EFFECTS AND PERCEPTIONS OF PARENTAL INVOLVEMENT ON THE MATHEMATICAL ACHIEVEMENT OF STUDENTS IN A STEM COURSE: A MIXED-METHODS STUDY

by

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ABSTRACT

SARAH DANIELLE JOHNSON. Effects and perceptions of parental involvement on the mathematical achievement of students in a STEM course: A mixed-methods study. (Under the direction of DR. DAVID K. PUGALEE)

To understand how to identify and examine factors that influence parental involvement and math achievement of high school students, I conducted a mixed-methods study was guided by the following questions:

1. What are the perceptions of students, teachers and parents regarding parental involvement in secondary math education?
2. Does parental involvement in MINDSET influence mathematics performance for students?
3. Do the weekly newsletters and progress reports used in the MINDSET class influence the perception students, teachers and parents have about parental involvement?

This study builds on research that suggests parental involvement impacts students' academic achievement. Data were collected over a period of twelve weeks and included 8 weeks of implementing weekly newsletters and progress reports in a fourth-year math course that consisted of eleventh and 12th graders. The data included students' writing, field notes, conferencing transcriptions, my journal mathematical assessment performance, grades, surveys, field notes, and interviews with the students, parents, and teachers. I analyzed these data to answer the research questions above. According to my findings, parents, students, and teachers' perceptions about parental involvement were placed in four categories: strategies for parental involvement, barriers

of parental involvement, parents and students' transitional roles, and students' independence. Quantitative analysis revealed that the implementation of weekly newsletters and progress reports did not improve students' academic achievement, as well as influence students, parents, and teachers' perception of parental involvement. However, qualitative analysis revealed that parents and students perceived that the weekly progress reports and newsletters helped improved students grades because of accountability and helped parents to have a positive outlook in involving themselves with their teenagers' math education.

DEDICATION

This dissertation is dedicated to my greatest supporters, my parents, the late Kent Byron Johnson I and Andrea Michelle Johnson. I am grateful for my parents who taught me about living for God and have shown me unconditional love and support throughout the years. The legacy my father left me will forever be embedded in me. There is not a day that goes by in which I do not think of you. I love you Daddy (Mody). I also want to dedicate this dissertation to my siblings: TaNeesha, Byron, and Aaron. TaNeesha you set the tone for all of us and I love you so much for that. Byron and Aaron, I am truly blessed to have loving and supportive brothers. I love you Bywee and Aawee!

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CHAPTER 1: INTRODUCTION

Purpose of Study

Research has shown that students whose parents effectively communicate and establish shared responsibilities with their children's school, tend to obtain high academic achievement, especially in mathematics (Epstein, 2001; Knipping, Reid, Gellert, & Jablonka, 2008). Unfortunately, there is a lack of U.S. parents effectively involved in their children's math education, even though parents and teachers agree that parental involvement in children's schooling is important (Eccles & Harold, 1996). Having parents and schools function as a team would be an incentive for children to remain dedicated to their education, particularly mathematics (Civil & Bernie, 2006). Mathematics is a subject for which the U.S. government encourages greater student motivation and success (National Science Foundation Report, 2007). To accomplish this goal, the government funds organizations, such as the National Science Foundation (NSF) and National Aeronautics and Space Administration (NASA), to promote areas of Science, Technology, Engineering, and Mathematics (STEM), (NSF, 2007). These organizations promote and support parental involvement strategies such as: interactive homework, school or class newsletters, and parent organization meetings that allow parents to become invested in their children's education (Epstein, 2001). Still, there are factors that hinder parents' participation in their children's math education including:

(a) time limitations, (b) social economic status (SES), and (c) differing educational levels (Edin & Lein, 1997; Lareau, 2003).

Despite these factors, parents and schools seem to have the same agenda; providing students the best education (Epstein, 2001). How can students receive the best math education when parents and schools are not developing into a cohesive unit in which they are supporting one another and respecting one another's respective differences (Epstein, 2001)? With schools being diverse among the student body as well as among teachers, schools, and families, these groups need to collaborate with one another to determine approaches for the betterment of the children's math education. Unfortunately, this is difficult when factors, such as the parents' level of education and SES become a concern (Caldas & Bankston, 1997; Hanushek, 1997).

