroom for seventh grade math students make a significant difference in academic achievement?

The second research question has to do with the self-confidence of the student in the single-gender environment. Student confidence is impacted by peers according to developmental theory and plays a large role in the cognitive development of students during their middle school years.

2. To what extent do students report being more self-confident learning in a single-gender setting for their mathematics class?

There may be a difference in student behavior in the single-gender class as the children now would have only children of the same gender in the class with them. Therefore, some students with discipline issues may be less inclined to “show off” in front of the class. Quite possibly, these children may be more inclined to model the behavior of the better behaved, higher-achieving students in the class with them, according to the social learning theory framework.
3. To what extent is there a difference between discipline referrals in the single-gender classroom and the co-educational classroom?

**Hypotheses**

The researcher believes that there will be a significant difference in achievement when examining the heterogeneous students that have been placed into single-gender mathematics classrooms and comparing them to the heterogeneous students that have been placed in the co-educational classrooms. This is based on the notion that the students will feel more confident without having to worry about the opposite gender in the room, and will freely be able to ask questions and/or ask for help. This will be measured by examining and comparing the MCAS results of the students in both groups, as well as comparing the MCAS results of the students in the single-gender math classes to their own personal results from the prior school year in math.

**H1:** Students will feel more confident in a classroom where all of the students are of the same gender.

**H2:** Student achievement in math will improve when the students are placed in the classroom with only students of the same gender.

The researcher also believes that there will be a significant difference in the amount of discipline referrals from the students in the single-gender math classes compared to the students in the co-educational math classes. This is based on the belief that the students will have less reason to “show off” since there are not students of the opposite gender in the classroom with them. Instead, it is believed that the students will be more focused on the work at hand and the instruction from the teacher, and will be less likely to misbehave, which will lead to less referrals to the office. This will be measured by using the school’s database (a computer program called X2) to compare the total number of discipline referrals of students in single-gender math classes compared to co-educational math classes.
H3: Students will have less behavioral issues when they are placed in the classroom with only students of the same gender.

**Summary of paper contents and organization**

In addition to presenting the problem of practice and its significance, in addition to the practical and intellectual goals and research questions, this paper will also explain the theoretical frameworks behind the research that is being analyzed for the single-gender education study. Furthermore, the paper includes an extensive literature review which is divided into the following relevant sections; biological differences between males and females, the single-gender classroom and the influence on mathematics achievement in middle school, and the affirmative as well as negative arguments for the implementation of single-gender classrooms with context examples provided. Moreover, the paper will analyze student attitudes toward mathematics, as well as discipline in regard to single-gender education.

The second half of the paper will be in regard to the research design of the study. In this section, the methodology used will be explained. Information will be provided such as the site and participants for the study, the type of data that was collected and how it was analyzed, and also the validity and credibility of the research.

**Theoretical Framework**

Social learning theory and developmental theory are two frameworks which become vital in viewing the topic of single-gender education. Social learning theory is one theoretical framework which is relevant for analyzing social perceptions in regard to how people form impressions and make inferences about other people and how they react to other people when observing them. This is relevant to the single-gender study as people adjust their behaviors based on what they think the people around them are thinking or how they are behaving (Neill,
Albert Bandura’s explanation of social learning theory emphasizes how observing and modeling other people and their behaviors as well as attitudes and reactions to others are pertinent to the learning process. Bandura (1977) states: “Learning would be exceedingly laborious, not to mention hazardous, if people had to rely solely on the effects of their own actions to inform them what to do. Fortunately, most human behavior is learned observationally through modeling” (p.22).

Thorne (1993) explains that children are socialized into existing gender arrangements, and that socializing influences come from many directions. She fully supports the view that gender is socially constructed based on countless observations that she has made at the elementary school level. Thorne also indicates that children also influence adults in addition to being influenced by them. She believes that children pick up gender stereotypes from the media that surrounds them as well as their peer groups. Thorne states that peer groups are “steeped in cultural ideas about what it is to be a girl or a boy, (and) also perpetuate gender-typed play and interaction (p.2).” Therefore, boys and girls are different, but they are made that way as opposed to born that way.

Socialization has a tremendous impact on learning styles and classroom behavior. “Throughout their learning girls are encouraged to be passive, caring, to take no risks, and to defer to male voices in the public discussion. They are also given the message that math is for males. Such an orientation obviously has an impact on how they learn and behave in school” (Hanson, 2001, p.7). Hanson makes the point that children adopt sex-stereotyped roles, with boys playing with action toys, learning about mathematical concepts such as velocity, angles, and three-dimensional configurations. Girls, on the other hand, are encouraged to express themselves verbally. The concepts that the boys discover while playing become the core of
mathematics, according to Hanson. “For boys, mathematics is not just an abstract concept, but a firm part of their experiential base, and they can visualize math processes. For instance, young boys can create a three dimensional object in their heads. Young girls often need to try to construct this knowledge without a base in reality; it therefore seems to have no relevance in their own experiences (Hanson, 2001, p.7).” With this knowledge, it makes sense that if students are grouped by gender, the questions and problems that may arise while in class may be of a similar nature. Therefore, when the teacher addresses these issues, the total population benefits with less time being wasted, even if the teacher is not making a conscience effort to gauge his or her strategies toward the particular gender.

Research shows that problems such as math anxiety are learned behaviors. According to Hanson (2001), females are encouraged from an early age to avoid risk taking, and mathematics is a risky subject in the culture of the United States. She feels that girls have historically remained outside of the standard discourse patterns for math classes. According to Hanson’s research, it is important for girls to be a public presence in math and science classrooms, and if that were to happen gender inequalities would be done away with and achievement could be improved.

Social learning theorists focus on observable behavior. According to Lindsey (2005), social learning theorists are concerned with how children model behaviors that are viewed in others, such as cooperation. Through reinforcement, patterns of behavior develop that eventually become habitual. As parents and teachers model gender roles during socialization years, children imitate them as such. Lindsey believes that social learning theory provides for a vast amount of research when it is combined with a symbolic interaction perspective. For example, data on adolescents planning for the future show that they model parents and peers, but also
judge the influence of both when determining those future plans. This would show that symbolic interaction theory is more important than modeling or social learning theory. Therefore, social learning theory cannot account for all of gender role socialization. However, it is important to note that same-gender parents and peers would be defined as more influential than other-gender parents and peers, which is congruent with gender socialization, according to Lindsey.

Social learning theory explains human behavior in terms of continuous reciprocal interaction between cognitive, behavioral, and environmental influences. Because of this, it is possible that the boys and girls in the single-gender classes will have more opportunity to observe their peers of the same gender that are excelling in class, and then model that behavior. Social learning theory focuses on the learning that occurs within a social context such as the single-gender classroom. It considers that people learn from one another, including such concepts as observational learning, imitation, and modeling (Omrod, 1999). An example of this is a study done by Sarah Buckley in which she presented a paper at the Australian Association for Research in Education’s Annual Conference. Buckley (2008) described the project in which a social network approach was adopted to explore peer influences on adolescent students’ motivation and anxiety in mathematics. The types of relationships that were examined were time spent between peers in class and specific help-seeking interactions. Results of the study suggested that peer influence within the mathematics classroom operates in complex ways and emphasizes the importance that social context has in the development of both motivation and anxiety in math, according to Buckley.

The other theory chosen to explore in order to better understand the concept of utilizing a single-gender classroom in a coeducational school is that of developmental theory in regard to gender differences. Differences in gender have been associated with various tendencies in how
students take in information, process information, and communicate their ideas. As Dr. Mary Gauvain states in *The Social Context of Cognitive Development*, in order “to examine the role of the social world in cognitive development, one must examine how the people that are central to children’s lives may contribute to this important developmental process” (Gauvain, 2001, p. 59). Gauvain notes how with the child’s increasing age, peers assume greater significance. Gauvain believes that by middle childhood, the peer group is the main social context of development and that peers play a different role in cognitive development than family members. Interaction with peers is open and egalitarian, and this can lead to unique opportunities for children’s cognitive development (Gauvain, 2001). Gauvain notes that interaction with peers facilitates learning because the peers contribute new information. It seems as though the opportunity for peers of the same gender to work together in a collaborative fashion would be significantly more beneficial, as they have may have a more similar understanding of how the concepts are understood. Research shows that problems such as math anxiety are learned behaviors.

Cognitive development theoretical explanations for gender socialization can contrast sharply with social learning theory, however both theories are important for this study. Jean Piaget’s work laid the foundation for cognitive development theory. According to Lindsey (2005), his work is consistent with that of symbolic interaction theory as he believes that cognitive abilities are developed in stages through ongoing social interaction, with behavior depending on how a person perceives a social situation at each cognitive stage. It is still essential to remember that although a person’s perception of a social situation will determine behavior, it is not the sole factor. Like social learning, cognitive development theory cannot account for all of gender role socialization either, according to Lindsey. Lindsey studied the work of Lawrence Kohlberg, who claims that children learn their gender roles according to level
of cognitive development. “Once gender identity is developed, much behavior is organized around it. Children seek models that are labeled as girl or boy and female of male and identification with the same-sex parent may occur.

Although children base much of their behavior on reinforcement, cognitive theorists see a different sequence in gender socialization than do social learning theorists. (Lindsey, 2005, p.58). Although reinforcements are important, which align under the social learning theory category, the child chooses behavior and roles according to the sense of self. Lindsey believes that children may perceive these experiences based on reinforcement, so there is a consistency with social learning theory. Lindsey references Bussey and Bandura (1992): “A social cognitive theory of gender self-regulation integrates ideas from social learning and cognitive development theories. Gender constancy motivates children to seek out social interactions where they can learn gender appropriate behavior” (Lindsey, 2005, p. 58).

An important subset of cognitive development theory is what is referred to as Gender Schema Theory. According to Lindsey it is the schema that tells a child what they can and cannot do according to gender, and it is the schemas that affect their behavior and influence their self-esteem. As these schemas are developed they are used to organize thinking. She states that there are two types of schemas, in-group (same gender) and out-group (opposite gender). “In-group schemas are used by children to process new information, plan activities, and choose roles. This helps to explain why a person’s world becomes so differentiated by gender over the life course” (Lindsey, 2005, p.59). It is easier to remember activities and people when they are gender stereotyped, and our memories are better for information consistent with gender schemas.
The developmental theory informs my question regarding student achievement and single gender classrooms by examining the idea that if the students are grouped together by gender, their achievement may improve even if the strategies used by the teacher do not change.
II. Literature Review

Introduction

The gender gap in regard to academic subjects is something that has been of interest for educators and researchers alike for many years. Many researchers have indicated a lack of achievement in mathematics for females, as well as a lack of involvement of women when it comes to careers in math and science related fields. Age is a variable when it comes to examining the issue. Research on math achievement for girls indicates a strong pattern of socialization to success or failure when it comes to math, according to Hanson (2001). The literature that exists on socialization leads the researcher to believe that implementing single-gender classrooms at the middle school level could be an intervention that improves student achievement and confidence in the mathematics classroom. It is difficult to summarize the existing literature on single-gender education because of the fact that the findings have been inconsistent, and the researchers are often measuring different things. Smithers and Robinson (2006) make the point that some researchers have completely changed their opinion years after conducting their original research. According to them, Rowe (1988) analyzed a study where boys assigned to a single-gender math class improved more than boys in a co-educational class. Eight years later, Marsh and Rowe (1988) interpreted the data as showing that it was the girls who fared better.

Hanson (2001) finds that researchers in this field focus on different angles when it comes to gender disparity, with some looking at the biological explanation, and others that point toward environmental factors. These factors include differential course work, home support, the sense of math as useful, the sense of math as a male domain, or the teacher-student interaction. This
The Single-Gender Classroom

researcher will focus on biological differences between males and females when looking at the single-gender classroom and the influence on mathematics achievement in middle school.

**Biological differences between males and females**

The biological cognitive differences between males and females are an important determinant in the decision to group students by gender for academic study. A study by Sax (2005) found the following when it comes to how male and female brain function occurs:

Women have higher blood flow per gram of tissue than men. In some critical areas of the brain, women have larger brain cells that receive more inputs than are found in corresponding areas in men’s brains. For many tasks, brain imaging studies showed that women used the most advanced areas of the brain, the cerebral cortex; whereas men doing the same task use more “primitive” areas of the brain such as the globus pallidus, the amygdale, or the hippocampus. (p.31)

Sax (2005) found that girls hear four times better than boys do. Anatomical differences in the eye enable girls to discern details and males to adhere to action (Sax, 2005). There is tremendous research stating that boys are wired to be risk-takers and more likely to show physical aggression. Weil (2008) cites some notable differences that Sax believes, such as the idea that boys solve maze puzzles using the hippocampus; girls use the cerebral cortex. Boys covet risk; girls shy away. Boys perform better under moderate stress; girls perform worse. Stress activates different neurotransmitters and shuts down the brain’s capacity to retrieve or process data (Hensel, 1989).

A program called *Boys and Schools*, which is part of the Men’s Health Network, a 501c (3), a non-profit educational organization, has gathered some facts about the developmental differences between boys and girls. For example, areas of the brain related to language, speech,
processing grammatical structures and word production tend to be more developed or more highly active in females, resulting in their improved verbal communication skills. Another key fact is that males tend to use the right side of the brain to work on abstract problems, whereas females use both. The right side of the brain specializes in visual, spatial, and environmental awareness as well as visual memory. This is why it seems that males tend to be superior at spatial relationships. Also, neurotransmitters, essential parts of brain function that help to transmit messages in the brain, differ between males and females, resulting in clear differences in how the male and female brains process information (Boys and Schools, 2010). A full examination of physiological and developmental differences in boys could span volumes according to the program.

The corpus callosum is the part of the brain which connects the two halves of the brain. This part of the brain is generally larger in boys than in girls. According to Gurian and Stevens (2004), greater corpus callosum activation in the female brain that is seen during cognitive processing could allow for better “cross talk between hemispheres in the female brain” (Gurian & Stevens, 2004, p. 22). Magon (2009) references a vast number of researchers that have studied the functional gender differentiation of the brain. Significant statistics include the fact that physiologically, female brains metabolize glucose at higher rates and to experience greater blood flow in comparison to males is significant. Also, certain skills and tasks will be generally easier for one gender over another. Blunt cites an example that men’s larger activation volume in the visual cortex and greater spatial-mechanical aptitude give them a performance advantage over women when playing video games.

Gurian and Stevens (2004) explain that girls have stronger neural connectors in their temporal lobes than boys have. These connectors lead to more sensually detailed memory
storage, and better listening skills. Another memory storage area in the brain is the hippocampus, which is larger in girls than in boys, increasing their learning advantage, especially in language arts. Also, girls’ prefrontal cortex is generally more active than boys’ and develops at earlier ages. For this reason, girls tend to make fewer impulsive decisions than boys do. According to Havers (1995), boys’ brains operate with less blood flow than girls’ brains, but they are also structured to compartmentalize learning. Therefore, the girls may tend to multitask better than boys, with few attention span problems.

