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Effects of Single-Gender and Coeducational Learning Environments on Middle School Mathematics Achievement

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COLLEGE OF EDUCATION

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2015

Abstract

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MA, Bowie State University, 2001

BS, University of Maryland Eastern Shore, 1996

Doctoral Study Submitted in Partial Fulfillment

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Abstract

As a result of the increased number of schools failing to meet adequate yearly progress (AYP), school districts are searching for innovative ways to raise student achievement and meet the rigorous performance standards set by state governments. Using the theoretical framework provided by brain research and the theory of multiple intelligences, the purpose of this quantitative study was to compare 2 middle school classroom structures for differences in mathematics achievement among students. The study examined whether a significant difference existed in mathematics achievement scores on the state-mandated mathematics test for 2 groups (single gender classes versus coeducational classes) in 6 middle schools during a 3-year period. Mean scores from the Palmetto Assessment of State Standards (PASS) performance statistics in mathematics were used to determine achievement levels of single-gender and coeducational instruction. Study results indicated a statistically significant difference in academic performance for students in single-gender mathematics classes compared with academic performance for students in coeducational mathematics classes. Further, girls outperformed boys. These findings led to a project consisting of implementing a professional learning community and a series of professional development sessions for Algebra I teachers. The results of this study may contribute to social change by identifying an academic program structure in which all students can be supported academically while providing teachers with ongoing opportunities to collaborate and build their capacities with the goal of improving student performance.

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Dedication

This study is dedicated to my aunt, Dr. Connie S. Ross. Although you are not here to witness this chapter of my life, your determination, dedication, and perseverance paved the way for me to accomplish this task. I also dedicate this study to my parents, Robert and Bonnie Graves. Without your constant encouragement, words of wisdom, love, support, and prayers, I wouldn't have been able to accomplish this monumental task. I thank you for being the best parents one could ask for and for always being there for me. Words cannot express how much I love you and appreciate all that you have done to shape me into the person I am.

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Introduction

The No Child Left Behind Act (NCLB) of 2001 mandates that school districts increase their standards of accountability and provide all students with opportunities to be successful in college and/or in the workforce. Through this legislation, school and student performances are measured based on the outcomes of content-specific assessments (U.S. Department of Education, 2004). Each year, school districts are required to administer high-stakes assessments to ascertain the levels of growth students have accomplished during the academic school year. If the school district fails to demonstrate improvement, it may face decreased state funding (U.S. Department of Education, 2006). Consequently, if a specific school fails to meet the established state accountability standards for adequate yearly progress (AYP), parents may opt to relocate their children to a different school within the district (U.S. Department of Education, 2006). The emphasis on high-stakes testing has led to increased school accountability nationwide. As a result of the NCLB legislation, school districts are allowed to use federal funding to create and implement innovative academic programs to assist in accomplishing the established educational goals determined by the state (National Association for Single Sex Public Education (NASSPE), 2008). By allowing school leaders to have a voice in academic planning and increasing school autonomy, they are provided with more opportunities to focus on academic programs based on student needs rather than only complying with external demands (Honig, 2009).

In the current era of school accountability and reform, educators must search for strategies to improve student achievement and performance (Belgrave, 2010). Research has shown some nationwide school districts are determined to resolve academic, attendance, and behavioral issues by replacing traditional coeducational classrooms with single-gender classrooms (Bradley, 2009; Cable & Spradlin, 2008; McFarland, Benson, & McFarland, 2011; Weil, 2008). Therefore, single-gender classrooms and schools are being implemented at an accelerated pace (Spielhagen, 2008). These classrooms support government mandates, cultural and technological forces, and increased academic demands (Weil, 2008). Single-gender classrooms use gender-specific instructional strategies that support learning styles for girls and boys. The theory that boys and girls learn differently is supported by research findings on single-gender classrooms.

Historically, Title IX of the U.S. Education Amendments of 1972 forbade gender discrimination in federally assisted educational programs and activities. Conversely, if a local educational agency (LEA) chose to provide a single-gender school, the school is required to provide boys and girls with comparable educational experiences. Consequently, schools that insisted on providing students with single-gender learning experiences fell prey to conflicts between educators and policy makers with regard to equity, ideology, stereotypical attitudes, and resources (Sutton, 2009). In 2006, single-gender education began proliferating, with amendments to Title IX by the U.S. Department of Education, which provided public school districts with the flexibility to implement single-gender classes in a nondiscriminatory manner with funding from the federal government (McLane, Colby, Yudof, & Bradshaw, 2006). Accordingly, public

schools throughout the nation have begun to implement single-gender instructional programs to improve academic outcomes (McNeil, 2008). Schools that elect to offer their students single-gender classes differ greatly in their motivation to provide different learning experiences which, in conjunction with positive school and classroom environments, are more likely to achieve variable outcomes for students (Datnow & Hubbard, 2008).

Research conducted in the last two decades has recognized the many differences between boy and girl brains. Gurian (2001) and Sax (2010) found male brains and female brains begin to develop differently early in utero. In the male's brain, the left hemisphere is more developed than the right hemisphere. In addition, the male brain has more white matter than grey matter, whereas the female brain has more grey matter than white matter. Sax found significant differences in the way girls and boys listen, process information, and show their emotions. Because of these differences, research suggests gender-specific instructional methods might have a greater effect on the academic achievement of students enrolled in single-gender classrooms. Corso (1959) and Sax found girls hear two to four times more than boys hear. Because of this hearing difference, boys are more likely to demonstrate off-task behavior in classrooms where the teacher is soft spoken. Gurian, Stevens, and Daniels (2009) found boys tend to use deductive reasoning skills, whereas girls tend to use inductive reasoning.

Research conducted by Gurian et al. (2009) and Powell and Kusuma-Powell (2007) found boy brains have more cortical areas that are specialized to spatial and mechanical functioning than girls. As a result of their increased spatial ability, boys tend

to flourish in geometry, mechanical design, navigation, and other subjects. In addition, the researchers found boys often earn higher scores on multiple-choice exams than girls do (Gurian et al., 2009; Powell & Kusuma-Powell, 2007). Boys also tend to use abstract reasoning skills more effectively than girls, which may explain why boys often excel in mathematics learning (Gurian et al., 2009). In contrast, Gurian et al. and Powell and Kusuma-Powell found girl brains have a greater cortical emphasis on verbal and emotional processing. Accordingly, girls tend to use a broader vocabulary and think more verbally. Owing to their increased verbal ability, girls tend to earn higher scores on essay exams than boys Gurian et al., 2009). Girls are more sensitive to negative feedback from adults than boys (Gurian et al., 2009). Girls generalize negative feedback, whereas boys, who are generally less concerned with pleasing others, apply the feedback only to the particular situation (Gurian et al., 2009).

Sax (2010) identified three benefits of single-gender classrooms for girls: (a) opportunities to explore nontraditional subjects; (b) teaching methodologies and approaches tailored to their unique needs; and (c) creating environments that promote self-confidence and self-esteem. Conversely, Sax identified two benefits of single-gender classrooms for boys: (a) opportunities to take risks without fear of embarrassment; and (b) creating learning environments tailored to their unique learning needs. However, opponents suggest that because boys learn differently from girls, they should not always learn in separate classrooms.

The single-gender initiative was established by the U.S. Department of Education to provide students with opportunities to spend more time focusing on academics instead

of social issues and to provide safe and comfortable classroom environments where girls can develop confidence and flourish in the areas of mathematics, science, and technology (Spielhagen, 2008; Ahmad, Jelas, & Ali, 2011). Research conducted by Burman, Bitan, and Booth (2008); Sax (2010); and Tyre (2008) suggested that due to brain differences, girls and boys learn, organize, and process information differently; therefore, students experienced greater academic success when teachers used differentiated instruction. For example, boys have a preference for competitive learning, whereas girls favor cooperative learning. Spielhagen and Sax asserted that gender differences have also been observed in how students communicate and express their ideas. For example, girls express their ideas using the auditory learning process, whereas boys express their ideas using the visual learning process (Gardner, 2011).

Sax (2010) posited boys and girls have innate differences and those differences should be acknowledged and used for their educational benefits. In a single-gender classroom, teachers can personalize and individualize instructional activities and lessons that best support boy and girl learning preferences. By tailoring instructional practices to meet the needs of a specific gender, students are provided with more opportunities to experience academic success. Ultimately, this teaching and learning paradigm will segue into closing the gender gap between boys and girls (Boykin & Noguera, 2011; Duncan & Schmidt, 2009; Sax, 2010; Schott Foundation, 2010; and Noguera, 2008, 2012).

Despite the increased presence and significance of offering single-gender classes and schools, many voices exist on both sides of this nontraditional approach to education. Those in support of separating boys and girls during instructional time contend it limits

distractions, enhances learning experiences, elevates achievement, and boosts confidence (Duncan & Schmidt, 2009; Hughes, 2006). However, those in opposition believe male students are given increased opportunities and resources to raise their academic achievement levels, whereas female students are given less attention and fewer resources (Outlaw, 2009). Conversely, research conducted by Gollick and Chinn (2009) and Noguera (2008) posited single-gender classes and schools focus on developing student confidence, academic achievement, and leadership skills of both genders by using students' unique learning styles and cultural differences. In looking at the data, research has indicated positive, negative, and mixed results for single-gender classes and schools (Ahmad, Jelas, & Ali, 2011; Bigler & Signorella, 2011; Cable & Spradlin, 2008; Datnow & Hubbard, 2008; Dwarte, 2014; Feniger, 2010; Fergus & Noguera, 2010; Hasan, Murat, & Sabo, 2012; and McFarland, Benson, & McFarland, 2011). More specifically, findings have shown limitations and differences in high-stakes assessment scores of boys and girls; however, these differences are not significant until high school (U.S. Department of Education, 2006; Elam, 2009). The purpose of this quantitative study is to determine whether the single-gender classroom model has a positive effect on student achievement in mathematics in the state under study.

Definition of the Problem

Poor academic performance in mathematics is a problem among the middle schools I am investigating. As a result of the poor academic performance in mathematics, these students are held back a year and failing the mathematics state assessment needed to determine whether the school makes AYP goals. More important, the assessment

results are used to determine the students' mastery of the mathematics curriculum. In a report published by the U.S. Department of Education, Riley (1997) proposed the gateway for future academic success relies primarily on the secondary advanced mathematics curriculum and success in algebra served as the gatekeeper for advanced classes in mathematics and science. Student success in mathematics is mandatory to prepare them for subsequent mathematics courses and to comply with the state mandate that all students graduate ready for college and/or a career.

Rationale

Evidence of the Problem at the Local Level

The rationale for this study resonates from my desire and interest to identify nontraditional educational programs, more specifically single-gender instruction, to promote academic success for all students. Research conducted by Fergus and Noguera (2010); Finkel (2010); Gordon, Iwamoto, Ward, Potts, and Boyd (2009); Kirp (2010); Noguera (2008); and the Schott Foundation (2010) reveals exclusive academic and social quandaries experienced by boys, which include low scholastic performance, disproportionate suspensions and expulsions, low attendance rates, avoidance of academic engagement, motivation and competition, and low graduation rates. Further, the NCLB mandates that all school districts must demonstrate increased accountability and academic success in the content areas of English, reading, and mathematics by 2014.

Evidence of the Problem From the Professional Literature

In response to the increased numbers of schools failing to meet AYP, school districts are searching for innovative ways to raise student achievement and meet the

rigorous performance standards set by states. Single-gender education is an instructional strategy that offers students a conducive and supportive environment for learning, which has revealed positive gains in core content areas in most schools (NASSPE, 2008). By using the single-gender approach, students may be provided with an instructional environment that is differentiated and supports their various developmental levels while accommodating the learning preferences of boys and girls. This nontraditional approach will result in a higher level of student learning and engagement, which will promote student achievement (Bradley, 2009). Conversely, research conducted by Spielhagen (2008) posited, "Separating the genders can create more comfortable classrooms, in which both genders are willing to take risks, speak up, contribute answers, express uncertainties, and ask questions" (p. 51). In accordance with NCLB, I use this to understand if single-gender classes can improve academic performance among boys and girls.

Definitions

To provide a better understanding of coeducational and single-gender education, I have defined the following terms.

Adequate yearly progress (*AYP*) is the state's accountability measure to track individual student achievement toward a goal of mastering 100% of the state academic standards in reading and math.

At-risk students are students who have been identified as those who have difficulty relating learning to future education and career aspirations and are classified as

unmotivated, unfocused, unsuccessful, and of low socioeconomic status (McWorter, 2007).

Coeducational (traditional) classrooms are heterogeneous classroom environments in which students from both genders are given instruction at the same time (Protheroe, 2009).

Gender is the biological makeup (boy or girl) of an individual person (Sax, 2010).

Intelligence is a biopsychological potential to process information in certain ways to process and solve problems or fashion products that are valued in a culture or community (Gardner & Moran, 2006).

Palmetto Assessment of State Standards (*PASS*) is a standards-based assessment that is given to students in Grades 3 through 8, which is used to measure student achievement in English language arts, mathematics, science, social studies, and writing.

Performance standards are expectations for students to achieve satisfactory levels on standardized tests. For this study, the following performance standards will be used: exemplary, met, and not met.

School reform is academic restructuring of a school that addresses rigor, achievement, and curriculum while meeting the diverse and unique needs of the schools targeted student population (Noguera, 2008).

Single-gender classrooms are homogeneous classroom environments in which students of one gender (all boys or all girls) are educated simultaneously (NASSPE, 2008).

Significance

For decades, educators have been searching for methods to address the underachievement of boys and girls in mathematics, science, and reading. Research contends there are several physiological and anatomical differences between the boy and girl brain and based on these differences boys and girls process information, listen, read, and experience emotions in different ways (Duncan & Schmidt, 2009; Gurian, Stevens, & Daniels, 2009; Sax, 2010; Weil, 2008). Research conducted by Ferrara (2009), Finkel (2010), Noguera (2012), and the Schott Foundation (2010) revealed that academically, boys are falling behind in their studies at disturbing rates and to address the complexities of their underachievement schools must provide boys and girls with learning experiences that are tailored to meet their specific needs and learning styles.

In an effort to address the rigorous accountability standards set forth by the NCLB, it is imperative that educators search for strategies to improve student achievement and performance. A viable solution to address the gap in student achievement is single-gender educational programs. Duncan and Schmidt (2009) asserted:

> Gender is hard-wired, but there are no hard-wired differences in the ability to learn. Though the areas of learning develop at different times for males and females, they will eventually reach the same place. That is why gender-specific teaching strategies will help to work towards closing the achievement gap between the sexes, thus enhancing their learning experience and increasing test scores. (p. 24)

Similarly, Sousa (2006) asserted boys and girls organize and process information differently, which transfers to the various learning modalities that are exhibited in the classroom environment. The significance of this study is to determine if the single-gender classroom model has a positive effect and improves student performance on the PASS mathematics assessment in the state under study. By providing the appropriate teaching strategies and instructional programs that address the needs of every student based on brain and gender differences, all students will be afforded increased opportunities for academic success, confidence, motivation, and self-esteem (Duncan & Schmidt, 2009; Emdin, 2012; Harjes, 2010; Schott Foundation, 2010). For example, Gardner (2011) contended that all students have "jagged cognitive profiles" and further explained that some students are good in math, average in reading, and poor in other academic areas (e.g., science and social studies). Concentrating on the unique learning needs of each gender, students are more likely to experience the academic curriculum as meaningful, personalized, and relevant.

Guiding/Research Questions

This study will examine the academic performance and outcomes of middle-school students enrolled in single-gender mathematics classrooms compared with the academic performance and outcomes of middle-school students enrolled in coeducational mathematics classrooms. The following research questions compose the foundation of this study:

1. Is there a significant difference between type of class and mathematics performance score as measured by the PASS?

2. Is there a significant difference between gender and mathematics performance score as measured by the PASS?
3. Is there a significant difference between grade level and mathematics performance score as measured by the PASS?
4. Is there a significant difference between school year and mathematics performance score as measured by the PASS?

Review of the Literature

Information gathered in this subsection was obtained from reviewing books and academic journals on girl and boy learning styles and preferences, middle school, single-gender, coeducation, student achievement, teaching strategies and mathematics instruction. The resources were obtained by accessing multiple online research databases through the Walden University Library such as Academic Search Complete, ProQuest, Education Research Complete, Educational Resources Information Center (ERIC), Google Scholar, and SAGE Premier. The literature analysis provided the framework to develop a review of single-gender and coeducational instructional methods and its impact on student achievement.

In response to the higher accountability standards placed on schools due to the NCLB legislation, schools have been permitted to offer single-gender schools and classes as a way of improving academic performance and outcomes for all students (U.S. Department of Education, 2006). Single-gender schools and classrooms are not intended to replace current teaching strategies and pedagogies but they can be a catalyst for

engaging students by altering learning experiences, classroom structures and teacher/student dynamics while addressing specific learning styles.

A literature gap exists in the few studies involving single-gender instruction in public schools in the United States. Most of the research governing single-gender instruction in the United States occurs in private and parochial schools. Most of the studies involving single-gender instruction have involved school systems in other developed countries.

Theoretical Framework

The theoretical framework for this study of single-gender education is embedded in brain research and the theory of multiple intelligences. The justification for applying this specific theory to this study was based on the premise that boy and girl brains develop differently beginning shortly after conception (Gurian, Stevens, & King, 2008). Due to their brain differences, boys and girls code and organize their thoughts and information differently, which manifests in different learning modalities exhibited in the educational environment (Sousa, 2006).

Brain research conducted by Sax (2005), Gurian (2009), Levine (2002), and Gardner (2011) supports gender differences and boy and girl physiological distinctions. Sax's educational learning theory centers on innate gender differences in cognitive, emotional, and social development. His research focuses on the development of the human brain, brain chemistry, and boy and girl performance. He supports teaching methodologies that accommodate gender differences in the classroom. Similarly, Gurian posits that learning differences between boys and girls exist as a result of how the brain is

wired. According to Gurian, the androgynous classroom does not support the learning styles of boys, which has a negative impact on their academic performance. Conversely, Levine's theory of neurodevelopment suggests that neuro dysfunctions in cognitive development are responsible for differences in the learning process among boys and girls. He suggested each gender is born with a mixture of strengths and weaknesses, aptitudes, and problems. He supports the need for schools to adjust instruction to accommodate the range of intelligences instead of expecting students to adapt to classroom instruction.

Gardner (2011) suggested human beings have numerous ways of learning and processing information; however, these methods are relatively independent of one another. His theory of multiple intelligences asserts that individuals possess nine or more autonomous intelligences. Individuals draw on these intelligences, individually and corporately, to create products and solve problems that are relevant to the societies in which they reside (Gardner, 2006, 2011). Gardner (2011) contended that intelligence is a combination of inherited potentials and skills that can be developed in unique but diverse ways through relevant experiences. Through the exploration of the nine intelligences, students are able to bridge prior knowledge and current information in order to make real-life connections with learning experiences.

Similarly, Kunjufu (2011) found that students learn in one of four combinations: concrete sequential, abstract sequential, abstract random, and concrete random. The concrete sequential category describes learners who are: hardworking, accurate, factual, consistent, and organized. The abstract sequential category describes learners who are: analytical, objective, logical, and deliberate. The abstract random category describes

learners who are sensitive, idealistic, spontaneous, and flexible. The concrete random category describes learners who are: curious, creative, innovative, and intuitive.

Kunjufu (2011) found that learners possessed either analytical tendencies or global tendencies. Learners who possessed analytic tendencies were: detail oriented, factual, reality based, and emphasized order. Learners who possessed global tendencies were: emotional, embraced risk, creative, and impulsive. The Kunjufu Learning Styles Model recognized three learning styles: Visual Learners, Oral/Auditory Learners, and Tactile/Kinesthetic Learners. Kunjufu recognized visual print learners who were left brain thinkers and visual picture learners who were right brain thinkers. Kunjufu found that oral learners enjoyed hearing themselves talk, while auditory learners enjoyed hearing others speak. Tactile learners enjoyed using their hands to build models, while kinesthetic learners enjoyed moving around. Further, Kunjufu found that left brain thinkers preferred to do one task at a time while right brain thinkers preferred to take on more than one task at a time by accomplishing one step then switching to another task and accomplishing another small step and then altering back and forth. Kunjufu concluded that a significant number of boys were right brain learners. Consequently, he discovered, boys had been receiving instruction appropriate to left brain thinkers.

In order to address the learning needs of all students, teachers must develop and use teaching strategies that focus on the diverse learning styles exhibited in boys and girls. Research conducted by Gouws (2008) and Kazu (2009) suggested that through the use of the intelligence pathways, students are given a viable method of learning that assists them in achieving instructional goals and outcomes based on their specific

learning style, which leads to academic success in the classroom. Accordingly, students are able to have productive learning experiences and gain a better understanding of the curriculum when it is delivered using teaching strategies that concentrate on their dominant intelligence and/or their specific learning style (Kazu, 2009). “When students believe that they can perform a task in a proficient manner, they will become more engaged in the activity, work harder, and sustain high levels of effort” (Zimmerman & Cleary, 2006, p. 52).

When applying the multiple intelligence theory to teaching and learning, educators must individualize and pluralize student learning experiences (Gardner, 2011). According to Gardner, by individualizing student experiences, teachers must ascertain as much as they can about each learner and their dominant intelligence and learning style and present information and assess student mastery in an intelligence-friendly manner. Conversely, by pluralizing student experiences, educators determine what is truly important in the curriculum, based on instructional goals and outcomes and presents the context in a number of ways (e.g., vicarious experiences, enactive mastery, risk-taking, problem solving, and verbal persuasion) addressing the relevant intelligences (Gardner, 2011). By incorporating these two techniques into the teaching and learning process teachers’ provide students with learning experiences that build, facilitate, and encourage the use of their intelligences. Similarly, research conducted by Ozdemir, Guneysu, & Tekkaya (2006) posits, the theory of multiple intelligences makes its greatest impact on education by encouraging teachers to increase their repertoire of teaching tools, pedagogies and strategies, breaking free from the traditional linguistic and logical

approaches and functions not only as a specific remedy to one-sidedness in teaching–it complements existing educational pedagogy and develops innovative teaching strategies.

By incorporating the theory of multiple intelligences into teaching strategies based on gender differences, educators may be able to address a broader range of students with varying learning strengths and weaknesses by using teaching methodologies focused on specific intelligences and the learning styles of their students (Gardner, 2011; Sulaiman, Hassan & Yi, 2011; Kazu, 2009).

Historical Influences in Single-Gender Education

Historically, parochial and private schools in the United States have consistently provided students with educational opportunities to attend gender-specific schools without interference from educational legislation governing public education. While, in the public school setting curriculum has been influenced by societal and educational regulations and expectations. Although single-gender education in the United States has origins dating back to the 1700s, its educational objectives and purpose was very specific. Boys were educated in reading and writing to prepare them for grammar school and classical studies; while girls were educated to live up to their societal roles and their curriculum consisted of introductory reading and writing and "*Ladies Courses*" such as sewing and practical skills necessary for domestic life (Friend, 2007).

Toward the end of the 1700s, single-gender versus coeducational classrooms became a heated, public debate, which resulted in an education reform movement. Over the course of the 1800s and 1900s, schools began to implement coeducational classes, which provided girls with opportunities to take advanced mathematics and science

courses and attend college (Spielhagen, 2008). However, boys were favored in availability and quality of facilities and participation in programs, and extra-curricular activities. Although girls were educated in the same schoolhouses and classrooms as boys they were not provided with equal opportunities in academics or extra-curricular activities (Cohen, 2000). By close of the 1900s, rhetoric about the effectiveness of single-gender classes brought about conflicting opinions as to whether boys or girls academically benefited by participating in single-gender education. Accordingly, single-gender education became practically obsolete in the United States and educational researchers began to express concern in regards to boy achievement (Spielhagen, 2008; Tyack & Hansot, 1992).

In 1972, Title IX of the Elementary and Secondary Act (ESEA) mandated schools receiving federal funds had to provide all students with equal access to educational programs and activities. As a result, of this Amendment there was a decline in the number of single-gender schools in both the private and public educational sectors (Salomone, 2003). In addition, numerous lawsuits were filed against public school districts with unfair educational practices (Friend, 2007). However, in 1975, Title IX made a provision to allow school districts to offer single-gender schools and classes as needed to overcome discrimination (U.S. Department of Education, 2006a). Consequently, in the early 1990s evidence surfaced that suggested public schools were failing girls in issues of fairness and equality of learning opportunities, most specifically, in science and mathematics.

In 2002, President George W. Bush signed the NCLB Act of 2001, which reauthorized the Elementary and Secondary Act of 1965. The ultimate goal of the NCLB Act was to ensure that public schools are held accountable for the academic achievement of every student. The NCLB Act is a standards-based education reform, which is based on the principle that setting high standards and establishing measurable and attainable goals can improve student achievement and performance (Boykin & Noguera, 2011; Donnor & Shockley, 2010; U.S. Department of Education, 2004). In contrast to the 1965 ESEA, the reauthorization under the NCLB Act requires schools receiving Title I financial assistance to use standardized assessments in basic skills (e.g., mathematics, science, and reading or language arts) to ensure all students are receiving equitable education. These standardized assessments are administered to students, in Grades 3 through 8, annually at their respective schools in order for the school to receive federal funding (Boykin & Noguera, 2011). Upon completion of the assessments, test scores are disaggregated by race and other specific subgroups (e.g., English for speakers of other languages (ESOL), Special Education, those receiving free and reduced-price lunch) to allow school districts and stakeholders to identify academic success as well as deficiencies. In addition, teacher effectiveness and instructional capacity are measured by the students' performance on the standardized assessments and is a determinate as to whether the schools have met the states' targeted educational goals and objectives. Whereas each state determines their achievement levels, the NCLB Act mandates that a percentage of students, both aggregate and subgroups, must pass the standardized assessments in each school district.

Schools receiving Title I funding must make AYP in assessment performance. In order to meet the AYP mandates, states must demonstrate compliance in the following areas: (1) the same high standard of academic achievement applied to elementary and secondary students; (2) tests are statistically valid and reliable; (3) standardized assessments result in continuous and substantial academic improvement for all students; (4) progress for public elementary and secondary schools, and LEAs, is based on academic assessment; and (5) separate measurable annual objectives for continuous and substantial improvement are included for: (a) economically disadvantaged students, (b) students from major racial and ethnic groups, (c) students with disabilities, and (d) students with limited English proficiency (Public Law 107–110, Title I, Part A, Subpart 1).

Subsequently, the NCLB Act identifies practices and corrective procedures schools and teachers are to use to raise student achievement. For example, teacher pedagogy emphasizes curriculum coverage and pacing over culturally responsive teaching strategies (Donnor & Shockley, 2010). If a school consecutively performs poorly and fails to meet AYP targets, the following steps are taken to improve the school:

1. After two years, the school is publicly labeled as being in need of improvement and is required to develop a two year improvement plan for the content area(s) not meeting the state assessment requirement. Additionally, parents are given the option to transfer their children to a school within the district that has met AYP.
2. After three years, the school is required to offer free supplemental education services to struggling students.

3. After four years, the school is labeled in corrective action, which may require the replacement of all staff, implementation of new curriculum, or increasing instructional time in academic courses.

4. After five years, the State Dept. of Education develops a plan to restructure the school (e.g., closing the school, turning the school into a charter school, or the State Department of Education will operate the school). However, the plan is only implemented if the school fails to meet AYP targets six years in a row (U.S. Department of Education, 2004).

As a result of the NCLB Act, schools are held more accountable for students' academic achievement and "school districts have more freedom to implement innovations and allocate resources, thereby giving local people a greater opportunity to affect decisions regarding school programs" (U.S. Department of Education, 2004, p. 5). By increasing the standards placed on schools and by implementing a recommended curriculum underserved students will be able to have the same educational attainment and knowledge as those usually defined as academically successful.