The purpose of this study is to examine and explain the importance of parental involvement in secondary mathematics education. There are a limited number of research studies focusing on parents getting involved in their teenage children's math education. As a result, this research study will provide insights on strategies that will help schools promote parental engagement in their high school children's mathematics education. In addition, this study investigates the impact of parental involvement on student achievement in a STEM mathematics course, as well as the perceptions of parents, teachers and students regarding parental involvement. According to Olmsted, Wetherby, Leler, and Rubin (1982), there is not enough strong evidence to validate that teachers' practices for parental involvement directly influence student achievement.

Background of the Study

In recent years, the United States government has focused heavily on improving the nation's educational system and consequently the economy's future, which in turn, will make the U.S. more competitive. In order to meet those goals, there has been extensive emphasis on implementing Science, Technology, Engineering, and Mathematics (STEM) educational programs to help students, our future leaders, to become engaged in the STEM fields. According to the Government Accountability Office (GAO, 2012), the federal government has implemented, and is continuing to dispense, billions of dollars into programs such as Discovery Research K-12; Engineering Education, Math and Science Partnership; and Office of Science Education K-12 hoping to increase the number of students pursuing postsecondary degrees, and entering the STEM fields as professionals. In fact, in fiscal year 2010, federal agencies were positioned to spend $3.1 billion dollars on STEM programs as well as provide avenues to create inventory and assess the effectiveness of these federal STEM programs (GAO, 2012). In addition to utilizing the federal government resources, universities, colleges and private sectors have cultivated programs that would encourage students to pursue STEM education and careers (GAO, 2012). Federal agencies (GAO, 2012) have made efforts to enhance student' interest in STEM fields by implementing STEM education programs in K-12 schools. Unfortunately, the level of student interest in these fields is not as great as that targeted by the government's program goals. Though research shows the positive effect parental involvement can have on student achievement, and their career trajectory, it appears that educational programs continue to lack emphasis on parental involvement

as a factor in pushing students towards the STEM fields (Juang & Silbereisen, 2002; Patel & Stevens, 2010).

Research studies report that when parents are active participants in their children's academics, there is an increase in academic achievement (Ainley, Foreman, & Sheret, 1991; Fan, 2001; Griffith, 1998; Hubbard, 1999; Keith & Lichtman, 1992; Lara-Alecio, Irby, & Ebener, 1997; Majoribanks, 1995; Portes, Zady, & Dunham, 1998). In addition to parents having a positive influence on student' academic performances, they also impact student behavioral competence and educational aspirations (Hubbard, 1999; Lara-Alecio et al., 1997; Reynolds & Walberg, 1992). Therefore, the focal point for this research study will be an emphasis on parental involvement in mathematics.

Significance of the Study

The significance of this study is globally, education systems are being transformed in order to meet the demands of an industrialized world (Lipman, 2004; Stiglitz, 2002). Education policy makers are examining Science, Technology, Engineering, and Mathematics (STEM) education as critical factors for success in the nation (Darling-Hammond, 2010). To gain knowledge about the economic success of countries, students from the U.S. and other participating nations are tested by two large assessments, the Programme for International Student Assessment (PISA) and the Trends in International Mathematics and Science Study (TIMSS), and the results are analyzed to determine whether or not students will be well-prepared for the future (Furuto, 2009). Unfortunately, the United States of America has not excelled as well as other countries who participate in these assessments. PISA 2012 mathematics literacy results revealed that 9% of students scored at a proficiency level of five (5) or above. That placed the U.S.

35th out of 64 countries who participated in this assessment (National Center for Education Statistics, 2013). TIMSS 2011 results revealed U.S. 8th graders improved on the mathematics benchmark. This improvement positioned them to be among the top 24 education systems in mathematics among 56 countries and other educational systems (National Center for Education Statistics, 2012), which raises questions for the need to improve STEM education.

Prioritizing student growth on the PISA and TIMSS will demonstrate that future U.S. generations have the capacity to flourish within the world economy (Lipman, 2004). If there is more of a concentrated effort in STEM education, this should make students more equipped to compete with other students in the world, giving them more opportunities to prosper in the business and technology fields (Lipman, 2004). The world has been experiencing a rapid advancement in technology, which seems to have opened up the nation's innovation and competitiveness. With technology advancing, it seems as if U.S. citizens are increasingly struggling to catch up, causing many individuals who have non-STEM jobs to experience joblessness than STEM workers. As a result, the U.S. education system is being challenged to improve education in STEM. Congress concluded that there is a growing concern that the United States is not preparing a sufficient number of students, teachers and practitioners in the areas of STEM (Kuenzi, 2008). It has also been reported that "200,000 U.S. engineering jobs need to be filled, and every year only 60,000 U.S. engineers graduate–leaving more than two-thirds of these STEM positions vacant" (Heritage Foundation, 2009, p. 2). In addition, when Congress evaluated the proportion of natural science and engineering degrees obtained by 24 year olds in the United States, it was revealed that in 2008 the U.S. was ranked 20th in