Specific to cognitive differences according to gender when it comes to mathematics are some recent findings that Hanson (2001) discusses regarding achievement:

It seems that the socialization of young girls may, in fact, interfere with the initial development of brain patters that enhance mathematics learning. For instance, studies have shown that an enriched environment produces distinct physiological changes within the brain that enhance learning. Thus, if a brain receives repeated stimulation, it develops strengthened neurological pathways enabling faster and more complex processing of information. At the same time, chemical changes within the brain further increase the capacity to process complex information. The more a brain pathway is used, the faster and more permanently does that synaptic activity happen (p.5)

Based on this research, girls that are not exposed to mathematics as play, will have neurological pathways that take longer to develop than that of boys.

Ripley (2005) highlights other points of interest brought about by Leonard Sax. For example, women can see colors and textures that men cannot see. They also hear things men cannot hear, and they smell things men cannot smell. Therefore, since the eyes, ears and nose are portals to the brain, they directly affect brain development from birth on.
Vanderbilt University conducted a study in which the results were published in the May/June 2006 issue of the journal *Intelligence*. The study included more than 8,000 males and females ranging in age from 2 to 90 from across the United States. The researchers, Stephen Camarata and Richard Woodcock discovered females have a significant advantage over males on timed tests and tasks, and the differences were particularly significant among pre-teens and teens (Moran, 2006). The researchers found no significant overall intelligence differences between males and females, but that males scored lower than females in all age groups in tests measuring processing speed. Also, the study found that males consistently did better than females in some verbal abilities such as identifying objects and completing verbal analogies. Camarata believes that there are fundamental differences in how male and female brains end up getting organized (Moran, 2006).

**Single-gender classroom and the influence on mathematics achievement in middle school.**

Whether students in single-gender classes are advantaged with respect to mathematics learning is a topic that continues to attract research attention by educators and philosophers alike. Leder (1994) notes a study from Rowe (1988) where students in grades seven and eight were randomly allocated to single-gender or co-educational classes for math. In that study, no gender differences in achievement were found over a two year period of monitoring, however, there were significantly higher gains in confidence for the students in the single-gender classes. This was especially the case for the females.

Margaret Ferrara is an expert in the field of single-gender education. She completed a case study of a middle school who implemented single-gender classrooms as a three-year experiment. Ferrara (2005) states that the original purpose of single-gender classes was to provide opportunities for students, especially middle school students, to focus on their academic
learning and achievement rather than being concerned with social interferences that are commonplace for students of that age. Ferreira believes that despite a rich body of educational investigation that shows males and females act and learn differently in social settings, teachers often fail to appreciate the important difference gender makes in learning. The results of work showed that girls’ classes moved at a faster rate and attained a higher overall class average than the boys. According to Ferrara, girls found strength in leadership. Teachers reported that they had tended to call on boys more to keep them engaged. Overall, teachers reported that boys and girls participated more and were less self-conscious about their work in single-gender classrooms. The study makes a significant impact as it analyzes how students and teachers felt about the single-gender impact on teaching and learning. This research can be linked to that of a researcher named Celeste Dunlap (2002) who conducted a seven week study in which she divided fifty fifth grade students into single-gender math classes.

Dunlap wanted to examine if single-gender math classes affected the math achievement and attitudes of her female students. Prior to separating students into single-gender classrooms, the students were given a survey where they answered questions such as, “What is your favorite subject at school, how would you describe your abilities in math, and what do you see yourself being when you grow up?” After the experiment was completed, they filled out another survey to give their opinions about the way the math class was conducted. For example, “Did separating the classes help you learn math better? Why or why not?” Upon completion of the study the author found that there was no statistical significance in the girls’ achievement between a single-gender classroom and a co-educational classroom. There was a significant difference in the girls’ perception as how they best learn math. Dunlap felt that further study on the impact of single-gender classrooms for elementary students must be conducted. She also stated that it would be
beneficial to have the same teacher teach an all-girls mathematics class and also teach a coeducation class to eliminate any other outside factors that could influence the results of the research. This researcher has chosen to follow the aforementioned strategy.

There is valid research that indicates that student achievement will rise if the students do in fact have the experience of being placed in a math class with only others of the same gender. William Trapp (2010) hypothesized that when test scores were compared, the scores of the students who were part of single-gender class would be higher compared to those of the students in the mixed-gender class. The author also claimed that the scores of students exposed to two years of single-gender classes when compared to peers who were only exposed to one year would also indicate higher achievement. Although gender was not significant for predicting test scores, Trapp does not feel that the strategy was a complete failure at the school that it was studied. Trapp states there has been an increase across the United States in single-gender education settings, and that this could be an effective strategy for improving student performance in the age of high-stakes testing math testing.

Thorne (1993) states that study after study regarding sex segregation among children points to the conclusion that when boys and girls have a choice of companions, they more often separate than integrate. Thorne makes the point that gender separation is related to age, with researchers finding that as children grow older, they tend to separate more and more by gender. Thorne believes that gender separation by choice is more likely as children get older because they are more likely to be seen as potential romantic partners, for one reason. In that situation, they may be subject to teasing from others that would push them apart. Separation then makes sense for students at the junior high/middle school level, as it may make it more comfortable for them to work with students of the same gender so that they can focus on the task at hand rather
than worrying about other social pressures. Thorne expresses that she has observed children as well as adults tease a boy or a girl who chose to be with an individual or group of the other gender, explaining that if a girl or boy chose to work with the opposite gender, they risked people saying that they “liked” or had a “crush” on someone. This is a problem that this researcher has also noticed is an issue at the middle school level, having taught grades six through eight over a period of seven years. With the importance of cooperative learning amongst students in the classroom, and the use of this strategy being incorporated into lessons more and more, it makes sense for students to be relieved of unnecessary anxieties. Teachers today frequently have students pair off, even if it is just for a few minutes in order to bring clarity to a point in order to increase understanding. After reading the work of Thorne, this researcher feels that by pairing students with others of the same gender, the student will be able to more clearly focus on the academic task-at-hand. This is especially important in the mathematics classroom, where research shows that the two gender learn mathematic concepts in different ways.

McCord (n.d.) conducted research to determine the effectiveness of single sex classrooms on eighth grade girl’s mathematics achievement. According to McCord, research shows that girls tend to lose math ability around middle school for some unknown reason. “Some theorize that boys are favored in math and the historical stereotype of girls cannot do math beings to take hold in middle school. Boys are often more vocal and overbearing in the classroom, thus there are less opportunities for girls to participate. Some also feel that girls believe that they should not show themselves as smart in math and they will not actively participate in class in order to not look smarter than a boy” (McCord, n.d., para.4). McCord believes that if girls are specifically targeted and encouraged, the loss of math ability would be addressed and raise student achievement.
Affirmative argument for implementation of single-gender classrooms.

Context Examples

In the fall of 2009, Bellamy Middle School in Chicopee, Massachusetts conducted a study in which they created single-gender math classes for grade eight students which showed success. In an article written by DeForge (2010) which was published online, student comments about how the single-gender classroom had an influence on their achievement in math class. Female students pointed out that they didn’t feel embarrassed if they answered questions incorrect, and also felt that they could pay better attention without having to impress the boys. DeForge stated that the students in the single-gender classes that were returning homework weekly was eighty to ninety percent, while the school average was fifty percent. Also, the majority of the students who were attending after-school extra help were from the girls’ class.

Streitmatter (1999) cites Rowe (1988) examining one of the few studies at the time that looked at middle school students in a single-gender classroom. Although there were not vast differences regarding achievement, the results did show that students in the single-gender classes indicated greater levels of confidence in math. Furthermore, girls who moved from the single-gender to the co-educational math classes showed a decline in their confidence about their math abilities. Another context example that Streitmatter provides is one from Hamilton (1985) of Jamaican high school students where students in single-gender and co-educational classes were examined regarding academic achievement and school type. “Boys and girls in single-sex schools outsored those in coeducational schools; the overall performance of girls in single-sex schools was the highest, followed by boys in single-sex schools, then boys in coeducational schools, and lastly girls in coeducational schools” (Streitmatter, 1999, p. 40).
Salomone (2006) states that single-sex programs create an institutional classroom climate in which female students can express themselves freely and frequently as well as develop higher order thinking skills. Smithers and Robinson (2006) found positive as well as negative arguments for the implementation of single-gender classes when reviewing existing literature. Affirmatively, boys and girls feel more at ease in single-gender classes because they are more able to interact and show interest without worrying about what the other gender thinks. They feel that based on this, there could be positive effects on achievement for boys in foreign language class as well as English class. There could be positive effects for the girls in math and science classes.

Research from the National Association of Single-Sex Public Education (2006) highlights work from the organization’s executive director, Dr. Leonard Sax. Sax (2007) states that a growing number of boys do not have the drive that their sisters have, and that there are strategies that parents and teachers have used to get the boys on track, with single-gender education being one of them. Sax feels that the single-gender format can change a boy’s attitude toward school from resentful to enthusiastic. The NASSPE (2006) cites a report from Graham Able of Dulwich College in England where the performance of girls and boys in 30 single-sex and co-educational schools were studies throughout the country. He found that while both girls and boys did better in single-gender schools as compared to mixed-gender schools, the single-sex advantage was greater for boys than it was for the girls. The NASSPE cites Able’s report, stating that the results suggest that single sex schools give an even greater academic advantage to boys than for girls. This is a direct contradiction from the popular educational myth that boys do better in the classroom if girls are present to set them a good example, according to the NASSPE. Therefore,
one could surmise from this study that both boys and girls are academically disadvantaged in co-educational schools, but that the disadvantage is greater for boys. (NASSPE, 2006)

The organization also states that boys in a single-gender environment have more diverse role models of their own sex, and are free to be themselves. Andrew Hunter, a school principal with experience in both co-educational and single-gender education, states that he has heard of many young men sharing their interest in poetry, music, arts, drama, and other “non-macho” pursuits, only after experiencing what school is like in a single-gender environment (NASSPE, 2010).

Researchers at Stetson University in Florida completed a three-year pilot project comparing single-gender and co-educational classes at an elementary school. According to the NASSPE, all relevant parameters were matched. The results when looking at the percentage of students scoring proficient on the FCAT (Florida Comprehensive Assessment Test) were very much positive. Thirty-seven percent of the boys in the co-educational class scored proficient, with fifty-nine percent of the girls in the co-educational class scoring proficient. For the single-gender classes, boys scored eighty-six percent proficient, and girls scored seventy-five percent proficient (NASSPE, 2006, par.4).

The National Foundation for Educational Research studied the effect of school size and school type (single-sex vs. coed) on academic performance in July of 2002. The foundation found that even after controlling for students’ academic ability and other background factors, both girls and boys did significantly better in single-sex schools than in coed schools (NASSPE, 2006). They also found that girls in single-gender schools were more likely to take non-traditional courses that run against gender stereotypes, such as math and physics.

**Negative argument for implementation of single-gender classrooms.**
Context Examples

Gilson (1999) completed a comparative study in which math achievement and attitudes toward math of grade eight students attending independent coeducational middle schools were compared with the mathematics achievement and attitudes toward math of female students attending all-girls middle schools. The theoretical framework presented was social thinking theory. Several researchers have concluded that student backgrounds play a greater role in academic outcomes than does school environment. Some contend that single-gender schools enrolled a superior cliental of students. Others say that achievement differences between coeducational and single-gender schools could be explained more by the characteristics of the students who attended the schools than by school-type effects. Research comparing single-gender education has assumed that certain practices and conditions such as small class size, rigorous curriculums, and equitable teaching practices are typical of single-gender schools and not coeducational schools.

An attitude questionnaire was completed by all subjects, and achievement test data were obtained. This instrument consisted of 29 items which were chosen to fit with the theoretical models dealing with students’ self-efficacy in math and their attributions of their achievement in math to effort. Tests of statistical significance were used in order to compare the mathematics achievement, as reported on standardized tests, of students at the two school sectors.

This study did not find large differences in the math achievement, quantitative ability, or attitude toward math scores of female middle school students from independent single-gender and coeducational schools. The researcher felt that moving forward, it would be important to conduct longitudinal studies to ascertain whether differences that may exist at the eighth grade level between students from the two sectors persist as students further their education.
Campbell and Wahl (1998) express concern that there is a lack of contextual data in the existing research on single-gender classrooms. They believe that most studies do not address the teaching strategies used by the teachers, or anything for that matter, aside from the gender of the students. Because of this, the research does not answer the question which is more effective, single-gender or co-educational classes. They also make the point that most of the research has been interpreted by those with a view that is biased one way or the other on the issue.

The American Association of University Women (1998) focused on the achievement of female students. Some points of consensus that they found were that there is no evidence that single-gender education in general is more effective than co-educational classes. They make the point that in some settings, single-gender programs do produce positive results, but that this was not always the case. Moreover, researchers cannot say for certain whether those benefits are in fact directly linked to single-gender programs, or if those factors also exist in co-educational settings.

Smithers and Robinson (2006) reviewed research studies from Australia, the United States, Canada, New Zealand, Ireland, and the United Kingdom. Their results were that there were no findings that were consistent stating that single-gender education was more or less effective than co-educational settings for students. The research from these particular studies pointed out that other factors such as race, social background, and ability outweighed the influences of gender.

**Attitudes towards mathematics for middle school students.**

Student attitudes toward math at the middle school level is a crucial aspect of this study. The research of Hanmer (1996) sheds light on the significance of the issue. When the researcher
was working on her book, she had asked several adults what their worst year of school had been. She found that two answers from people that work in education today (one male, the other female) were particularly interesting. Both had answered that seventh grade was their worst year of school. The woman noted, “Up until seventh grade, I was really good in math. In fact, I was placed in a gifted and talented program in sixth grade. Then in seventh grade, and I still remember the day, my teacher, Mr. Gillespie, made fun of one of my answers. That was it for me. I stopped answering, and pretty soon my math grades went down, and by my junior year in high school, I stopped taking math all together” (p.17).

The male teacher, her colleague that taught chemistry, also had low self-esteem in junior high school. He stated that seventh grade was also his worst year of school. According to Hanmer, these are not isolated cases. Researchers continue to find that middle schools and junior high schools, students often have self-esteem issues. Researchers believe that there is a direct relationship between the way that math, science, and computer science are taught in most co-educational classrooms and the fact that the majority of girls choose not to study past basic levels in those content areas. Confidence is a consistent variable in predicting achievement in math for girls. Colley, Comber, and Hargreaves (1994) studied the school subject preferences of 327 female eleven- and twelve-year old students. Participants were asked to rank order thirteen school subjects, including mathematics, in order of preference. For students from single-gender schools, mathematics ranked the highest, whereas for their female counterparts from the coeducations schools, mathematics was one of the lowest ranked subjects (Gilson, 1992). Gilson cites Riordan (1990), in that female students in single-gender schools have an advantage over their peers in coeducational schools because they did more homework. With success in math depending on repeated application and practice of new concepts, Gilson states that Riordan
attributed higher achievement in math for the girls in the single-gender schools to the greater amount of mathematics homework they did compared to girls from the coeducational schools.