In October 2006, under the Bush administration, legislation was passed that eased the previously mentioned standards set forth by Title IX, which protects against gender discrimination (Office for Civil Rights, 2006; U.S. Department of Education, 2006). Under this legislation, public and private schools were granted permission to legally offer single-gender educational experiences and activities to boys and girls separately. The NASSPE posits, since the introduction of the new regulations, single-gender schools and classrooms are increasing as districts are implementing more effective strategies to

address the educational, social, and psychological challenges facing boys and girls (NASSPE, 2008).

The Brain and Gender Differences

For the last couple of decades, extensive research has been conducted on boy and girl brains. Research suggested that boy and girl brains develop at different times and through multiple stages beginning at conception (Gurian & Ballew, 2003; Sousa, 2006). In a study conducted to identify boy and girl brain differences in the development of the human fetus, researchers have found midway through pregnancy, testosterone levels in boys increase during certain periods to levels equivalent to those of a young man (Sax, 2005). Boy and girl brain differences continue and remain evident after birth. Research conducted by Gardner (2006), Gurian, Stevens, and King (2008), Sax (2010) and Sousa (2006) has shown that boys and girls have developmental, chemical, hormonal, and functional differences that manifest into diverging developmental paths. Based on these gender-specific differences, boys and girls exhibit different learning styles and behavior in their respective learning environments. Gurian and Ballew (2003) and Sax (2005) believed biological and structural differences during the development of the brain resulted in genetic, neurological, and endocrinological differences among boys and girls.

In a project study conducted at Virginia Tech, researchers studied the brain activity of 508 children, boys and girls, ranging from two months to sixteen years of age. The results of the study indicated that girl brains develop in a different sequence in the areas of language, spatial memory and motor coordination (Powell & Kusuma-Powell, 2007). Sax (2005) supported Powell and Kusuma-Powell's assertions and posited "that

while the areas of the brain involved in language and fine motor skills mature about six years earlier in girls than in boys, the areas of the brain involved in targeting and spatial memory mature about four years earlier in boys than in girls" (p. 93).

Structural Differences

Boys and girls learn and demonstrate variances in their behavior due to brain wiring differences. Gurian et al. (2008) proposed several structural differences in the way the brain develops for boys and girls. They contended that the hippocampus, which is needed for the retention of information, was larger in girls than in boys contributing to faster neural transmissions in boys but increased emotional memory for girls. Gurian et al. asserted the limbic system, which connects to the prefrontal cortex that controls emotional and sensory emotions, performed a vital role in the learning process and it was more active in girls than boys. However, the cerebellum, which controls the coordination of muscles and thinking, was larger in boy brains. Gurian et al. (2008) also found that the corpus callosum, which connects the left and right brain hemispheres, was denser in girls but larger in boys resulting in increased cross talk between the hemispheres for girls. The cerebral cortex, the location where intellectual functions of the brain takes place, has more neuron connections and matures earlier in the girl brain. Likewise, they found that blood flow was 20% greater in the girl brain, which coupled with the increased neural connections, allow girls to process information quicker than boys (Gurian et al., 2008). Additionally, Gurian et al. (2008) suggests the amygdala, which is central in the processing of emotions, is larger in boys "explaining the male tendency to be aggressive" (p. 7).

Processing and Communication Differences

According to Spielhagen (2008) and Gurian et al., (2008), differences in gender have also been recognized in the various tendencies in how boys and girls process and communicate information. They found each hemisphere of the brain is responsible for specific behaviors; as a result, boys rely on the right hemisphere for solving abstract problems whereas girls rely on the left hemisphere for decision-making. The left hemisphere processes information sequentially and analytically, interprets language verbally, ensures meanings are universal, and uses deductive reasoning (Sax, 2010; Gurian et al., 2008; Speilhagen, 2008). On the other hand, the right hemisphere processes information abstractly and holistically, and interprets language nonverbally; meanings are contextual and use inductive reasoning (Sax, 2010, Gurian et al., 2008 and Speilhagen, 2008). Gurian et al., posited language processing for boys was centralized in the left hemisphere whereas girls have multiple language processing areas in both hemispheres. Spielhagen asserted girls express themselves verbally while boys use graphic representations to express themselves. Boys have increased spatial resources in their right hemisphere; however, girls tend to process more sensory data and take in more tactile information (Gurian et al., 2008).

Hormonal Differences

Hormone levels fluctuate among boys and girls, which result in contrasting effects. Girls are dominated by estrogen and progesterone whereas boys are dominated by testosterone (Jensen, 2005; Gurian et al., 2008). Jensen (2005) and Gurian et al. argued hormonal variations influence learning abilities. For example, when estrogen levels are

elevated, during the menstrual cycle, girls tend to perform and score higher on standardized and teacher-made assessments. However, if testosterone levels are elevated, boys will perform significantly better on spatial exams but worse on verbal assessments (Gurian et al., 2008). Consequently, lower levels of testosterone assist boys in completing everyday tasks. Jensen (2005) also believed that hormonal variations were the root cause of mood swings in girls and aggression in boys.

Gender Differences in the Mathematics Learning Environment

Kyriakides and Antonio (2009) found that gender differences in the learning environment have been the subject of numerous research studies. Some researchers support that the traditional approach to teaching where the classroom teacher lectures while the students take notes is no longer effective with either boys or girls (Gurian, Stevens, & Daniels, 2009). At the other end of the spectrum, are the researchers who suggest that boys and girls learn in the same way (Kindlon, 2000). However, Geist and King (2008) found that "boys and girls are different . . . one is not better than the other; they are just different" (p. 44). For example, traditional instruction in mathematics classrooms is a great deal of memorization, whereas modern instructional methods use active learning approaches such as cooperative learning, problem-based learning, technology, and demonstration in mathematics. Most people assume that boys are better in math than girls. The debate as to whether a gender gap exists in education is deeply rooted. However, data from the National Association of Education Progress (NAEP) indicated that boys outperform girls by only three points. Four decades ago, though, girls outperformed boys in all grades except for the 12th-grade assessment (Bielinski &

Davison, 2001). Researchers have also found that a positive relationship exists between student achievement in math and confidence. Asi (2002) found the confidence level of girls on math assessments to be less than that of boys.

Despite the relative consistency of both boys and girls in math, there are some strategies that practioners recommend to support math instruction:

- Avoid promoting gender stereotypes
- teach to student's learning styles
- be aware of developmental differences
- develop and adapt problems that have a real-life context or purpose
- allow multiple methods for solving math problems
- encourage students to elaborate on their problem-solving strategies and solutions
- use active learning techniques
- use visual and verbal approaches to instruction
- keep in mind attention levels
- plan activities that promote competition and cooperation
- plan activities that allow students to work in individually and in groups
- use tasks that promote inductive and deductive reasoning
- use rubrics and checklists as instructional devices (Gurian, Stevens, & Daniels, 2009; Hughes, 2006; Picone-Zocchia & Martin-Kniep, 2008 & You, 2010).

With regard to gender stereotypes, practictioners must exercise caution in order to ensure that low expectations for girls' performance in math does not become a "self fulfilling prophesy" (Younger & Warrington, 2007). Societal norms, that recognize mathematics as a masculine subject and that boys must be somehow better in math than girls, have a substantial impact on student achievement in math with regard to motivation, confidence, and teacher expectations. Hall and Hoff (1988) found that "promoting the attitude that girls are not expected to do as well as boys in mathematics can result in girls not doing as well as they might otherwise do". (p. 21). The stereotype threat theory recognizes a positive relationship between negative stereotypes and sub-par peformance on assessments. Stereotype threat theory maintains that the greater the threat, then the greater the effect of gender bias (Hargreaves, Homer, & Swinnerton, 2008).

Patricia Murphy (1996), author of *Equity in the Classroom*, wrote that girls listen and show respect when others speak; come to class prepared; and complete their assignments at a quicker pace than boys. Murphy wrote that boys prepare less than girls; interrupt each other; and compete for the teacher's attention. Many scholars are perplexed by these differences in classroom behaviors. Scholars have attributed these behaviors to brain-based learning differences between boys and girls (Burman, Bitan, & Booth, 2008; Gurian, Stevens, & Daniels, 2009; Olson, 2010; Sax, 2010; Tyre, 2008).

Gurian (2001) found that gender differences existed in relation to the parts and function of the brain. In the book, *Girls and Boys Learn Differently*, he summarized the differences, similarities, and impact on instruction and student learning in relation to boy and girl brains. The amygdala, basal ganglia, hypothalamus, right hemisphere, pituitary

gland, and testosterone in boys are either in more supply, develop more rapidly, or is larger in boys. These differences assist in making boys more aggressive, able to respond to physical demands quicker, maintain a constant and consistent sex drive and be more self-reliant and competitive. On the other hand, for girls, the arcuate fasciculus, corpus callosum, temporal lobe, estrogen, frontal lobe, cerebellum, thalamus, Werencke's area, cerebrum, Broca's area and the hippocampus have stronger connecting paths, are more active and/or develop more quickly. These innate differences allow girls to learn and use language earlier and more effectively, multi-task, have better memory and be less aggressive, competitive, and self-assertive. As such, girls tend to be left brain dominant while boys tend to be right brain dominant, which enables girls to be superior in communication and fine motor skills and boys to be superior in spatial tasks (Gurian, 2001).

Teaching to students' learning styles also involves teaching to their strengths. Gibb, Fergusson, and Horwood (2008) found that developmentally, boys lag behind girls until late adolescence. In addition, Gibb et al. found that boys tend to work individually and they tend to succeed when and where traditional textbooks are used. They enjoy reaching answers quickly and they focus on getting the correct answer. Girls, on the other hand, tend to work together in groups. They do not emphasize being first, and they tend to look for more than one way to solve problems (Gibb et al., 2008). Research conducted by Geist and King (2008) indicates that boys tend to use manipulatives to solve problems whereas girls tend to use language. They also stated that boys tend to excel at applying mathematical knowledge and girls are better at verbal processing. In addition, Geist and

King (2008) found that boys tend to have difficulty in listening and following instructions. Boys prefer working under pressure and with allowances to move around the classroom, while girls perform better in groups with a lot of encouragement (McNeil, 2008). Boys prefer activities that promote competition, whereas girls prefer activities that promote cooperation (Cleveland, 2011). Boys are relatively more successful in abstract thinking and tasks that require deductive reasoning. However, girls are relatively more successful in tasks that require inductive reasoning and concrete thinking (Geist & King, 2008). Cleveland (2011) supported Geist & King's (2008), Gibb et al's (2008) and McNeil's (2008) theories in regard to learning differences and concurred learning strategies that help boys, differ greatly from those that help girls.

Researchers have found a gender gap in mathematics achievement in some countries. A great deal of research has been devoted to understanding the role of gender and its impact on science, technology, engineering and mathematics (STEM) disciplines. Else-Quest, Hyde, and Linn (2010) asserted gender inequalities exist as a result of the differences in available opportunities in education known as the gender stratification hypothesis. In the United States, the gender gap in academic performance is closing. Else-Quest et al. (2010) described a meta-analysis conducted in 1990 and concluded that the gender gap was most prevalent in high school and that girls slightly outperformed boys. In 2005, researchers concluded that the gender gap in mathematics achievement in the United States has been eliminated (Else-Quest et al., 2010). In addition, Else-Quest et al. (2010) found that the gender similarities hypothesis supports that boys and girls perform similarily on nearly all psychological assessments.

A host of other studies have focused on attitude, affect and perception of mathematics. In the United States, positive attitudes towards mathematics was greater in boys (Else-Quest et al., 2010). The gap in attitudes towards mathematics is at its largest in high school where male students report more self-confidence than female students (Else-Quest et al., 2010). Female students reported they experienced greater anxiety towards mathematics (Else-Quest et al., 2010).

The societal gender stratification hypothesis is that male students view mathematics achievement as a predictor of their future:

> The gender stratification hypothesis proposes that where there is more societal stratification based on gender, and thus more inequality of opportunity, girls will report less positive attitudes and more negative affect and will perform less well on mathematics achievement tests than will their male peers. Yet, where there is greater gender equity, gender similarities in math will be evident. (Else-Quest et al., 2010, p. 108)

Eccles (1994) recognized the expectancy-value model to apply to justify the reason students who are fearful of difficult coursework tend to avoid taking challenging courses. The Eccles Model suggested that students need to value and embrace the challenge as well as have the expectation that they will succeed. Cognitive social learning theory recognizes the role of social norms and their impact on gender–relevant behaviors. The availability of role models and gender stereotypes tend to have a significant influence on students' academic performance. Social structural theory suggests that social

roles influence the division of labor on the basis of gender in one's culture. For example, if girls are expected to maintain the household, then they are less likely to pursue STEM careers (e.g., Software engineer, computer systems analyst, biomedical engineer, medical scientist, . . .).

Single-Gender Learning Environments

Single-gender classrooms are designed to address the academic needs of students based on their gender differences. Single-gender classrooms can be a catalyst for engaging students academically by enhancing learning experiences, creating and implementing gender-specific pedagogies, altering classroom structures, and changing student dynamics (Rex & Chadwell, 2009). Single-gender classrooms provide students with a safe and hassle-free classroom environment in which they can speak and participate freely without fear or intimidation from the opposite sex. Gurian, Stevens, and Daniels (2009) found that single-gender classrooms provided students with a environment conducive to learning in which they were able to concentrate and remain engaged in learning tasks. Similarily, they found teachers experienced fewer discipline concerns and non-academic distractions were minimized in the single-gender classroom (Gurian et al., 2009). Through the implementation of single-gender classes students are challenged to take risks, are able to take responsibility for their learning and are provided with the encouragement to speak up (Younger & Warrington, 2006). Conversely, this approach provides students with positive learning experiences with fewer distractions which promote pride, self-esteem, and self-belief (Gibb et al., 2008).

Riordan (2002) asserted that single-gender schools are "places where students go to learn; not to play, not to hassle teachers and other students, and not primarily to meet their friends and have fun" (p.19). Researchers have found the following benefits to single-gender schools: (a) smaller school/classroom size, (b) gender-specific instruction, (c) increased leadership opportunities, (d) reduction of teacher bias in teacher-student inteactions, (e) reduction of sex stereotypes in peer interactions, (f) greater order and control and (g) relationship building and collaboration amongst teachers, parents and students (Gurian, Stevens, & King, 2010; Gurian et al., 2009; Kunjufu, 2011; Protherone, 2009; Rex & Chadwell, 2009; Riordan, 2002; Speilhagen, 2008; Tyre, 2008).

Rex and Chadwell (2009) concurred with the benefits of single-gender instruction and contended successful implementation of single-gender instruction involves several factors. However, they indicated the three most challenging factors were:

1. training teachers to understand the importance of gender and its influence on student learning,
2. communicating with parents during and throughout the implementation phase in order for them to make informed decisions and
3. using and analyzing data, in multiple formats, to determine the effectiveness and need for single-gender instruction.

Although research conducted by Gurian, Stevens, and Daniel (2009), Sax (2005) and Speilhagen (2008) maintains that each gender has specific needs, all students whether boy or girl are unique individuals. Therefore it is imperative to develop and implement pedagogical approaches that support the achievement of boys and girls through frequent

monitoring, observations, and assessments. According to Gurian, the "ultimate classroom can be a place where bonds run deep, conflicts are resolved, no child is left behind, gender biases are noted, and teachers are trained to move beyond hidden prejudice against either boys or girls" (p. 198). Single-gender classrooms paired with gender-specific teaching strategies can assist boys and girls in overcoming obstacles that cause the achievement gap.

Single-Gender Versus Coeducational Education

Several studies have been conducted to determine which method of instruction – single-gender or coeducational education is the most effective way to increase student achievement in boys and girls. However, there are a limited number of studies that have been conducted in the United States.

McFarland, Benson, and McFarland (2011) examined achievement scores of boys and girls in single-gender and coeducational classrooms. The study concluded girls in single-gender classrooms scored higher than boys in single-gender and coeducational classrooms. Boys in single-gender classrooms had higher mathematics achievement than boys in the coeducational classroom.

Younger and Warrington (2002) conducted a case study of a comprehensive coeducational high school where most classes were single-gender. The study revealed that both boys and girls achieved higher scores on the General Certificate of Secondary Education (GCSE) than the national average and girls consistently outperformed boys.

Mulholland, Hansen, and Kaminski (2004) conducted a study in Australia to measure the academic performance of boys. The results of the study yielded a significant

increase in boy performance in single-gender settings in English but not in mathematics performance when compared to boys in coeducational classes. Girl performance was greater than boys in single-gender classes.

Gibb, Fergusson, and Horwood (2008) conducted a study to examine the effects of single-gender and coeducational schooling on the educational achievement gap. The study concluded there were significant differences between single-gender and coeducational schools. In coeducational schools, girls consistently outperformed boys. Single-gender, boys outperformed girls on two of five comparisons and girls outperformed boys in the remaining three. Single-gender schools mitigate disadvantages for boys in educational achievement.

Hoffman, Badgett, and Parker (2008) conducted a two year mixed methods study to evaluate single-gender instruction and its effectiveness in regards to student achievement, instructional practices, teacher efficacy, student behaviors, and classroom culture in an at risk school. The study supported the notion that achievement results associated with single-gender were inconsistent and coeducation was superior. Year 1, single-gender instruction was more effective for algebra. Year 2, coeducational instruction was more effective for algebra and English. Based on the results of the study, the researcher's concluded coeducation was most beneficial for students.

Feniger (2010) conducted a study to compare advanced mathematics and science courses of students enrolled in religious single-gender schools to students enrolled in religious and secular coeducational schools in Israel. The results of the study yielded little effect on single-gender and coeducational class settings for boys and girls.

Cherney and Campbell (2011) measured achievement, intrinsic motivation, self-esteem and math performance for students who attended single-gender and coeducational schools. The single-gender advantage did not hold amongst boys. Students enrolled in single-gender schools performed better in mathematics than students in coeducational schools. However, within coeducational schools, girls performed better than boys.

Ahmad, Jelas, and Ali (2011) conducted a study to examine the learning styles and strategies of 15-year-old students and the relationship between academic achievement and school type (single-gender and coeducation). Student performance data were studied for six years in four core subjects – Malay, English, Mathematics and Science. The analysis revealed consistent under-achievement of boys compared to girls. Performance of boys in the single-gender school lagged boys in the coeducational school. The study further revealed girls continue to outperform boys and coeducational schools are more effective than single-gender schools.

Dwarte (2014) conducted a study to determine the impact of single-gender instruction on reading achievement for African American students. The findings of the study revealed mixed support for single-gender instruction for boys. However, the findings significantly favored single-gender instruction for girls.

In general, research has not shown any evidence to refute whether one educational strategy is better over the other. In 2005, The U.S. Department of Education commissioned a comprehensive study on public, single-gender schools in the United States. The purpose of the study was to determine if single-gender schools improved student achievement. According to the results of the study,

> "The findings are equivocal. There is some support for the premise that single-sex schooling can be helpful, especially for certain outcomes related to academic achievement and more positive academic aspirations… There is no evidence of either benefit or harm. There is limited support for the view that single-sex schooling may be harmful or that coeducational schooling is more beneficial for students" (U.S. Department of Education, 2005, p. 10).

Implications

Several existing studies have posited the significance of using gender-inclusive teaching strategies in the single-gender learning environment to make the classroom relevant for students (Herr & Arms, 2004; Hughes, 2006; Younger & Warrington, 2002). This project study will investigate the gender gap in mathematics achievement among students enrolled in single-gender and coeducational learning environments. The results of this study may have a significant impact on the instructional methodologies and pedagogies provided to boys and girls in school districts across the United States.

The NCLB (2001) has increased accountability and educational standards while providing school districts with opportunities to offer all students the opportunity to participate in single-gender instruction. If educators are to make any inroads in improving and closing the achievement gap between boys and girls, consideration must be given to their respective learning environments. Noguera (2012) asserted that student attributes such as gender, cultural background, socioeconomic class, race, and language fluency have a compelling influence on learning. Taking these attributes into consideration, LEAs, educators, and educational advocates need to discover ways to meet the diverse

needs of all students through differentiated instructional experiences. Single-gender instruction is an instructional methodology in which teachers can customize instruction to accommodate the various learning modalities present in their classrooms. Educators must rise to the challenge of providing rigorous and quality instruction to all students while recognizing their individual and cultural differences. By placing boys and girls in the right educational setting, students may be better provided with the academic resources, and support needed to increase their overall achievement. It is imperative that extensive research be conducted to determine the benefits of providing single-gender instruction to students. In order to close the gender gap in mathematics achievement and provide all students with equal educational opportunities, instructional decisions must be centered around data and empirical research instead of unproven strategies and theories. These data may provide an impetus to develop either single-gender mathematics classes, or possibly a staff development project to teach groups of mathematics teachers about single-gender instruction. The specific form the project will take must wait until the data are gathered and analyzed.

Summary

Based on the literature gathered in this study, research suggests there are biological differences between boys and girls, which affects how they process information and learn. Boy and girl brains develop at different rates during the various stages of development. Neither gender is superior or inferior over the other; however, to address their genetic, neurological and endocrinological differences teachers must tailor instructional practices to support these differences. For example, boys rely on the right

hemisphere of their brain, which supports inductive reasoning. Whereas, girls rely on the left hemisphere of their brain which supports deductive reasoning. Yet, research indicated that classrooms are geared to the left brained thinker. Single-gender instruction is an instructional strategy that can be used to address these differences and promote academic success for all. Single-gender classrooms allow teachers to focus and address the specific learning styles of each gender while providing students with a learning environment conducive and supportive to learning. Separating students by gender may well increase student performance by allowing teachers to personalize instructional lessons and activities based on how each gender processes, internalizes, and organizes information. Lessons developed in the coeducational classroom may address various learning styles and are not gender-specific.

The implementation of the NCLB (2001) holds school districts to higher accountability standards in regards to the academic achievement of their students. As educators, if we want students to be academically successful we must create and implement instructional pedagogies that support the learning modalities of all students in environments that are conducive to their gender-specific learning needs. Single-gender instruction is a viable option to assist educators in preparing boys and girls to be academically successful.

In Section 2, I will describe the design of the study, setting, the population to be sampled, instruments that will be used to gather study data, methodology that will be used to interpret the data, assumptions and limitations of the study and confidentiality measures.

Section 2: The Methodology

Introduction

Limited research is available in the public education sector that examines whether single-gender educational environments are academically beneficial for students in mathematics. The purpose of this section is to (a) describe the research design and approach of the study, (b) describe the study population and the instruments used to collect the data, (c) identify and describe the data analysis process, and (d) describe the assumptions and limitations of the study.

The purpose of this quantitative study was to assess whether academic differences existed between six sections of single-gender mathematics classes and six sections of traditional coeducational classes in mathematics based on school performance metrics. Specifically, the school performance metric consisted of comparing seventh and eighth-grade standardized assessment scores on the PASS in mathematics for students enrolled in single-gender and traditional coeducational mathematics classes. This metric was compared for three academic years: 2008–2009, 2009–2010, and 2010–2011. The achievement data measured by the PASS was used in the calculation of absolute ratings, growth ratings, and AYP for elementary and middle schools in the same state. The findings from this study were used to determine which instructional strategy was most beneficial for student achievement in mathematics amongst seventh and eighth-grade middle-school students. The following research questions compose the foundation of this study. Each research question is presented with its null and alternative hypothesis:

1. Is there a significant difference between type of class and mathematics performance score as measured by the PASS?
    - Ha_1: There is a significant difference between type of class and mathematics performance score as measured by the PASS.
    - Ho_1: There is not a significant difference between type of class and mathematics performance score as measured by the PASS.
2. Is there a significant difference between gender and mathematics performance score as measured by the PASS?
    - Ha_2: There is a significant difference between gender and mathematics performance score as measured by the PASS.
    - Ho_2: There is not a significant difference between gender and mathematics performance score as measured by the PASS.
3. Is there a significant difference between grade level and mathematics performance score as measured by the PASS?
    - Ha_3: There is a significant difference between grade level and mathematics performance score as measured by the PASS.
    - Ho_3: There is not a significant difference between grade level and mathematics performance score as measured by the PASS.
4. Is there a significant difference between school year and mathematics performance score as measured by the PASS?
    - Ha_4: There is a significant difference between school year and mathematics performance score as measured by the PASS.

- H_{O4}: There is not a significant difference between school year and mathematics performance score as measured by the PASS.

Research Design and Approach

The focus of this project study was to determine whether academic differences existed between single-gender and coeducational mathematics classes. Therefore, the goal of this project study was to determine whether a statistically significant difference exists between single-gender and coeducational instructional approaches to teaching and learning mathematics. The quantitative methodology method was used to complete this study and analyze the data. According to Creswell (2008), quantitative research is a form of educational research in which quantifiable data is collected from participants; the numerical data is then analyzed statistically; thus, the inquiry is conducted in an unbiased and objective manner. Quantitative research often ensures objectivity, generalizability, validity, and reliability (Lodico, Spaulding, & Voegtle, 2010). Using the quantitative research method allowed me to conduct a secondary, systematic scientific investigation by analyzing testing data obtained from student performance on the PASS assessment in mathematics for three school years for both seventh and eighth grades. Using the quantitative approach, I was able to identify trends or to ascertain relationships among variables (Lodico, Spaulding, & Voegtle, 2010).

I selected the causal-comparative design. I used this research design to better understand the cause and effect relationship between the variables. The findings of the study allow me to determine whether a relationship existed between variables. Owing to

the design of the study, participants were not randomly assigned to the control and treatment groups; hence, I did not have complete control over the variables of interest.

Appropriateness of Design

Causal-comparative research is used for studies in which the researcher has identified two or more groups that have had different experiences, and it measures how the experience may have affected the participants. Because the purpose of this study was to compare PASS achievement math scores to determine which instructional format, single-gender or coeducational classes, provided the highest level of achievement, the causal-comparative method was most appropriate for conducting this study.

Setting and Sample

The student sample for this study was composed of boys and girls who attended 12 public middle schools (seventh and eighth grades only), six that offered single-gender instruction in mathematics and six middle schools that used coeducational classes for mathematics instruction. All schools were located in the same state. The PASS was administered for the first time in Spring 2009; therefore, this study compares PASS scores in the area of mathematics for three academic years: 2008–2009, 2009–2010, and 2010–2011. PASS test results for students participating in single-gender instruction classes were compared with the results of students enrolled in coeducational instruction classes.

The PASS academic achievement scores from 12 middle school classes, in the same state, were studied. The population of the study was composed of students located in suburban, urban, and rural schools that offered single-gender and coeducational

instruction, which were similar in student enrollment, student-teacher ratio, socioeconomic status, and ethnicity. Geographically, the schools were located throughout the upper, middle, and lower regions of the state. The sample of middle schools was determined based on the data provided by the Department of Education for the same state and consisted of four suburban middle school classes, four rural middle school classes, and four urban middle school classes.

Instrumentation and Materials

The instrument used to gather mathematics student achievement data for this study was the PASS. With IRB approval (#01-14-14-0133017) from Walden University, I obtained PASS data from the state under investigation. The PASS is a criterion-referenced test and it was first administered Spring 2009 to students in Grades 3 through 8. The PASS is one of the statewide testing programs that has been identified, by the state under study, as its accountability measurement under the NCLB of 2001. It is used to determine if students demonstrate measurable evidence of academic achievement. The PASS assesses students in five areas, four of which are core content areas: English language arts, mathematics, science, social studies, and writing; however, this study only examined mathematics achievement. The test items on the PASS are aligned to the standards for mathematics and the grade level tested. The standards outline what schools are expected to teach and what students are expected to learn. Test items are written to assess the content knowledge and skills described in the academic standards and indicators. The PASS measures student achievement based on three performance bands: exemplary, met, and not met. The cutoff scores for seventh and eighth grade student

performance on the mathematics PASS are provided in Table 1. Students who score at the met level have achieved minimum state performance standards and possess the skills needed to be promoted to the next grade level.