comparison to all other nations (Kuenzi, 2008; Zhe, Doverspike, Zhao, Lam, & Menzemer, 2010). In order to stop the downfall of a nation that was based on innovative principles, interventions must provide an opportunity for the country's future generations to extend their knowledge and understanding of mathematical content and problem contexts indicative of STEM disciplines (Subotnik, Tai, Rickoff, & Almarode, 2010).

Politicians argue that the U.S. has to be careful about lagging behind in science, technology, engineering and math related skills, as lack of these skills may lessen future innovations that could damage economic progress. Not only will the economy be in danger, but the national defense and homeland security are also jeopardized (Heritage Foundation, 2009). For example, military forces will lack the capacity to create better devices to help protect this nation. Consequently, it is imperative that the U.S. conduct research and implement best practices to improve STEM knowledge that will support our country's defense. Questions have been raised concerning the steps the U.S. should take to help rebuild schools and establish high and equitable achievement, especially in the fields of STEM (Darling-Hammond; 2010 Lipman, 2004). Federal government leaders realize they cannot solve this STEM dilemma alone; therefore, schools have been engaged to work on improvements in the math achievement of students. In fact, the current mathematics-education reform highlights equity and quality for all students' mathematical learning in order for them to improve on their mathematics performance.

While some school systems focus on promoting a particular curriculum or certain instructional practices, researchers such as Peressini (1998) and Appelbaum (1999), examine parental roles to improve children's achievement in mathematics. Positioning parents to become a major component in their children's math education is indeed

necessary for the country's future (Civil & Bernier, 2006; Peressini, 1998). The disciplinary role cannot be the only role of parents. Parents should also act as a guide in their children's education and for careers they plan to pursue (Epstein, 2001). However, utilizing parents as educational resources tends to be difficult; since some schools do not fully embrace parents (Epstein, 2001). This eventually leads to parents not participating as much when their children reach the upper grades (Appelbaum, 1999).

In recent years, there has been an increase of research studies regarding parental involvement in math (Civil & Bernier, 2006; Gellert, 2005; Peressini, 1998). Within these studies, results revealed the positive and negative effects social and family background can have on the math education of students (Knipping et al., 2008). Findings such as these validate practitioners' and researchers' efforts to help parents, teachers and school administrators become more cognizant of factors that can positively and negatively impact students achievement in STEM (Moore, 2006).

Eventually, researchers began examining the correlation between determinants such as low-income families, minority students, and the low educational attainment of parents and noted how these contribute to lower parental involvement (Conger, Conger, & Elder, 1997; Entwisle & Alexander, 1990; Haveman & Wolfe, 1995; Hill & Duncan, 1987; Patterson, Kupersmidt, & Vaden, 1990). Studies reveal these agents may cause parents and teachers to not communicate effectively with one another (Epstein, 2001). The lack of dialogue between teachers and student families ultimately hinders the success of students (Epstein, 2001). As a result, teachers become neglectful in informing parents of various strategies to help support their children's education, and this hinders the ability of parents to effectively help their children (Baker, 1997).

In addition to miscommunication, teachers and other school officials negatively perceive these parents as not as involved in their children's education. Teachers and school officials are known to label these parents as "unfit parents" who do not care about their children's education (Epstein, 2001). Despite the perception educators may have of parents—or parents may have of teachers—educators must come to a realization that parents do want to participate in their children's education.

As a way to alter these negative perceptions and build a positive parent-teacher relationship, schools have attempted to establish well designed parental involvement programs that would help parents know their role in a child's education. Studies show schools developing a partnership between families and communities break down the barriers that were built from miscommunication between these entities (Epstein, 2001; Kessler-Sklar & Baker, 2000). Commonwealth Institute for Parent Leadership (CIPL), Parents and Teachers Talking Together (PT3), Parent Effectiveness Training (PET), and Parents for Student Success are parental involvement programs across the U.S. that help parents become immersed in their children's academics (Henderson, Jacob, Kernan-Schloss, & Raimondo, 2004). From these organizations, teachers obtain assistance from parents to persuade students to work hard in the classroom and encourage parents to become a source for students if they are struggling in their school work (de Acosta, 1996; Moll, Amanti, Neff, & Gonzalez, 1992). These efforts allow teachers to know and appreciate the contributions of their students, while parents are included in their children's education.