Hanson (2001) states that both males and female students in one state study agreed that math, science, and gym favored males. Their explanations were gender-stereotyped. The perception is backed up by the finding that liking math is a large factor in whether or not students do well. Girls’ confidence in themselves as math learners, their perception of math as a difficult subject, and their view that math is a male activity, all have an impact on their attitudes and achievement. “In a longitudinal study of sixth, eighth, tenth, and twelfth grades, Tartre and Fennema (1991) found that, for girls, viewing math as a male domain was correlated to math achievement. Girls—for instance those in single-sex schools or in out-of-school math projects—who do not see mathematics as an exclusively male domain tend to have higher math success. When this dynamic is changed to make mathematics accessible to both girls and boys, girls interest and involvement rises” (Hanson, 2001, p. 10).

The paper mentioned earlier in this work, by the American Association of University Women (“Shortchanging Girls, Shortchanging America: A Call to Action”) from 1992, shows that girls’ self-esteem, confidence in their abilities and pursuits in math and science decline as they get older. Teachers may contribute to girls’ problems by giving them less attention or a lower quality of attention during class. The paper highlights the fact that, especially during math instruction, teachers must be sure to call on girls for answers to questions and give them appropriate praise. Stipek and Granlinski (1991) indicate that girls have lower expectations for themselves in math than boys do, and that girls believe that they do not have mathematical ability. The paper states that the girl’s belief that they cannot do math begins early in their
education and continues into junior high school. Therefore, starting in elementary school, teachers need to encourage girls to have higher expectations of themselves in math.

Another interesting point is that the middle school students do not recognize the subjects that they must study in order to have specific careers. Pettit (1995) conducted a survey of 162 students regarding their career aspirations and found that students chose sex-stereotyped careers when participating in the survey. Girls felt that they would be capable of becoming doctors or veterinarians, but they did not want to have science-related careers as adults, with boys stating the opposite. In this case, neither the boys nor the girls recognized the relation between the study of math and science and their future career aspirations. This information showed that girls often didn’t realize that they needed a background in math or science to partake in their desired career choice. Therefore, teachers need to discuss the fact that most professional fields require a background in math or science, according to Petit.

Bailey (2002) discusses the consensus that girls in single-sex schools tend to perceive subjects such as math and physics as less masculine and may have stronger preferences for them than students in a co-educational environment. She references published studies that use subject preferences and girls’ attitudes toward math and science as indicators which conclude that single-gender classes have positive effects for girls;

“Girls in these environments rate fields such as physics as less masculine than do their coeducational counterparts. Foon notes that students attending single-sex schools seem to be less rigidly attached to traditional views about the appropriateness of subject areas by sex. Females, in particular, she found, were more likely to prefer science in single-sex than the coed schools.” (Bailey, 2002, p. 653).
Bailey also cites Mallam’s study (1993) which found that students in all-girls Nigerian schools favored math more than girls in coed Nigerian public boarding schools.

Thorndike-Christ (1991) studied the relationship of attitudes toward mathematics to mathematics performance, gender, mathematics course-taking plans, and career interests via the administration of a questionnaire to public middle and high school students to assess course-taking plans and career interest as well as overall attitude toward math. The results showed that attitudes toward math were predictive of final math course grade. Students in higher level math courses had more positive attitudes and were more interested in math-related careers. Overall, female attitudes were more positive than expected, but their lack of confidence in their ability to learn mathematics and their high levels of math anxiety suggested that there are important gender difference issues that still exist. The negative effects of math anxiety on student achievement has interested researchers for years and is an important piece to include in this research.

According to Wigfield and Meece (1988), most studies of math anxiety have been conducted with high school and college-age students. The few studies of math anxiety in younger students show that math anxiety scores, like test anxiety scores, increase across age. “We also know little about whether there are gender differences in math anxiety among younger students, though it appears that during the elementary and junior high years, boys express slightly more positive affect about math than do girls” (Wigfield & Meece, 1988, p.210-211). In the study conducted by Wigfield and Meece, boys and girls did not differ in their reports of math worry, which indicated that both genders were concerned about doing well in math. Having said this, girls still had stronger negative attitudes as they reported experiencing more negative affective reactions to math. These reactions may mean that as the courses become more difficult, the females would be less likely to take them. Wigfield and Meece indicate that the influence of
math anxiety on students’ performance and participation in math needs further clarification. They do conclude that cognitive and affective components of math anxiety can be identified, and that these components “relate to students’ perceptions of math ability, valuing of math, and math performance” (Wigfield and Meece, 1988, p. 215).

Buckley (2001) states that mathematics anxiety is considered one of the most attitudinal and emotional problems that faces mathematics educators. Mathematics anxiety is commonly studied in combination with mathematics motivation, according to Buckley. She cites Kindermann, et al. (2007) and Wentzel & Watkins (2002); “Simultaneous to the observed increase in mathematics anxiety/drop in motivation, early adolescence is also associated with the growing significance of peer relationships to the individual. Moreover, research has demonstrated that within friendship groups students share patterns of motivation, engagement and performance” (Buckley, 2001, p. 4). Buckley notes that the results of the study include that different types of peer networks can have varying effects on students’ affect in mathematics. She states that the results encourage further investigation of social context in adolescent educational research and support theoretical perspectives which highlight the social context in the development of students’ motivation and emotion in mathematics, which is one aspect of this researcher’s interest.

Haag (2000) found that studies of the effect of school type on girls’ self-esteem suggest that the sources of self-esteem for girls may differ in single-sex and coeducational schools. The findings suggest that level of esteem in girls in individual subcategories such as academics, athletics, and social esteem may differ between single-sex and mixed-sex environments. Several studies that Haag explored found that girls in single-sex schools have stronger preferences for subjects such as math and physics than students in co-educational schools.
Gender differences in the mathematics classroom has an impact on student confidence. Dunlop (2010) spent time researching gender differences in the mathematics classroom, and learned that the issue had a great impact on student confidence and success in mathematics. Dunlop learned that collaboration is important when it comes to maximizing confidence in math class. She was able to obtain feedback from her students in regard to confidence via a questionnaire. The students rated working with a partner as the factor that most helped them with confidence in math class. The girls also found homework important when it came to boosting their confidence. She also learned that both students with high and low confidence ratings attributed working with a partner as the key aspect of assisting with confidence. Dunlop came to realization that developing confidence is critical to math success for middle school students. She discovered that the need for math confidence does cross gender lines, with both boys and girls being able to benefit from a boost in math confidence. She stated that in the future she would continue to use collaboration as a key strategy in her teaching. She does not make any mention of whether or not she thought having students work collaboratively by gender would make a difference.

**Discipline in single-gender classroom versus co-educational**

There is research which has been conducted supporting the point that single-gender classrooms could bring about an overall reduction in students that receive disciplinary referrals. In a study by Ferrara (2005), behavioral referrals in single-gender classrooms decreased, most notably in the male classes. Gurian and Stevens (2004) state that boys represent ninety percent of all discipline referrals. Bradley (2009) included discipline referrals as part of her study. This was one of two non-academic outcomes that were studied, with the other being attendance. Due to the fact that there were lower than expected frequencies in referral data, she was only able to
report a simple calculation of the frequencies. She was not able to determine if there was a
significant difference in the frequencies of the students referred for administrative discipline
between single-gender and co-educational students. “Single-sex males were referred with
greatest frequency and single-sex females were not referred at all. Coed males and females were
referred at the same frequency” (Bradley, 2009, p.119).

Michelson (2005) conducted a study where he examined the effects of sex-segregated
classrooms on boys, especially in regard to discipline that is used in all-male classrooms. She
makes the point that females are less likely to be called on teachers and more likely to be ignored
because of the fact that frequently, male students are seen as being discipline problems.
Therefore, the teacher needs to control those students, and does so by calling on them and
involving them often in the lesson. Michelson states that mathematics (as well as science) are
specific concerns because “the material is geared toward males. In order to excel in these areas,
(females) must be separated from males” (Michelson, 2005, p.4). Michelson cites Skiba,
Michael, Nardo & Peterson (2000) stating that there is ample information stressing that boys are
punished more than girls and that their punishments are more severe. However, the research on
what happens to these trends in single-gender classroom is minimal. The results of Michelson’s
study showed that in the male classroom, discipline practices differed a great deal from those of
co-educational classrooms because of the student’s needs. He found that students who are known
as “discipline problems” at the beginning of the year had the potential to change their label in
that setting. It is important to note that in this study, the teacher in the all-male classroom was a
male, who according to Michelson, had a “unique approach (which) is less severe and fairer than
that of other teachers and what previous research claims. He personally deals with each student’s
problems and avoids simply sending the students out of the classroom to receive discipline for
their bad behavior” (Michelson, 2005, p.21). Michelson notes that boys in the single-gender class appeared to respond positively to the specific discipline environment that had been created. It is important to note that in this study, the teacher used strategies and interventions to decrease the likelihood of having discipline problems in class. For example, he would keep the lights off unless it was dark out in order to keep the children calm. This researcher would find it interesting to know how this classroom would stand in regard to discipline problems in comparison to an all-girls classroom where no interventions were implemented for either. This is a point of interest for this researcher’s specific study.
III. Research Design

Research Questions

The researcher’s main research question asks, “To what extent will the single-gender classroom for seventh grade math students make a significant difference in academic achievement?” This is the reason behind the work, as there is tremendous existing research that indicates that this may make a difference and show improvement in student test scores for seventh grade math. This particular level has repeatedly shown that some intervention needs to be implemented in order to bring about academic improvement.

The second research question asks, “To what extent do students report being more self-confident learning in a single-gender setting for their mathematics class?” This is a valid question as prior research indicates that many students do not feel comfortable and confident in their math classes. Therefore, this intervention may again be one that will bring about a feeling of self-assurance which may heighten overall confidence, leading to higher academic achievement in seventh grade math which would be evident via improved MCAS scores.

The third research question asks, “To what extent is there a difference between discipline referrals in the single-gender classroom and the co-educational classroom?” When teachers are able to successfully manage their classrooms without distractions from misbehaved students, the teacher is more effectively able to teach, while the students are more effectively able to learn. The hypothesis that the single-gender classroom would cause a decrease in discipline referrals may also cause for better opportunity for effective teaching and learning to take place in the math classroom on a daily basis, increasing MCAS test scores.
Methodology

This is research is studied by the researcher using a quantitative approach. The researcher will look at MCAS data in order to see if there was an increase in student achievement. Student’s attitudes toward mathematics as well as perceptions of self-confidence in a single-gender setting will be measured using a survey. The overall program will be evaluated using a summative program review.

Summative evaluation is used to assess the project’s success once it has come to an end. It is meant to evaluate a program at its conclusion. This type of evaluation will determine the success of the project by examining whether the goals were met, participant satisfaction, effectiveness, and whether or not the program should continue or be terminated. This is unlike a formative process evaluation which would be conducted throughout a program period to monitor implementation and successful program activities. (MacDonald, 2010)

The summative evaluation is an outcome evaluation rather than a process evaluation. It is designed to evaluate the researcher’s success at achieving the outcomes or objectives that were proposed. Although data may be collected throughout the project, the evaluation itself is completed at the end. The summative evaluation plan includes a description of how well the program met the objectives that were established in the researcher’s proposal. The plan includes measures that are tailored to the objectives that the researcher set. For example, the main objective for this work is to implement a program that will make a positive difference in the declining mathematics MCAS scores for grade seven students at Joseph Case Junior High School. One evaluation strategy, therefore, will be to look at the 2011 MCAS results for students in the single-gender math classes and compare them to the previous year when they were sixth graders in mixed-gender math classes.
Dr. John Evans, a professor at Nova Southeastern University in Florida, explains the purpose of such evaluations for students that face the task of implementing an intervention for their dissertation project and determining whether or not the intervention is effective. Evans believes that beyond the dissertation, educators must be able to develop programs and assess their effectiveness throughout the careers. Evan provides information regarding what types of programs call for what type of evaluation. Based on the information he provides, it is apparent to this researcher that a summative evaluation is necessary for this study. Specifically, this project would use a quasi-experimental design. According to Evans (2010), this is the strongest and therefore the most credible type of the summative evaluations. It uses random assignment and post tests only on both treatment and control groups. Evans explains that in this case, there is a large group of students which has been divided into two smaller groups by randomly assigning students to one or the other two groups. The experimental or treatment group receives the program, while the control group does not. Pre-tests are omitted on the assumption that the scores of the two groups are equal as a result of random assignment. This design, according to Evans, is useful in cases where a pre-test is impossible to administer or might alert the participants to the program’s intended effects. After administering the post-test, if there is a difference that favors the treatment group, you can be reasonably confident that it was due to the program. (Evans, 2010)

This information leads this researcher to believe that the quasi-experimental design is the proper summative evaluation for the program on the single-gender classroom. For this project, the large group of students has been divided into groups, single-gender or mixed-gender. The experimental (treatment) group would be the single-gender classes, while the control group would be the mixed-gender classes. Both groups would take a pre-test as well as a post-test
which would both be analyzed at the end of the school year. In addition, all students will take the 2011 grade seven mathematics MCAS test. This test is administered in the Spring at the end of the school year. If there is a difference which favors the treatment group, one can be reasonably confident that it was due to the program. It also may be necessary to look at individuals in the single-gender classes and compare their scores to the previous school year as another means analyzing the data.

This evaluation seems to make the most sense for the project at hand, as opposed to, for example, an ethnographic study. An ethnographic study would require the researcher to emerge himself into the culture of the participants and make direct notes on what was observed. These studies can be effective as they allow the researcher to spend a great amount of time actually in the field making observations. However, in this case, it is important that the students not see the researcher an extraordinary amount of time in the classroom. As the Assistant Principal of the school, being in the classroom more than what the students (or the teachers) are used to, could skew the results, especially in regard to the qualitative work that includes focus groups and interviews. Also, the time requirements to do an ethnographic study are impossible due to the day to day administrative responsibilities of the researcher as the Assistant Principal.

Summative program evaluations have been a useful tool for researchers that have designed a program to be evaluated for the dissertation work. In analyzing one dissertation, Vagnoni (2007) conducts a study where she evaluates the distance-education program at a community college. Her applied dissertation “employed a summative process evaluation model based on identifying how well a distance-education program was implemented, what barriers to success existed, and what were program strengths to build on and weaknesses to correct” (Vagnoni, 2007, p.39). Vagnoni states that the methods was appropriate because summative
evaluations use established criteria as the foundation for developing a mechanism to collect assessment information, referencing Varcoe (2003). Vagnoni followed Stufflebeam’s (2003) CIPP (context, input, process, product) evaluation model because it is “used to make decisions about a program, takes into account the individual perspective of stakeholders, and is a comprehensive framework for guiding program evaluations, particularly those aimed at effecting long-term, sustainable improvements” (Vagnoni, 2007, p. 39).