Table 1

Score Requirements for Mathematics PASS by Grade Level

Grade level	Not met	Met	Exemplary
7	300–599	600–651	652–900
8	300–599	600–656	657–900

Student achievement in this study was measured by the mean scores on the PASS assessment in mathematics and the percentage of students scoring met or greater in mathematics. According to the NCLB of 2001, met is the established benchmark of student achievement. PASS scores were obtained and retrieved from the same state, Department of Education archival sources, which was publicly available on the website and considered public domain. PASS scores were compared between grade level, gender, and type of instruction for student performance in mathematics for single-gender and coeducational classroom environments.

The Department of Education, for the state under study has established procedures and protocols for testing and for the validation of the testing instrument. Test coordinators, administrators, and proctors have received specialized training in administering, collecting, and the handling of the assessments. Adhering to the established protocols as it relates to testing procedures or instrumentation can minimize

threats to internal validity and student scores can be considered valid. Validity is verified through an in-depth review of the instrument, and ensuring that the instrument accurately measures the content being tested (Lodico, Spaulding, & Voegtle, 2010).

Lodico, Spaulding, and Voegtle (2010) identified three types of validity: content validity, criterion validity, and construct validity. Content validity examines each item on the assessment to determine if it measures the content taught. The PASS evaluates student mastery of the Mathematical Standards for Algebra I. Criterion validity uses the performance scores to predict future success. The PASS determines readiness for the next sequence course in mathematics. Construct validity determines the usefulness of the scores and their relevance. The scores on the PASS determine student mastery of content. Scores are further broken down into specific categories – met, not met and exemplary.

Data Collection and Analysis

In this project study, the PASS data were used to illustrate the similarities and differences between student achievement in mathematics among students enrolled in single-gender and coeducational classroom models (class type served as the predictive variable of the study). Data were collected based on one criterion variable: seventh-and eighth-grade mathematics PASS scores. Data were collected for three academic years: 2008–2009, 2009–2010, and 2010–2011. PASS scores were mined from aggregated archival data collected and stored in electronic storage warehouses by the state under investigation.

Mathematics student performance data (e.g., PASS performance scores) for this study were retrieved from archival records located on the state under investigation,

Department of Education website. Aggregated mathematics mean scale scores were provided for the PASS mathematics assessment. I used a Microsoft Excel spreadsheet (Mac version) to compile aggregated assessment data, student gender, and grade level in table form for each of the 12 middle schools participating in the study for three academic years: 2008–2009, 2009–2010, and 2010–2011. Analytic triangulation was conducted by two peers to aid in probing the researcher's thinking in order to pursue a deeper analysis of the data. Assessment data from seventh and eighth-grade single-gender and coeducational classes were analyzed for central tendency. Aggregated mean scores and the percentages of students that performed at the levels of exemplary, met, or not met by school have been provided by the state. The chi-square test for independence was the inferential measure used to compare whether single-gender or coeducational instruction had an impact on student achievement, its significance, and to what degree. A 2 x 3 contingency table was created to examine the relationships between the categorical data. Data were analyzed to determine student achievement patterns by gender, class type, grade level, and year. Chi-square is a non-parametric form of analysis, which evaluates the relationship between two categorical variables (Green & Salkind, 2011). It measures whether there is a statistically significant association between the two variables. The goal of a chi-square test is to compare the expected frequencies with observed frequencies (Green & Salkind, 2011). Descriptive statistics were created to compare and contrast student academic patterns by gender, class type, grade level, and year. Individual school names were not linked to the student achievement data in this study. School names were

replaced by numerical codes assigned to each school (e.g., S001, S002, T001, T002, . . .). Coding was used as a way to protect anonymity.

Assumptions, Limitations, Scope and Delimitations

There are several assumptions to be made regarding this investigation of single-gender and coeducational learning environments and student achievement. First, seventh and eighth grade students currently enrolled in single-gender classes were previously enrolled in coeducational classes at some point during their formal education. The effect of the coeducational experience may have had a significant influence on the students' prior knowledge and prevented the student from mastering the prerequisites needed to be successful in the next grade.

Second, it was assumed that the mathematics curricula being taught and implemented in grades seven and eight are aligned with the State Standards in each school under investigation. Building level administrators and teacher coordinators periodically conduct formal and informal observations to ascertain if the teachers' teaching practices are aligned with the mathematics curriculum.

Third, it was assumed that teachers (single-gender and coeducational) are using gender-specific strategies designed to meet students' individual learning needs.

Fourth, it was assumed that the PASS scores collected from the school district's data warehouse were accurate, reliable, and provides a true account of the academic achievement of students.

Last, it was assumed that teacher standards and expectations of the students' academic performance were commensurate between single-gender and coeducational learning environments.

Limitations

All research projects and studies present, at some point, some form of limitations and/or barriers that may have an impact on the study. The following limitations were identified prior to investigating the academic achievement of students enrolled in single-gender and coeducational learning environments: First, based upon student performance data provided by the Department of Education, some middle schools implemented single-gender classes in each core area (English language arts, mathematics, science and social studies). However, this study was limited to the investigation of mathematics achievement. Consequently, the results of the study are only applicable to mathematics.

Second, there was no way to determine and/or identify if the teachers assigned to teach single-gender classes have been provided with ongoing professional development on the best teaching and learning practices to use when teaching specific genders.

Third, the time slot during which mathematics instruction is scheduled could affect academic performance. Student performance on the PASS assessment may have been impacted by the time of day the class was offered and the time at which the PASS was administered to the students.

Fourth, the PASS assessments analyze the percentage of students in each school who scored within three performance bands (exemplary, met, and not met); consequently, individual student performance data were not analyzed.

Fifth, the dataset does not include information on previous achievement.

Last, this project study compares PASS data for only three academic years: 2008–2009, 2009–2010, and 2010–2011. As a result, the long-term effect of single-gender classes cannot be determined based on this study.

Delimitations

The boundaries that limited the generalizability of the findings in this study included: (a) size and sample of the population - the study compared six single-gender and six coeducational schools within the same state; consequently the data is only a reflection of a small student sample in the state under investigation; (b) the time frame of the study–the study compares student data for only three academic school years; accordingly, long-term impact cannot be determined; (c) the research parameters and procedures–the degree to which the findings can be generalized are bound by the implementation of the quantitative research approach and (d) data collection–the study analyzes the percentage of students in each school who scored in each performance band (e.g., met, not met, and exemplary) on the PASS; as a result, individual student data for each year were not analyzed.

Participant Rights

Archival data were used as the source of data for the study. Students were not interviewed or surveyed since secondary archival public domain data were retrieved electronically from the state, Department of Education website. Student names, school names, and the school district were not mentioned in the study. Pseudonyms were used to identify schools and student data were coded to ensure anonymity. The state, Department

of Education was contacted to obtain the state-approved listing of public middle schools, which offered single-gender classes and those, which offered coeducational classes for three academic years: 2008–2009, 2009–2010, and 2010–2011.

All original data (e.g., school name, school district, . . .) were kept at the researcher's residence in a locked and password protected laptop computer, which was housed in a locked and fireproof file cabinet. Student achievement data were archived on an external hard drive and secured in a locked and fireproof file cabinet stored in the researcher's private residence. Student achievement data will be deleted five years after the completion of the study as directed by Walden University.

Data Analysis Results

Research question one, "Is there a significant difference between type of class and mathematics performance score as measured by the PASS?"

- Ha_1: There is a significant difference between type of class and mathematics performance score as measured by the PASS.
- Ho_1: There is not a significant difference between type of class and mathematics performance score as measured by the PASS.

A chi-square test of interdependence was conducted to compare overall middle-school student performance on the mathematics PASS amongst single-gender and coeducational classes. In the single-gender mathematics classes 55% of the students met or exceeded the level of expectations based on school system and state standards. In the coeducational mathematics classes 45% of the students met or exceeded the level of expectations based on school system and state standards. The results of the chi-square

analysis were statistically significant, χ^2 (2, N = 17,860) = 11.40, p < .003. These findings suggest that single-gender instruction was significantly more effective in fostering achievement in mathematics. As a result, the null hypothesis was rejected suggesting that there is enough evidence to conclude that an association exists between type of class and math achievement. Percentages are shown in Figure 1.

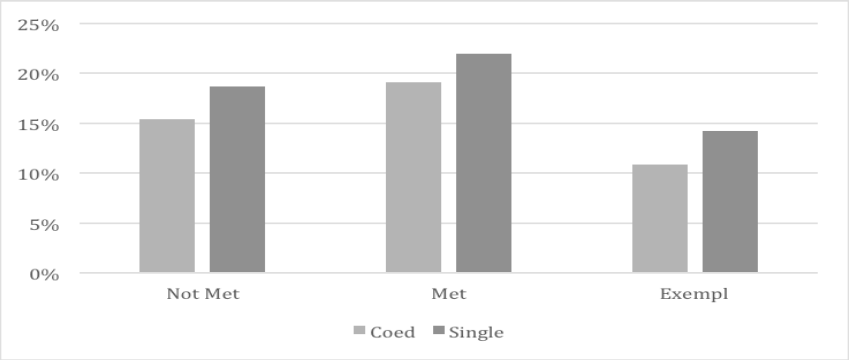

Figure 1. Percentage of single-gender and coeducational class for each PASS proficiency category.

Research question two was, "Is there a significant difference between gender and mathematics performance score as measured by the PASS?"

- Ha_2: There is a significant difference between gender and mathematics performance score as measured by the PASS.
- Ho_2: There is not a significant difference between gender and mathematics performance score as measured by the PASS.

A chi-square test of interdependence was conducted to compare middle-school student performance on the mathematics PASS based on gender amongst single-gender and coeducational classes. Girls outperformed boys by 51% in single-gender and coeducational classes. Girls met the school system and state standards for performance on

the PASS at a rate of 51%. Boys met the school system and state standards for performance on the PASS at a rate of 15%. The results of the chi-square analysis differed by gender χ^2 (2, N = 17,817) = 3.82, p = .15. Accordingly, the null hypothesis could not be rejected suggesting that there is not enough evidence to conclude that a difference exists between gender and math achievement. Percentages are shown in Figure 2.

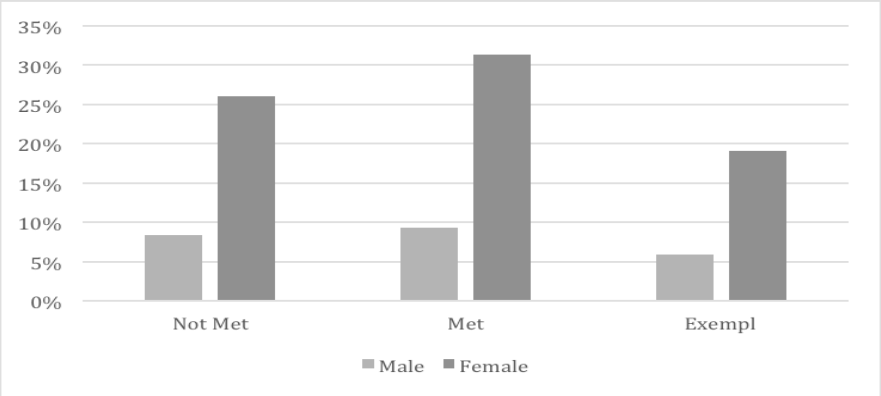

Figure 2. Percentage of boys and girls for each PASS proficiency category.

Regarding research question three, "Is there a significant difference between grade level and mathematics performance score as measured by the PASS?"

- Ha_3: There is a significant difference between grade level and mathematics performance score as measured by the PASS.
- Ho_3: There is not a significant difference between grade level and mathematics performance score as measured by the PASS.

A chi square test of interdependence was conducted to compare middle school mathematics PASS performance amongst seventh and eighth grade students enrolled in single-gender and coeducational classes. Thirty four percent of seventh grade students

met or exceeded the state and school district standards; conversely, 31% of eighth grade students met or exceeded the state and school district standards. The results of the chi-square analysis were significant by grade level χ^2 (2, N = 17,769) = 50.28, p < .001. Therefore the null hypothesis was rejected suggesting that there is enough evidence to conclude that a difference exists between grade levels in math achievement. Percentages are shown in Figure 3.

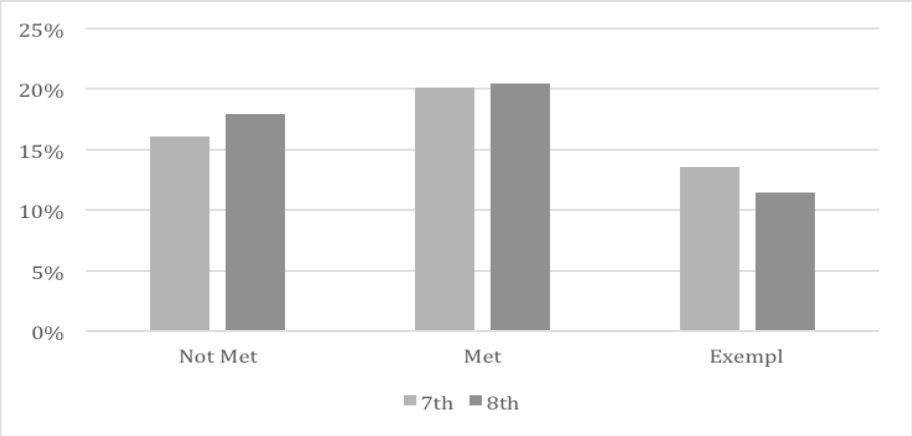

Figure 3. Percentage of seventh and eighth graders for each PASS proficiency category

Regarding research question 4. "Is there a significant difference between school year and mathematics performance score as measured by the PASS?"

- Ha_4: There is a significant difference between school year and mathematics performance score as measured by the PASS.
- Ho_4: There is not a significant difference between school year and mathematics performance score as measured by the PASS.

A chi-square test of interdependence was conducted to compare student performance on the PASS by school year. During academic school years: 2008–2009 and

2009-2010, 21% of the students tested met or exceeded state and school district standards for PASS mathematics performance. In academic school year 2010–2011, 23% of the students tested met or exceeded state and school district standards for PASS mathematics performance. The results of the chi-square analysis were significant by school year χ^2 (2, N = 17,800) = 65.71, p < .001. Therefore the null hypothesis was rejected; suggesting that there is enough evidence to conclude that a relationship exists between school year and mathematics achievement. Percentages are shown in Figure 4.

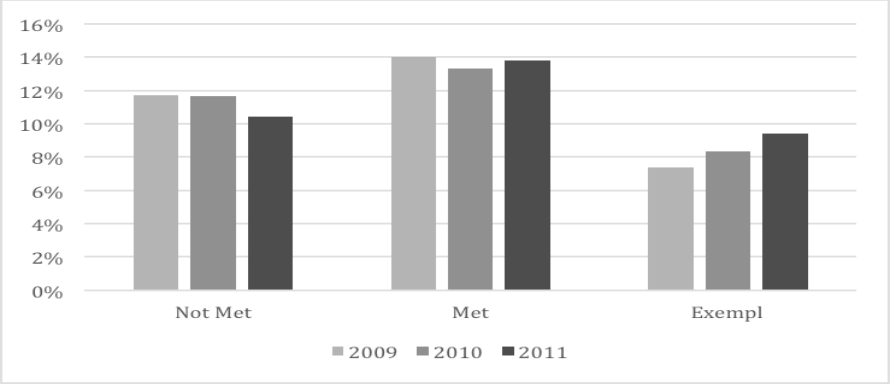

Figure 4. PASS proficiency category by school year.

Conclusion

Section 2 explained the methodology of the study in terms of the research design and approach, setting and sample, data collection, and data analysis. Archival testing data obtained from the PASS was analyzed using the chi-square test of independence to determine whether single-gender or coeducational instruction had an impact on student achievement. The data were analyzed for three academic years: 2008–2009, 2009–2010, and 2010–2011. The data revealed that there is a relationship amongst class type, gender and grade level when comparing single-gender to coeducational instruction. In addition,

this section addressed the measures that were taken to ensure ethical protection of study participants. Section 3 will introduce the project study, review the literature related to the project itself, and discuss the project in relation to the research data.

Section 3: The Project

Introduction

Based on the data analysis, which compared student performance on the PASS in mathematics for single-gender and coeducational instruction, a clear need emerged: developing ongoing professional development by implementing a professional learning community (PLCs) for teachers of middle school single-gender and coeducational mathematics classes. Teacher training on the benefits, components, and instructional practices of an effective PLC may assist in the development of a learning community centered on improving teacher capacity with a focus on academic achievement for seventh- and eighth-grade Algebra I students.

Middle-school students face many influences that affect their academic achievement, which include higher academic standards and expectations, rigorous curriculum and instruction, diverse student populations, and changing teachers and/or instructional settings throughout the school day (Holas & Huston, 2012). In addition, middle-school students must be able to relate to various teachers and their teaching styles instead of the previous elementary model of having one or two teachers. Adding to the mayhem for these young adolescent students is the onset of puberty and the increased interest in the opposite sex. This newfound interest creates competition for the adolescent student's academic focus (National Middle School Association, 2010). Conversely, Holas and Huston (2012) identified three theoretical reasons for a decline in student performance at the middle-school level: first, the mismatch between the developmental needs of adolescents and middle-school classrooms. Adolescents strive for strong and

caring relationships with adults, seek more inclusion in the decision-making processes, and value trust and autonomy from adults (Holas & Huston, 2012, p. 334). Second, middle schools are generally larger than elementary schools owing to the student body being pulled from broader geographic areas, and middle schools tend to be ethnically and economically diverse (Holas & Huston, 2012, p. 334). Last, the introduction to the new school format disrupts routines and social circles. In response to these challenges, educators must develop instructional strategies to motivate and support student learning.

Research suggests boys and girls learn, experience, and behave differently (Sax 2010; Gurian, Stevens, & King, 2010). In recognizing the differences associated with each gender, effective academic strategies should be implemented to provide successful and rich learning experiences for all students. The state-mandated curriculum assumes that all students have successfully mastered course curriculum and content standards for their grade level prior to being promoted to the next grade. This assumption may be accurate for some but does not take into consideration that boys and girls who are the same age differ in their learning styles, experiences, readiness to learn, interests, and life circumstances. These differences often are significant enough to hinder student motivation and academic achievement. The NMSA has identified five key areas of adolescent development that affect academic performance:

1. Cognitive–Intellectual development: curious, make decisions that require cognitive and social emotional skills, able to be motivated, prefers interactions with peers, moves from concrete to abstract thinking, may challenge authority, prefers active over passive learning experiences.

2. Physical development: mature at varying rates, growth spurts, restlessness and fatigue due to hormonal changes, concern with changes in body size and shape, develop sexual awareness, experiment with drugs, alcohol, and high risk sexual behavior.
3. Moral development: idealistic with a strong desire to make the world a better place, self-centered, show compassion, quick to judge others but slow to acknowledge own faults, rely on parental advice when facing major decisions.
4. Psychological development: vulnerable, self-conscious, seek to become increasingly independent, mood swings, sensitive to personal criticism, psychologically resilient, a belief that their personal experiences are unique to themselves.
5. Social–Emotional development: intense need to belong, over concerned with peer acceptance, intense and unpredictable mood swings, socially vulnerable, overreacting to ridicule, embarrassment and rejection, lag behind in mental and physical maturity (pp. 59–60).

The development of mathematical reasoning is an essential goal of education and due to its fundamental purpose for employment and higher education, the NCLB identified mathematics as one of the domains in which all students will be proficient (Ketterlin-Geller, Chard, & Fien, 2008). NCLB legislation accentuates the need to monitor student growth and progress toward meeting proficiency standards. Inconsistencies in mathematics student achievement often manifests in middle school as a result of curricular shifts to algebra when students are required to integrate and extend

previously learned math skills (Ketterlin-Geller, Chard, & Fien, 2008). To have an understanding of algebra students must demonstrate several skills, some related to the specific construct of algebra (e.g., understanding of variables and constants, decomposing and setting up word problems, symbolic manipulation, and understanding functions) and others related to mathematics in general (e.g., inductive reasoning, understanding rational numbers, procedural fluency with computational skills, and advanced problem-solving skills) (Ketterlin-Geller, Chard & Fien, 2008). Many students enter middle school lacking this foundation, which is necessary to build algebraic understanding.

DuFour and Marzano (2011) posited the PLC model might create instructional equity for every student by incorporating teaching strategies focused on common learning expectations with diversified resources and methodologies. By creating and implementing a PLC for teachers who teach single-gender and coeducational middle school mathematics courses teachers will be able to increase professional collaboration, develop specific instruction based on student need and increase ownership of student achievement. Providing opportunities for teachers to actively and collaboratively participate in a PLC directly supports the five criteria for high-quality professional development established by the NCLB:

1. It is sustained, intensive, and content-focused–has a positive and lasting impact on classroom instruction and teacher performance.
2. It is aligned and directly related to state academic content and student achievement standards as well as assessments.
3. It increases and improves teacher capacity.

4. It advances teachers' understanding of effective instructional strategies.
5. It is regularly evaluated for teacher effectiveness and student achievement (Patel, Franco, Miura, & Boyd, 2012).

Current school district data reveals seventh- and eighth-grade students are struggling in mathematics and are unable to pass the mathematics exit assessment, which is needed to obtain a high-school diploma. Seventh- and eighth-grade students take the assessment in the spring of the school year after the completion of Algebra I. The purpose of this project is to create a PLC for teachers working with single-gender and coeducational, seventh and eighth grade Algebra I students to improve teacher pedagogical practices and student performance on the mathematics state assessment. With the increasing demands on educational standards and testing accountability, student learning and performance is becoming increasingly ambitious; however, to meet the demands of education reform and exit requirements for graduation teachers must provide students with academic experiences that support their unique learning styles and needs. Tomlinson, Brimijoin, and Narvaez (2008) assert "throughout the literature of the current school reform movement is a call for teachers to adjust curriculum, materials and support to ensure that every student has equity of access to high-quality learning" (p. 120). Research postulates the work of a PLC can be a catalyst to school improvement by focusing on school collaboration and student achievement and learning while continuously grappling with the questions what, when and how learning should occur (DuFour, DuFour, Eaker, & Many, 2010; Hord & Sommers, 2008; Lalor & Abani, 2014; Lippy & Zamora, 2012; Sigurdardottir, 2010; Stoll & Seashore, 2007).

The Project

The Algebra I PLC project will consist of 10 planned professional development modules; however, if the teachers would like additional information or support, two additional modules will be added. The modules focus on implementing an effective PLC designed to address the attainment of increased levels of student achievement while increasing collaboration amongst teachers. The PLC will consist of seven Algebra I teachers–six of the teachers teach Algebra I to students in the seventh and eighth grade and the other teacher teaches students who have failed the course previously. Three of the seventh and eighth grade teachers teach single-gender classes and the remaining three teachers teach coeducational Algebra I. All of the teachers invited to participate in the PLC teach four or more sections of Algebra I and the class meets every other day on a block schedule. In order to address the immediate need of passing the state mathematics assessment participation in the PLC was limited to Algebra I teachers.

Prospective PLC members will receive a letter (see Appendix A) inviting them to participate in a series of professional development modules aimed at establishing an Algebra I PLC. On receipt of the invitation, participants will respond via email or regular mail if they are interested. Interested participants will be sent an electronic version of a PLC self-assessment (see Appendix A) to complete prior to the start of the modules. The self-assessment will ask questions pertaining to the participant's knowledge, perceptions, and current professional practices as it relates to a PLC. The self-assessment will also be used to determine areas that may require additional resources and/or development. Participants will also receive the agenda–sequence of activities (see Appendix A) for the

PLC modules which will include: (a) goals for student learning, (b) gender-specific learning strategies, (c) lesson development, (d) common assessments, (e) evaluating and analyzing student data and (f) developing appropriate interventions. In addition, participants will be issued the materials (see Appendix A) needed to complete the prework for the first session. All teacher materials needed for the professional development modules will be purchased by the school.

Participants will participate in a 10-week, professional development consisting of 10 PLC modules. The modules will be conducted biweekly for three hours. The focus of the PLC modules will be effective instructional practices that will facilitate improved student achievement in mathematics, more specifically Algebra I. During the sessions the participants will use the collaborative inquiry cycle to guide the work, participate in deep discussions and take an improvement approach to looking at student work and performance. In addition, to the guided modules the participants will participate in weekly collaborative planning sessions with the seventh and eighth grade team. After each professional development module, PLC participants will complete a module evaluation form (see Appendix A) based on their perceptions of the information presented. This evaluation will also allow participants to indicate if additional clarification or training is needed on the topics covered in that particular module. Teachers will complete reflections on current practices and how their new learning can promote student learning and achievement. For example, teachers will make a journal entry titled, "I used to think . . . but now I know . . .". and complete a self-evaluation (see Appendix A), at the conclusion of the last module. This evaluation will provide

participants with the opportunity to respond to questions based on their participation in the Algebra I PLC and provide the project facilitator with suggestions for module refinement.

Several themes are embedded throughout the 10 modules to equip participants with tangible methods for increasing Algebra I student performance. The collegiality, collaboration and the establishment of common lessons and assessments, the sharing of best classroom practices, identifying strategies for analyzing student data, and the development of appropriate interventions will serve as the evidence for promoting the accomplishments of the team. Student gains on common assessments, learning activities, and the state mathematics assessment will demonstrate the effectiveness of the PLC. Teacher success will be measured by increased collaboration amongst team members, instructional practices, and ongoing informal observations. Based on the increased emphasis on meeting state standards and accountability for student achievement educators must foist new expectations for student and teacher learning through the implementation of a PLC. A project consisting of continuous professional development to increase middle school mathematics learning is needed for this study.

Goals

Teaching has become more complex and exigent than ever before due to the pressure to connect everyday learning experiences to state–mandated educational standards and the increasing diversity of students. With the implementation of an Algebra I PLC teachers can work collaboratively to identify learner outcomes, clarify what must be taught, monitor and assess student progress, provide interventions as needed and

extend, refine, and enrich learning experiences when identified outcomes have been mastered. The primary goal of the PLC is to provide teachers with authentic interactions with colleagues which include collaborating, sharing successes and failures, constructively analyzing and critiquing instructional practices and assessing, and monitoring student work to improve student achievement and engagement. The ultimate goal is to ensure that all students demonstrate proficient and advanced levels of achievement on the state performance assessment in mathematics.

Rationale

The rationale for creating the PLC for teachers teaching single-gender and coeducational mathematics classes is to create a learning community in which teachers learn together through a continuous process of collaboration and reflective practices for the purposes of improving day–to–day instruction and student achievement. According to the Standards for Professional Learning, teacher collaboration is effective when it is student-focused (Mizell, Hord, Killion, & Hirsch, 2011). Student–focused collaboration is typically identified by determining learner outcomes, examining student data, analyzing student work, identifying effective instructional strategies, designing instructional lessons, and developing common assessments (Mizell, Hord, Killion, & Hirsch, 2011). Additionally, PLCs foster shared practice, trust, and mutual respect amongst colleagues (Teague & Anfara, 2012). The development of these vital skills could be an important piece in improving student achievement and classroom performance. Theories on how students learn, process, organize, and code information they learn and the teaching and learning strategies used in the classroom to support their learning has

been the core of discussion amongst educational circles (Duncan & Schmidt, 2009; Gurian, Stevens, & Daniels, 2009; Sax, 2010; Sousa, 2006). In order to provide students with increased opportunities for academic success, teachers must give every student what he/she needs before, while and after instruction. Hence, teachers will have to alter their traditional teaching methods and identify the most appropriate learning path for their curriculum that supports the needs of the students present in their classroom. The intent is for every student to learn the same content, master the content standards, and increase academic achievement. By creating a PLC, seventh and eighth grade teachers will have an "undeviating focus on student learning" which is the hallmark of an effective PLC (Wells & Feun, 2013, p. 236).