Beyond the Classroom

When students step into a classroom, they are not only students, but they are sons, daughters and sometimes the providers of their households. One of the many purposes of schools is to educate students; so they can be productive individuals in an industrial society (Darling-Hammond, 2010). When these students complete school, they should not only be able to be make a sufficient living for themselves, but they should be equipped to become leaders of their communities as well. This is all possible when they receive a comprehensive education. However, it can be difficult for students, future leaders of the world, to be pioneers for their community if schools do not accept all their facets, which include family values and beliefs. Encouraging and establishing a family and school partnership is necessary for academic productivity in the lives of these children.

Teachers are experts in the content they are teaching, but they are sometimes unprepared to understand the background of their students (Epstein, 2001). Having teachers become more aware of their students helps teachers to become more effective. Since parental involvement is not a requirement, there is no reason, at first, to make student family backgrounds a component of their STEM education. However, teachers need to know about their socio-cultural background, especially regarding students living in impoverished areas (Epstein, 2001). Those students are the ones who are disregarded in public school systems because of the disconnect between low-income families and unaware or unresponsive teachers (Astone & McLanahan, 1991; Epstein, 1984; Lareau, 1987; Stevenson & Baker, 1987). The students' family values and beliefs are a part of their development as a responsible and intellectual individual (Epstein, 2001).

Considering that studies have shown that parental involvement helps increase the success rates of students (Epstein, 2001; Knipping et al., 2008), one may wonder why parental involvement has not been widely promoted in subjects like science, technology, engineering, and mathematics. This could be a question of power and the teacher's willingness to share the responsibility of academic achievement. In many cases, the teacher controls the ability to share responsibility within his or her classroom. In one study, the researcher's agenda was to analyze the position of parents in school mathematics reform. Peressini (1998) presents how the professionalism of the teachers, as well as administrators, can affect the way parents interact with their children's math education process. By teachers and administrators using their position of power, the parents are inhibited to not exercise their rights and power (Civil & Bernier, 2006; Peressini, 1998; Sarason, 1995). For example, only the ones who understand the linguistic habitus can help with the construction of the school mathematics reform literature, which reaffirms what and who is being taught within the classroom.

With Peressini's (1998) study showing that parents need to have a voice in their children's math education reform, parents should become more active in order to promote positive math achievement for their children. Improvements in incorporating parental involvement in students' STEM education is an essential addition that the United States needs to promote, because it is evident that factors outside of the classroom, such as one's family background and individual responsibilities, influence the work and progress within the classroom and enable the students to be successful throughout life.

The MINDSET Curriculum

This research will focus on a STEM education curriculum called Mathematical Instruction using Decision Science and Engineering Tools (MINDSET). Specifically, this research study examines parental involvement in two MINDSET (Mathematics Instruction using Decision Science and Engineering Tools) classrooms through mathematical assessment performance, grades, surveys, and interviews. MINDSET was a project funded by the National Science Foundation to improve math student ability to formulate and solve multi-step problems and interpret results and to improve students' attitude toward mathematics. Incorporating a curriculum that exercises problem-based learning will assist students in appreciating mathematics and encourage them to consider further studies in STEM areas (Chelst et al., 2011).

The MINDSET curriculum consists of two sections: deterministic and probabilistic. Problem contexts covered in the deterministic curriculum include linear programming, the critical path method, facility location problems, and transportation problems. In the probabilistic section, topics include probability distributions, decision trees, quality control, and queuing theory. Techniques and tools incorporated in MINDSET encourage students to utilize logical and deductive reasoning to solve problems (Chelst et al., 2011). Problem contexts covered in the deterministic curriculum include linear programming, the critical path method, facility location problems, transportation problems, and multi-criterion decision making. In the probabilistic section, topics include probability distributions, decision trees, quality control, Program Evaluation Review Technique (PERT), Markov chains, and queuing theory. The

techniques and tools used in MINDSET help students to view mathematics as a tool for solving problems by using logic and deductive reasoning.