Daniel Stufflebeam developed the CIPP evaluation model because of the fact that he recognized the need to expand thinking about administrative studies and education decision making. The CIPP framework was developed in order to link evaluation with programmed decision making, according McLemore. “It aims to provide an analytic and rational basis from programmed decision-making, based on a cycle of planning, structuring, implementing and reviewing and revising decisions, each examined through a different aspect of evaluation such as context, input, process and product evaluation.” (McLemore, 2009) The CIPP model is useful as it attempts to make evaluation directly relevant to the needs of decision-making during the different phases and activities of a program.

Site and Participants

The site for this project is Joseph Case Junior High School, located on 195 Main Street in Swansea, Massachusetts. The school is part of the Swansea Public School System. The approximate enrollment for the school during the 2010-2011 school year was five hundred. Students in grades six through eight attend the school.

The participants include just over half of the seventh grade. There were one hundred and sixty-seven students enrolled as seventh graders. The actual participants included eighty-two of
those students. Forty of the students were enrolled in single-gender classes. Forty-two were enrolled in mixed gender classes. At the school, there are two academic teams for each grade level. One team is called “The Case Team,” while the other is called “The Gold Team.” Four divisions make up each team, either “C,A,S, and E,” or “G,O,L, and D.” Students are placed in a division based on grades from the previous school year, teacher recommendations, and MCAS scores from the prior year. Each team has a top division (C or G) where the students are challenged on a higher level. Each team also has an at-risk division (D or E). The at-risk classes are that in which students receive small group instruction at a slower pace. In fact for math, the special education students are often pulled from the at-risk class to meet in an even smaller group with a special education teacher. The participant divisions are the classes in the middle, including A, S, O, and L. The students are heterogeneously grouped as students that are not advanced needing to be challenged, nor at-risk. For this project, all of the boys in the A and O divisions were placed in a single-gender math class with the male teacher from the GOLD team. Likewise, all of the girls from the A and O divisions were placed with the female teacher from the CASE team. The S and L divisions were left alone as mixed-gender classes that were scheduled with the either the GOLD or CASE team teacher respectively. All of the students in the middle groupings (A,S,O, and L) had an equal chance to be selected either for the single-gender group or the mixed-gender group, as the selection took place totally randomly. At the time that students were placed in their division (A,S,O, and L) it had not even been decided which of the groups would be single-gender classes and which would be mixed-gender classes.

Data Collection

The following section reports the researcher’s work in regard to data collection. It will provide an explanation of what assessments were used and how those assessments are scored.
The research questions will also be addressed once again along with an explanation of how the researcher used data to answer those questions.

The quantitative data will consist of MCAS test scores for the eighty-seven students that have participated in the project, whether they were enrolled in the single-gender classroom or the mixed-gender classroom. The final results of the grade seven MCAS testing for mathematics will be accessible to the researcher in August 2011. The scores will be based on multiple choice questions as well as open response. Quantitative data will also include diagnostic pre and post test scores to measure growth, as well as surveys to measure confidence, and office referrals to measure behavior. This data is explained in more detail later in this section.

According to the Massachusetts Department of Elementary and Secondary Education (DESE), the MCAS test development process is designed to ensure that the test results are valid and reliable. This process includes the selection of learning standards that are included in each test to the development of the test questions, all the way through to the production of the test booklets. Students in Massachusetts take the mathematics MCAS in grades three, four through eight, and ten. All of the students in the school that this researcher works in take the mathematics MCAS test therefore. Students score in one of four performance levels. Students scoring in the highest performance level, Advanced, achieve scores ranging from 260-280. These students demonstrate a comprehensive and in-depth understanding of rigorous subject matter, and provide sophisticated solutions to complex problems, according to the DESE. The next level, Proficient, are the students that score from 240-259. These students demonstrate a solid understanding of challenging subject matter and solve a wide variety of problems, according to the DESE. The Needs Improvement category is for students scoring from 220-239. The DESE states that these students demonstrate a partial understanding of subject matter and
solve some simple problems. The remaining category is called Warning, and the DESE states that students at this level demonstrate a minimal understanding of subject matter and do not solve simple problems. In grade ten, this category is titled Failing. The goal of the school administration is to provide ample classroom instruction and supplemental assistance so that students are able to improve from one category to the next annually. Other quantitative data would include the number of disciplinary referrals from the single-gender classrooms in comparison to the heterogeneously grouped mixed-gender classrooms.

(Massachusetts Department of Elementary and Secondary Education, 2011)

In regard to the first research question which will analyze student achievement, baseline statistical data for this research would include the 2010 mathematics MCAS scores for all of the students in the single-gender classes. This would actually be considered the initial collection of data that would serve as a basis for comparison with the subsequently acquired data, which is the 2011 mathematics MCAS scores for those same students. The researcher will also compare the mean scores of the single-gender math students 2011 MCAS results to the co-educational students 2011 MCAS results.

In order to be sure that the research takes into account the big picture, and does not base results in regard to achievement on one test and one test only, the researcher will also collect other test scores. All students at Joseph Case Junior High School take a diagnostic pre-test and post-test in mathematics. Therefore, the researcher will collect these scores for all participating students and include them for analysis. This data is stored in the school’s database and is accessible to the researcher, as is the case with student conduct data.

All participating students in both the co-education and single-gender classes will also take a paper and pencil survey in order to analyze quantitative data in regard to how the students
felt about their experience in mathematics class for the 2010-2011 school year. Research surveys are important in order to gain an understanding of the attitudes, beliefs, and opinions of all of the students involved. The survey would be considered a cross-sectional survey because of the fact that the data would be being collected at one point and time. The survey questions would be closed-ended, or questions in which the responses of the subject would be limited to stated alternatives. The survey that will be used is the Dimensions of Self-Concept (1977), written by William Michael and Robert Smith from the University of Southern California. The *Dimensions Of Self-Concept* (DOSC) is a self-report instrument for measuring non-cognitive factors that are associated with self-esteem or self-concept in the school setting. Students will be instructed to answer the question with only the experiences from this school year’s math class in mind.

**Data Analysis**

**Quantitative**

Quantitative data will be studied using analysis of variance (ANOVA) to test the hypothesis that students placed in single-gender environments will be more successful on the mathematics MCAS test in the seventh grade. The one-way analysis of variance will look for differences between the means of more than two groups; male classroom, female classroom, and co-educational classrooms. Because of the fact that there are more than two groups, the simple analysis of variance is the proper test to use. If there were only two groups, the researcher would use a *t* test for independent samples.

The researcher will look at this data in order to compute correlations because the interest is in the relationship between variables. Both of the variables are continuous in nature (test
scores). However, there are other variables that are not continuous (gender). Correlations express a relationship that is associative and give us valuable information about relationships and how variables change or remain the same in concert with others. (Salkind, 2007)

The researcher uses an Analysis of Variance (ANOVA) to compare three means for student achievement; the single-gender boys’ class versus the co-educational group, and the single-gender girls’ class versus the co-educational group, as well as the single-gender boys vs. the single-gender girls. This would be a one-way analysis of variance looking for differences between the means of more than two groups. The data being examined would be the MCAS results in mathematics for the 2010-2011 school year. Therefore, the ANOVA is a one-way analysis of variance, or single factor because of the fact that there is only one grouping dimension. The researcher chooses the use of the one-way ANOVA over a t-test because of the fact that there is a greater chance of error involved when using the t-test as opposed to the ANOVA. In this case, the variance due to differences in performance “is separated into variance that’s due to differences between individuals within groups and variance due to differences between groups. Then, the two types of variance are compared with one another.” (Salkind, 2007, p. 252)

In order to bring validity to the study, the researcher conducts an ANOVA using the pre-test and post-test from the single-gender and mixed-gender classes. This is the diagnostic classroom assessments taken by all of the students in the school for mathematics. Both groups, mixed and single-gender, will be compared as a whole. The researcher will be computing the difference between the pretest and posttest scores for each person and then analyzing those differences in a one-way ANOVA using treatment (treatment vs. control) as the only factor.
The researcher will use an ANOVA in order to compare the single-gender students’ MCAS scores from the 2010-2011 school year to the 2009-2010 school year when they were placed in co-educational classes for mathematics. These are two independent groups, in which the results being examined are derived from unrelated, uncorrelated samples (because of the fact that we are not looking at pre-test / post-test, but rather two different tests given at the end of two different school years with different curriculum and standards being covered).

Quantitative surveys were obtained from a publisher and distributed to all students participating in the project. The surveys measure student’s attitudes toward their mathematics class from the 2010-2011 school year, as well as self-confidence. The survey scales level of aspiration, anxiety, academic interest and satisfaction, leadership and initiative, and identification versus alienation. Students in all participating single-gender and mixed-gender math classes completed the survey at the end of the 2010-2011 school year. The surveys were analyzed quantitatively and scored manually. The items corresponding to each of the five factor scales of the DOSC are arranged in order to facilitate scoring. “The higher the weight assigned to a response the greater is the extent to which an individual posses the underlying trait. In all cases items are so worded that the higher extent of agreement with the ordered alternative responses, the greater is the possession of the factor being represented. With the exception of the factor scale of Anxiety, the expectation would be that the higher the score, the greater the degree of success in learning.” (Michael et al, 1989)

The researcher also compares the amount of referrals/consequences from students in single-gender classes as compared to those in mixed-gender classes using the school’s database which is where incidents of conducts for students is recorded. In order to do this, the research used a Fisher’s Exact test to compare the means.
Validity and Credibility

All academic researchers must realize that there can be threats to the validity of any type of study. Researchers must make every possible attempt to control variables that may pose a threat to internal validity. Researchers must be straightforward and acknowledge any internal threat to a study that cannot be controlled. Experimental researchers must identify and indicate potential threats to the validity of their experiments and design so that threats will not likely arise or are minimized. (Creswell, 2009).

There is the possibility that in this study of single-gender mathematics classroom there could be some internal validity threats. Creswell states that internal validity threats are “experimental procedures, treatments, or experiences of the participants that threaten the researcher’s ability to draw correct inferences from the data about the population in an experiment.” (Creswell, 2009, p. 230) Creswell indicates some types of threats to internal validity that must be taken into account for the study on single-gender mathematics classrooms. History is one threat because as time passes during an experiment, events can occur that influence the outcome. In response, Creswell states that the researcher can have both the experimental and control groups experience the same external events. This is the case for the seventh grade math students at Joseph Case Junior High School. The two groups of co-educational classes, as well as the all-male and all-female classes, all experience the same general events. All students are maturing at the same pace in the study. Historical considerations are not likely but will be reported if outside events do in fact have an impact on the study.

Selection is also a type of threat. Participants can be chosen who have similar characteristics that predispose them to have certain outcomes. In this case, the researcher has
selected the participants randomly with the characteristics having the probability of being equally distributed. (Creswell, 2009)

One threat that is difficult for the researcher in this study to control is diffusion of treatment. Participants in both the control and experimental groups are able to communicate and influence each other because of the fact that they are mixed when it comes to their other academic subjects. This could not influence the achievement data (MCAS results and discipline records), but may influence the data in regard to confidence and attitudes toward mathematics (surveys). Any known events that may influence the data in regard to student confidence and general feelings about the topic will be disclosed.

The researcher also has taken great pains to not allow for the subjects to know the interest that he has in the study. The students know that the researcher, the Assistant Principal of the school, has organized this study. This was necessary as a letter had to be sent to the parents of all of the students that were randomly selected to participate. Since then, the researcher has only observed the classes an average number of times, no more than he would for other subject areas or grade levels. The teachers were instructed to not lead the students on in any way so that they thought the study was a big event that was out of the ordinary or that certain results were expected by anyone.

Although this is only one individual study, the researcher hopes that the work will add to the body of knowledge that exists in order to help conclusions be drawn in the future.

**Protection of Human Subjects**

In accordance with the policy of Northeastern University, this proposal will be submitted for approval by Northeastern University’s Institutional Review Board (IRB). The researcher has completed the course for protecting human research participants as required in addition to
attending a workshop and understands the requirements outlined by the IRB. Students range in age from twelve to thirteen years of age. All student identities will remain confidential when reporting information including MCAS results and discipline records for quantitative data. All student identities will also remain confidential in regard to quantitative surveys when examining confidence levels for single-gender mathematics classes.

Conclusion

When looking at the problem of student underperformance in mathematics at the middle school level at Joseph Case Junior High School and surrounding middle schools through two theoretical lenses as well as the beginning stages of a literature review, it seems as though an intervention is certainly necessary, and that the single-gender classroom for math at the middle school level makes sense. By implementing this strategy, the school is attempting an intervention which is unique to the area in an effort to bring about higher student achievement and self-efficacy in the math classroom for our adolescent students. This study should make a significant impact as it analyzes how students and teachers felt about the single-gender impact on teaching and learning.

The proposed study looks at more than just test scores and student achievement. It will examine the correlation between social behavior and math achievement in a single-gender classroom. An important point to take into consideration is the stage of life of the students. Middle school-aged students are going through major emotional and physical changes. For many of these students, their social lives are becoming just as important, if not more important, than their academic achievement. According to Robert Reasoner, peer esteem is a powerful source of one's sense of self at the middle school level. Reasoner also believes that at this age, student’s
feelings of self-worth come more from peers rather than adults (Patterson, 2007). Therefore, by grouping students in a class with students of the same gender, the students should be more focused on the instruction rather than social interactions with others, therefore raising achievement.

By dividing students into classrooms where they are with only the same gender, students may feel more comfortable and confident while in class and be able to focus more heavily on the material that is being covered without “having to perform” to impress the opposite gender. Based on core content from the courses in the Ed.D program through Northeastern University as well as the literature which I have reviewed to this point, I am inspired to move ahead with this topic of study as the data and existing research shows significantly that single-gender classroom for math in a co-educational public school may be a possible solution toward solving a problem regarding academic achievement for middle school mathematics students.
IV. Report of Research Findings

The next chapter of the work provides results of data analyses and findings of the study. There has been a decline in achievement for students when it comes to mathematics in their seventh grade year at Joseph Case Junior High School, based on analysis of student cohort results on the MCAS test. The school has not met the target for Adequate Yearly Progress in mathematics under the performance category since 2006. The trend of underperformance is also evident amongst other surrounding middle schools. The school has provided several interventions to improve results in mathematics for grade seven students, but they have not yielded the results that the administration wants and needs. Therefore, further intervention was necessary to impose on to the students. The school was looking to change a situation in order to meet a need. The objective of the study was to review a program which would make a positive difference in mathematics achievement. The original thinking was that by reviewing a program where the researcher analyzes two single-gender classrooms in the seventh grade, he would see an increase in student confidence, which would lead to an increase in student achievement as well as a decrease in student discipline referrals for students in the single-gender classrooms for mathematics.