Review of the Literature

Information gathered in this subsection was obtained from reviewing books and academic journals on professional learning communities, professional development, student achievement, and building teacher capacity. The resources were obtained by accessing multiple online research databases through the Walden University Library such as Academic Search Complete, ProQuest, Education Research Complete, ERIC, Google Scholar, and SAGE Premier. The literature analysis provided the framework to develop a review of increasing student academic performance and teacher capacity through the implementation of a professional learning community.

A plethora of reform agendas have emerged in response to the NCLB requirement to increase student achievement. The most challenging aspects of increasing student achievement for an instructional leader are: teacher expectations, collegial relationships

and teacher capacity (Lippy & Zamora, 2013). Hopkins and Reynolds (2001) and MacBeath and Mortimore (2001) conducted research studies on school effectiveness and found that there are more differences among classes within a school than in other schools when it came to effective classroom instruction. Conversely, the literature speaks considerably on the significance of the teacher and how school effect determines student outcomes, which are channeled through the teacher (Harris & Muijs, 2005; Silins & Mulford, 2004; Sigurdardottir, 2010; Brodie, 2013; Lippy & Zamora, 2013; Leane, 2014). In a study completed by McKinsey (2007) on the world's best-performing school systems it revealed that the teacher is the change agent and the only way to improve student academic outcomes is to improve instruction. Acknowledgement of the effect of schools on student achievement has paved the way for school improvement as an opportunity to make schools a viable place for students to learn. According to Sigurdardottir (2010), "authentic school improvement programs are achievement focused, empowering, research-based, context-specific and capacity- building in nature" (p. 397).

Accelerated educational outcomes for students are being increasingly linked to teacher capacity, as a result there is a need for consistent and ongoing professional development activities to ensure that content knowledge and teaching practices are current within the era of education reform (Owen, 2014). OECD (2011) characterized education reform as organizational and pedagogical restructuring, integration of technological resources, using resources to accommodate the change in curriculum content in innovative contexts including interdisciplinary approaches and focusing on competencies and values. Research has revealed that the key to sustainable school

improvement lies in the ability of the educators within a school to function as a PLC (Bowgren & Sever, 2010; DuFour, DuFour, & Eaker, 2009; Graham & Ferriter, 2010; Katz, Earl, & Jaafar, 2009 and Lunenberg, 2010). The formation of PLCs has been touted by many as an effective strategy for building teacher capacity and skills (DuFour, DuFour, & Eaker, 2008; Owen, 2014; Sigurdardottir, 2010; Wells & Feun, 2013; Hughes-Hassell, Brasfield, & Dupree, 2012; Teague & Anfara, 2012; Brodie, 2013; Lippy & Zamora, 2013).

Professional Learning Communities

Thessin (2015) defines a PLC as "a cohesive group of teachers that engage in a process of working together to deepen expertise on a particular topic and to discuss common challenges thereby exemplifying elements of the learning organization" (p.16). Similarly, DuFour, DuFour, and Eaker (2008) define a PLC as "educators committed to working collaboratively in ongoing processes of collective inquiry and action research in order to achieve better results for the students they serve" (p. 14). PLCs operate from the premise that student learning is driven by ongoing, job-embedded learning for educators (DuFour, DuFour, Eaker, & Many, 2010). PLCs provide teachers with opportunities to work interdependently to identify students' learning needs, make progress to achieve collective goals and common understandings of practices, and improve classroom instruction (Thessin, 2015). PLCs have three foci. The first focus is "ensuring all students learn at high levels" (DuFour, DuFour, & Eaker, 2008, p. 18). Members of a PLC work together to clarify and determine what each student must learn, monitor and assess each student's learning, and provide academic interventions as necessary to assist students in

mastering identified outcomes. The second focus is a "collaborative culture" (DuFour, DuFour, & Eaker, 2008, p. 18). To be efficacious as a PLC schools must support a culture in which educators work interdependently and accept responsibility for student achievement. DuFour, DuFour, and Eaker (2008) asserts that through working in a PLC "educators create an environment that fosters shared understanding, a sense of identity, high-levels of involvement, mutual cooperation, collective responsibility, emotional support, and a strong sense of belonging as they work together to achieve what they cannot accomplish alone" (p. 20). The third focus is "results" (DuFour, DuFour, & Eaker, 2008, p. 18). Teachers must continuously and consistently monitor, evaluate and analyze student learning to guide and gauge continuous improvement.

PLCs provide a pathway to a paradigm shift in schools in which a learning culture is grown and supported. The learning culture is composed of a group of professionals who take an active, reflective, collaborative, learning-oriented and growth-promoting approach toward the perplexities and problems of teaching and learning. In a PLC the primary goal of learning is to "improve staff effectiveness" and ensure all students learn at "high levels" (Hord, 2008, p. 13). In a PLC, learning is "purposeful, collaborative, and continuous" (Hord, 2009, p. 40).

PLCs change the day–to–day teaching norms by shifting "teaching to learning, isolation to collaboration, and intentions to results" (Lippy & Zamora, 2012, p. 52). PLCs according to Senge (2000) change "people's habitual ways of talking and thinking" and require them to interact using a mature but professional approach to teaching and learning (p. 76). PLCs permit educators to directly impact student achievement through

continuous collaboration and reflection on teaching and pedagogical practices, data analysis and accountability (Lalor & Abawi, 2014). For example, when a school functions as a PLC, at any given day you will see teachers talking to one another – discussing student learning goals and daily lessons and identifying learning activities/strategies that will aid in students mastering the predetermined outcomes. Teacher attitudes are that of cooperation and there is a willingness to accept or ask for help from other team members (Lunenburg, 2010). At their core, PLCs improve student learning by building and strengthening teacher capacity. Participation in a strong PLC lends itself to a community of educators that build stronger teaching practices which leads to greater student success in the classroom (Fulton, Yoon, & Lee, 2005). DuFour, DuFour, and Eaker (2008) posits PLCs, when well developed, are unequivocally linked to accelerated student achievement and improved teacher instruction. Similarly, according to Sigurdardottir (2010) an effective PLC "has the capacity to promote and sustain the learning of all professionals in the school community with the collective purpose of enhancing pupil learning" (p. 397).

DuFour, DuFour, and Eaker (2008) articulate the value and commitment of the members of a PLC and the guiding principles. In order for this approach to raising student achievement to be successful the school must embrace the identified characteristics of PLCs. PLCs are generally characterized as having a "shared mission, vision, values and goals, collaborative culture, collective inquiry, action orientation, continuous improvement and results orientation" (DuFour, DuFour, & Eaker, 2008, p. 15–17). These characteristics outline the expectations for PLCs. Shared mission, vision,

values and goals are the collective beliefs of the members of the PLC. These beliefs determine and clarify how the PLC will accomplish identified goals (DuFour, DuFour, & Eaker, 2008). Collaborative culture the process in which the members of the PLC work interdependently to achieve established common goals (DuFour, DuFour, & Eaker, 2008). This collaboration allows PLC members to improve student achievement through a reciprocal process of reflection, assessing, monitoring, and evaluating student performance. Collective inquiry is the method of questioning amongst PLC members. Through this line questioning members share best practices, clarify current practices and assess student performance in order to build shared knowledge and to make informed decisions about student learning needs (DuFour, DuFour, & Eaker, 2008). Action orientation is the modus in which PLC members learn by doing–they try new things and use the learning experience to grow professionally. According to DuFour, DuFour, and Eaker (2008), "they avoid paralysis by analysis and overcome inertia with action" (p. 16). Continuous improvement is the approach PLC members use to create perpetual learning. Through continuous improvement PLC members are always looking for an alternative way to achieve identified goals–ongoing cycle of gathering evidence, developing and implementing strategies to address deficiencies, analyzing effectiveness, and applying new knowledge (DuFour, DuFour, & Eaker, 2008). Results orientation is the commitment displayed by PLC members to achieve the desired outcomes–student data serves as the evidence that supports the work of the PLC (DuFour, DuFour, & Eaker, 2008). These characteristics are germane to the creation, implementation, and sustainability of PLCs.

PLCs create an environment in which its members collaborate on a regular basis. Collaboration in a learning community fosters discussion amongst colleagues, the sharing of best teaching practices, questioning of data, and a sense of shared accountability as the members work toward increasing student achievement. DuFour, DuFour, and Eaker (2008) acknowledged a culture of collaboration, in which PLC teams promote rich learning experiences through a cycle of questions centered on student achievement: (a) What do we want our students to know and demonstrate?, (b) How will be assess student mastery?, (c) How will we reteach or provide extended learning opportunities for students who did not master the indicated outcomes?, and (d) What will do with students who have already mastered the outcomes? Similarly, a component of effective teaching includes collaboration among colleagues and the ability to determine what should be taught and the best way to teach it in accordance with student learning needs (Roberts & Pruitt, 2003). Creating a culture of collaboration establishes an environment for teachers to take risks, openly share failures and mistakes, share pedagogical techniques and best practices, grow professionally and participate in deep learning to improve student achievement (Elbousty & Bratt, 2010).

Research has revealed encouraging outcomes for teachers and students as a result of the implementation of PLCs. Staff benefits include (a) reduction of isolation of teachers; (b) increased commitment to the mission and goals of the school; (c) shared responsibility for the total development of students; (d) collective responsibility for student success; (e) new knowledge and beliefs about teaching and students; (f) increased understanding of content and the role of helping students achieve; (g) higher morale and

lower absenteeism; (h) collaborative culture and (i) commitment to making sustainable instructional changes (DuFour, DuFour, & Eaker, 2008; Seashore Louis, Dretzke, & Wahlstrom, 2010). Student benefits include (a) decreased dropout rate; (b) fewer instances of class cutting and truancy; (c) increased learning; (d) academic gains in math, science, history and reading; and (e) smaller achievement gaps amongst students from different backgrounds (DuFour, DuFour, & Eaker, 2008).

Given the importance of teacher capacity and its congruence to student achievement, PLCs are being explored as a viable means for school improvement. PLCs provide school leaders with a structure and theoretical foundation for supporting teacher learning and growth while providing a positive way to increase student achievement. PLCs is an approach to teaching and learning in which teachers collaboratively create lessons and assessments, analyze data, reflect on instructional practices, and develop interventions for the purpose of increasing student achievement. If PLCs are established and operated effectively, the culture of the school becomes grounded in collaboration. Through this collaboration, teachers work interdependently to continuously assess teaching strategies, assist one another in developing methods to support student learning, discuss perplexities and classroom issues, support, encourage and celebrate one another and confer regarding pedagogical methodologies. DuFour, DuFour, and Eaker (2008) contend, “if students are to learn at high levels, the adults must also be continually learning” (p. 18).

Project Description

Potential Resources and Existing Supports

In order to facilitate a successful and effective professional development activity several resources will be essential. The PLC participants will need literature on improving mathematics instruction, gender–based learning strategies, common assessments, and PLC implementation. A list of required and suggested readings will be furnished (see Appendix A). All required textbooks would be purchased by the school. The project facilitator will provide supplemental journal articles. Teachers will be encouraged to build their own professional toolbox of instructional strategies, research and resources; additional, internet resources and reproducible websites will be provided (see Appendix A). The other needed resources for this project include an invitation to participate in the PLC, self-assessment, module sequence of activities, end of module evaluation, and the final self–assessment (see Appendix A). Additional materials such as chart paper, dry erase markers, post its, graphic organizers, markers, an easel, timer, snacks and supplemental periodic materials to support teacher learning will be provided by the project facilitator. Teachers will be required to maintain a journal for recording reflections.

Teacher support is embedded into an effective PLC. Participants will work collaboratively to create common goals, lessons and formative assessments, assess and analyze student data based on established goals, and develop appropriate academic interventions for students. In addition to the professional development modules, participants will participate in weekly collaborative planning meetings with the grade

level team. Participants will provide support to one another by participating in peer–to–peer mentoring, job shadowing, videotape analysis, focus groups, mutual engagement and the sharing best practices and through the use of rich discussions built around the process of inquiry. Teachers will take an active approach in discussions and write reflective journal entries to share with the group about their new learning. Furthermore, the PLC modules will provide teacher support by fostering a culture of learning in which participants feel comfortable to ask questions, share practices and explore new pedagogical approaches to support student learning and achievement.

Potential Barriers

One potential barrier to forming the Algebra I PLC is buy–in. If the PLC is viewed as a waste of time or another passing mandate teachers will be reluctant to participate and not see the relevance. Another potential barrier will be time/commitment on the teachers' behalf. In order for the teachers to effectively participate in the professional development activities teachers will have to devote time after school to participate in the modules, complete prework activities, develop common lessons and assessments and continuously analyze student data. The final potential barrier will be teacher responsibilities. The teachers participating in this study also meet once a week with the seventh and eighth grade team to create interdisciplinary lessons, assess student attendance, monitor student discipline, analyze student work, and modify lessons to accommodate student academic needs. Participation in the PLC will add to their teacher responsibilities, considerably.

Proposal for Implementation and Timetable

Prior to the project implementation, a meeting will be arranged with the principal, the assistant principal over the mathematics department, the department chair, single-gender coordinator and all members of the seventh and eighth grade Algebra I mathematics team. During the meeting, the team will analyze mathematics student performance data based on the identified indicators from the state, review student learning outcomes and to discuss the current structure of Algebra I instruction. Student achievement data will be reviewed in the form of a PowerPoint presentation. Upon careful review of the data, a discussion will be held with the team regarding the implementation of an Algebra I PLC. A brief presentation of PLCs will be conducted through the use of a PowerPoint presentation. The presentation will cover the purpose, characteristics, benefits and value of PLC, and how the implementation of a PLC can help the school increase student performance in Algebra I.

After the meeting, prospective participants will be invited to participate in a PLC for the purpose of improving student achievement in Algebra I. Interested participants will be provided with a self-assessment to complete based on their knowledge, perceptions, and current professional practices as it relates to a PLC. The project facilitator will lead and/or facilitate modules based on the PLCs established norms. Participants will be encouraged to facilitate modules to support the PLCs vision of shared leadership. Participants will actively participate in 10, three-hour professional development sessions that meet biweekly centered around increasing student achievement (see Table 2). The professional development modules will engage

participants in rich discussions, real–life scenarios, and hands–on experiences as it relates to implementing a PLC and improving student achievement in mathematics. Participants will create presentations based on material from required reading assignments. Participants will examine research-based articles and participate in creating common goals, instructional lessons, formative assessments, analyzing student data and developing appropriate student interventions for students enrolled in Algebra I. Participants will reflect on current practices and how their new learning can support student achievement and make journal entries. Participants will complete an evaluation at the end of each module presentation. After the final module, participants will complete the module evaluation and a final self-evaluation that documents the participants' perceptions on their PLC experience. The project coordinator will retain all self-assessments and module evaluations to analyze participant feedback and to make program refinements, if needed.

The team will develop the mission and vision of the PLC. SMART (specific, measurable, achievable, realistic and time-bound) goals will be developed to assist in planning stages. Norms will be established to ensure meetings and collaborative planning sessions remain on task and productive. The mathematics department will be scheduled for common planning periods through the master schedule; therefore, the seventh and eighth grade Algebra I team will use common planning time to discuss curriculum in relation to student outcomes, analyze and compare student work, extended learning opportunities, calibrate assessments and develop intervention strategies for students who required additional assistance in addition to the PLC modules. All instructional decisions

will focus on the four processes identified by DuFour, DuFour, and Eaker (2008): (a) What do we want students to know and be able to do?; (b) How will we assess whether students have mastered the information?; (c) What interventions will we use for students that are deficient?; and (d) What will we do with the students who have demonstrated mastery?

As a team, we will identify fifteen competency skills that every student enrolled in Algebra I must know and be able to demonstrate. Based on the list of essential skills, a common assessment will be created with the sole purpose of ascertaining if students have any knowledge or have already mastered the identified competency skills. Based on the results of the assessment, a plan of action will be developed to address students who did not complete the assessment satisfactorily and for students who mastered the assessment. The testing data will further be analyzed to determine individual student progress on each of the identified competency skills on the assessment. The team will establish a designated intervention time to reteach the competency skills. Each seventh and eighth grade teacher will create a poster size spreadsheet for each class and place stars next to each competency skill as the student masters it. Each competency skill will be worked on until as many of the students master the skill, then they will progress to the next skill. The team will develop six lessons and two assessments for each of the identified competency skills. Students will also be assigned peer tutors for additional assistance. On Fridays the team will use the common planning period to collaborate about student progress and challenges, as it relates to the mathematics competencies.

The team will have monthly meetings to discuss academic progress based on quarterly benchmarks, analyze student data, share findings and share suggestions for program refinements. Additionally, the department chair will maintain a database of student assessment data by teacher, specific instructional strategies used to teach specific indicators and successful teaching practices used throughout the school year.

Assessment data will be analyzed to determine PLC appropriateness and effectiveness. Findings will be communicated to all stakeholders. Program changes will be made quarterly, if needed, based on the analysis of the data and team consensus. The final evaluation of PLC success will be student performance on the Spring administration of the state assessment and teacher perceptions based from module evaluations and the final self-assessment.

Table 2.

Professional development modules: Implementation timetable

Preliminary Activities	• Potential members of the Algebra I PLC will receive an invitation to participate in the PLC and the professional development modules. • Teachers will notify the project facilitator of their intent in regards to the PLC and the professional development modules. • Teachers participating in PLC will complete a PLC self-assessment and return it to the project facilitator via e-mail or U.S. mail. • On receipt of the PLC self-assessment–the project facilitator will provide participants with the dates, times, and location of the PLC modules and the materials to complete the prework for the first module: • Prework reading assignments o Book – Revisiting Professional Learning Communities at Work: New Insights for Improving Schools by DuFour, DuFour & Eaker (2008) – "Chapter 1: What is a Professional Learning Community?" pp. 13–17 and "The Big Ideas that Drive Professional Learning Communities" pp. 18–30. o Book – Learning By Doing: A Handbook for Professional Learning Communities at Work–Chapter 5: "Building the Collaborative Culture of a Professional Learning Community" pp. 117–153. o Journal Article – (e-mailed by facilitator) Professional Learning Communities

	and System Improvement by Alma Harris & Michelle Jones o Handout – (e-mailed by facilitator) Professional Learning Communities Information Brief
1	• Session title: "What is a Professional Learning Community?" • Icebreaker activity • Establish norms & roles of PLC members • Overview of a PLC o Definition o Purpose o Mission o Characteristics o Big Ideas that Drive PLCs • Group discussion on prework activities o What are the components of an effective PLC? o What is the focus of this PLC? o What are some strengths of forming a PLC at your school? o What are some weaknesses of forming a PLC at your school? • Teachers will present assigned sections of the journal article. • Review survey responses – Perceptions & Knowledge of PLCs • Teachers will create a journal entry – I used to think . . . Now I know . . . based on information obtained in today's module. • Distribution of additional books • Teachers will complete a module evaluation. • Prework for next module: o Book – Revisiting Professional Learning Communities at Work: New Insights for Improving Schools by DuFour, DuFour & Eaker (2008) – "Chapter 3: Making A Case for PLCs" pp. 67–86 and "Chapter 4: The Challenge of Cultural Change" pp. 89–110.
2	• Icebreaker activity • Overview – "The Importance of Adopting a PLC" o Why the work of a PLC is important o Share research on student success as a result of PLC implementation • Teachers will be divided into groups to present Chapter 4. • Teachers will brainstorm/finalize the mission and goals for the Algebra I PLC. • Teachers will share their thoughts regarding the implementation of a PLC. Teachers will have a discussion about what a PLC can do to promote student success. • Teachers will create a journal entry – I used to think . . . Now I know . . . based on information obtained in today's module. • Teachers will complete a module evaluation. • Prework for next module: o Book –Learning By Doing: A Handbook for Professional Learning Communities at Work by DuFour, DuFour, Eaker & Many (2010) – "Chapter 2: Clear & Compelling Purpose" pp. 19–57.

	○ Book – Cultures Built to Last – Systemic PLCs at Work by DuFour & Fullan (2013) – "Chapter 2: Creating Coherence & Clarity" pp. 21–31. ○ Finalize the mission and goals for the Algebra I PLC. This should be completed with the input of the group. The secretary should type in final form.
3	• Icebreaker activity • Overview – creating a coherent PLC ○ Building the PLC foundation ○ Barriers & strategies for coherence ○ Tips for moving forward • Group discussion – mission & goals of the Algebra I PLC; (1) Where will we begin? and (2) What steps will be followed to implement the team's goals? • Teachers will chart the steps to implementing the team's goals. • Teachers will create a journal entry – I used to think . . . Now I know . . . based on information obtained in today's module. • Teachers will complete a module evaluation. • Prework for next module: ○ Book – Cultures Built to Last–Systemic PLCs at Work – "Chapter 3: The Loose Tight Dilemma" pp. 33–42. ○ Book – Learning By Doing: A Handbook for Professional Learning Communities at Work by – "Chapter 3: Creating A Focus on Learning" pp. 59–92. ○ Teachers will gather student data from SLO pretest, benchmark assessments, and failure data for Algebra I. ○ Bring Curriculum Guide and Performance Indicators for Algebra I to next meeting.
4	• Icebreaker activity • Teachers will break into groups - define and chart characteristics of too-tight or too-loose PLCs and present to group. • Teachers will work in groups to analyze and share their student data (SLO pretest, benchmark assessments which indicate lowest performing indicators, and failure data for Algebra I) • Overview – creating a focus on learning ○ What do we want them to learn? ○ How will we know they learned it? ○ Clarifying and monitoring student success – How will this look? • Teachers will use the Algebra I curriculum guide and course performance indicators to map out what the students should learn by the end of quarter 1 and 2. • Teachers will determine what skills the students must know pertaining to each indicator and what evidence will be used to demonstrate student mastery. • Teachers will create a journal entry – I used to think . . . Now I know . . . based on information obtained in today's module. • Teachers will complete a module evaluation. • Prework for next module: ○ Continue working on the skills students need to master for performance indicators. ○ Book – Revisiting Professional Learning Communities at Work: New Insights for Improving Schools – "Chapter 7: Teaching in a Professional Learning Community" pp. 169–193.

	○ Book – Cultures Built to Last – Systemic PLCs at Work – "Chapter 4: The Loose & Tight System in Action" pp. 47–61. ○ Log on to http://www.go.solution-tree.com/PLCbooks to view reproducible documents that may be helpful to the Algebra I PLC. ○ Bring the following books to class: Successful Single Sex Classrooms . . . Teaching the Female Brain . . . and Teaching the Male Brain . . .
5	• Icebreaker activity • Discussion – What reproducible documents will be most helpful to the PLC? • Overview – PLC in Action ○ Creating curriculum ○ Monitoring progress ○ Supporting improvement • Teachers will work in groups to identify and chart what instructional activities and strategies will be implemented to facilitate student success in Algebra I. ○ Differentiation ○ Multiple intelligences ○ Ipads • Book – Successful Single-Sex Classrooms: A Practical Guide to Teaching Boys & Girls Separately by Gurian, Stevens & Daniels – "Chapter 5 – A Boy Friendly Classroom – What Does It Look Like?" and "Chapter 6 – A Girl friendly Classroom – What Does It Look Like?" • Book – Teaching the Female Brain: How Girls Learn Math & Science by Abigail Norfleet James – "Chapter 4: Teaching Math to the Female Brain". • Book –Teaching the Male Brain: How Boys Think, Feel and Learn in School by Abigail Norfleet James – "Chapter 9 – Content-Specific Learning Strategies". • Teachers will identify and chart learning styles specific to boys and girls and use this as a guide when designing the lesson. • Teachers will work in groups to design a lesson that will be used by all members of the PLC. • Based on previous data, teachers will identify possible interventions that may be needed to assist students. Teachers will create a journal entry – I used to think . . . Now I know . . . based on information obtained in today's module. Teachers will complete a module evaluation. Prework for next module: ○ Book (purchased by participants) – Common Formative Assessment: A Toolkit for Professional Learning Communities at Work by Bailey & Jakicic (2012) – "Chapter 2: Setting the Stage for Common Assessments" pp. 13–24 and "Chapter 5: Designing Quality Common Formative Assessments" pp. 49–61. ○ Log on to http://www.go.solution-tree.com/assessment to view reproducible documents that may be helpful in writing common assessments. ○ Identify and be prepared to share best practices used in the classroom to assist students in understanding course material.
	• Icebreaker activity • Sharing of best classroom practices. • Teachers will present the lesson developed in the last class. • Teachers will be assigned sections in the reading to present to the group. ○ Setting the stage for common assessments ○ Designing quality common formative assessments

6	• Group discussion regarding presented material • Teachers will begin developing a common formative assessment. • Teachers will create a journal entry – I used to think . . . Now I know . . . based on information obtained in today's module. • Teachers will complete a module evaluation. • Prework for next module: o Each member of the PLC will create 15 problems relating to the identified standard or learning outcome to be considered for adding to the common formative assessment. Participants will bring these problems to the next session. o Book – Revisiting Professional Learning Communities at Work: New Insights for Improving Schools – "Chapter 8: Assessment in a Professional Learning Community" pp. 199–220.
7	• Icebreaker activity • Review of the major highlights about common assessments – formative and summative. • Common assessment discussion among team. • Teachers will examine the common formative assessment problems created by each team member. Teachers will use problems to finalize the common formative assessment. This will be a flexible assignment, if the team agrees with all questions presented a 2nd formative assessment will be created. • Teachers will create a journal entry – I used to think . . . Now I know . . . based on information obtained in today's module. • Teachers will complete a module evaluation. • Prework for next module: o Book – Learning by Doing: A Handbook for Professional Learning Communities at Work – "Chapter 4: How will we Respond When Some Students Don't Learn" pp. 95–115. o Book – Common Formative Assessment: A Toolkit for Professional Learning Communities at Work – "Chapter 7: Using Data to Make a Difference pp. 73–82 and "Chapter 8: Getting the Most Bang for Your Assessment Buck" pp. 83–89.
8	• Icebreaker activity • Essential question – How do you feel about creating common formative assessments and using it to assess student knowledge? Every member of the PLC will have an opportunity to share their feelings and perceptions in regard to this question. • Teachers will create a rubric for scoring common formative assessment(s) and determine proficiency levels. • Teachers will identify the date in which the common formative assessment will be given and a date for collaborative grading– student results will be brought to next session. • Overview of using data to determine intervention strategies to facilitate student success. • Discussion and creation of an intervention plan to address students who possibly demonstrate deficiencies on the common formative assessment. • Teachers will create a journal entry – I used to think . . . Now I know . . . based on information obtained in today's module. • Teachers will complete a module evaluation. • Prework for next module: o Item analysis of common formative assessment – identify how many students got each question correct & incorrect. o Bring student samples of the assessment for review.

	○ Review intervention plan and identify changes (if any) that should be made to accommodate student needs. ○ Book – Learning By Doing: A Handbook for Professional Learning Communities – "Chapter 7: Using Relevant Information to Improve Results" pp. 181–204.
9	• Icebreaker activity • Teachers will be assigned sections to present to the class from the prework activity. • Teachers will examine the student work samples and data from the common formative assessment to identify common themes and patterns amongst students. • Teachers will discuss the student data (results) in relation to the identified learning outcomes and goals determined by the team. • Teachers will discuss current school-wide or departmental interventions currently in place to address student deficiencies. • Teachers will revisit the previously developed intervention plan and make adjustments based on student data. • Teachers will create a journal entry – I used to think . . . Now I know . . . based on information obtained in today's module. • Teachers will complete a module evaluation. • Prework for next module: ○ Book – Cultures Built to Last Systemic PLCs at Work – "Chapter 5: Sustaining the Improvement Process" pp. 63–77.
10	• Icebreaker activity • Discussion – Sustaining the improvement process • Overview of How the PLC should look ○ Share teaching experiences that provide positive results. ○ Review current assessment data for the purpose of measuring results against goals as stated in the PLC action plan. ○ Review current leading and lagging indicators relative to strategies to monitor progress. ○ Review and update PLC action and work plans. ○ Complete item analysis of assessment(s). ○ Determine a protocol that will be used to guide discussion and a working binder will be kept to maintain an historical record of data, discussion, and decisions. ○ Make recommendations for improving assessment(s). Make recommendations for improving and aligning instruction with assessments. • Teachers will assess and articulate the PLC work completed during sessions. • Teachers will celebrate the accomplishments of the PLC. • Teachers will share journal entries. • Teachers will discuss the plan for continuing work within the PLC. • Teachers will complete a final evaluation.