When the MINDSET project was developed, parental participation was not a focus. Since the MINDSET project does not promote parent involvement in their children's mathematics education, teachers are left with the responsibility to obtain parental involvement. The fact that teachers are held accountable to get parents involved aids the researcher in analyzing the teachers' beliefs and strategies as they attempt to get the parents involved.

Research Questions

1. What are the perceptions of students, teachers and parents regarding parental involvement in secondary math education?
2. Does parental involvement in MINDSET influence mathematics performance for students?
3. Do the weekly newsletters and progress reports used in the MINDSET class influence the perception students, teachers and parents have about parental involvement?

Definitions

Parental Involvement

A parent being an active participant in his or her child's academic life through talking to his or her child about school, communicating with the child's teacher to discuss progress and participating in school activities—whether at home or at school—in order to communicate more effectively for the betterment of the child's education.

School

An institution that entails academics, social life, extra-curricular activities, teachers, students, and administrators and the relationship among these components.

Progress

Entails analyzing if children are advancing in academics and/or are on grade level, and if they are interacting with peers as well as teachers to enhance and build social skills.

School Activities

Homework/assignments given by teachers that require the parents to help students with homework, field trips, extracurricular activities, parent-teacher conferences, and parent-student interaction (Epstein, 2001).

Limitations

There were a couple of limitations that existed when conducting this study. First, the study consisted of only two fourth-year math course classes in one high school, located in a southeastern state. Due to this limitation, results cannot be generalized to a larger population. Second, the implementation of the weekly newsletters and progress reports were constricted to eight weeks. The time constraint of implementing the parental involvement interventions could have affected results.

Summary

In summary, parental involvement has been shown to be a vital component in students' schooling. A parent becoming an influential resource in their children's schoolwork is a goal that teachers and parents would like to achieve. A teacher and parent partnership is believed to be beneficial for students in order to improve schools, assist

teachers, and strengthen families (Epstein, 2010). Therefore, the researcher implemented, parental involvement interventions to examine student achievement and the perspectives of teachers, parents, and students as they relate to parental involvement. The findings of this study may assist educators in creating strategies for parents "to initiate and maintain active roles in their children's education and development" (Epstein, 2010, p. 5).

Chapter 2 provides a review of related literature important to this study. A description of the methodology used is presented in Chapter 3. A summary of the results is presented in Chapter 4. A discussion, including implications of this study, limitations and areas of future research is presented in Chapter 5.

CHAPTER 2: LITERATURE REVIEW

This chapter will provide a literature review that will set a foundation for the study. The literature review related to this research study is organized into five sections: (a) STEM education (b) introduction to parental involvement, (c) possible barriers of parental involvement, (d) perceptions of parental involvement, and (e) preparing educators and integrating parental involvement in STEM education.

STEM Education

This study focuses extensively on parental involvement; however, this research's context is STEM education. The government's priority for STEM education is intended to encourage the nation, especially parents, to accept a more supportive role in their children's STEM education. It has been acknowledged through the media that the United States government is trying to raise awareness and convince students to enter areas of STEM. The government is concerned that there is not an adequate number of students, teachers and professionals who are being prepared in the areas of science, technology, engineering, and mathematics (STEM) (GAO, 2012; Kuenzi, 2008; NSF Report, 2007). This provides little hope that the United States of America will remain one of the top nations in STEM field, as historical data shows: "Once a leader in STEM education, the United States is now far behind many countries on several measures" (Kuenzi, 2008, p. 2). These downfalls have resulted in the government making a proactive move in education to become well-established in the STEM fields again.

One effort the federal government has made to improve and discontinue the declivity of the nation's rankings in math literacy and science literacy is to fund STEM educational programs. These federally funded programs are intended to help students develop a career interest in the STEM fields by exposing them to these disciplines in their schooling. This will assist the U.S. to become more innovative and expand economically; since "science and engineering occupations are projected to grow by 20.6% between 2008 and 2018, while employment in all occupations is projected to grow 10.1% over the same period" (NSB, 2012, p. 12).

To ensure productivity in these programs, Congress has enacted legislative actions to promote STEM education. The 109th Congress passed three bill proposals containing STEM education related acts: The National Aeronautics and Space Administration Authorization Act of 2005, The National Defense Authorization Act of 2006, and The Deficit Reduction Act of 2005. Some of these legislative statues have a set agenda influenced specifically by academic, scientific and business affiliations. In addition to those three bills, the 110th Congress passed the America Creation Opportunities to Meaningfully Promote Excellence in Technology, Education and Science Act (America COMPETES Act). This act was established to "expand existing STEM education programs, and establishes several new programs under the Department of Energy (DOE), Department of Education (ED) and the National Science Foundation (NSF)" (Kuenzi, 2008, p. 30). These legislative actions continue to promote improvement for U.S. students' knowledge in STEM education.