This chapter will explain the findings of the instruments that were used to test the students in order to answer the research questions. Research question one (1), *To what extent will the single-gender classroom for seventh grade math students make a significant difference in academic achievement?* In order to answer this question, MCAS data was analyzed in SPSS statistical software for students in the single-gender and mixed-gender classes. The researcher ran an ANOVA which is a one-way analysis of variance. The first section of the chapter will explain these findings.
Research question two (2), To what extent do students report being more self-confident learning in a single-gender setting for their mathematics class? In order to answer that question, students in both single-gender and mixed-gender classes completed a survey. The survey was titled Dimensions of Self-Concept (DOSC). It is a self-reported inventory of five school-related factors of self-concepts. Students answered the questions in the survey with only their experience in math class in mind for the 2010-2011 school year. Students took the survey in June 2011 at the completion of their coursework. The test measured level of aspiration, anxiety, academic interest and satisfaction, as well as leadership and initiative.

Research question three (3), To what extent is there a difference between discipline referrals in the single-gender classroom and the co-educational classroom? This question was answered by analyzing discipline data from the school’s data base. The number of discipline referrals by each of the teachers for all of the students involved in the study was recorded. There were two categories looked at; students with no referrals versus students with one or more referrals. Students in both single-gender math classes were compared to students in both mixed-gender math classes. A Fisher’s Exact Test was utilized to analyze the data. The only correct comparisons here are to look at each teacher and their single-gender group versus their mixed-gender group, because all of the students in the table should have the same instructor in order to keep the test valid.

This chapter will be divided in to each of the sections explained above. The chapter will report on key findings from the research conducted in relation to the hypotheses being tested or research questions being answered.
Academic Achievement

Before presenting the results of the ANOVA, it is important to present basic information about the sample itself and the data that it produced. There were four groups of students along with two teachers participating in the study. Each teacher had a single-gender class, and a mixed-gender class. The four classes were homogeneous in that they were what the school considers to be average students. In other words, they are not members of the high-level classes where students are highly challenged. They are also not part of the at-risk class of students, where students receive small-group instruction and many accommodations are made. The male teacher had the all-boys class and one mixed-gender group. The female teacher had the all-girls class and a mixed-gender group. The single-gender classes each had twenty students in them. The mixed gender class, for the male teacher, had twenty students. These were not the original numbers for this mixed group as two students had done so well that they were promoted to a top division to be more highly challenged. This occurred at the midpoint of the school year, and their grade 7 MCAS results have been included as part of the mixed-gender class for the data analysis. The mixed gender class for the female teacher had twenty-two students.

The researcher used a one-way ANOVA to analyze student data for all four groups. The data included grade 6 MCAS scores, grade 7 MCAS scores, change in MCAS scores from grade six to grade seven, as well as other assessments. Those assessments included a pre-test which was administered in the beginning of the school year, a post-test which was administered at the end of the year, and the change from the pre-test score to the post-test score. This is an assessment that has been developed by the mathematics department.

The researcher includes sixth grade MCAS data as a means of comparison. To be certain that our groups were homogeneous at the start of the experiment, it was necessary to run the
ANOVA on the sixth grade MCAS data as well. Please realize that no students were grouped in single-gender classes during that year. The number of students for $n$ does not match up as some of the seventh grade students included in the research project were not students at the school during their sixth grade year. The data includes the students that were enrolled during both years and took the grade 6 and grade 7 MCAS as students at Joseph Case Junior High School. When looking at the descriptive data for the sixth grade MCAS scores, there is an overall mean of 242.29. The highest score possible on the MCAS test is a 280. The single-gender boys group, labeled as Group 1, scored a mean of 244.89, which is higher than the overall mean. The mixed-gender group that had the female teacher (Group 4), scored a mean of 246.50, which was even better than the all-boys group. So, to reiterate, these scores are slightly above the overall mean. Group 2, the single-gender girls’ group (239.47), and Group 3, the mixed-gender class with the male teacher (238), scored slightly below the mean. The null hypothesis is that the population means are all equal, so it is true that the intervention did not make a difference in regard to student achievement for MCAS, as all of the groups are equal at the beginning and the end. This is apparent after analyzing the scores for the student’s grade seven MCAS scores (see pg. 53).
Table 1

Descriptives for Student Grade 6 MCAS Scores

<table>
<thead>
<tr>
<th>Descriptives</th>
<th>MCAS-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Mean</td>
</tr>
<tr>
<td>1</td>
<td>18</td>
</tr>
<tr>
<td>2</td>
<td>19</td>
</tr>
<tr>
<td>3</td>
<td>18</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td>75</td>
</tr>
</tbody>
</table>

The ANOVA shows a p-value of .051. This is borderline significant, but when you look at the group of comparisons, no group is significantly different than the others.

Table 2

ANOVA - Student Grade 6 MCAS Scores

<table>
<thead>
<tr>
<th>ANOVA</th>
<th>MCAS-6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sum of Squares</td>
</tr>
<tr>
<td>Between Groups</td>
<td>958.032</td>
</tr>
<tr>
<td>Within Groups</td>
<td>8343.515</td>
</tr>
<tr>
<td>Total</td>
<td>9301.547</td>
</tr>
</tbody>
</table>

The researcher also ran group comparisons for the sixth grade MCAS scores using two types of tests, the Tukey HSD, and the Games-Howell in order to make multiple comparisons between groups. For this particular assessment, sixth grade MCAS scores, no group was significantly different from any other group, which means the groups were homogeneous at the start of the experiment.
The researcher ran the same tests for the students’ grade seven MCAS scores. The overall scores ranged from 212 to 264. The single-gender boys group was the only class that scored above the overall mean of 233.02. The boys scores slightly above that at 234.90. The overall mean for the seventh grade was approximately nine points lower than the mean from grade six.

Table 3  
**Descriptives for Student Grade 7 MCAS Scores**

<table>
<thead>
<tr>
<th>MCAS-7</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error</th>
<th>95% Confidence Interval for Mean</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower Bound</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Upper Bound</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Std. Error</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>20</td>
<td>234.90</td>
<td>12.904</td>
<td>2.885</td>
<td>228.86 - 240.94</td>
<td>212</td>
<td>264</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>231.90</td>
<td>9.436</td>
<td>2.110</td>
<td>227.48 - 236.32</td>
<td>218</td>
<td>248</td>
</tr>
<tr>
<td>3</td>
<td>22</td>
<td>233.18</td>
<td>12.508</td>
<td>2.667</td>
<td>227.64 - 238.73</td>
<td>216</td>
<td>262</td>
</tr>
<tr>
<td>4</td>
<td>22</td>
<td>232.18</td>
<td>9.835</td>
<td>2.097</td>
<td>227.82 - 236.54</td>
<td>218</td>
<td>250</td>
</tr>
<tr>
<td>Total</td>
<td>84</td>
<td>233.02</td>
<td>11.311</td>
<td>1.215</td>
<td>230.61 - 235.44</td>
<td>212</td>
<td>264</td>
</tr>
</tbody>
</table>

Table 4  
**ANOVA for Student Grade 7 MCAS Scores**

<table>
<thead>
<tr>
<th>MCAS-7</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>111.807</td>
<td>3</td>
<td>37.269</td>
<td>.293</td>
<td>.830</td>
</tr>
<tr>
<td>Within Groups</td>
<td>10172.145</td>
<td>80</td>
<td>127.152</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>10283.952</td>
<td>83</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The ANOVA shows no significant statistical difference with a p-value of .830. There is no reason to reject the null hypothesis of equal means. The post hoc tests, the Tukey HSD and more conservative Games-Howell, also do not show statistical significance when analyzing the groups using multiple comparisons. All four groups had very similar scores. By this measure there does not appear to be any effect due to the intervention.
The researcher also used this data to analyze the change in individual MCAS scores for all participants from sixth grade to seventh grade. The overall mean shows a nine point loss from the sixth grade year to the seventh grade year, showing that the test was more difficult as it was more algebraic in the seventh grade. There is a general perception among middle school math teachers that the more algebraic nature of the seventh grade curriculum causes this drop. Creating a new measure by subtracting the scores will allow an analysis of how individual student scores changed between grades. For all groups, there was a mean loss of 9.17 points. The two single-gender classes scored very similarly, with the boys scoring a -8.89, and the girls scoring -8.00, which was very close to the overall mean of -9.17. Group 4, the mixed-gender group with the female teacher, had a greater loss -14.70 than Group 3, the mixed-gender group with male teacher. That group scored a -4.56. This may be showing that teacher differences are effecting outcomes along with the changes imposed by the intervention. Teaching styles vary greatly along with how each student reacts to the different styles. Although it is not statistically different, the male teacher’s mixed class did better than his all male class. The female teacher’s all female class did better than her mixed class. One has to realize that there are vast numbers of variables in the classroom including what is going on in the student’s personal lives outside of school that make it difficult to control, muddying the effects of any interventions.

When looking at the results of the ANOVA, the researcher must reject the null hypothesis because of the fact that one of the groups is different, with a p-value of .024. The post hoc tests show that group 3, the mixed-gender students with the male teacher, is significantly different from group 4, the mixed-gender students with the female teacher. Group 3 has an overall five point loss, versus the fifteen point loss of group 4.
### Table 5
**Descriptives for Change in MCAS Scores for Students from Grade 6 to Grade 7**

<table>
<thead>
<tr>
<th>MCAS +/-</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error</th>
<th>95% Confidence Interval for Mean</th>
<th>Minimum</th>
<th>Upper Bound</th>
<th>Lower Bound</th>
<th>Maximum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>18</td>
<td>-8.89</td>
<td>12.218</td>
<td>2.880</td>
<td>-14.96</td>
<td>-2.81</td>
<td>-34</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>19</td>
<td>-8.00</td>
<td>6.864</td>
<td>1.575</td>
<td>-11.31</td>
<td>-4.69</td>
<td>-20</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>75</td>
<td>-9.17</td>
<td>10.589</td>
<td>1.223</td>
<td></td>
<td>-11.61</td>
<td>-6.74</td>
<td>-34</td>
<td>18</td>
<td></td>
</tr>
</tbody>
</table>

### Table 6
**ANOVA for Change in MCAS Scores for Students from Grade 6 to Grade 7**

<table>
<thead>
<tr>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>1022.324</td>
<td>3</td>
<td>340.775</td>
<td>3.326</td>
</tr>
<tr>
<td>Within Groups</td>
<td>7274.422</td>
<td>71</td>
<td>102.457</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>8296.747</td>
<td>74</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Groups 4, 1, and 2 are homogeneous. Group 3 does not have a mean score that fits with these, as they had a lower loss of points, shown in Table 7:
Table 7
Tukey HSD Post Hoc for Change in MCAS from Grade 6 to Grade 7

<table>
<thead>
<tr>
<th>Gender Placement</th>
<th>Subset for alpha = 0.05</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
</tr>
<tr>
<td>Tukey HSD\textsuperscript{a,b}</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Sig.</td>
<td></td>
</tr>
</tbody>
</table>

All students at Joseph Case Junior High School take a diagnostic pre-test and post-test for mathematics. The assessments are benchmark tests that cover the grade level curriculum. These tests were part of the data analysis, as the test was distributed to students in both the single-gender and the two mixed-gender classes. When analyzing the descriptive data, the comparison tests show that group 2, the single-gender girl’s group, is different from group 3, the mixed-gender class that had the male teacher. The girls’ class had a mean of 13.95, while the mixed-gender class scored a mean of 30.11. These gains are made from September to June. Also, group 3, was significantly different from group 4, the mixed-gender class with the female teacher, as that class scored a mean of 8.09. Group 3, the mixed class with the male teacher, is statistically different from the all girl’s class, and the mixed class with the female teacher. However, group three had a different instructor. Furthermore, this group started with a much lower score, which is probably the factor that drives their large increase. When the ANOVA was run, the p-value of .001 shows that the null hypothesis would be rejected, as at least one group is different.
Table 8
**Descriptives for Change in Diagnostic Pre-Test to Post-Test**

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Pre-Test</th>
<th>Post-Test</th>
<th>+/-</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error</th>
<th>95% Confidence Interval for Mean</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower Bound</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Upper Bound</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Minimum</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Maximum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>18</td>
<td>22.22</td>
<td>22.975</td>
<td>.75</td>
<td>5.415</td>
<td>22.975</td>
<td>5.415</td>
<td>10.80</td>
<td>33.65</td>
<td>-20</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>13.95</td>
<td>11.767</td>
<td>2.09</td>
<td>2.631</td>
<td>11.767</td>
<td>2.631</td>
<td>8.44</td>
<td>19.46</td>
<td>-10</td>
</tr>
<tr>
<td>3</td>
<td>18</td>
<td>30.11</td>
<td>14.628</td>
<td>4.48</td>
<td>3.448</td>
<td>14.628</td>
<td>3.448</td>
<td>22.84</td>
<td>37.39</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>78</td>
<td>17.94</td>
<td>18.486</td>
<td>1.09</td>
<td>2.093</td>
<td>18.486</td>
<td>2.093</td>
<td>13.77</td>
<td>22.10</td>
<td>-24</td>
</tr>
</tbody>
</table>

Table 9
**ANOVA for Change in Diagnostic Pre-Test to Post-Test**

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>5449.022</td>
<td>3</td>
<td>1816.341</td>
<td>6.442</td>
<td>.001</td>
</tr>
<tr>
<td>Within Groups</td>
<td>20865.657</td>
<td>74</td>
<td>281.968</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>26314.679</td>
<td>77</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

When running post hoc tests for multiple comparisons, there is an apparent difference between groups 2 and 3, and groups 3 and 4. In examining the Tukey HSD, group 2 compared to group 3 at shows a p-value of .021. However, we are seeing a difference between the all girls’ with the female teacher, and the mixed-gender class with the male teacher. This is not significant to the study. Likewise, we see a difference between group 3 compared to group 4 at .001. Again, this is not significant to the study as it is the mixed-gender group with the male teacher showing a significant difference over the mixed-gender group with the female teacher. The all-boys’ class (group 1) and the mixed-gender class with the female teacher (#4) shows a p-value of .048, which is significant. Furthermore, when looking at these groups in the Games-Howell test, the p-
value is 0.148, not significant. The Games-Howell test is the more conservative test of the two.

This information is projected in Table 10.