Roles and Responsibilities of Student and Others

My role and responsibility as the developer of the PLC project consists of creating a learning environment in which participants can collaborate, reflect and learn effective

instructional strategies as it relates to student achievement. As the developer my primary responsibilities are to invite prospective participants to participate in the professional development modules, provide participants with a self-evaluation, assign participants to the PLC, encourage shared leadership, develop an outline of proposed activities to support each module, provide participants with the necessary materials to actively participate in the modules, distribute and retain module evaluations as well as the final evaluation and analyzing teacher data to refine and/or make changes to the professional development activity to support student learning and achievement.

Teachers who elect to participate in the PLC activities will be expected to attend all sessions and actively participate in readings, discussions, and examining relevant research. Teachers will be encouraged to share leadership responsibilities by volunteering to facilitate presentations and/or group discussions. Teachers will work collaboratively to develop common goals, lessons, assessments, analyze data and develop and/or identify intervention strategies aimed at improving student achievement. Teachers will also be asked to bring course curriculum guides, share instructional resources and provide current student data to complete a comparative analysis on student achievement in mathematics.

The project facilitator will create the agendas, develop the topics of study for the modules, assess and evaluate teacher learning as it pertains to the implementation of a PLC. The facilitator will lead the PLC module by facilitating the discussions and the lessons. The project facilitator will use both the self-assessment and the summative assessment to determine if the goals of the PLC were met.

Project Evaluation

Participating teachers will be evaluated quarterly through the use of formal and informal classroom observations, teacher perceptions and formative and summative assessments (e.g., state benchmarks, common teacher made assessments, assessments developed by the publisher of the textbook, and quarterly projects). Through the use of formative and summative assessments teachers can identify which content standards have been mastered and which need further development prior to the administration of the state assessment in May. Use of the assessments will also provide teachers with opportunities to teach students testing strategies and testing format in order to prevent potential problems prior to state testing and to ensure that all students are prepared for the test.

The project will be evaluated at the end of each quarter to gauge whether the PLC objectives and the mathematics classes are meeting the goals for student achievement based on the established quarterly outcomes. Student data will also be evaluated quarterly to determine the percentage of students meeting target growth on formative and summative assessments and passing algebra class with a C or better. Student performance data will also be compared for single-gender and coeducational seventh and eighth grade mathematics classes to analyze if there are any differences between student groups. This will also allow for triangulation of the data to ensure all students are receiving the same academic support and interventions. At the end of the school year, student performance data will be analyzed and evaluated to determine if the students enrolled in single-gender and/or coeducational seventh and eighth grade mathematics classes showed academic

gains in the mathematics course and on the state assessment as a result of the implementation of the PLC. In addition, a comparative analysis will be conducted on seventh and eighth grade Algebra I student performance from the previous year on the state assessment to see if the implementation of the PLC had a major influence over student success.

The PLC project will be further evaluated using the goal-based evaluation model. The goal-based evaluation model seeks to assess whether identified program goals have been met and ascertains the effectiveness of the program (Spaulding, 2008). The goals of the project are for teachers to establish an effective PLC with a focus on improving student achievement in Algebra I. By administering a goal-based evaluation to the participants in the project study, an evaluation form will be distributed at the end of each professional development session and teachers will complete teacher reflections. Based on the information provided on the evaluation forms the project can be continuously revised to meet the needs of the PLC in solving the problem of increased student learning in Algebra I.

At the final PLC session, a summative evaluation will be administered to the participants in order to evaluate their professional development experience. Teachers will respond to the following questions:

1. How has your participation in the PLC impacted your professional practices?
2. Has the PLC sessions provided you with any strategies and methods for enhancing student academic achievement? If so, please provide.
3. Describe any modifications, if any, to your pedagogy as a result of your involvement in the PLC.

4. What factor(s) would you attribute to the success or failure of the PLC?

5. Please provide any recommendations for improving the PLC sessions as it relates to student achievement.

The final PLC evaluation form will be used to indicate whether teachers were successful in designing and implementing educational tools for improving Algebra I learning in the classroom. Effective evaluation methods are essential for verifying and maintaining high quality instruction and student learning, ensuring that goals and objectives are achieved, providing a focus for instructional improvement, and holding educators accountable for their instruction.

The overall goal for the project evaluation is to determine the effectiveness of the Algebra I PLC. The purpose of the project is to help participants acquire the knowledge and skills to effectively deliver instruction and assess student mastery. The goal-based evaluation is the most appropriate assessment method to determine whether the project study was a beneficial professional development activity. Project success is contingent upon the participant's willingness to modify current instructional practices and adopt new and improved ways to deliver instruction based on student need.

Implications Including Social Change

Local Community

With student achievement and learning being significantly impacted by the quality of teaching, teacher preparation and development is vital. PLCs can be a catalyst to creating a culture of collaboration in the school. Collaborative work in an environment

build upon trust provides a basis for continual inquiry and reflection by allowing teachers to ask questions, reflect on current instructional practices, take risks, and address dilemmas in their own practices (Owen, 2014; Lippy & Zamora, 2012; Lalor & Abawi, 2014). Research conducted on PLCs can assist educational stakeholders (e.g., superintendents, principals, assistant principals) in making imperative decisions regarding programs to implement to build teacher capacity with the goal of improving student performance (Brodie, 2013; Bowgren & Server, 2010; Cranston, 2011; Denver & Lash, 2013; DuFour & Marzano, 2011; Kutsyuruba, 2013; Lippy & Zamora, 2012). Furthermore, it will abet all stakeholders in developing a supportive structure for schools to continuously transform themselves through their own internal capacity.

The implications for social change from this study include increasing teacher collaboration, building teacher capacity through a continuous professional development, increasing ownership of student outcomes and developing instruction based on the specific academic needs of the students. PLCs may become embedded in the teaching and learning culture as a way to empower teachers to collaborate and participate in continuous professional development activities in order to increase achievement levels in students.

Far-Reaching

Stakeholders and the educational community have a collective responsibility to prepare, promote and provide appropriate learning experiences to meet the diverse needs of all students. With student learning and achievement being so greatly impacted by the quality of teaching, continuous and effective teacher training is vital.

This project supports teacher learning by creating an opportunity for educators to collaboratively work together to establish common goals, lessons and assessments; analyze student data and to develop appropriate academic interventions to increase student achievement in mathematics. Furthermore, this project reveals the importance of reviewing student data in order to make critical instructional decisions based on student need.

The project will assist educators in identifying an instructional strategy to promote coherence in the execution of mathematics instruction in Algebra I whether students are enrolled in single-gender or coeducational classes. The project may also provide a blueprint for other schools and districts that are experiencing low levels of student success in Algebra I or any other content.

Conclusion

In Section 3, I explained the goals, rationale, supporting literature, implementation plan, evaluation, and social change implications of the project study. The project will be implemented next school year at a public high school in this researcher's region. The data obtained from the project will provide stakeholders with valuable information to determine whether implementing a PLC is a viable solution to increase student achievement in mathematics, specifically in single-gender mathematics classrooms.

In Section 4, I will complete this project study by discussing the strengths and limitations of the planned project, and by making recommendations to address the problem differently in future studies. In the concluding section, I will also include

reflections on scholarship, project development, and evaluation. Finally, in Section 4, I will address reflections on the importance of the research and discuss implications, applications, and directions for future research.

Section 4: Reflections and Conclusions

Introduction

I developed this quantitative study to compare seventh- and eighth-grade single-gender and coeducational instructional models to determine which model yielded greater academic success for students. Based on the data from the study, I developed a PLC to bring coherence to both instructional models to increase student achievement. This section includes the reflective process and conclusions based on the findings of the study. In this section, I will present scholarship, project development, leadership, and change as well as what I learned about myself throughout this process. Last, I will articulate the importance of the study and the implications for further research.

Project Strengths

One of the strengths of the PLC project was I developed and designed it using research practices that have been proven effective in promoting continuous teacher development and student achievement. Tobia and Hord (2012) identified six characteristics of an effective PLC: shared and supportive leadership, shared values and vision, intentional collective learning, supportive relational conditions, peers supporting peers, and structural conditions. PLCs further provide teachers with empowerment as such teachers take ownership over curriculum development by making it their own and, at the same time, promote professional improvement (Song, 2012).

Another strength of the project is it allows teachers to collaborate and share best practices. Effective collaboration processes are important for teachers and can be linked to school effectiveness. Teacher learning is the underlying attribute of a PLC: emphasis is

placed on creating a blame-free environment of autonomous and collaborative teacher learning (Song, 2012). Similarly, Hoaglund, Birkenfeld, and Box (2014) assert collaboration provides opportunities for teachers to work on matters related to learning while holding them accountable for results that promote continuous improvement. Nevertheless, collaboration has been identified as the foundation of schools, serving as a starting point for problem solving and making critical instructional decisions as well as decisions related to planning, culture, development, organization, and research in schools (Kutsyuruba, 2013). Teacher collaboration is a major component to the strength of this PLC project.

The final strength of this PLC project is it uses data to focus on instructional practices. Owing to the increased accountability for student achievement, teachers must effectively use data to gauge and guide instruction, identify a plan for how student data will be used, implement the plan, continuously evaluate student progress, and make informed decisions based on the analysis of student data (Lujan, 2010). This PLC project uses student data to refine teaching practices, assist in determining meaningful and appropriate professional development to accommodate school needs, and provide an accurate picture of student performance in mathematics. Teacher analysis of the student data is another contributing component to the strength of this project and has the potential to improve teacher pedagogical practices and student achievement.

Recommendations for Remediation of Limitations

This project has several strengths surrounding its effectiveness the implementation of the PLC professional development modules; however, the project has

a few limitations that can impede PLC performance. One limitation of the PLC project is trust amongst faculty members. Cranston (2011) suggested trust is the key ingredient to formulating collegial relationships that encourage professional dialogues, sharing of wisdom and expertise, and providing opportunities for collective learning. Accordingly, trust is vital to execute an effective PLC; nevertheless, lack of trust will impede all work toward its development.

Another limitation of the PLC project is student interventions. The teachers develop student interventions based on student data; however, differentiated learning experiences were not considered for diverse student populations. The PLC will need to integrate differentiated learning experiences into instructional interventions to support student learning. Students may need to be creatively scheduled to implement ongoing interventions throughout the school day to create personalized learning experiences for all children.

Recommendations for Alternative Approaches

The professional development genre through the implementation of a PLC is the most appropriate method for providing educators with continuous developmental and hands-on activities. Professional development activities strive to expand teachers' content knowledge and pedagogical practices as well as their perceptions about the content. Research has shown that teacher preparedness has a direct correlation to student achievement (Telese, 2012; Dever & Lash, 2013). Dever and Lash (2013) assert, "professional development links teacher learning to immediate, real-world problems and allows for direct application, experimentation, and adaptation to the teacher's situation"

(p. 13). Similarly, several researchers characterize professional development as activities aimed at improving teacher capacity that range from formal, topic specific workshops to informal discussions. In addition, PLC professional development activities allow participants to function as a collaborative group when developing strategies to improve student achievement.

An alternative approach to address student achievement in the area of mathematics is to provide all teachers with ongoing professional development through the implementation of a series of instructional workshops that focus on algebraic strategies. The information provided in these workshops could be implemented into the PLC modules.

Scholarship

During the course of the completion of the project study I realized that the attributes of scholarship include persistence, inquiry, investigative skills, and the acceptance of the best practices when dealing with change initiatives. Morrison (2012) suggested the following characteristics be present when presenting scholarly work: (a) state achievable goals, (b) knowledge of relevant literature, (c) ensure appropriate methods have been applied, (d) achieve goals that add knowledge, (e) clearly articulate the results, and (f) critically reflect on the value of the work. Through the research and completing the project study, I have completed all of the characteristics of scholarly work. For example, I indicated the purpose of the project, reviewed and analyzed current literature, used an appropriate method to address the local problem, presented information to add to the current body of knowledge, and reflected on the value of PLCs,

teacher collaboration, and increasing student achievement. Scholarship was not only exhibited through the research process but through the analyzing of student data and accurately presenting the findings. The creation of the project study in response to the findings lead to a level of scholarship that can create increased student achievement in Algebra I and a culture of continuous learning for teachers and students alike, while presenting a path for social change.

Project Development and Evaluation

The project was developed in response to the local problem of increasing student performance on the Algebra I state assessment needed for graduation. Based on current academic data, student performance in the single-gender and coeducational Algebra I classes were in need of academic improvement in order for students to matriculate to the next mathematics level, graduate and pursue postsecondary opportunities. Hence, the project was designed as a series of professional development modules to emphasize the importance of collaboration, analyzing student data and using student data to gauge and guide daily instructional practices. In addition, the Algebra I teachers will also participate in weekly collaborative planning sessions to identify learner outcomes, strategize on how they will achieve the indicated outcomes, develop common lessons and assessments, analyze student work and develop appropriate interventions to address student academic needs. Providing teachers with extra time to collaborate will allow teachers to identify areas in which they need further support and development to provide focused and beneficial professional development activities that will lend itself to improved student achievement.

In order to determine the effectiveness and relevance of the project there must be ongoing evaluation throughout the process. Evaluations allow the participants an opportunity to assess knowledge, clarify learning, develop questions, and determine the programs effectiveness as it pertains to their beliefs and perceptions. At the end of each module, participants will complete a module evaluation. At the conclusion of the professional development participants will complete a final evaluation about their total PLC experience.

Leadership and Change

Throughout the process of completing the project study I have come to understand the significance of leadership and implementing school reform initiatives to address student achievement. In the field of education, change is continuous; accordingly, an instructional leader must always align their vision of change around increasing student achievement. In order to achieve this goal, instructional leaders must listen to the ideas and the various experiences of the school staff and build leaders within, at all levels. Gralamas, Pelonis, and Medeiros (2014) asserted successful school reform should be holistic. Similarly, Ronneberg (2013) posited "effective leaders develop the capacity of formal and informal leaders (e.g., new and experienced classroom teachers, staff, instructional coaches, teacher mentors, curriculum coordinators, department chairs, teacher coordinators, and assistant principals) to provide support, give a necessary push at times, so colleagues are able to navigate the highs and lows they will experience through learning and change" (p. 67). Each member of the school learning community provides a

different view to guide, support and address the learning path and to preserve through uncertainty.

In implementing change initiatives, the educational leader is tasked with inspiring and leading the school learning community to adopt change and alleviate apprehensions of the change process by creating a culture in which risk taking is embraced. In order to be successful at building a collaborative learning community there has to be trust, support, collegiality, and ongoing collaboration. Nolan (2007) identified five principles to leading change – (a) Focus on understanding the reform initiative, (b) Think long-term, start small, (c) Focus on the commitment of achieving the identified goal, (d) Question the "status quo", and (e) Use naysayers to your advantage. Educational leadership requires a fervor, dedication and responsibility for initiating processes that not only emphasize and strengthen respectful collegiality amongst the staff but also addresses the academic achievement of the students the school serves.

Analysis of Self as Scholar

As a result of participating in the doctoral program at Walden University I have gained a multitude of insight regarding leadership, educational research and solutions to address current educational issues. In addition, I have gained knowledge about research methods, the research process and the application of theory to practice. Based on this strong knowledge base and foundation, I was able to identify a current educational issue and determine the most appropriate research approach, methodology, into understanding the effectiveness of a PLC and how when implemented with fidelity can increase student achievement. When I decided to pursue this degree, I knew this would be a tough and

challenging academic journey. However, based on my persistence, tenacity and determination to obtain further knowledge in educational leadership, I realized my goal was within reason and I could do it. These significant steps groomed me for the transition from student to scholar.

Each course in the educational leadership program has provided me with an additional layer of knowledge as a research scholar. I have grown in my ability to problem solve and make scholarly decisions apropos the research design, rationale, sample population, data collection, and data analysis. With the support, collaboration, and assistance of each chairperson I was able to align the data collected and complete a research-based narrative that encompassed the knowledge acquired throughout the research experience. Accordingly, I was able to evaluate PLCs and its influence over improving teacher quality and capacity while improving student achievement. As a result of the extensive preparation through the coursework and the guidance of the chairpersons, I was able to progress from a student to a scholar.

As a scholar, I was able to apply my critical thinking and decision making skills, complete a comprehensive literary analysis, complete a data analysis, construct a project study, reflect on the strengths and weaknesses, and use feedback in order to design a scholarly-based project study. As a scholar, I have grown as a result of this experience. I have read articles, research and educational briefs to improve education, specifically teaching and learning. I have kept up–to–date on current trends in the educational arena and reform initiatives to minimize achievement gaps and increase student achievement.

Accordingly, I am now better prepared to critically examine an article in context and determine how it supports my prior learning and its correlation to my understanding.

Analysis of Self as Practitioner

As a seasoned educator and instructional leader, I have had the opportunity to develop, implement and participate in professional development activities to develop teachers and to improve student performance. The knowledge that I have attained as a result of matriculating through the program and completing this doctoral program has considerably impacted my actions as an instructional leader and education practitioner. I have a better understanding of the importance of collaboration, in a school building over working in isolation. As a practitioner, I will use knowledge gained regarding PLCs to improve teacher capacity, encourage participation by stressing the importance of a learning community in order to increase student achievement, and articulate the importance of analyzing student data prior to making critical instructional decisions. Additionally, I will use the research to enhance the PLCs in my school building by encouraging combined knowledge and expertise of the collective group in order to interpret content standards, planning lessons, sharing and establishing instructional strategies and creating formative and summative assessments. According to the research contained in this study PLCs have been deemed a highly effective tool in raising student achievement when implemented with fidelity.

Analysis of Self as Project Developer

Throughout the research process, I have gained a wealth of knowledge in educational research and design through textbooks provided by the university, instructors,

journal articles, extensive discussions with my chairpersons, and collaborating with my peers. By employing the critical thinking and problem solving skills developed through Walden University, I was able to create a project that would not only increase student achievement but also build teacher capacity. I realized that more time was needed to actually identify, organize, and develop an effective and beneficial staff development activity. Through this experience, I have learned that research is not an easy task and it takes dedication, commitment, persistence, patience, and time.

As a result of completing this project, I am equipped to critically analyze an educational issue and use a research-based approach to develop solutions to address the problem. For example, I will identify a problem, complete a literary search to identify possible solutions, analyze data gathered, and design a project to address the identified problem. I am more knowledgeable on teacher needs as it pertains to continuous professional development and the use of research–based practices to foster valuable professional development activities. Last, I have created a toolbox of best practices to increase student achievement that will be instrumental to teachers as they prepare to increase student performance for all.

The Project's Potential Impact on Social Change

Although the project has yet to be implemented it can be extrapolated based on the literary review that if executed with fidelity this project can enhance the instructional practices of teachers and increase student achievement. Literature reveals that schools that function as PLCs encourage teachers to refrain from using traditional isolated teaching methods and use collaborative, data-driven and learning-centered model of

teaching. The benefits of teacher collaboration include: (a) openly sharing failures, successes and mistakes, (b) analyzing student data to guide and gauge instructional practices, (c) providing constructive criticism for teaching practices, and (d) the ongoing support system developed through collegial relationships, as such, contribute to social change amongst the local community.

The school and district continue to grapple with appropriate instructional strategies, professional development activities, and alternative approaches to the traditional classroom setting to increase the academic performance of students and to prepare all students to be college and career ready. This project is a feasible means to address the district problem of improving student learning through the implementation of PLCs. By providing a curriculum structure for teachers to collaborate and to receive ongoing training teachers, not only school but district wide will have an opportunity to integrate PLCs; hence, increasing student academic performance by using student data to continuously guide and gauge instructional practices and monitor student achievement. The implementation of the PLC professional development activity will provide assurance that everyone has the knowledge and clarity of the purpose, procedures, and expectations which center around teachers collaborating and providing ongoing support to improve student achievement and build teacher capacity.

Through the implementation of the project, there is a potential for increased student achievement in classrooms and student performance on the state assessments district wide. Increasing student achievement will elevate the graduation rate by providing the necessary academic interventions in order for all students to meet the state

standards and pass the rigorous exit examinations needed to graduate; thereby, contributing to positive social change.

Implications, Applications, and Directions for Future Research

The project study was designed to increase mathematics achievement and assessment scores of students enrolled in Algebra I in order to matriculate to the next level of mathematics and meet graduation requirements for the state. Through the research process, the problem was identified, a literature review was conducted, a data analysis was performed, and an appropriate method was used to address the problem. As a result, of the local problem an applicable project study was developed to address the problem and build teacher capacity with the aim of increasing student achievement in Algebra I. The project study has the ability directly influence ongoing teacher learning, collaboration, analyzing student data to guide instructional practices, and to increase student achievement at the district and local levels.

One of the most influential ways to improve student achievement is through continuous professional development. PLCs are a conduit for supporting instructional initiatives. Via participating in a PLC, teachers can participate in collegial interactions that can "increase their knowledge and skills, improve their teaching practice and contribute to their personal, social and emotional growth" (Desimone, 2011, p. 68). Mindich and Lieberman (2012) suggest that successful PLCs are comprised of educators from the same school that have received training in the importance of collaboration, who use data driven decision making, and have the autonomy to determine student learning objectives. As a result of implementing the project, instructional performance of the

Algebra I teachers may have contributed to instructional gains in mathematics achievement.

In the future, research on teacher perceptions and beliefs as it relates to teacher participation in PLCs may be very beneficial. Teachers considering participating in a PLC could benefit from the information obtained and use when considering implementing a PLC at their school. Additional areas of foci for future research would be to expand the project to encompass content specific courses (e.g., English/Reading, Science, Social Studies), student performance in teacher organized versus school organized PLCs, and student success on state assessments as a result of teacher participation in a PLC.

Conclusion

In Section 4, I examined the project study by providing reflections and conclusions. I also included reflections on the strengths, limitations, alternative approaches, and project development. In Section 4, I also analyzed the importance of the work, implications and applications, and directions for future research. Last, this section included my personal reflections in the areas of scholarship, leadership and change, and myself as a scholar, practitioner, and project developer.

I examined the impact of single-gender and coeducational instruction and the academic performance of the students enrolled in mathematics classes. The research findings yielded that there was a significant difference in student performance for students who were enrolled in single-gender mathematics courses. In light of the data, there was a need to implement a PLC to build teacher capacity and provide all students

with the same opportunities to increase their academic performance. The project was implemented to increase student achievement by emphasizing the importance of teacher dialogue and collaboration, using data to gauge and guide instruction, analyzing student data prior to making instructional decisions concerning students and developing appropriate intervention activities to support student success. Research asserts PLCs are one conduit for professional dialogue supporting instructional shifts. In sum, PLCs improve student learning by building and strengthening teacher capacity. Teacher participation in a strong PLC lends itself to a community of educators that build stronger teaching practices which leads to greater student success in the classroom. PLCs ultimately support NCLB legislation and contribute to student success on day-to-day instructional activities, quarterly benchmarks, and state assessments.

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Appendix A: The Project

Professional Learning Community Participation - Invitation

[*Insert Date*]

Dear Colleague,

Public education has been drastically changed due to the reenactment of the No Child Left Behind Act. Under this legislation, school and student performance is measured based on the outcomes of content specific assessments. As a result, of the increased accountability for student achievement, educators must be cognizant of effective teaching methodologies and instructional strategies to meet the diverse needs of the students in which they teach. A professional learning community is a key component for improving schools. Research has indicated that schools that have created and implemented PLCs have shown major improvements in student achievement (Seo, K., & Han, Y. K., 2012).

As a fellow educator, interested in seeing all students be successful in their academic pursuits. I am proposing the creation and implementation of a PLC at [*insert school name*]. As a member of the PLC, you will work collaboratively with a team of content specific colleagues to identify the current level of student achievement, establish common improvement goals, identify instructional strategies to achieve goals, develop common assessments, analyze student data, establish instructional interventions and provide periodic evidence of student progress in order to increase student achievement. Additionally, group discussions will be conducted on current research and best classroom practices in teaching and learning.

The primary goal of the PLC is to improve the academic performance of the seventh and eighth grade students enrolled in Algebra I at your school. Research-based components of an effective PLC will guide the work of the team. Professional development activities have been developed to support and enhance the implementation of the PLC.

The PLC activities will commence on [*insert date and time*] in [*insert meeting location*] and ten meetings will occur. If you are interested in participating in the Algebra I PLC, please notify me via email or contact me personally at [*insert cellular number*]. I look forward to collaborating with you to increase student achievement at [*insert school name*].

Respectfully,

[Insert full name]
Project Facilitator

Reference: Seo, K., & Han, Y. K. (2012). The vision and the reality of professional learning communities in Korean schools. *KEDI Journal of Educational Policy, 9*(2), 281–298.

Professional Learning Community Self-Assessment

Please indicate your job classification:

- ○ Teacher
- ○ Administrator
- ○ School-Based Staff
- ○ Other

Directions: Complete the short questionnaire below by rating (circling) your responses 1–5, with 1 being the lowest and 5 being the highest.

1. Rate the degree to which you are familiar with professional learning communities.
   1 2 3 4 5

2. Rate the degree to which you and department members share in a common vision, mission and set of goals regarding student achievement.
   1 2 3 4 5

3. Rate the degree in which the school/department has provided additional time and support to ensure all students master content and concepts (e.g., collaborative planning, block scheduling, additional training in teaching strategies, . .).
   1 2 3 4 5

4. Rate the degree in which you collaborate with colleagues regarding instructional practices and learning strategies.
   1 2 3 4 5

5. Rate the degree of trust you have in working with your colleagues.
   1 2 3 4 5

6. Rate the degree in which teachers work together to design lessons and common assessments to support student achievement.
   1 2 3 4 5

7. Rate the degree in which teachers work together to analyze student assessment data.
   1 2 3 4 5

8. Rate the degree in which you have identified academic interventions for your students who haven't mastered the curriculum content.
   1 2 3 4 5

Professional Development Modules – Sequence of Activities

Preliminary Activities

- Potential members of the Algebra I PLC will receive an invitation to participate in the PLC and the professional development modules.
- Teachers will notify the project facilitator of their intent in regards to the PLC and the professional development modules.
- Teachers participating in PLC will complete a PLC self-assessment and return it to the project facilitator via email or US mail.
- Upon receipt of the PLC self-assessment – the project facilitator will provide participants with the dates, times and location of the PLC modules and the materials to complete the prework for the first module:
    - Prework reading assignments
        - Book – Revisiting Professional Learning Communities at Work: New Insights for Improving Schools by DuFour, DuFour & Eaker (2008) – "Chapter 1: What is a Professional Learning Community?" pp. 13–17 and "The Big Ideas that Drive Professional Learning Communities" pp. 18–30.
        - Book – Learning By Doing: A Handbook for Professional Learning Communities at Work–"Chapter 5: Building the Collaborative Culture of a Professional Learning Community" pp. 117–153.
        - Journal Article–(e-mailed by facilitator) Professional Learning Communities and System Improvement by Alma Harris & Michelle Jones
        - Handout–(e-mailed by facilitator) Professional Learning Communities Information Brief

Session 1–3 hours

- *Session title*: "What is a Professional Learning Community?"
- Icebreaker activity
- Establish norms & roles of PLC members
- Overview of a PLC
    - Definition
    - Purpose
    - Mission
    - Characteristics
    - Big Ideas that Drive PLCs
- Group discussion on prework activities
    - What are the components of an effective PLC?
    - What is the focus of this PLC?