Introducing these acts highlights the significance STEM disciplines have in society and the impact schools can have on students' motivation in these specialties.

Marshall (2010) addresses the need to redesign STEM academies in order to "ignite a new generation of global STEM talent, innovation, and entrepreneurial leadership" (p. 48). This need questions the government ability to implement STEM educational programs with the goal that the nation will become well-positioned for science, technology, engineering, and mathematics achievements.

In 2004, the federal government distributed 2.8 billion dollars to science, technology, and education agencies in signifying the importance of STEM education. Just recently, President Obama's administration proposed a budget to spend $3.7 billion on STEM education programs (Center for Science, Technology, & Congress, 2010). The majority of the budget is given to agencies that would help promote STEM education such as the National Institutes of Health (NIH), National Science Foundation (NSF), National Aeronautics and Space Administration (NASA), and the Department of Education (ED). These funded agencies were changed to administer STEM education programs. Programs, such as Math and Science Partnership (MSP), Discovery Research K-12 (DR K-12), and Transforming STEM Learning (TSL) are several programs that were successful implemented by these agencies.

In addition to financing educational programs that increase student motivation in STEM fields, the government also supports educational programs that employ STEM discipline workers who assist classroom teachers. According to the Congressional Research Service report for Congress (Kuenzi, 2008), the United States has more than one million professionals in STEM areas, however, many of the specialists are over the age of 60 with a bachelor's degree or higher. As a result, the government has invested in certain programs targeting U.S. schools to allow senior scientists and engineers to assist

teachers by providing classroom support. Retirees Enhancing Science Education through Experiments and Demonstrations (RE-SEED) and Teaching Opportunities for Partners in Science (TOPS) are the names of a couple of organizations that have volunteers, who have experience in STEM disciplines, to commit a few hours a week for an entire school year to help teachers with classroom and materials management, research-based teaching strategies, and lesson planning. Indeed STEM education has been a pressing issue the U.S. government is addressing; however, there continues to be a specific factor that continues to be absent in promoting STEM education: parental involvement. If parental involvement is essential in students' overall academic success, it should be considered as an educational asset in these STEM programs.

Parental Involvement

Parental involvement is an underused educational resource (Epstein, 1986). As students continue in their primary and secondary education, research shows that parental involvement decreases (Eccles & Harold, 1996; Shumow & Miller, 2001). Researchers have claimed that this is partly due to students becoming adolescents (Eccles & Harold, 1996; Epstein, 2001). Adolescents are known to desire more independence in the choices they make, whether it pertains to their social or academic lives (Eccles & Harold, 1996). Eccles and Harold (1996) assert that parents, as well as teachers and school personnel, may recommend it is best parents not be as involved in their adolescents' schooling. This recommendation has negatively affected the way parents, teachers and students interact with each other (Epstein & Dauber, 1991). Teachers and school personnel who do not embrace the families of their students in the classroom, while, simultaneously, teachers,

parents and schools gradually omit communication amongst each other (Epstein & Dauber, 1991; Hoover-Dempsey, Bassler, & Brissie, 1987).

As previously discussed, many parents do want to get involved in their children's academics, but knowing how to do it can be a challenge (Epstein, 2001). Watkins reported that parents "would be more involved in helping their children at home if teachers communicated more with them or requested their cooperation" (Watkins, 1997, p. 3). Establishing parental involvement programs opens up communication among parents, teachers and students; thereby, creating a community of togetherness, which will promote an interconnected dialogue among school, community and home domains. In this context, communication is an essential tool for schools to utilize in order for parents to become more involved in their children's academics. Epstein (1986) elaborates about the need for communication by stating "limiting communications and collaborative activities, teachers reinforce the boundaries that separate the two institutions" (p. 293). Breaking these walls to communication prompts parents to have higher expectations of their children's academics (Watkins, 1997) and builds partnerships with teachers and parents (Epstein, 2001).