Table 10

*Multiple Comparisons for Change in Diagnostic Pre-Test to Post-Test*

<table>
<thead>
<tr>
<th>(I) Gender Placement</th>
<th>(J) Gender Placement</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
<th>Lower 95% Confidence Interval</th>
<th>Upper 95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tukey HSD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>8.272</td>
<td>5.456</td>
<td>.433</td>
<td>-6.07</td>
<td>22.61</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>-7.889</td>
<td>5.697</td>
<td>.498</td>
<td>-22.60</td>
<td>6.82</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>14.131*</td>
<td>5.337</td>
<td>.046</td>
<td>.10</td>
<td>28.16</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>-8.272</td>
<td>5.456</td>
<td>.433</td>
<td>-22.61</td>
<td>6.07</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>-16.161*</td>
<td>5.696</td>
<td>.021</td>
<td>-30.50</td>
<td>-1.82</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>5.859</td>
<td>5.188</td>
<td>.673</td>
<td>-7.78</td>
<td>19.50</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>7.889</td>
<td>5.697</td>
<td>.498</td>
<td>-6.82</td>
<td>22.60</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>16.161*</td>
<td>5.696</td>
<td>.021</td>
<td>1.82</td>
<td>30.50</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>22.020†</td>
<td>5.337</td>
<td>.001</td>
<td>7.99</td>
<td>36.05</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>-14.131*</td>
<td>5.337</td>
<td>.046</td>
<td>-28.16</td>
<td>-.10</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>-5.859</td>
<td>5.188</td>
<td>.673</td>
<td>-19.50</td>
<td>7.78</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>-22.020†</td>
<td>5.337</td>
<td>.001</td>
<td>-36.05</td>
<td>-7.99</td>
</tr>
<tr>
<td>Games-Howell</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>8.272</td>
<td>6.021</td>
<td>.527</td>
<td>-8.30</td>
<td>24.84</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>-8.272</td>
<td>6.021</td>
<td>.527</td>
<td>-24.84</td>
<td>8.30</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>-16.161*</td>
<td>4.337</td>
<td>.004</td>
<td>-27.90</td>
<td>-4.42</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>5.859</td>
<td>4.370</td>
<td>.534</td>
<td>-5.88</td>
<td>17.60</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>16.161*</td>
<td>4.337</td>
<td>.004</td>
<td>4.42</td>
<td>27.90</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>22.020†</td>
<td>4.905</td>
<td>.000</td>
<td>8.84</td>
<td>35.20</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>-14.131</td>
<td>6.442</td>
<td>.148</td>
<td>-31.65</td>
<td>3.39</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>-5.859</td>
<td>4.370</td>
<td>.534</td>
<td>-17.60</td>
<td>5.88</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>-22.020†</td>
<td>4.905</td>
<td>.000</td>
<td>-35.20</td>
<td>-8.84</td>
</tr>
</tbody>
</table>

* The mean difference is significant at the 0.05 level.
The researcher also runs tests with the data for just the pre-test, and then just the post-test in order to see if by this measure the groups started with the same level of knowledge. The descriptives show that group 3, the mixed-gender with the male instructor, clearly starts with a lower score (30.63). Whatever the reasons for the low score here would be beyond the control of the researcher, such as time constraints, instructor input, and level of student anxiety. This could invalidate differences at post-test or when examining the difference from pre-test to post-test. In the ANOVA, the p-value is .000 which shows that the pre-test groups did not start with equal means.

Table 11
*Descriptives for Diagnostic Pre-Test*

<table>
<thead>
<tr>
<th>Pre-Test</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error</th>
<th>95% Confidence Interval for Mean</th>
<th>Lower Bound</th>
<th>Upper Bound</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20</td>
<td>44.65</td>
<td>16.426</td>
<td>3.673</td>
<td>36.96</td>
<td>52.34</td>
<td>10</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>54.25</td>
<td>12.260</td>
<td>2.741</td>
<td>48.51</td>
<td>59.99</td>
<td>37</td>
<td>77</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>19</td>
<td>30.63</td>
<td>17.128</td>
<td>3.929</td>
<td>22.38</td>
<td>38.89</td>
<td>10</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>22</td>
<td>54.14</td>
<td>11.081</td>
<td>2.362</td>
<td>49.22</td>
<td>59.05</td>
<td>37</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>81</td>
<td>46.31</td>
<td>17.020</td>
<td>1.891</td>
<td>42.55</td>
<td>50.07</td>
<td>10</td>
<td>80</td>
<td></td>
</tr>
</tbody>
</table>

When examining the post-test, the ANOVA shows a p-value of .182, so the null hypothesis is accepted as the means are equal. All of the groups are considered to have equal means on the post-diagnostic test, as shown in Table 12. There is a lot of variability in the scores listed in this table.
Table 12
*Tukey HSD Post Hoc Test for Diagnostic Post-Test*

<table>
<thead>
<tr>
<th>Gender Placement</th>
<th>N</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tukey HSD\textsuperscript{a,b}</td>
<td>19</td>
<td>59.37</td>
</tr>
<tr>
<td>4</td>
<td>22</td>
<td>62.23</td>
</tr>
<tr>
<td>1</td>
<td>18</td>
<td>67.56</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>68.20</td>
</tr>
</tbody>
</table>

Means for groups in homogeneous subsets are displayed.
b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

**Discipline**

The researcher also examines data on student discipline between the groups as part of the study. The hypothesis was that the students in the single-gender classes would be less apt to get referred to the office or receive a consequence by a teacher because of the fact that they were in the class with only those of the same gender, and would be less likely to act out to impress others. Along those lines of thinking, this would improve academic achievement as well. The researcher ran a 2x2 Fisher’s exact test for all of the groups. The test looks at students with no referrals, versus students with one or more referral.

The all-boys group had 14 students with no referrals, and 6 students with one or more. The all-girls group had 16 students with no referrals, and 4 students with one or more. The mixed-gender class with the male teacher had 13 students with no referrals, and 8 with one or more referrals. The mixed-gender class with the female teacher had 12 students with no referrals, and 10 students with one or more referrals. Really, the only correct comparisons here
are to look at each teacher and their single-gender group versus their mixed-gender group, because all of the students in the table should have the same instructor in order to keep the test valid. When looking at the male teacher’s single-gender versus mixed-gender data, we see a p-value of 0.1628. The female teacher’s comparison of groups yields a p-value of 0.1547. Therefore, we see no statistical significance in the discipline referrals between the groups and their instructor. Neither instructor had statistically significant differences in their referral rate.

**Student Self-Confidence and Interest**

All participants took a survey at the end of the school year. The survey, Dimension of Self-Concept, measured the following: aspiration, anxiety, academic interest/satisfaction, leadership/initiative, and identification vs. alienation. All students participating were told to answer the survey questions with only the experience in this school year’s math class in mind. The survey as well as the prompt for the proctor to read can both be found in the Appendices section of this report. This particular survey was chosen because the researcher wanted to use a quantitative survey in order to measure student’s feelings about their math class in regard to the categories listed above.

Levels of Aspiration “reflects behavior patterns that portray the degree to which achievement levels and academic activities are consistent with students' perceptions of their scholastic potentialities.” (Edits online. 2011, p. 1). The all-boys class scored slightly lower in this category with a mean of 50.82 as opposed to the all-girls score of 51.35, which is not significant because the numbers are so close. When comparing the all-boys class to the mixed-class which was taught by the male instructor, we see that the mixed-class scored a mean of 45.25, slightly lower than that of the single-gender male class with that same instructor. This is not statistically significant as shown by the similar scores. The mixed-gender class with the
female teacher scored a mean of 48.95, slightly lower than the single-gender female class. So, both of the mixed-gender classes scored lower for means for aspiration than that of their single-gender counterparts that had the same instructor. It is possible that the students in the single-gender environment felt more inspired to put forth more effort, therefore we see a difference in the results for level of aspiration for the single-gender classes versus that of the mixed gender classes.

Anxiety “reflects behavior patterns and perceptions associated with emotional instability, lack of objectivity and heightened or exaggerated concern about tests and preserving self-esteem in relation to academic performance.” (Edits online. 2011, p. 2). The single-gender male class scores a mean of 33.82 for anxiety compared to the female single-gender class which scored 34.20. These numbers are very close, meaning that both single-gender classes felt about the same level of anxiety. When comparing the single-gender male class to its mixed-gender counterpart with the same instructor, we see that the all-boys groups scored actually higher in the anxiety category, as the mixed group scored 28.00. So, we see that the boys in the single-gender class actually were more anxious, which is the opposite of what the researcher initially believed would be the case. The mean for the mixed-gender class with the female teacher was 34.59, which compared to the all-girls class score of 34.20 is very close, and shows no significance for the study. Therefore, it can be said that the single-gender boys felt a higher level of anxiety than their mixed-gender counterparts, however, the single-gender female group and their mixed-gender counterparts felt about the same level of anxiety. So, for whatever reason, the boys in the single-gender grouping actually felt more anxiety, to which the researcher thought the opposite would be true, especially based on some observations that he made. It seemed to make more sense that the students in the single-gender classes would feel less anxiety as they would not
have to “show off” or compete against each other in front of the opposite gender students that were in classroom with them.

Academic interest and satisfaction “portrays the degree of intrinsic motivation, involving love of learning for its own sake gained by students in doing academic work and in studying new subject matter.” (Edits online. 2011, p. 3). The single-gender male class scored a mean of 45.29, compared to their mixed-gender counterpart with the same instructor, which scored 34.85. This shows that the boys in the single-gender class did show more academic interest and satisfaction in regard to intrinsic motivation. The single-gender female class scored a mean of 40.55, whereas their counterpart with the same teacher scored 39.91. So the single-gender class scores higher than their mixed-gender counterparts here too, but not significantly.

Leadership and initiative “represents those behavior patterns and perceptions that are associated with star-like qualities, as when a student demonstrates mastery of knowledge and willingness and ability to help and give guidance to others, and takes pride without display of conceit in the capability of doing a job quickly and well.” (Edits online. 2011, p. 4). The single-gender male class scored a mean of 45.29 for this category, just as they did for academic interest and satisfaction. Their mixed-gender counterparts scored a mean of 38.20. Again, we see evidence that the single-gender male class perceived themselves to have more confidence when it comes to leadership and initiative than the mixed-gender class did. The all-girls class scored a mean of 38.80, compared to 38.09, showing no difference.

Identification versus alienation, “represents the extent to which a student feels accepted by the academic community and respected by teachers and peers for his or her own personal worth and integrity as opposed to feeling isolated or rejected by the academic environment.” (Edits online. 2011, p. 5).
The single-gender male class scored a mean of 51.06, compared to the mixed-gender class with the same male teacher, which scored 43.80. Again, we see a drop off in the mixed-gender results when it comes to self-confidence in comparison to the single-gender male group, in this case how students feel accepted and respected by teachers and those in the academic community. The single-gender female group scored a mean of 45.05, compared to their counterparts with the same instructor who scored 46.91. Again, those numbers do not show much if any difference between the girls in the single-gender class compared to the mixed-gender class that had the same instructor.
V. Discussion of Research Findings

This study originates because of a need to improve achievement in math for students in seventh grade at Joseph Case Junior High School. The idea to separate students by gender and compare their results to students in co-educational classes was an intervention that was thought could possibly make a difference. The trend of underperformance is evident amongst middle schools in the surrounding area, so the problem is not specific to students at Joseph Case Junior High School in Swansea, Massachusetts. The purpose of the study was to implement a new intervention which would make a positive difference in the declining math achievement. This practical goal led to research questions in regard to student achievement, self-confidence of students, and student discipline.

The first research question would examine the notion that the students grouped together by gender would be asking questions, explaining concepts to each other, and working collaboratively in addition to instruction by the teacher.

1. To what extent will the single-gender classroom for seventh grade math students make a significant difference in academic achievement?

The second research question was in regard to the self-confidence of students in the single-gender environment. It is this question that we see that the project had the most bearing on, especially for the boys in the single-gender classroom.

2. To what extent do students report being more self-confident learning in a single-gender setting for their mathematics class?

The third question was developed with the idea that there may be a difference in student behavior in the single-gender classroom as the children would have only other kids of the same gender in the class with them. The researcher believed that children that were looking to “show
off” may be more inclined to model the behavior of the better behaved students, according to the social learning theory framework.

3. **To what extent is there a difference between discipline referrals in the single-gender classroom and the co-educational classroom?**

The project was formed by the researcher with the thought that students would feel more confident in the classroom where all of the students are of the same gender, and that the student achievement in math would improve when the students are placed in the classroom with only students of the same gender.

Social learning theory was the theoretical framework which guided the study along with developmental theory. People form impressions and make inferences about other people and how they react to other people observing them. As mentioned earlier in this work, this is relevant to the single-gender study as people adjust their behaviors based on what they think the people around them are thinking or how they are behaving (Neill, 2008). This study is quantitative in nature, so the researcher only examines the hard numerical data. If the study was qualitative or used a mixed-methods approach, then the researcher may have recorded observations made by the teachers in regard to what they noticed when it came to students modeling the behaviors of other students in the single-gender classroom. For this project, the researcher believed that the quantitative data would show improvement in both achievement and behavior (discipline), and then it would be implied that social learning theory played a major role in this document improvement.

In order to answer the first question, *To what extent will the single-gender classroom for seventh grade math students make a significant difference in academic achievement?*, the researcher analyzed two years of MCAS results as well pre-tests and post-tests for the 2010-2011
school year for students in both the single-gender and mixed-gender classes. The sixth grade MCAS results were analyzed in order to establish the fact that students involved were homogeneous in nature. Students were all grouped in mixed-gender classes that school year, and the results show that there were no major differences between the student results. The researcher ran an ANOVA for the sixth and seventh grade MCAS results. The seventh grade MCAS results were taken by the students at the conclusion of the seventh grade, which was the year that the intervention had occurred. A p-value of .830 showed no significant statistical difference between the students in the single-gender and mixed-gender classes. The researcher also analyzed the data through the use of post hoc tests which did not show statistical significance when using multiple comparisons. The four groups all had very similar scores. The intervention of the single-gender classroom did not seem to have any effect on achievement in mathematics when using the MCAS as a measure for student achievement.

The researcher used the diagnostic pre-test and post-test for comparison as well. This measure also did not show that the intervention of the single-gender classroom to have an effect on student achievement. The researcher notices some interesting points regarding differences in the student achievement, but they are not relevant to the topic of single-gender. Instead, they are only relevant to the instructors. The students of the male teacher which taught the single-gender boys and one mixed-gender class, scored a higher overall mean on the change in pre-test to post-test. The mean for the single-gender male class was 22.22, and the mean for that teacher’s mixed-gender class was 30.11. These numbers are significantly higher than that of the other teacher. Her single-gender female class scored 13.95, much lower than the all-boys group. Her mixed-gender class scored the lowest, at 8.09, vastly lower than the male teacher’s mixed-gender class. So, we do not see a difference here when it comes to the single-gender classes compared to
their mixed-gender counterparts with the same instructor. A difference here would have shown that the intervention had made a difference in the student achievement if the two single-gender means had been significantly higher than that of their single-gender counterparts. The male teacher’s single-gender class actually scored a difference of about seven points when comparing mean scores from pre-test to post-test. The female teacher’s single-gender girl’s class scored about six points higher when comparing mean scores for the change in pre-test to post-test.