  - What are some strengths of forming a PLC at your school?
  - What are some weaknesses of forming a PLC at your school?
  - Teachers will present assigned sections of the journal article.
- Review survey responses–Perceptions & knowledge of PLCs
- Teachers will create a journal entry – I used to think . . . Now I know . . . based on information obtained in today's module.
- Distribution of additional books
- Teachers will complete a module evaluation.
- Prework for next module:
  - Book – Revisiting Professional Learning Communities at Work: New Insights for Improving Schools by DuFour, DuFour & Eaker (2008) – "Chapter 3: Making A Case for PLCs" pp. 67–86 and "Chapter 4: The Challenge of Cultural Change" pp. 89–110.

Session 2–3 hours

- Icebreaker activity
- Overview–The Importance of Adopting a PLC
  - Why the Work of a PLC is important
  - Share research on student success as a result of PLC implementation
- Teachers will be divided into groups to present Chapter 4.
- Teachers will brainstorm and finalize the mission and goals for the Algebra I PLC.
- Teachers will share their thoughts regarding the implementation of a PLC.
  Teachers will have a discussion about what a PLC can do to promote student success.
- Teachers will create a journal entry – I used to think . . . Now I know . . . based on information obtained in today's module.
- Teachers will complete a module evaluation.
- Prework for next module:
  - Book – Learning By Doing: A Handbook for Professional Learning Communities at Work by DuFour, DuFour, Eaker, & Many (2010)–"Chapter 2: Clear & Compelling Purpose" pp. 19–57.
  - Book – Cultures Built to Last–Systemic PLCs at Work by DuFour & Fullan (2013)– "Chapter 2: Creating Coherence & Clarity" pp. 21–31.
  - Finalize the mission and goals for the Algebra I PLC. This should be completed with the input of the group. The secretary should type in final format.

Session 3–3 hours

- Icebreaker activity

- Overview–Creating a coherent PLC
    - Building the PLC foundation
    - Barriers & strategies for coherence
    - Tips for moving forward
- Group discussion–mission & goals of the Algebra I PLC; (1) Where will we begin? and (2) What steps will be followed to implement the team's goals?
- Teachers will chart the steps to implementing the team's goals.
- Teachers will create a journal entry – I used to think . . . Now I know . . . based on information obtained in today's module.
- Teachers will complete a module evaluation.
- Prework for next module:
    - Book – Cultures Built to Last – Systemic PLCs at Work – "Chapter 3: The Loose Tight Dilemma" pp. 33–42.
    - Book – Learning By Doing: A Handbook for Professional Learning Communities at Work by – "Chapter 3: Creating A Focus on Learning" pp. 59–92.
    - Teachers will gather student data from SLO pretest, benchmark assessments, and failure data for Algebra I.
    - Bring curriculum guide and performance indicators for Algebra I to next meeting.

Session 4–3 hours

- Icebreaker activity
- Teachers will break into groups–define and chart characteristics of too-tight or too-loose PLCs and present to group.
- Teachers will work in groups to analyze and share their student data (SLO pretest, benchmark assessments which indicate lowest performing indicators, and failure data for Algebra I)
- Overview–Creating A Focus on Learning
    - What do we want them to learn?
    - How will we know they learned it?
    - Clarifying and monitoring student success–How will this look?
- Teachers will use the Algebra I curriculum guide and course performance indicators to map out what the students should learn by the end of quarter 1 and 2.
- Teachers will determine what skills the students must know pertaining to each indicator and what evidence will be used to demonstrate student mastery.
- Teachers will create a journal entry – I used to think . . . Now I know . . . based on information obtained in today's module.
- Teachers will complete a module evaluation.
- Prework for next module:
    - Continue working on the skills students need to master for performance indicators.
    - Book – Revisiting Professional Learning Communities at Work: New Insights for Improving Schools – "Chapter 7: Teaching in a Professional Learning Community" pp. 169–193.

- Book – Cultures Built to Last–Systemic PLCs at Work–"Chapter 4: The Loose & Tight System in Action" pp. 47–61.
- Log on to http://www.go.solution-tree.com/PLCbooks to view reproducible documents that may be helpful to the Algebra I PLC.
- Bring the following books to class: Successful Single Sex Classrooms . . . Teaching the Female Brain . . . and Teaching the Male Brain . . ..

Session 5–3 hours

- Icebreaker activity
- Discussion–What reproducible documents will be most helpful to the PLC?
- Overview–PLC in Action
  - Creating curriculum
  - Monitoring progress
  - Supporting improvement
- Teachers will work in groups to identify and chart what instructional activities and strategies will be implemented to facilitate student success in Algebra I.
  - Differentiation
  - Multiple Intelligences
  - Ipads
- Book–Successful Single-Sex Classrooms: A Practical Guide to Teaching Boys & Girls Separately by Gurian, Stevens & Daniels–"Chapter 5–A Boy Friendly Classroom – What Does It Look Like?" and "Chapter 6–A Girl friendly Classroom–What Does It Look Like?"
- Book–Teaching the Female Brain: How Girls Learn Math & Science by Abigail Norfleet James–"Chapter 4: Teaching Math to the Female Brain".
- Book–Teaching the Male Brain: How Boys Think, Feel and Learn in School by Abigail Norfleet James–"Chapter 9 – Content-Specific Learning Strategies".
- Teachers will identify and chart learning styles specific to boys and girls and use this as a guide when designing the lesson.
- Teachers will work in groups to design a lesson that will be used by all members of the PLC.
- Based on previous data, teachers will identify possible interventions that may be needed to assist students.

- Teachers will create a journal entry – I used to think . . . Now I know . . . based on information obtained in today's module.
- Teachers will complete a module evaluation.
- Prework for next module:
  - Book–Common Formative Assessment: A Toolkit for Professional Learning Communities at Work by Bailey & Jakicic (2012) – "Chapter 2: Setting the Stage for Common Assessments" pp. 13–24 and "Chapter 5: Designing Quality Common Formative Assessments" pp. 49–61.
  - Log on to http://www.go.solution-tree.com/assessment to view reproducible documents that may be helpful in writing common assessments.

- Identify and be prepared to share best practices used in the classroom to assist students in understanding course material.

Session 6–3 hours

- Icebreaker activity
- Sharing of best classroom practices.
- Teachers will present the lesson developed in the last class.
- Teachers will be assigned sections in the reading to present to the group.
  - Setting the stage for common assessments
  - Designing quality common formative assessments
- Group discussion regarding presented material
- Teachers will begin developing a common formative assessment.
- Teachers will create a journal entry – I used to think . . . Now I know . . . based on information obtained in today's module.
- Teachers will complete a module evaluation.
- Prework for next module:
  - Each member of the PLC will create 15 problems relating to the identified standard or learning outcome to be considered for adding to the common formative assessment. Participants will bring these problems to the next session.
  - Book–Revisiting Professional Learning Communities at Work: New Insights for Improving Schools–"Chapter 8: Assessment in a Professional Learning Community" pp. 199–220.

Session 7–3 hours

- Icebreaker activity
- Review of the major highlights about common assessments–formative and summative.
- Common assessment discussion among team.
- Teachers will examine the common formative assessment problems created by each team member. Teachers will use problems to finalize the common formative assessment. This will be a flexible assignment, if the team agrees with all questions presented a 2nd formative assessment will be created.
- Teachers will create a journal entry – I used to think . . . Now I know . . . based on information obtained in today's module.
- Teachers will complete a module evaluation.
- Prework for next module:
  - Book–Learning by Doing: A Handbook for Professional Learning Communities at Work–"Chapter 4: How will we Respond When Some Students Don't Learn" pp. 95–115.
  - Book–Common Formative Assessment: A Toolkit for Professional Learning Communities at Work–"Chapter 7: Using Data to Make a Difference" pp. 73–82 and "Chapter 8: Getting the Most Bang for Your Assessment Buck" pp. 83–89.

Session 8–3 hours

- Icebreaker activity
- Essential question–How do you feel about creating common formative assessments and using it to assess student knowledge? Members of the PLC will have an opportunity to share their feelings and perceptions in regard to this question.
- Teachers will create a rubric for scoring common formative assessment(s) and determine proficiency levels.
- Teachers will identify the date in which the common formative assessment will be given and a date for collaborative grading–student results will be brought to next session.
- Overview of using data to determine intervention strategies to facilitate student success.
- Discussion and creation of an intervention plan to address students who possibly demonstrate deficiencies on the common formative assessment.
- Teachers will create a journal entry – I used to think . . . Now I know . . . based on information obtained in today's module.
- Teachers will complete a module evaluation.
- Prework for next module:
    - Item analysis of common formative assessment–identify how many students got each question correct & incorrect.
    - Bring student samples of the assessment for review.
    - Review intervention plan and identify changes (if any) that should be made to accommodate student needs.
    - Book–Learning By Doing: A Handbook for Professional Learning Communities–"Chapter 7: Using Relevant Information to Improve Results" pp. 181–204.

Session 9–3 hours

- Icebreaker activity
- Teachers will be assigned sections to present to the class from the pre–work activity.
- Teachers will examine the student work samples and data from the common formative assessment to identify common themes and patterns amongst students.
- Teachers will discuss the student data (results) in relation to the identified learning outcomes and goals determined by the team.
- Teachers will discuss current school–wide or departmental interventions currently in place to address student deficiencies.
- Teachers will revisit the previously developed intervention plan and make adjustments based on student data.
- Teachers will create a journal entry – I used to think . . . Now I know . . . based on information obtained in today's module.
- Teachers will complete a module evaluation.
- Prework for next module:
    - Book–Cultures Built to Last Systemic PLCs at Work–"Chapter 5: Sustaining the Improvement Process" pp. 63–77.

Session 10–3 hours

- Icebreaker activity
- Discussion–Sustaining the Improvement Process
- Overview of How the PLC should look
    - Share teaching experiences that provide positive results.
    - Review current assessment data for the purpose of measuring results against goals as stated in the PLC action plan.
    - Review current leading and lagging indicators relative to strategies to monitor progress.
    - Review and update PLC action and work plans.
    - Complete item analysis of assessment(s).
    - Determine a protocol that will be used to guide discussion and a working binder will be kept to maintain an historical record of data, discussion, and decisions.
    - Make recommendations for improving assessment(s). Make recommendations for improving and aligning instruction with assessment.
- Teachers will assess and articulate the PLC work completed during sessions.
- Teachers will celebrate the accomplishments of the PLC.
- Teachers will share journal entries.
- Teachers will discuss the plan for continuing work within the PLC.
- Teachers will complete a final self–evaluation.

Additional Resources for Creating and Implementing a PLC

The following resources are included to provide additional information for PLC planning and pedagogy. These resources provide activities, ideas, strategies, reproducible handouts and best practices. As you continue to work in your PLC consider examining, researching, and creating your own professional toolbox of teaching resources.

Required Reading

Bailey, K., & Jakicic, C. (2012). *Common Formative Assessment: A Toolkit for Professional Learning Communities at Work*. Bloomington, IN: Solution Tree.

DuFour, R., DuFour, R., & Eaker, R. (2008). *Revisiting Professional Learning Communities at Work: New Insights for Improving Schools*. Bloomington, IN: Solution Tree.

DuFour, R., DuFour, R., Eaker, R., & Many, T. (2010). *Learning By Doing: A Handbook for Professional Learning Communities at Work*. Bloomington, IN: Solution Tree.

DuFour, R., & Fullan, M. (2013). *Cultures Built to Last – Systemic PLCs at Work*. Bloomington, IN: Solution Tree.

Gurian, M., Stevens, K., & Daniels, P. (2009). *Successful Single-Sex Classrooms: A Practical Guide to Teaching Boys & Girls Separately*. San Francisco, CA: Jossey-Bass.

James, A. N. (2009). *Teaching the Female Brain: How Girls Learn Math & Science*. Thousand Oaks, CA: Corwin.

James, A. N. (2007). *Teaching the Male Brain: How Boys Think, Feel and Learn in School*. Thousand Oaks, CA: Corwin.

Additional Suggested Reading

Ainsworth, L. B., & Viegut, D. J. (2015). *Common Formative Assessments 2.0: How Teacher Teams Intentionally Align Standards, Instruction, and Assessment*. Thousand Oaks, CA: Corwin.

Collins, A. (2012). *Using Classroom Assessment to Improve Student Learning: Math Problems Aligned with NCTM and Common Core State Standards*. Reston, VA: National Council of Teachers of Mathematics.

Coil, C. (2010). *Differentiated Activities & Assessments: Using the Common Core Standards*. Thousand Oaks, CA: Corwin.

Coyne, M. D., Carnine, D. W., & Kame'enui, E. J. (2010). *Effective Teaching Strategies that Accommodate Diverse Learners.* Thousand Oaks, CA: Corwin.

DuFour, R., & Marzano, R. J. (2011). *Leaders of Learning: How District, School & Classroom Leaders Improve Student Achievement*. Bloomington, IN: Solution Tree.

Graham, P., & Ferriter, W.M. (2010). *Building a Professional Learning Community at Work: A Guide to the First Year*. Bloomington, IN: Solution Tree.

Gurian, M., Stevens, K., & King, K. (2008). *Strategies for Teaching Boys & Girls Secondary Level: A Workbook for Educators*. San Francisco, CA: Jossey-Bass.

Keeley, P. D., & Tobey, C. R. (2011). *Mathematics Formative Assessment: 75 Practical Strategies for Linking Assessment, Instruction and Learning*. Thousand Oaks, CA: Corwin.

Lieberman, A., Miller, L., Roy, P. A., Hord, S. M., & Von Frank, V. (2014). *Reach the Highest Standard in Professional Learning: Learning Communities*. Thousand Oaks, CA: Corwin.

McRel (2010). *What We Know About Mathematics Teaching & Learning*. Bloomington, IN: Solution Tree.

Orlich, D., Harder, R. J., Callahan, R. C., Trevisan, M. S., Brown, A. H., & Miller, D. E. (2013). *Teaching Strategies: A Guide to Effective Instruction*. Belmont, CA: Wadsworth Cengage Learning.

Texas, L., & Jones, T. (2013). *Strategies for Common Core Mathematics – Implementing the Standards for Mathematicsal Practice*. New York, NY: Routledge.

Thomas, E. J., Brunsting, J. R., & Warrick, P. L. (2010). *Styles and Strategies for Teaching High School Mathematics: 21 Techniques for Differentiating Instruction and Assessment*. Thousand Oaks, CA: Corwin.

Internet Resources

Professional Learning Communities
http://www.oma.ku.edu/soar/smartgoals.pdf
http://ncpublicschools.org/profdev/resources/proflearn/
http://www.allthingsplc.info/
http://www.sedl.org/change/issues/issues61.html

Common Core Standards and PARCC Initiative
http://www.parcconline.org/parcc-model-content-frameworks
http://www.corestandards.org/the-standards
http://illustrativemathematics.org/
http://www.nctm.org/standards/mathcommoncore/Default.aspx?_taxonomyid=418026&path=%5cmathcommoncore.org%5cStandards&_taxonomyshowall=1

Formative Assessment
http://www.utdanacenter.org/pre-kindergarden-12-education/tools-for-teaching-and-learning/formative-assessment-tools-and-tasks/
http://map.mathshell.org/materials/index.php

Single-gender
www.gurianinstitute.com

Differentiation Strategies
www.aislusaka.org/uploaded/Differentiating_strategies.pdf
www.differentiationworkshop.pbworks.com
www.cnweb.cn.edu/tedu/new%20website%docs/differentiatedinstructionstrategieskit.pdf

Questioning Strategies
www.nsrfharmony.org/protocol/doc/choosing_question.pdf

Reproducibles
http://www.go.solution-tree.com/PLCbooks
www.marzanoresearch.com/classroomstrategies
http://www.go.solution-tree.com/assessment

Professional Learning Community Module – Evaluation Form

This evaluation will be completed at the end of each session

Directions: Make solid, dark marks by using a pencil or black/blue pen.

Please indicate your job classification:

- ○ Teacher
- ○ Administrator
- ○ School-Based Staff
- ○ Other _____

Please assess the session based on the following questions:

1. Did the presenter(s) use effective presentation strategies?

○ Not at All ○ A Little ○ Somewhat ○ Quite a Bit ○ Very Much

2. Did the module provide you with practical information you can use in your own work?

○ Not at All ○ A Little ○ Somewhat ○ Quite a Bit ○ Very Much

3. Did the presentation make you reflect on your own practice/work?

○ Not at All ○ A Little ○ Somewhat ○ Quite a Bit ○ Very Much

4. Did you have an opportunity to participate or ask questions during the session?

○ Not at All ○ A Little ○ Somewhat ○ Quite a Bit ○ Very Much

5. Did the module deepen your interest in PLCs?

○ Not at All ○ A Little ○ Somewhat ○ Quite a Bit ○ Very Much

6. Overall module rating:

○ Poor ○ Fair ○ Good ○ Very Good ○ Excellent

7. Was there anything else that you would have liked to learn from the presenter(s) regarding today's module?

_____

_____

8. Other comments/feedback about the module for the presenter(s):

_____

_____

Professional Learning Community – Final Self-Evaluation

Directions: Please respond to the following questions based on your participation in the Algebra I PLC.

1. How has your participation in the PLC impacted your professional practices?

2. Have the PLC modules provided you with any strategies and methods for enhancing student academic achievement? If so, please provide.

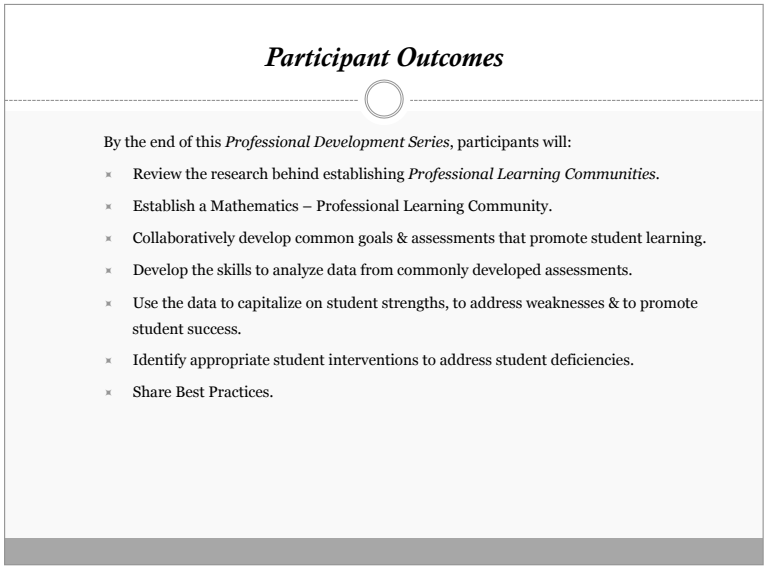
3. Describe any modifications, if any, to your pedagogy as a result of your involvement in the PLC.

4. What factor(s) would you attribute to the success or failure of the PLC?

5. Please provide any recommendations for improving the PLC sessions as it relates to student achievement.

Thank you for your participation in the Algebra I professional learning community! Please return this evaluation form to the project facilitator as you exit the room.

PowerPoint Presentation Slides



Participant Questions

1. What evidence in your school points to a shared vision and values that are focused on students?
2. What evidence in your school exists for shared and supportive leadership?
3. In what ways are teachers at your school sharing their practice with colleagues?
4. What structures are in place at your school to support collaboration among teachers, administration, and other staff?
5. How would you describe the relationships that exist in your school among teachers, administrators, and other staff?

Module 1 – What is a Professional Learning Community?

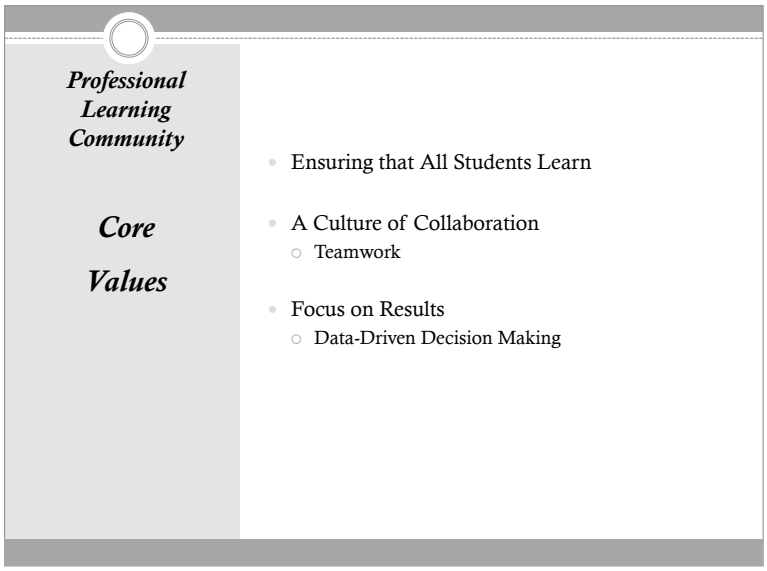
What is a Professional Learning Community?

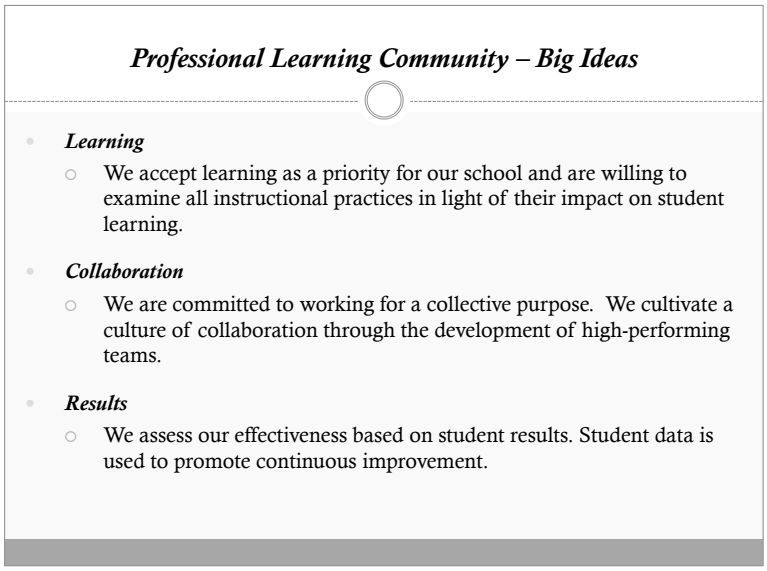
A professional learning community is characterized by the collaborative work of educators to continuously seek, share, and act on their learning in order to improve their instructional practices for the purpose of improved student outcomes.

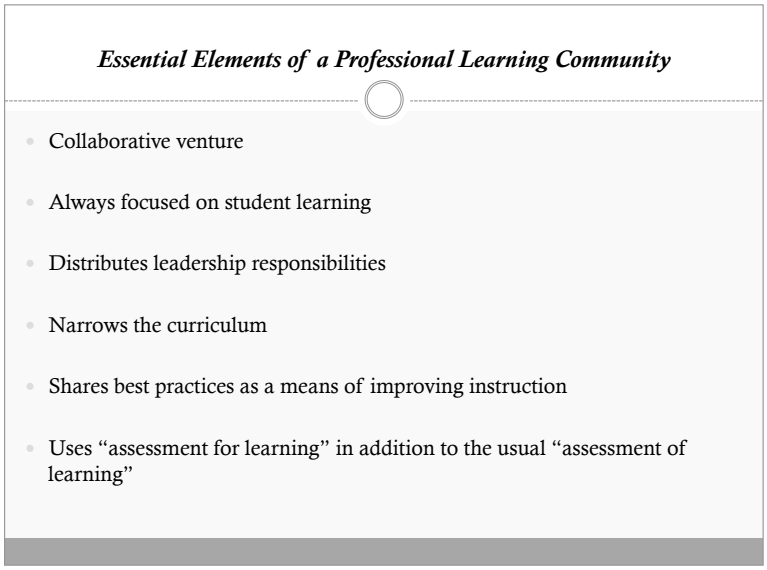
Professional Learning Community

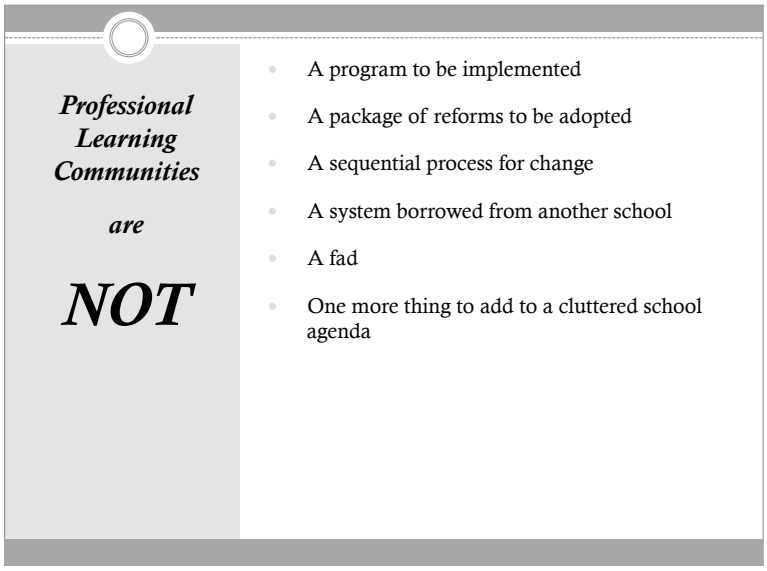
Characteristics

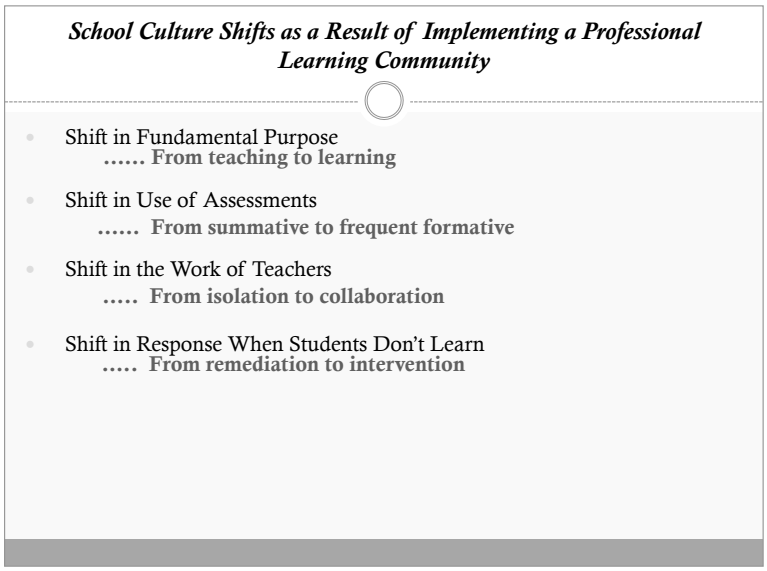
- Shared Mission, Vision, and Values
- Collective Inquiry
- Collaborative Teams
- Action Orientation and Experimentation
- Continuous Improvement
- Results Orientation

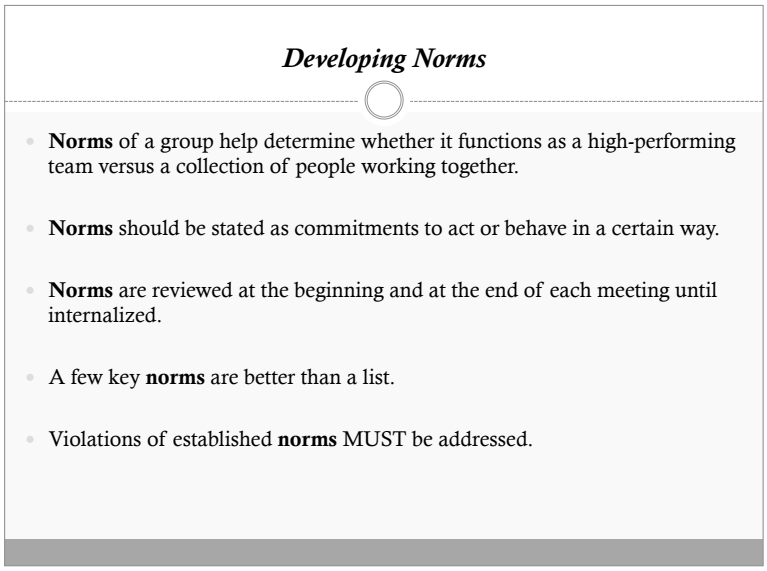

Professional Learning Community
Core Values
Ensuring that All Students Learn
A Culture of Collaboration
Teamwork
Focus on Results
Data-Driven Decision Making

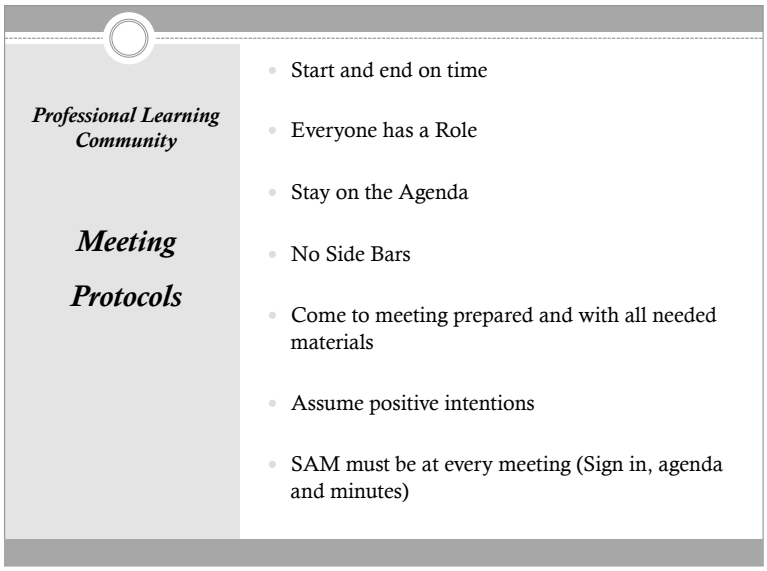

Professional Learning Community – Big Ideas
Learning
We accept learning as a priority for our school and are willing to examine all instructional practices in light of their impact on student learning.
Collaboration
We are committed to working for a collective purpose. We cultivate a culture of collaboration through the development of high-performing teams.
Results
We assess our effectiveness based on student results. Student data is used to promote continuous improvement.