The researcher’s review of literature showed that gains could be made in math achievement for students in single-gender classrooms to some degree. McCord’s point that research shows that girls tend to lose math ability around middle school for some unknown reason, but if they are specifically targeted and encouraged that loss of math ability could be addressed, effecting achievement, made a lot of sense. McCord believes that the boys are often more vocal and overbearing in the classroom, giving the girls less opportunities to participate, was grounded in research and the idea of segregating students by gender for math at the middle school level seem like a worthwhile intervention. (McCord, n.d, para. 4)

Dunlap’s (2002) work showed that there was a significant difference in the girls’ perception as how they best learned math. She gave ideas for further study which included the benefit of having the same teacher teach an all-girls mathematics class and also teach a coeducation class in order to eliminate outside factors that could influence the results, which was a recommendation followed in this particular study by this researcher.

Another example from the literature review was Hamilton (1985) where Jamaican high school students in single-gender and co-educational classes were examined regarding achievement and school type, and the boys and girls in the single-sex schools outscored those in coeducational schools (Streitmatter, 1999, p. 40). Of course this is a different type of study, as
The Single-Gender Classroom

this study is looking at co-educational schools vs. single-gender schools, as opposed to single-gender settings with mixed-gender schools.

The second research question, To what extent do students report being more self-confident in a single-gender setting for their mathematics class?, is the question that brought about some interesting conclusions according to the data in this study. All participants took a survey which measured aspiration, anxiety, academic interest/satisfaction, leadership/initiative, and identification vs. alienation. The students that participated were told to respond to the survey statements with only the experience in this school year’s math class in mind. Students had to answer either Never, Seldom, About Half the Time, Very Often, or Always for each of the statements. Certain statements related to each of the categories in no particular order, and the students did not know which category the statement was measuring.

The students in the mixed-gender classes scored lower when it came to aspiration. The researcher believes this is because the students in the single-gender environment may have felt more inspired to put forth effort. Both the single-gender groups scored relatively close to each other when the means were compared (50.82 for the boys group, 51.35 for the girls group), and the two mean scores were somewhat higher than that of the two mixed gender classes (45.25 for the mixed class with the male instructor, 48.95 for the mixed class with the female instructor). Remember, that the students were instructed to answer the questions with only their experience in this year’s math class in mind. Therefore, the single-gender students seemed to have felt that the effort that they put forth made a positive difference in the class. Statements which students responded to for this category included but were not limited to the following; I work hard to be among the best students in my classes, My grades are higher than I expected, I believe my teachers are pleased with the quality of my schoolwork, I refuse to give up on a difficult school
assignment or task, I would welcome the chance to do an extra assignment or to take a makeup test to improve a low grade, I do the very best I can in my schoolwork, I keep trying to do better each day in my schoolwork, I am willing to work long hours outside of class to do well on a difficult assignment. It seems as though the students in the single-gender setting more closely related the effort that they put forth to success in their math class.

Aspiration is related to confidence, and the researcher did believe that students in the single-gender classroom would feel more confident in themselves than students in mixed-gender classes, as they may be more able to focus on tasks-at-hand and minimize outside distractions. This related to the literature review done for this study. In a study by Rowe (1998) where students in grades seven and eight were randomly assigned to either single or mixed-gender math classes, there were not differences in achievement. However, there were significantly higher gains in confidence for the students in the single-gender classes. This was especially the case for females in that particular study. This study also indicated that girls who moved from the single-gender to the co-educational math classes showed a decline in their confidence about their math abilities. This researcher’s study did not include any students that left the single-gender classes for the mixed-gender setting.

The results of the anxiety responses were surprising to the researcher. It would seem going in that if boys were only grouped with other boys, then their anxiety in the math class may be less than if girls were also in the class. Instead, according to the survey, the boys seemed to have a little more anxiety. The single-gender male class scored 33.82 as a mean compared to their mixed-gender counterparts with the same teacher, which scored 28.00. The difference in mean between the all-girls’ class and their mixed-gender counterparts was very close (34.20 vs. 34.59), but the difference between the boys’ class and their mixed-gender counterparts was
almost six points. Statements that measured anxiety included but were not limited to the following: *Statements that some teachers make about my schoolwork hurt my feelings, I feel so nervous about some of my classes that it is hard for me to attend, I become tense and nervous when I am studying, I am upset about so many things that I cannot concentrate on or do my schoolwork, I worry about how well I am doing in my classes.*

According to literature review, the researcher believed that the boys would be more comfortable and less anxious in an all male class. This work cites the NASSPE with the example of Andrew Hunter, a school principal with experience in both co-educational and single-sex education. Hunter stated that he has heard of many young men sharing their interest in poetry, music, arts, drama, and other “non-macho” pursuits, only after experiencing what school is like in a single-gender environment (NASSPE, 2010).

Academic interest and satisfaction was also analyzed as part of the survey. Interestingly enough, the single-gender male class scored a mean of 45.29, which was over ten points higher than the mixed-gender students that had the same teacher. This is significant because of the large margin between the two groups with the same teacher in regard to how they felt about interest in their math class for seventh grade and whether or not they felt satisfied. Realize that the single-gender female class also scored higher than their mixed-gender counterparts, but by a fraction of a point. Some of the statements addressed in order to measure the academic interest and satisfaction of the students included but were not limited to the following: *I enjoy doing schoolwork, I like to study new topics, I enjoy talking to my friends about what we are doing in our classes, I become so interested in school assignments that I lose track of time, I like to participate in games such as solving puzzles, riddles, or trick problems, I look forward to working on each new school assignment, I talk to someone at home almost every day about what*
we are doing in school. Again, it is important for the researcher to reiterate to the reader that the students responded to these statements with only their experience in this year’s particular math course in mind. It is important to remind the reader that the single-gender boys class also showed a higher score over their mixed-gender counterparts when it came to aspiration, so we are seeing a link here in these dimensions of self-concept for boys in the single-gender math class, which seem to show more overall confidence than the students in the mixed-gender class with the same teacher. The single-gender girls’ class also scores higher than their mixed-gender counterparts, but the difference in the mean scores are not significant, as the numbers are much closer. A ten-point mean difference for academic interest, and a five-point mean difference for aspiration, does show some statistical significance when analyzing these dimensions of self-concept.

This pattern continues when examining how the students felt about leadership and initiative. The single-gender boys’ class actually scored the exact same mean for this concept, 45.29. The mixed-gender counterparts scored seven points less than that when looking at mean scores. The single-gender female class and their mixed-gender counterparts both scored a mean in the range of 38, showing no difference at all. Again, we notice a difference between the single-gender boys’ group when comparing them to the mixed class with the same teacher, learning the same lessons, and receiving the same instruction. The boys, when grouped only with boys, are more apt to take on leadership roles. Some of the statements that they responded to for leadership include but were not limited to; I am pleased when a teacher calls on me in class, I like to answer questions in class, Other students seek my advice or help in completing their assignments, I enjoy giving speeches in front of a class or other groups, I like school jobs when I am the leader, I am the first one in class to know the answer to a question, I can persuade
other classmates to go along with my ideas, I can solve problems faster than anyone in class, I like to make suggestions to the teacher about what we might do in class, I am confident that my classmates think my ideas are good. These statements, when answered affirmatively, show that students are confident in the class and are not afraid to take on leadership roles. Students are not afraid to take initiative when it comes to the activities that are taking place in class. Again, we see that the boys’ group especially feels confident when it comes to this dimension of self-concept, significantly more so than the students that are in the mixed-gender class with the same teacher.

The last category focuses on identification versus alienation of students. This represents the extent to which as student feels accepted by the academic community and respected by teachers and peers as opposed to feeling isolated or rejected (Edits online. 2011, p. 5). The mean score of the single-gender boys’ class is once again seven points higher than their mixed-gender counterparts. Again, the single-gender girls’ class and their mixed-gender counterparts are within one point of each other. Statements on the survey for this category measurement include but are not limited to the following; Teachers care about their students, Teachers require homework with enough variety and challenge to make it worthwhile, I have more fun in than out of school, Teachers make schoolwork enjoyable, I respect the teachers I have had, I feel that I belong to and am a part of what is happening in class, It is important to me that my teachers like me, I think that what I study in school is important, Teachers listen to my ideas.

There is a statistically significant difference between boys in the single-gender boys’ class when it comes to dimensions of self-concept. It is important to once again look at the theoretical framework that the researcher is using in this study. Remember that social learning theorists are concerned with how children model behaviors that are viewed in others, such as
cooperation. Lindsey (2005) believes that social learning theory provides for a vast amount of research when it is combined with a symbolic interaction perspective. Cognitive development theory includes a subset called Gender Schema Theory, mentioned earlier in this work. Lindsey (2005) states that there are two types of schemas, in-group and out-group. She explains that the in-group schemas are used by children to process new information, plan activities, and choose roles. It seems as though grouping the boys by gender, although it did not improve their academic achievement, did improve their self-concept in the mathematics classroom, and that developmental theory plays a role in that. Remember the work of William Trapp (2010) from this literature review, who hypothesized that when test scores were compared, the scores of the students who were part of the single-gender class would be higher compared to those of the students in the mixed-gender class. The author did claim that the scores of students exposed to two years of single-gender classes when compared to peers who were only exposed to one year would also indicate higher achievement. He did not see a difference, but did not feel that it was a wasted effort. As this study has shown a difference in self-confidence for boys in the single-gender class over their counterparts, one might wonder if those particular were exposed to three years of junior high school, grades six through eight in a single-gender setting for math, that by the second or third year the boost in self-confidence would eventually bring about a gain in mathematics achievement. Although it wasn’t the case for this study, there could also be gains in confidence for the girls when in a single-gender environment, as Rowe (1988) observed results that did show that the girls in the single-gender environment as well as the boys indicated greater levels of confidence. It would be interesting to see boys and girls at Joseph Case Junior High School grouped in single-gender settings for math over their three year experience at the school to see if in fact they would gain such an increased amount of confidence over time that the
achievement may also improve when analyzing MCAS results as well as difference in pre-test to post-test.

The thinking when developing the second research question about self-concept is grounded in literature such as Salomone (2006) states that a single-gender environment creates an institutional classroom climate which in one particular case allowed for female students to express themselves freely and frequently as well as to develop higher-order thinking skills. Smithers and Robinson (2006) concluded that boys and girls feel more at ease in single-gender classes because they are more able to interact and show interest without worrying about what the other gender thinks.

The third research question, To what extent is there a difference between discipline referrals in the single-gender classroom and the co-educational classroom?, was answered via the analysis of student conduct records which was accessible to the researcher via the school database, X2. The researcher ran a 2/2 Fisher’s exact test for all of the groups involved in the study. The test looks at students with no referrals, versus students with one or more referral. The only way to conduct the comparison properly was look at each teacher and their single-gender group versus their mixed-gender group. There were no statistical difference in the discipline referrals between the groups and their instructor. Neither instructor had statistically significant difference in their referral rate. The reader must keep in mind that this analysis only addresses situations where students received a consequence for misconduct, which would then in turn be recorded in the school’s database. The study does not account for the amount of times that, for example, the female teacher may have had to speak with the all-girls class or the mixed-gender class for excessive talking. In other words, we do not see whether not either teacher had a particularly difficult time with one class or another, because often times teachers will address a
class as a whole, or privately speak to students in the hallway, and this is not recorded in the
database because of the fact that no consequence was given. Furthermore, often time teachers
may verbally warn students or give additional chances, and there is no way to document these
occurrences. The female teacher stated to the researcher that the all-girls class was more easily
distracted by each other, and much more talkative than the mixed-gender class that she had, but
this is a quantitative study that does not allow for such points reported by the teachers.

The researcher hypothesized that without the opposite gender in the classroom, students
would be less apt to “show off” or draw attention to each other to gain the attention of the
opposite gender. This idea was grounded in literature such as Thorne (1993) concluded that
when boys and girls have a choice of companions, they more often separate than integrate.
Thorne believes that separation is related to age and that as children grow older, they separate
more and more by gender because as they get older they are more likely to be seen as potential
romantic partners. Thorne believes that separation makes sense for junior high students, as they
may feel more comfortable with the same gender so that they can focus on the task at hand rather
than worry about social pressures. Recall in the literature review that this researcher mentioned
his own experiences as a teacher in grades six through eight, and with the importance of
cooperative learning in this day and age, after reading the work of Thorne it makes sense that
students will more easily be able to concentrate on tasks-at-hand when paired with students of
the same gender.

Conclusion

After analyzing data for academic achievement, this project does not show that placing
students in single-gender classrooms for mathematics raised student achievement. It made sense
according to research that by grouping students in a single-gender environment, the level of
distraction in the classroom would be minimized, and increase student concentration as well as student confidence, to the point that achievement would be raised. The researcher believed that by putting this program review into effect, students may even become more excited about their math class as it was now something totally unique to them, and that may cause their scores to increase. It made sense to try something different and implement a change to the math program rather than just adding more math learning opportunities, as adding programs was not changing the results.

After analyzing the results of the student survey to measure self-concept, it does seem that boys in a single-gender environment for math are more confident in the areas of leadership and initiative, aspiration, academic interest and support. The analysis showed that the boys may have felt more anxiety, but the numbers were close to those of the mixed-gender students. Also, when looking at the statements, it could be said that they boys were answering the questions in order to show that they cared about their work and what their teachers think to some extent. The boys showed that they felt accepted in their single-gender environment and respected by teachers and peers for their own personal worth as opposed to feeling isolated or rejected by the academic environment (Edits online, 2011, p.3), more so than that of their mixed-gender counterparts with the same instructor. These are main conclusions drawn from the study. The research expected that students in the single-gender class would feel more confident and more apt to be considered leaders and show initiative. It was also expected that the students would feel more accepted and possibly respected by teachers and peers because of the fact that they could fully focus on tasks at hand, without worrying about the opposite gender making comments to or about them, or even just worrying about what those students may or may not be thinking about them. The lack of drama in the class would cause more focus on the material. Having said this, according to the
data described above, this was the case, especially for the all-male class. If the discipline study had been analyzed in a more qualitative fashion, there may have even been evidence provided to possibly show a difference in the maturity and focus of the boys in the all-male class. The researcher uses the data and information at hand to make a point that with a longer time frame in which to study these students in the single-gender environment, it may in fact make sense that students would raise their achievement in math over a period of time.

**Practice Implications**

The study brings about some interesting points which allows for the researcher to offer some implications for practice and future research. The rise of self-confidence may over time bring about an increase in student achievement if the students were to have more opportunity to stay in the single-gender environment. This researcher would recommend implementing a similar study to what was tried at Joseph Case Junior High School and expand the study to three years for these students. The research should be designed to continue in to high school when the students return to the mixed-gender setting. It would be interesting to note whether or not those students that had experienced the single-gender education for the three years of middle school proved to be more mature, better behaved, or more focused compared to their classmates that had experienced three years of mixed-gender education during their middle school years.