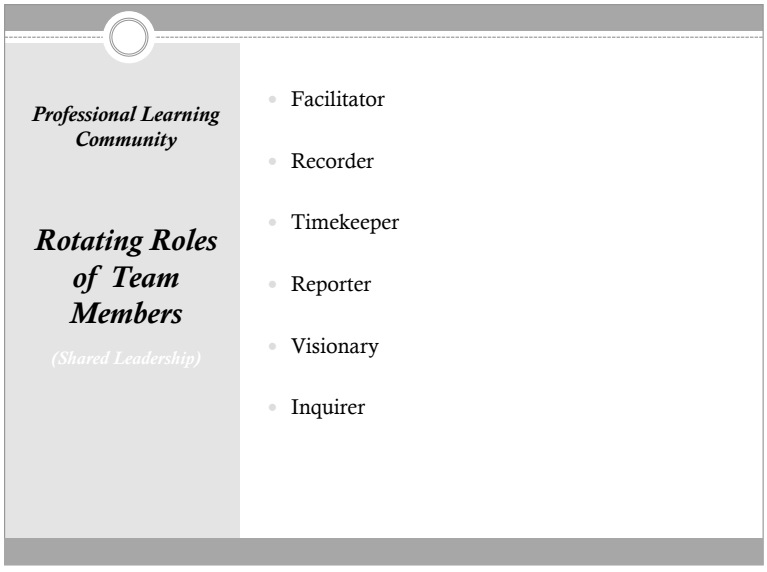

Essential Elements of a Professional Learning Community
Collaborative venture
Always focused on student learning
Distributes leadership responsibilities
Narrows the curriculum
Shares best practices as a means of improving instruction
Uses "assessment for learning" in addition to the usual "assessment of learning"


Professional Learning Communities are NOT
A program to be implemented
A package of reforms to be adopted
A sequential process for change
A system borrowed from another school
A fad
One more thing to add to a cluttered school agenda


School Culture Shifts as a Result of Implementing a Professional Learning Community
Shift in Fundamental Purpose
..... From teaching to learning
Shift in Use of Assessments
..... From summative to frequent formative
Shift in the Work of Teachers
..... From isolation to collaboration
Shift in Response When Students Don't Learn
..... From remediation to intervention


Developing Norms
Norms of a group help determine whether it functions as a high-performing team versus a collection of people working together.
Norms should be stated as commitments to act or behave in a certain way.
Norms are reviewed at the beginning and at the end of each meeting until internalized.
A few key norms are better than a list.
Violations of established norms MUST be addressed.


Professional Learning Community
Meeting Protocols
Start and end on time
Everyone has a Role
Stay on the Agenda
No Side Bars
Come to meeting prepared and with all needed materials
Assume positive intentions
SAM must be at every meeting (Sign in, agenda and minutes)


Professional Learning Community
Rotating Roles of Team Members
(Shared Leadership)
Facilitator
Recorder
Timekeeper
Reporter
Visionary
Inquirer

Class Activity & Discussion

- Develop Norms
- Identify roles of team members
- Review
- Selection of Modules by Facilitators
- Answer the following questions:
  - What are the components of an effective PLC?
  - What will be the focus of this PLC?
  - What are some of the strengths of forming a PLC at your school?
  - What are some challenges you may encounter?

Professional Development Community

Reflection Activity

- If you were to spend a day in a school of your choice, observing the culture, what characteristics or key indicators would you look for to determine if the school were a *Professional Learning Community*?
- What evidence would indicate that the school was **NOT** a *Professional Learning Community*?

Professional Learning Community

Pre-Work for Next Module

- Book – *Revisiting Professional Learning Communities at Work: New Insights for Improving Schools* by DuFour, DuFour & Eaker (2008) – Chapter 3: Making A Case for PLCs pp. 67-86 and Chapter 4: The Challenge of Cultural Change pp. 89-110.

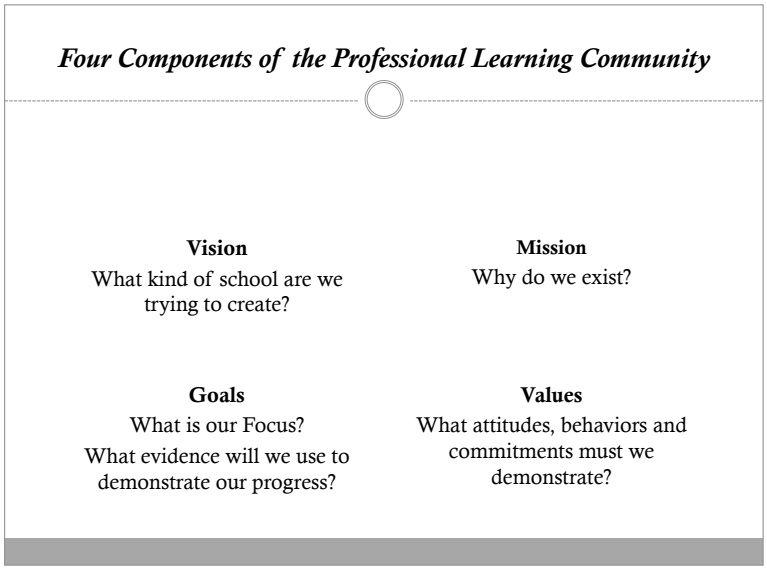
Module 2 – The Importance of Adopting a Professional Learning Community

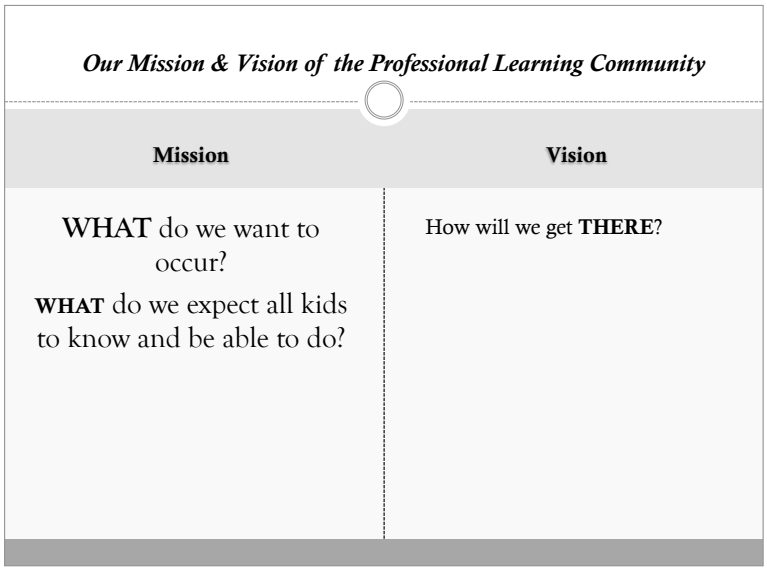
Why are Professional Learning Communities Important?

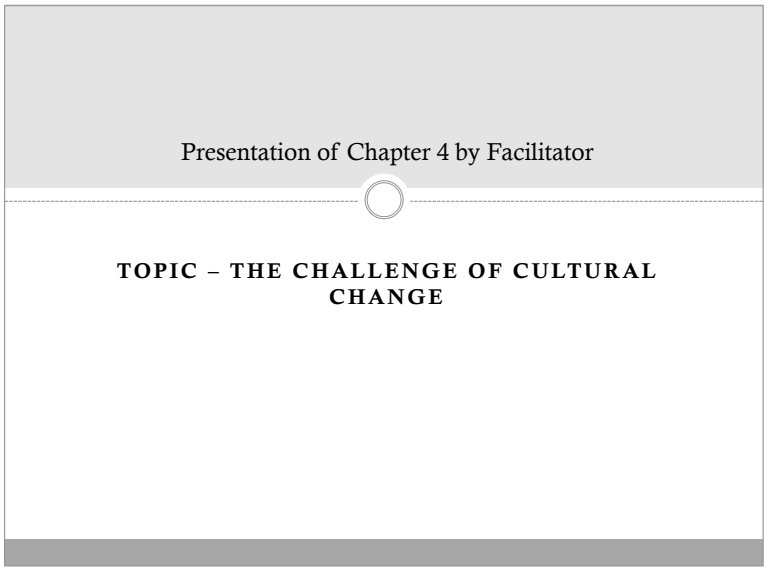
- They operate under the assumption that the key to improved learning for students is continuous, job embedded learning for educators.
- They function as an effective strategy for building school capacity around core issues of teaching and learning.
- They foster practices required to undertake and sustain change.
- They can serve as a mechanism for transforming school culture.

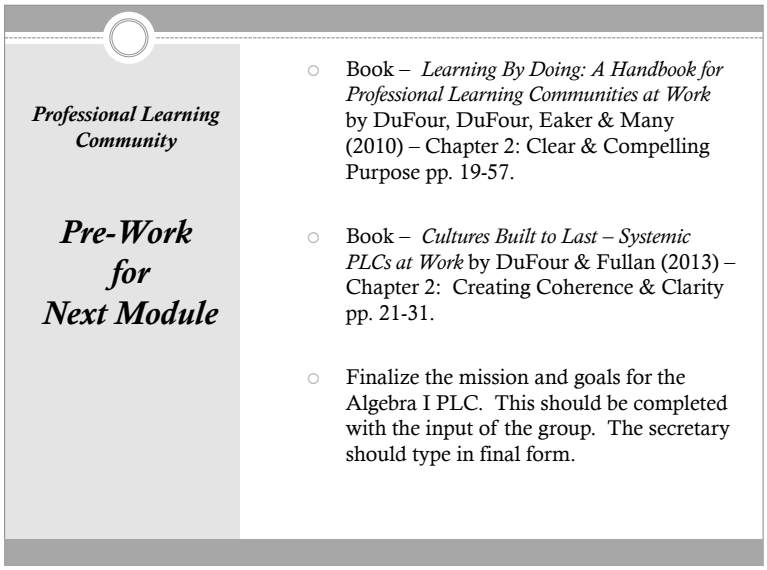
How do Professional Learning Communities Impact Student Learning?

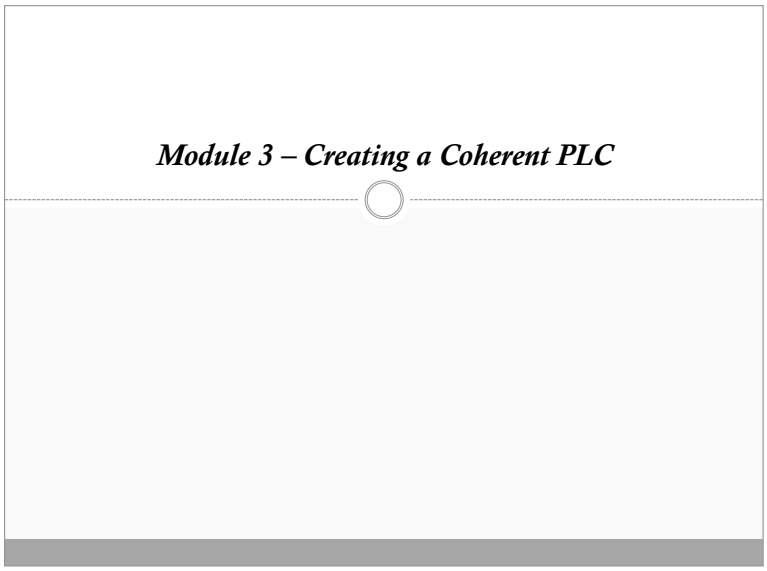
- By modeling collegiality, intellectual inquiry, critical discourse, and continuous improvement, professional learning communities raise the expectation and standard for students' level of engagement, development, and achievement.
- Studies indicate that students tend to be engaged in learning at high intellectual levels when the adults are engaged with one another and with their students at high intellectual levels around a shared vision for student success.

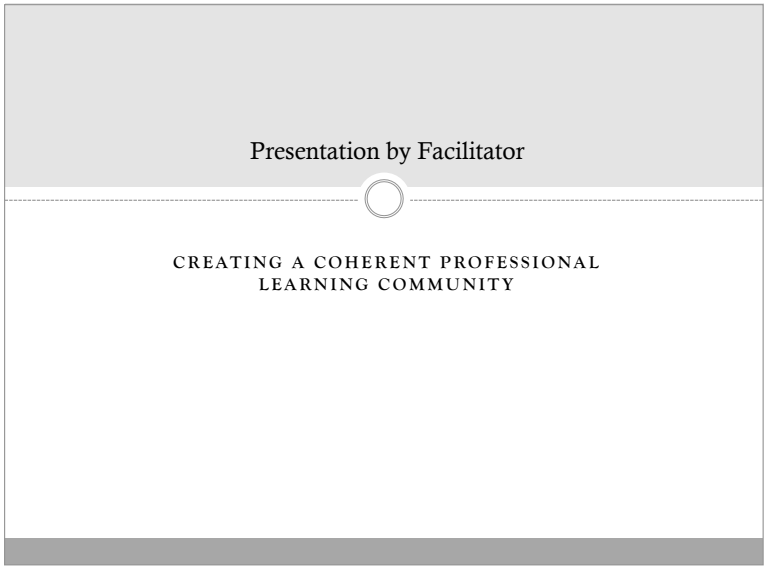

Four Components of the Professional Learning Community
Vision
What kind of school are we trying to create?
Mission
Why do we exist?
Goals
What is our Focus?
What evidence will we use to demonstrate our progress?
Values
What attitudes, behaviors and commitments must we demonstrate?

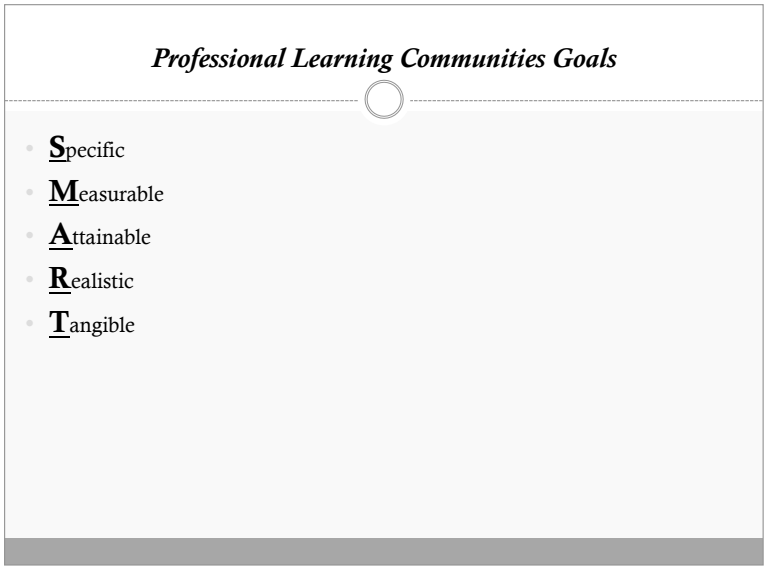

Our Mission & Vision of the Professional Learning Community
Mission
Vision
WHAT do we want to occur?
WHAT do we expect all kids to know and be able to do?
How will we get THERE?

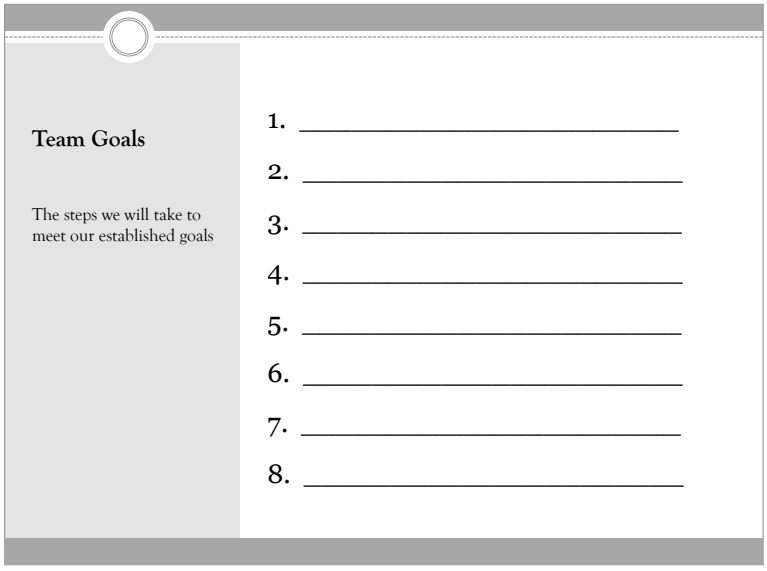

Presentation of Chapter 4 by Facilitator
TOPIC – THE CHALLENGE OF CULTURAL CHANGE


Professional Learning Community
Pre-Work for Next Module
Book – Learning By Doing: A Handbook for Professional Learning Communities at Work by DuFour, DuFour, Eaker & Many (2010) – Chapter 2: Clear & Compelling Purpose pp. 19-57.
Book – Cultures Built to Last – Systemic PLCs at Work by DuFour & Fullan (2013) – Chapter 2: Creating Coherence & Clarity pp. 21-31.
Finalize the mission and goals for the Algebra I PLC. This should be completed with the input of the group. The secretary should type in final form.


Module 3 – Creating a Coherent PLC


Presentation by Facilitator
CREATING A COHERENT PROFESSIONAL
LEARNING COMMUNITY


Professional Learning Communities Goals
Specific
Measurable
Attainable
Realistic
Tangible

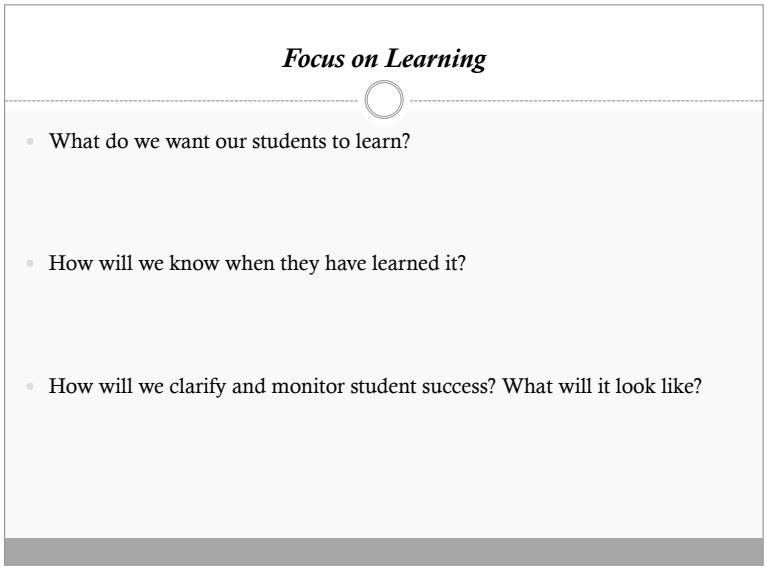

Team Goals
The steps we will take to meet our established goals
1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

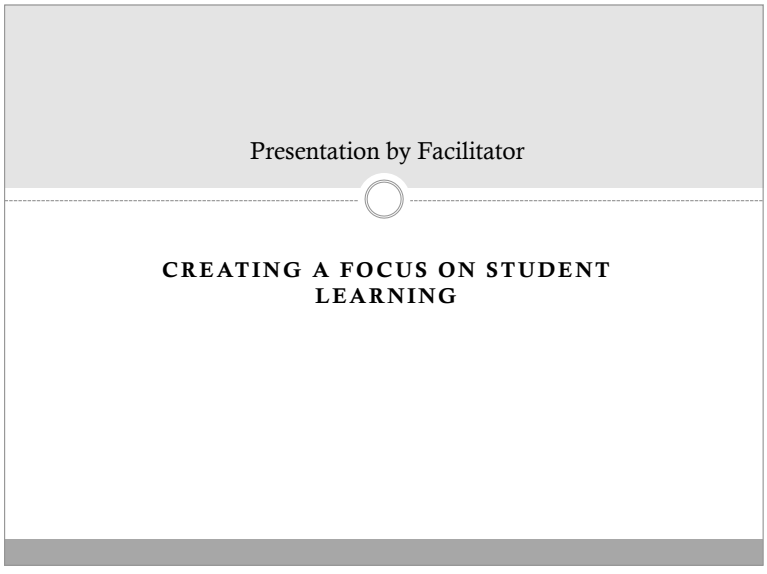
Professional Learning Community

Pre-Work for Next Module

- Book – *Cultures Built to Last – Systemic PLCs at Work* – Chapter 3: The Loose Tight Dilemma pp. 33-42.
- Book – *Learning By Doing: A Handbook for Professional Learning Communities at Work* by – Chapter 3: Creating A Focus on Learning pp. 59-92.
- Teachers will gather student data from SLO pretest, benchmark assessments, and failure data for Algebra 1.
- Bring Curriculum Guide and Performance Indicators for Algebra 1 to next meeting.

Module 4 – Creating A Focus on Learning


Focus on Learning
What do we want our students to learn?
How will we know when they have learned it?
How will we clarify and monitor student success? What will it look like?


Presentation by Facilitator
CREATING A FOCUS ON STUDENT LEARNING

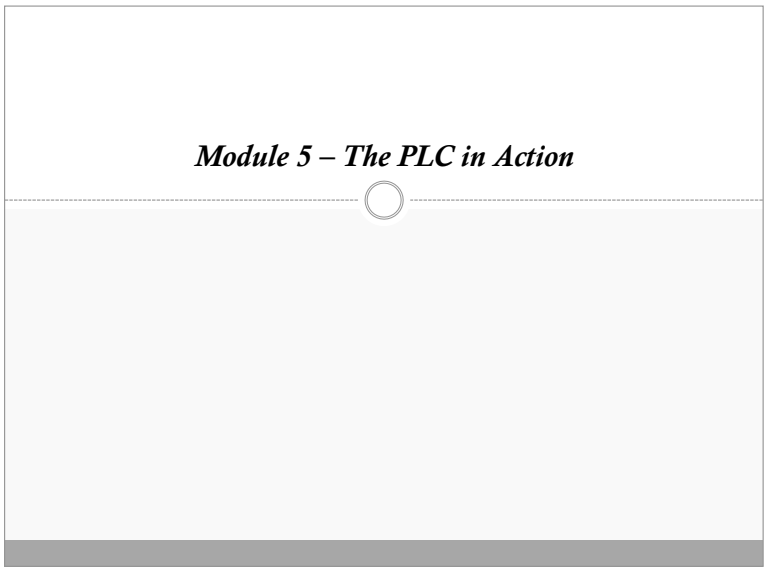
Presenting Your Findings Activity

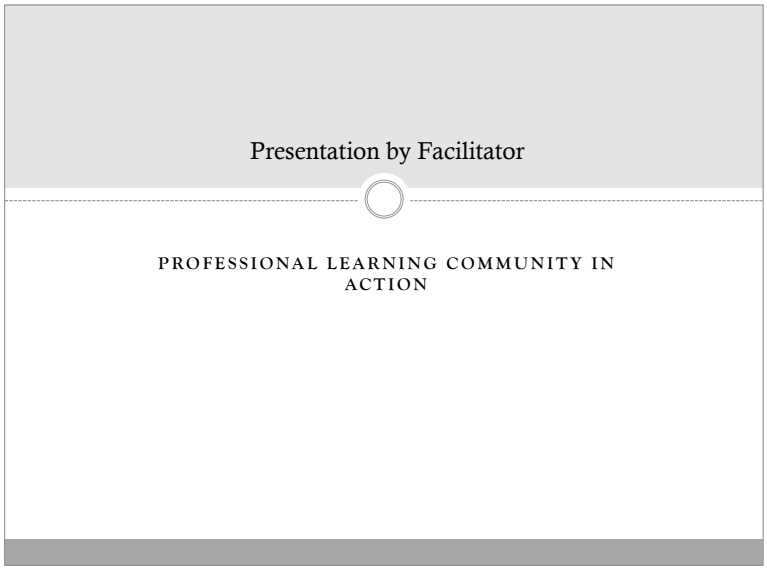
- Describe your instructional unit: What did you teach?
- Discuss your learner outcomes: What were your goals? How did you measure success? What formative assessment did you use?
- Discuss student performance: Excellent, Good or Bad? Did they learn what you wanted them to learn? Identify strengths and weaknesses. What instructional strategies yielded success? How did you address deficient students?
- What did you take from the data? Were there any surprises?
- Describe any alternations you will make when teaching the unit again.

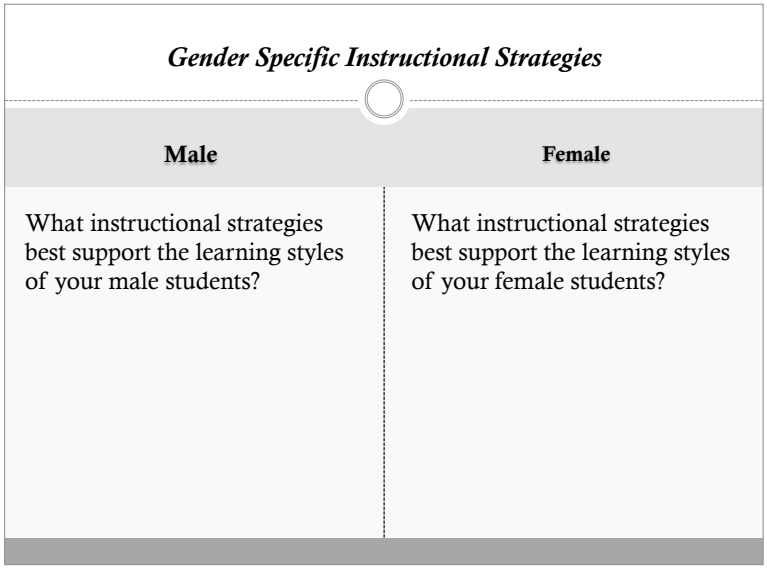
Professional Learning Community

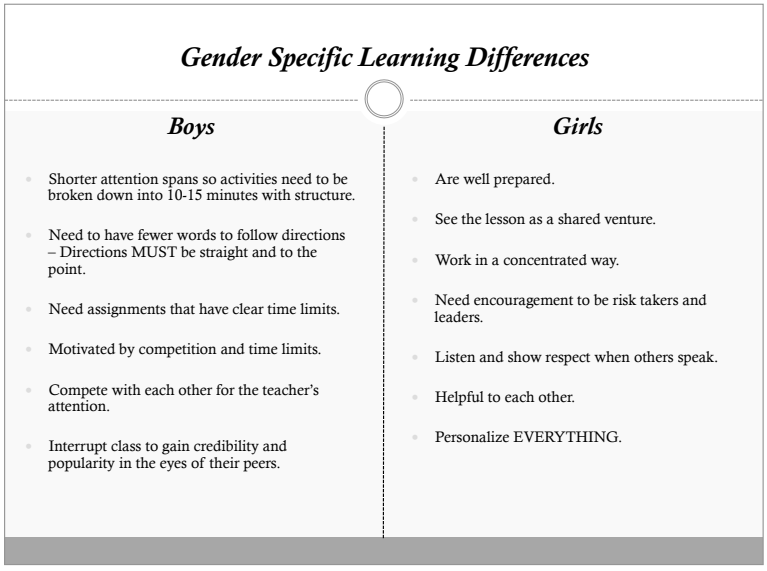
Pre-Work for Next Module

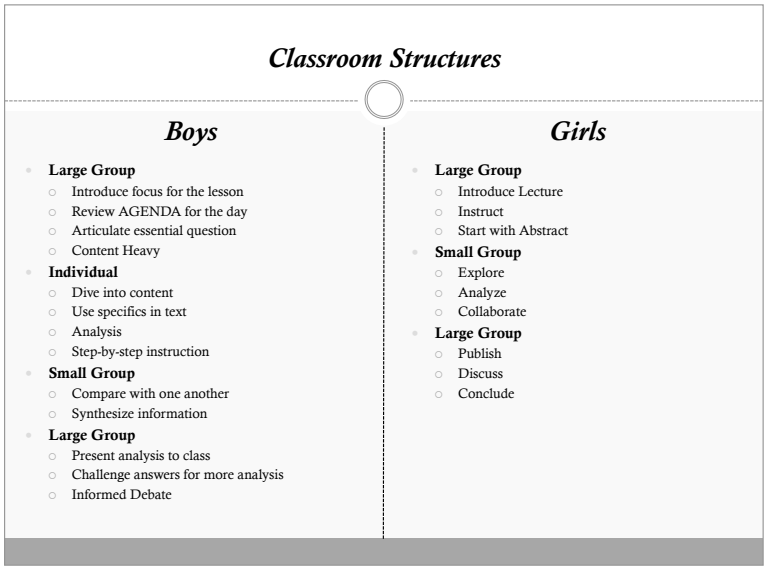
- Continue working on the skills students need to master for performance indicators.
- Book - *Revisiting Professional Learning Communities at Work: New Insights for Improving Schools* – Chapter 7: Teaching in a Professional Learning Community pp. 169-193.
- Book – *Cultures Built to Last – Systemic PLCs at Work – Chapter 4: The Loose & Tight System in Action* pp. 47-61.
- Log on to http://www.go.solution-tree.com/PLCbooks to view reproducible documents that may be helpful to the Algebra 1 PLC.
- Bring the following books to class: *Successful Single Sex Classrooms…, Teaching the Female Brain… and Teaching the Male Brain….*

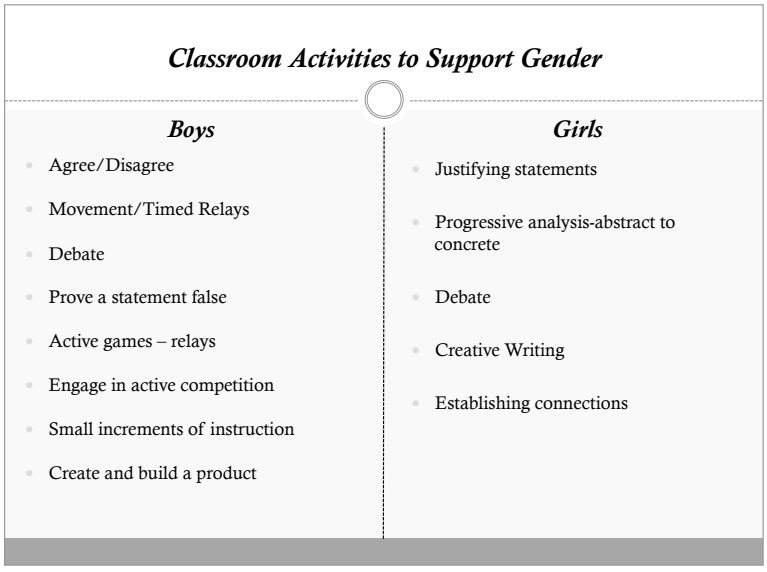

Module 5 – The PLC in Action

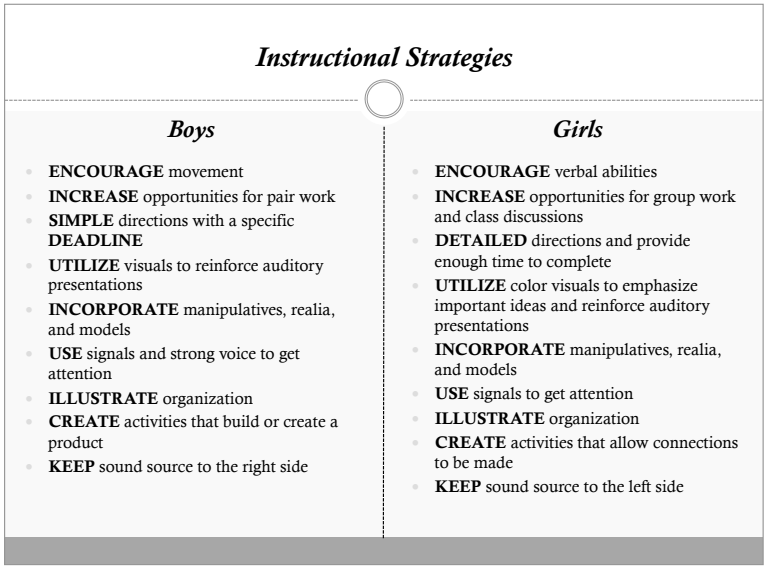

Presentation by Facilitator
PROFESSIONAL LEARNING COMMUNITY IN ACTION

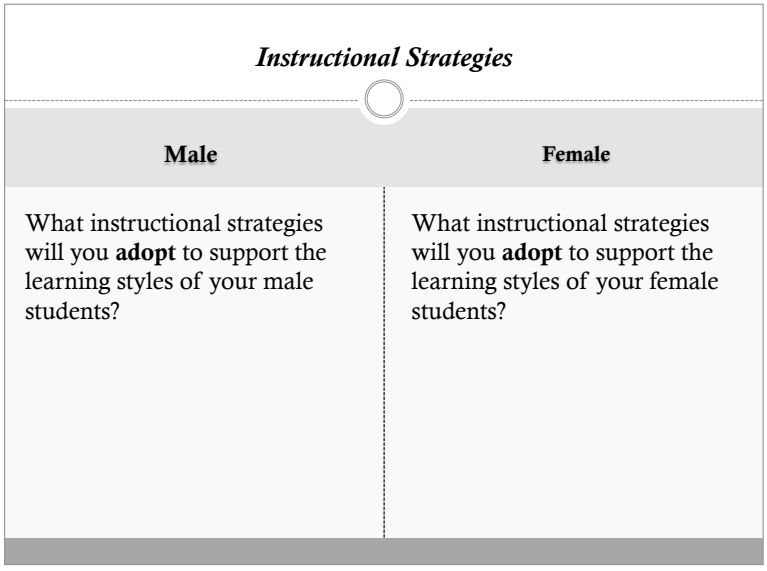

Gender Specific Instructional Strategies
Male
Female
What instructional strategies best support the learning styles of your male students?
What instructional strategies best support the learning styles of your female students?


Gender Specific Learning Differences
Boys
Shorter attention spans so activities need to be broken down into 10-15 minutes with structure.
Need to have fewer words to follow directions – Directions MUST be straight and to the point.
Need assignments that have clear time limits.
Motivated by competition and time limits.
Compete with each other for the teacher's attention.
Interrupt class to gain credibility and popularity in the eyes of their peers.
Girls
Are well prepared.
See the lesson as a shared venture.
Work in a concentrated way.
Need encouragement to be risk takers and leaders.
Listen and show respect when others speak.
Helpful to each other.
Personalize EVERYTHING.


Classroom Structures
Boys
Large Group
Introduce focus for the lesson
Review AGENDA for the day
Articulate essential question
Content Heavy
Individual
Dive into content
Use specifics in text
Analysis
Step-by-step instruction
Small Group
Compare with one another
Synthesize information
Large Group
Present analysis to class
Challenge answers for more analysis
Informed Debate
Girls
Large Group
Introduce Lecture
Instruct
Start with Abstract
Small Group
Explore
Analyze
Collaborate
Large Group
Publish
Discuss
Conclude


Classroom Activities to Support Gender
Boys
Agree/Disagree
Movement/Timed Relays
Debate
Prove a statement false
Active games – relays
Engage in active competition
Small increments of instruction
Create and build a product
Girls
Justifying statements
Progressive analysis-abstract to concrete
Debate
Creative Writing
Establishing connections


Instructional Strategies
Boys
ENCOURAGE movement
INCREASE opportunities for pair work
SIMPLE directions with a specific DEADLINE
UTILIZE visuals to reinforce auditory presentations
INCORPORATE manipulatives, realia, and models
USE signals and strong voice to get attention
ILLUSTRATE organization
CREATE activities that build or create a product
KEEP sound source to the right side
Girls
ENCOURAGE verbal abilities
INCREASE opportunities for group work and class discussions
DETAILED directions and provide enough time to complete
UTILIZE color visuals to emphasize important ideas and reinforce auditory presentations
INCORPORATE manipulatives, realia, and models
USE signals to get attention
ILLUSTRATE organization
CREATE activities that allow connections to be made
KEEP sound source to the left side


Instructional Strategies
Male
What instructional strategies will you adopt to support the learning styles of your male students?
Female
What instructional strategies will you adopt to support the learning styles of your female students?

Mathematic Skills

What skills **MUST** each student master in order to be successful in Algebra I?

How will you **teach** and **develop** these skills?

Activity - Common Mathematics Lesson

Teachers will work collaboratively to develop an Algebra lesson that will be utilized by each member of the Professional Learning Community

Guiding Questions: What do we expect them to learn? How will we know when they have learned it?

Professional Learning Community

Pre-Work for Next Module

- Book (purchased by participants) – *Common Formative Assessment: A Toolkit for Professional Learning Communities at Work* by Bailey & Jakicic (2012) – Chapter 2: Setting the Stage for Common Assessments pp. 13-24 and Chapter 5: Designing Quality Common Formative Assessments pp. 49-61.
- Log on to http://www.go.solution-tree.com/assessment to view reproducible documents that may be helpful in writing a common assessments.
  - Identify and be prepared to share best practices used in the classroom to assist students in understanding course material.

Module 6 – Common Assessments

Presentation by Facilitator

SETTING THE STAGE FOR ASSESSMENT

Formative Assessments

- **Formative assessments** provide information during the instructional process *before* summative assessments. The purpose is to inform the teacher and students how well the learning is going.
- **Formative assessments** are assessments **FOR** learning that are used by the student *and* teacher to make decisions about what actions to take to promote further learning.
- **Summative assessments** are assessments **OF** learning that are used to sum up learning that has taken place. Summative assessments generally serve as a grade, certificate, or other marker of learning achieved.

Activity - Common Mathematics Assessment

Teachers will work collaboratively to develop an Algebra assessment that will be utilized by each member of the Professional Learning Community

Guiding Question: What questions and/or activities will give students the greatest chance of demonstrating their newly acquired learning?

Professional Learning Community

Pre-Work for Next Module

- Each member of the PLC will create 15 problems relating to the identified standard or learning outcome to be considered for adding to the common formative assessment. Participants will bring these problems to the next session.
- Book – *Revisiting Professional Learning Communities at Work: New Insights for Improving Schools* – Chapter 8: Assessment in a Professional Learning Community pp. 199-220.

Module 7 – Common Assessments (Cont.)

Presentation by Facilitator

COMMON ASSESSMENT RECAP OF PREVIOUS CLASS

Sharing Best Practices

Each member of the TEAM will share one or more best practices that they use in their classroom. Teachers will also share if the strategy is suited for males, females or both.

Activity - Common Mathematics Assessment

Teachers will work collaboratively to analyze and finalize the Algebra assessment that will be utilized by each member of the Professional Learning Community

Guiding Question: What questions and/or activities will give students the greatest chance of demonstrating their newly acquired learning?

Professional Learning Community

Pre-Work for Next Module

- Book – *Learning by Doing: A Handbook for Professional Learning Communities at Work* – Chapter 4: How will we Respond When Some Students Don't Learn pp. 95-115.
- Book – *Common Formative Assessment: A Toolkit for Professional Learning Communities at Work* – Chapter 7: Using Data to Make a Difference pp. 73-82 and Chapter 8: Getting the Most Bang for Your Assessment Buck pp. 83-89.

Module 8 – Intervention Strategies

Turn & Talk Activity

Each participant will turn to their neighbor and ask:

How do you feel about creating common formative assessments and using it to assess student knowledge?

Each pair will discuss their responses with the larger group.

Presentation by Facilitator

USING DATA TO DETERMINE INTERVENTION STRATEGIES

Activity - Student Interventions

Teachers will create academic interventions to support the lesson.

Guiding Questions: How will we respond when they do not master the lesson? What will we do to assist them in mastering the objectives of the lesson?

Professional Learning Community

Pre-Work for Next Module

- Item analysis of common formative assessment – identify how many students got each question correct & incorrect.
- Bring student samples of the assessment for review.
- Review intervention plan and identify changes (if any) that should be made to accommodate student needs.
- Book – *Learning By Doing: A Handbook for Professional Learning Communities* – Chapter 7: Using Relevant Information to Improve Results peps. 181-204.

Module 9 – Cohort Presentations

Data Presentations by TEAM members

Teachers will examine and share data from the administration of the common assessment and identify common strengths and weaknesses. Based on their findings we will determine if interventions need to be modified. ** All TEAM members will share student samples with the group.

Professional Learning Communities

Pre-Work for Next Module

- Book – *Cultures Built to Last Systemic PLCs at Work* – Chapter 5: Sustaining the Improvement Process pp. 63-77.

Module 10 – Sustaining the Improvement Process

Presentation by Facilitator

SUSTAINING THE IMPROVEMENT PROCESS

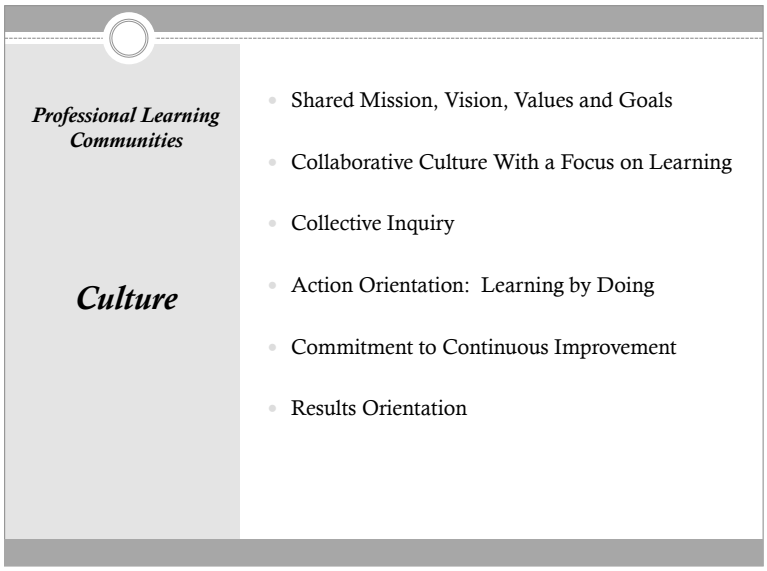
Professional Learning Communities

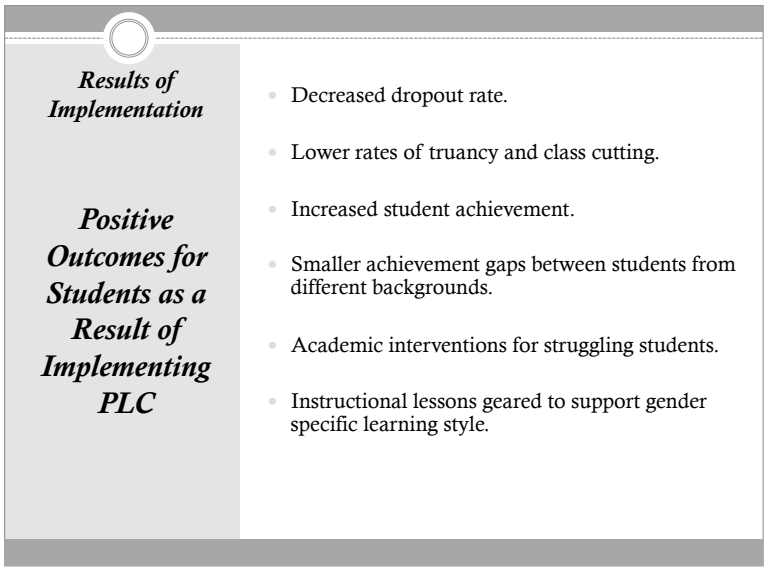
Final Concluding Thoughts!

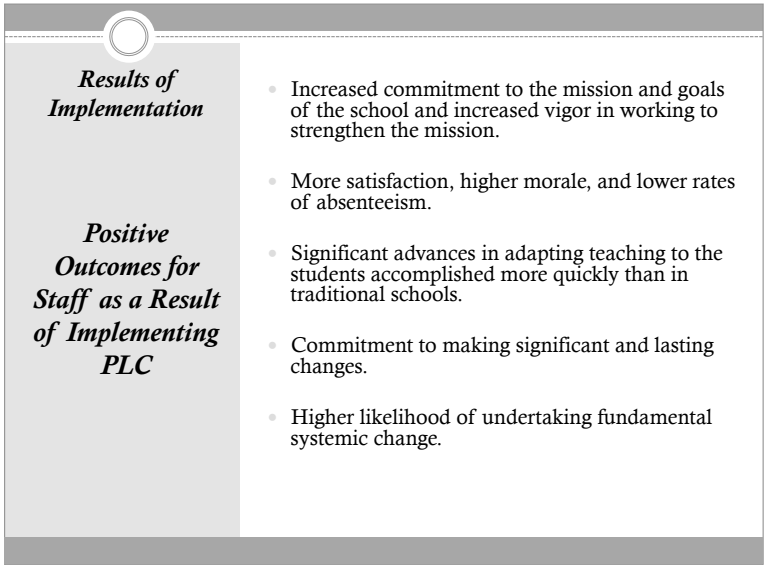
Communities of educators committed to working collaboratively in a continuous process of collective inquiry and action research to achieve improved results for the students they serve.

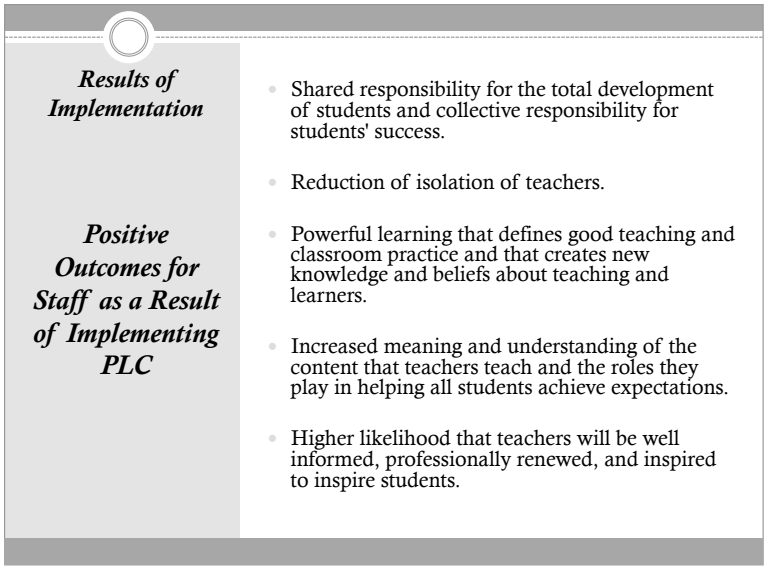
By modeling collegiality, intellectual inquiry, critical discourse, and continuous improvement, professional learning communities raise expectations and standards for student learning and achievement.

Schools immersed in the professional learning community concept have used shared leadership and decision making to bring about CHANGE and SCHOOL IMPROVEMENT.


Professional Learning Communities
Culture
Shared Mission, Vision, Values and Goals
Collaborative Culture With a Focus on Learning
Collective Inquiry
Action Orientation: Learning by Doing
Commitment to Continuous Improvement
Results Orientation


Results of Implementation
Positive Outcomes for Students as a Result of Implementing PLC
Decreased dropout rate.
Lower rates of truancy and class cutting.
Increased student achievement.
Smaller achievement gaps between students from different backgrounds.
Academic interventions for struggling students.
Instructional lessons geared to support gender specific learning style.


Results of Implementation
Positive Outcomes for Staff as a Result of Implementing PLC
Increased commitment to the mission and goals of the school and increased vigor in working to strengthen the mission.
More satisfaction, higher morale, and lower rates of absenteeism.
Significant advances in adapting teaching to the students accomplished more quickly than in traditional schools.
Commitment to making significant and lasting changes.
Higher likelihood of undertaking fundamental systemic change.


Results of Implementation
Positive Outcomes for Staff as a Result of Implementing PLC
Shared responsibility for the total development of students and collective responsibility for students' success.
Reduction of isolation of teachers.
Powerful learning that defines good teaching and classroom practice and that creates new knowledge and beliefs about teaching and learners.
Increased meaning and understanding of the content that teachers teach and the roles they play in helping all students achieve expectations.
Higher likelihood that teachers will be well informed, professionally renewed, and inspired to inspire students.

Results of Implementation

Positive Outcomes for Staff as a Result of Implementing PLC

- Decreased dropout rate and fewer classes "skipped".
- Lower rates of absenteeism.
- Increased learning that is distributed more equitably in the smaller high schools.
- Greater academic gains in math, science, history, and reading than in traditional schools.
- Smaller achievement gaps between students from different backgrounds.

References

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- DuFour, R. & Fullan, M. (2013). *Cultures Built to Last – Systemic PLCs at Work*. Bloomington, IN: Solution Tree.
- Gurian, M., Stevens, K. & Daniels, P. (2009). *Successful Single-Sex Classrooms: A Practical Guide to Teaching Boys & Girls Separately*. San Francisco, CA: Jossey-Bass.
- James, A. N. (2009). *Teaching the Female Brain: How Girls Learn Math & Science*. Thousand Oaks, CA: Corwin.
- James, A. N. (2007). *Teaching the Male Brain: How Boys Think, Feel and Learn in School*. Thousand Oaks, CA: Corwin.
- Teague, G. M. & Anfara, V. A. (2012). Professional learning communities create sustainable change through collaboration. Middle School Journal, 58-64.

Appendix B: Data Request Form

Data Request Form

TO:	
ORIGINATING SDE OFFICE	School Transformation
SDE CONTACT NAME	
SDE CONTACT PHONE	(xxx) xxx-xxxx
SDE CONTACT EMAIL	
DATE	June 14, 2012
REQUIRED COMPLETION DATE	June 22, 2015
DATE OF LAST SIMILAR REQUEST	Unknown
STAFF PERSON WHO COMPLETED LAST SIMILAR REQUEST	Unknown
REQUESTING ENTITY	
REQUESTOR'S CONTACT	
REQUESTOR'S TELEPHONE	(xxx) xxx-xxxx
REQUESTOR'S EMAIL	
BRIEF DESCRIPTION OF THE DATA NEEDED, TO INCLUDE THE PURPOSE OF THE REQUEST	Listing of middle schools that participate in single-gender instruction. Information is needed to compare academic achievement in the area of mathematics in single-gender and coeducational classes on the Palmetto Assessment of State Standards assessment.
SCHOOL YEAR AND/OR SASI QUARTERLY COLLECTION PERIOD	2008–2009; 2009–2010; 2010–2011; 2011–2012
OTHER HELPFUL INFO	

Appendix C: Confidentiality Agreements

CONFIDENTIALITY AGREEMENT – PEER DEBRIEFER

Name of Signer: _____

Peer Debriefer #1

During the course of proofreading data for this research: *"Effects of Single-Gender and Coeducational Learning Environments on Middle-School Mathematics Achievement"*. I, *[Peer Debriefer #1]* will have access to information, which is confidential and should not be disclosed. I, *[Peer Debriefer #1]*, acknowledge the information must remain confidential, and that improper disclosure of confidential information can be damaging to study participants.

By signing this Confidentiality Agreement I acknowledge and agree that:

1. I will not disclose or discuss any confidential information with others, including friends or family.

2. I will not in any way divulge, copy, release, sell, loan, alter or destroy any confidential information except as properly authorized.

3. I will not discuss confidential information where others can overhear the conversation. I understand that it is not acceptable to discuss confidential information even if the participant's name is not used.

4. I will not make any unauthorized transmissions, inquiries, modification or purging of confidential information.

5. I agree that my obligations under this agreement will continue after termination of the job that I will perform.

6. I understand that violation of this agreement will have legal implications.

7. I will only access or use systems or devices I'm officially authorized to access and I will not demonstrate the operation or function of systems or devices to unauthorized individuals.

Signing this document, I acknowledge that I have read the agreement and I agree to comply with all the terms and conditions stated above.

Signature: _____ **Date:** _____

CONFIDENTIALITY AGREEMENT – PEER DEBRIEFER

Name of Signer: _____

Peer Debriefer #2

During the course of proofreading data for this research: *"Effects of Single-Gender and Coeducational Learning Environments on Middle-School Mathematics Achievement"*. I, *[Peer Debriefer #2]*, will have access to information, which is confidential and should not be disclosed. I, *[Peer Debriefer #2]*, acknowledge the information must remain confidential, and that improper disclosure of confidential information can be damaging to study participants.

By signing this Confidentiality Agreement I acknowledge and agree that:

1. I will not disclose or discuss any confidential information with others, including friends or family.

2. I will not in any way divulge, copy, release, sell, loan, alter or destroy any confidential information except as properly authorized.

3. I will not discuss confidential information where others can overhear the conversation. I understand that it is not acceptable to discuss confidential information even if the participant's name is not used.

4. I will not make any unauthorized transmissions, inquiries, modification or purging of confidential information.

5. I agree that my obligations under this agreement will continue after termination of the job that I will perform.

6. I understand that violation of this agreement will have legal implications.

7. I will only access or use systems or devices I'm officially authorized to access and I will not demonstrate the operation or function of systems or devices to unauthorized individuals.

Signing this document, I acknowledge that I have read the agreement and I agree to comply with all the terms and conditions stated above.

Signature: _____ **Date:** _____