Such as study should again look at discipline issues as well, but should be addressed in a different manner. For example, there needs to be a way to measure the observations of the teacher in addition to having to address individual students or classes as a whole about their behavior even when no consequence is implemented. Therefore, and for that reason, it may make sense to conduct a mixed-methods study so to take into account the qualitative aspects of the topic. In this way, the observations of the teacher through notes, interviews, and open-ended
surveys can also be taken into account not only for the discipline aspect of the study, but for the individual or overall student confidence piece as well.

Keeping the above mentioned implication in mind, it would also be beneficial for the teachers to receive training in how boys and girls learn differently, and then plan lessons and strategies with this information in mind. This literature review for this study speaks to the biological differences between males and females that are cognitive and important in the decision to group students by gender for academic study. Although research does not find significant overall intelligence differences between males and females, studies to show that each gender may show gains over the other when it comes to specific abilities. The literature review notes how there are fundamental differences in how male and female brains are organized. The anatomical differences in the brains of both genders need to be taken into consideration when planning instructional strategies for single-gender classes. It does seem that simply grouping the students by gender may not be enough, but that the specified gender-driven instruction could play a role that would improve student achievement for children participating in a single-gender setting for mathematics. For this particular study in this particular school environment, it did seem to the researcher that the gains made in confidence alone would be enough to see a positive difference in student achievement for math. Although some gains in confidence were apparent as expected, it was not enough to see a rise in overall achievement without the specific gender-driven instruction. This instruction would have to come from teacher that received training which would be based on research. In order to get teachers to partake in such training, a researcher would have to find an organization that would offer the instruction to educators and provide professional development points toward recertification. Possibly a district that has an interest in such a topic would be willing to compensate the teacher or teachers that participate in the
training in order to offer incentive for teachers to participate. Without some type of training, it would be difficult for a teacher to offer valid, gender-driven instruction to a classroom of single-gender students; however, it would be what is necessary in order to analyze whether or not single-gender instruction in mathematics at the middle school level could raise student achievement in mathematics.

The sample of the students is also something to take into consideration. By increasing the sample size, it may be easier to see whether or not academic gains have been made. In a larger school with a high population, you may be able to group more students in a single-gender setting by increasing the amount of classes being offered. If this researcher had been able to group four classes of single-gender students and compare them to mixed-gender classes, it would be easier to see whether or not gains may have been made in academic achievement.

**Future Research Implications**

It is recommended, based on this study, for someone interested in this topic for a dissertation or other professional study to conduct a mixed-methods approach where the observations of the teachers play a role not only for disciplinary data, but also for confidence and achievement. Also, it is important to reiterate the idea that the study should be done over the student’s entire junior high/middle school experience, with student achievement being analyzed again after the freshman year of high school. Furthermore, the teachers should receive some type of training in how males and females learn differently, and then develop instructional strategies and lesson plans specific those differences.
Conclusion

This research evolved because as a school administrator, the researcher was looking to implement a program review in order to meet a need. The goal was to study single-gender education and examine its effects on seventh grade math students with the hope of seeing a positive difference in the declining mathematics achievement in the school at the current time. It was the problem of the declining math achievement that brought about the idea. Several programs had been added at the school with the goal of improving student achievement in math to no avail. Therefore, based on academic research, the idea that student confidence would be raised based on a single-gender environment in math, resulting in an increase in achievement, did make sense. After conducting the study, the research still believes that this approach could positively impact the achievement in math for seventh graders at the school. However, it must be approached in a different fashion, which would involve professional development for the teachers involved. It would also have to be organized in such a way that students would be emerged in a single-gender math class for the entire junior high school experience, with the results being monitored and assessed frequently. It will be important to include more methods of assessments rather than just MCAS scores and pre-test/post-test results.

Moving forward, even with this particular study completed for the purpose of the researcher’s doctoral thesis, he would like to continue to research single-gender education for middle school students and implement such a program at the school that will bring about positive change to math achievement at the school. In the coming years, we will see changes to standardized math assessment for students in Massachusetts, but that will not change the need for this implementation and improvement to happen, it will only change the standardized assessment tool that is used. The results of the study in regard to rise in self-confidence brings confidence to
the researcher that suburban middle school students can benefit from this single-gender instruction in mathematics, if the program is implemented properly over time using the proper professional development and data analysis.
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Dear Parent/Guardian:

I am tremendously excited to tell you about something new and innovative that will be occurring in some seventh grade mathematics classrooms at Joseph Case Junior High School during the 2010-2011 school year. As the Assistant Principal of Joseph Case Junior High School, as well as a candidate enrolled in the Ed.D. program at Northeastern University, I am looking to implement a new intervention in regard to improving mathematics achievement as well as confidence in the mathematics classroom. I have spent countless hours studying existing research on single-gender classrooms. Given the results of the research, it seems that by grouping heterogeneous students in grade seven by gender, we will see an improvement in student achievement as well as self-efficacy when it comes to math for our students.

Your child has been randomly selected to take part in this opportunity. Two classes of seventh graders will meet for math class in a single-gender setting this upcoming school year. The curriculum itself, the standards to be covered, as well as the instructional strategies used to teach the content, have not changed and will not differ from the co-educational math classes that will also be taught. Also, the class size will not be affected in any way. Your child will learn in the single-gender setting for math class only, taking the rest of his/her classes in the traditional co-educational atmosphere.

As you know, part of the reason that this strategy should prove to be beneficial is in regard to the stage of life that these students are in. Middle school-aged students are going through major emotional and physical changes. For many of these students, their social lives are becoming just as important, if not more important, than their academic achievement. This is probably the case for seventh grade students especially, as they range in age from twelve to thirteen years old. It is with this in mind that we hope that all of the students will be more focused on the instruction being provided by the teacher rather than any social distractions which would be more prevalent in a mixed-gender class.

I hope that you and your child are as excited about this opportunity as our seventh grade math teachers and I am. Please contact me by July 24, 2010 if you have any questions or concerns regarding this intervention to improve student performance and self-esteem in the classroom. As the parent, you do have the right to opt out of this educational intervention. If you chose to opt out, please fill out the attached form and mail it to Joseph Case Junior High School, 195 Main Street, Swansea, MA. Also, I can be reached via email at wwhalen@swanseaschools.org, or you may call the Main Office at 508-675-0116.

Sincerely,

William V. Whalen III
Assistant Principal
☐ Please check this box if you chose not to have your child included in a single-gender math class.

Student Name: _______________________

_______________________________

Parent Signature: _______________________

_______________________________

If you choose to opt out, please mail this form back to:

Joseph Case Junior High School
195 Main Street
Swansea, MA 02777
Attn: Mr. William Whalen
Certificate of Completion

The NIH Office of Human Subjects Research certifies that William Whalen completed the computer-based training course for NIH IRB members.

Date: 08/21/2009

Certification Number: 1250921541
Please take the following survey keeping only your experience in this year’s math class in mind. Please take your time with each question. Please answer every question the best that you can, even if you do not think that it pertains to this year’s math class.

Again, it is very important that you answer the questions with only your experience in THIS YEAR’S MATH CLASS in mind.

Instructions for the first page:

Do not put your name on the survey. Where it asks for your name, write either SINGLE if you are in the single-gender math class, or MIXED if you are in the co-educational math class.

Fill in the seven for #2.
Fill in the correct gender for #3. This is very important!
Fill in June 11 for the date.
For #5 write CJHS on the line.

Skip school location code.

Once again, please take your time, and answer the questions only with regard to this year’s experience in your math class.
# TO THE STUDENT

This survey contains statements on **attitudes, feelings, and opinions** about school-related matters. There are five possible responses to each statement:

<table>
<thead>
<tr>
<th>NEVER</th>
<th>SOMETIMES</th>
<th>ABOUT HALF THE TIME</th>
<th>ALMOST ALWAYS</th>
<th>ALWAYS</th>
</tr>
</thead>
</table>

For each statement select ONE response. Choose the ONE response that best describes your **attitudes, feelings, or opinions**. There are no right or wrong responses.

1. I work hard to be among the best students in my classes
   - NEVER
   - SOMETIMES
   - ABOUT HALF THE TIME
   - ALMOST ALWAYS
   - ALWAYS

2. Statements that some teachers make about my schoolwork hurt my feelings
   - NEVER
   - SOMETIMES
   - ABOUT HALF THE TIME
   - ALMOST ALWAYS
   - ALWAYS

3. I enjoy doing schoolwork
   - NEVER
   - SOMETIMES
   - ABOUT HALF THE TIME
   - ALMOST ALWAYS
   - ALWAYS

4. I am pleased when a teacher calls on me in class
   - NEVER
   - SOMETIMES
   - ABOUT HALF THE TIME
   - ALMOST ALWAYS
   - ALWAYS

5. Teachers care about their students
   - NEVER
   - SOMETIMES
   - ABOUT HALF THE TIME
   - ALMOST ALWAYS
   - ALWAYS

6. My grades are higher than I have expected
   - NEVER
   - SOMETIMES
   - ABOUT HALF THE TIME
   - ALMOST ALWAYS
   - ALWAYS

7. I feel so nervous about some of my classes that it is hard for me to attend
   - NEVER
   - SOMETIMES
   - ABOUT HALF THE TIME
   - ALMOST ALWAYS
   - ALWAYS

8. I like to study new topics
   - NEVER
   - SOMETIMES
   - ABOUT HALF THE TIME
   - ALMOST ALWAYS
   - ALWAYS

9. I like to answer questions in class
   - NEVER
   - SOMETIMES
   - ABOUT HALF THE TIME
   - ALMOST ALWAYS
   - ALWAYS

10. Teachers require homework with enough variety and challenge to make it worthwhile
    - NEVER
    - SOMETIMES
    - ABOUT HALF THE TIME
    - ALMOST ALWAYS
    - ALWAYS

11. I believe my teachers are pleased with the quality of my schoolwork
    - NEVER
    - SOMETIMES
    - ABOUT HALF THE TIME
    - ALMOST ALWAYS
    - ALWAYS

12. I become tense and nervous when I am studying
    - NEVER
    - SOMETIMES
    - ABOUT HALF THE TIME
    - ALMOST ALWAYS
    - ALWAYS

13. I enjoy talking to my friends about what we are doing in our classes
    - NEVER
    - SOMETIMES
    - ABOUT HALF THE TIME
    - ALMOST ALWAYS
    - ALWAYS

14. Other students seek my advice or help in completing their assignments
    - NEVER
    - SOMETIMES
    - ABOUT HALF THE TIME
    - ALMOST ALWAYS
    - ALWAYS

15. Teachers explain carefully and clearly what they expect in their assignments
    - NEVER
    - SOMETIMES
    - ABOUT HALF THE TIME
    - ALMOST ALWAYS
    - ALWAYS

16. I refuse to give up on a difficult school assignment or task
    - NEVER
    - SOMETIMES
    - ABOUT HALF THE TIME
    - ALMOST ALWAYS
    - ALWAYS

17. I am upset about so many things that I cannot concentrate on or do my schoolwork
    - NEVER
    - SOMETIMES
    - ABOUT HALF THE TIME
    - ALMOST ALWAYS
    - ALWAYS

18. I like to use the library to do reference work and special assignments
    - NEVER
    - SOMETIMES
    - ABOUT HALF THE TIME
    - ALMOST ALWAYS
    - ALWAYS

19. I enjoy giving talks or speeches in front of a class or other groups
    - NEVER
    - SOMETIMES
    - ABOUT HALF THE TIME
    - ALMOST ALWAYS
    - ALWAYS

20. I have more fun in school than out of school
    - NEVER
    - SOMETIMES
    - ABOUT HALF THE TIME
    - ALMOST ALWAYS
    - ALWAYS
| 21. I would welcome the chance to do an extra assignment or to take a makeup test to improve a low grade | NEVER | Seldom | About Half | Very Often | Always |
| 22. I worry about how well I am doing in my classes | | | | | |
| 23. I like to do non-assigned reading outside of class | | | | | |
| 24. I like school jobs when I am the leader | | | | | |
| 25. Teachers make schoolwork enjoyable | | | | | |
| 26. I do the very best I can in my schoolwork | | | | | |
| 27. I am afraid to ask teachers to explain a difficult concept a second or third time | | | | | |
| 28. I become so interested in school assignments that I lose track of time | | | | | |
| 29. I am the first one in class to know the answer to a question | | | | | |
| 30. Teachers give sufficient time for class discussion and student questions | | | | | |
| 31. I keep trying to do better each day in my schoolwork | | | | | |
| 32. I avoid talking to my classmates about schoolwork because they might make fun of me | | | | | |
| 33. Some of my classes are so interesting that I do much more work than is required | | | | | |
| 34. I serve as the leader in many group projects and group activities | | | | | |
| 35. I respect the teachers I have had | | | | | |
| 36. I would gladly stay after school to get the extra help I need in order to complete a difficult assignment successfully | | | | | |
| 37. I become frightened when a teacher calls on me in class | | | | | |
| 38. I like to participate in games such as solving puzzles, riddles, or trick problems | | | | | |
| 39. I can persuade other classmates to go along with my ideas | | | | | |
| 40. I feel that I belong to and am a part of what is happening in class | | | | | |
| 41. I try to do my best in school so that I will be prepared to go to college or get a good job | | | | | |
| 42. Talking in front of class makes me feel nervous | | | | | |
| 43. Whenever the opportunity is given, I like the freedom of choosing which books to read | | | | | |
| 44. I do my school assignments without receiving help | | | | | |
| 45. The tests that teachers give help me see how much and how well I have learned | | | | | |
The Single-Gender Classroom 101

46. I want to attend college

47. I feel upset when I have to take a test

48. I look forward to working on each new school assignment

49. I am one of the fastest readers in my classes

50. Teachers appreciate my efforts or class contributions

51. I am willing to work long hours outside of class to do well on a difficult assignment

52. I am afraid to tell a teacher that he or she made a mistake in explaining an assignment or in working a problem

53. I can do well on my schoolwork when I do it by myself

54. I can solve problems faster than anyone else in class

55. It is important to me that my teachers like me

56. I work hard to earn the highest grades possible

57. I have trouble sleeping well the night before an important examination

58. I enjoy trying to discover shortcuts in doing schoolwork or in solving assigned problems

59. I receive higher grades than anyone else in my classes

60. I think that what I study in school is important

61. I check and recheck my assignments and answers to test questions to make certain I have made no careless mistakes

62. I am embarrassed to face my friends or family if I have made a low grade on a test or assignment

63. I am pleased when teachers let me do school assignments in my own way

64. I like to make suggestions to the teacher about what we might do in class

65. Most school rules are fair and reasonable

66. If given the chance I would like to do extra schoolwork for extra credit

67. I worry that my score on a test will not be one of the highest in class

68. I talk to someone at home almost every day about what we are doing in school

69. I am confident that my classmates think my ideas are good

70. Teachers listen to my ideas