Parents and teachers both are trying to help students get the best quality education. Having them work together for one goal will increase academic achievement (Ainley et al., 1991; Fan, 2001; Griffith, 1998; Hubbard, 1999; Keith & Lichtman, 1992). Watkins (1997) examined factors such as a child's academic achievement, a parent's education level, and a parent's ethnicity to understand the value of parent involvement. In addition, he investigated parents' beliefs and perceptions that may affect parental involvement. Results from this study revealed that there was a statistically significant

difference between ethnicity and education-level groups. The academic achievement of White children was higher than other ethnic groups. Results also revealed that parents who completed some college had more of an understanding of their students' school performance than parents who only completed high school.

Definition of Parental Involvement

The definition of parental involvement varies according to numerous related research studies. This poses a great challenge to researchers and educators when they attempt to obtain a specific definition of parental involvement (Wright, 2010). In some instances, parental involvement can be defined or associated with the collaboration between schools and families (Fantuzzo, Davis, & Ginsburg, 1995). The Fantuzzo, Davis, and Ginsburg (1995) study revealed that the collaboration between parent with the child and parent with the school will be beneficial to children's higher academic achievement and increase development of their positive, emotional and behavior (Henderson, 1987).

Eccles and Harold (1993) defined parent involvement using five variables: (a) monitoring (parent responses to teacher request and information), (b) volunteering (the rate of parent participation in volunteer activities at school), (c) involvement (parents report of frequency of involvement with child's daily activities, (d) progress (parents report how much they contact school about child's progress), and (e) extra help (parents report how much they contact school about how to give child extra help). Haynes and Ben-Avie (1996) examined a three-tier model of parental involvement. The third layer of the tier deals with general participation of the students. The second tier layer is composed of parents helping teachers in the classrooms or sponsoring and supporting school programs. The top of the tier is composed of parent participation in the school planning

and management team. Since the definition continues to be somewhat ambiguous, it is necessary to provide an overview of the different forms of parental involvement.

Joyce Epstein is a researcher and educator, known for her extensive research on implementing various parental involvement practices in order to improve school, family and community partnership. She constructed a framework of six different practices of parental involvement (Epstein, 2001).

Research studies (Civil & Bernier, 2006; Epstein, 2001; Fan & Chen, 2001) that focused primarily on teachers, families and communities collaborating within the elementary, middle and high schools support the development of Epstein's six types of involvement. These six types of parental involvement are essential in improving programs that are attempting to promote school and family partnerships (see Table 2.1).

TABLE 2.1: Epstein's six types of involvement

Type of Parental Involvement	Objective
Type 1: Parenting	Help all families establish home environment to support children as students.
Type 2: Communicating	Design effective forms of school-to-home and home-to-school communications about school programs and their children's progress.
Types 3: Volunteering	Recruit and organize parent help and support.
Type 4: Learning at Home	Provide information and ideas to families about how to help students at home with homework and other curriculum-related activities, decisions and planning.
Type 5: Decision Making	Include parents in school decisions, developed parent leaders and representatives.
Type 6: Collaborating with the Community	Identify and integrate resources and services from the community to strengthen school programs, family practices and student learning and development

Note. Adapted from "School, family and community partnership: Preparing educators and improving schools," by J. L. Epstein, 2001, p. 408. Copyright 2001 by Westview Press, Boulder, CO.

Educators and families recognize the contribution each practice provides (Epstein, 2001). Parents and teachers become more equipped to help students balance home and academic life when responsibilities for students are shared. Subsequently, this allows parents to play a more meaningful role in their children's education than ever before. Below is a synopsis of each involvement.

Involvement Type 1: Parenting

Parenting is associated with supporting children's intellectual development. Researchers have examined how parents' beliefs play an intricate role on their parenting skills such as supporting their children's education (Hoover-Dempsey & Sandler, 1995; Hoover-Dempsey et al., 2005). Studies show that parents' beliefs about their children's development influence the roles they play when promoting their children's education

(Hoover-Dempsey & Sandler, 1997). Parents who are cognizant of their roles become more active in their children's education than the parents' who do not understand their roles (Epstein, 2001; Hoover-Dempsey & Sandler, 1997).

Involvement Type 2: Communicating

The purpose of communication is to share information about students schooling in a precise and productive way among parents, teachers and students. It is necessary that teachers and parents make an effort to communicate with one another whether it is through verbal or written exchanges. The type of exchange depends solely on the preferences of the teachers and parents. Examples of verbal communication are parent-teacher conferences and phone calls; whereas written communications include progress reports, newsletters, and report cards. These methods of communication address concerns each may have about a student's progress.

Unfortunately, when exchanging information about a student whose family speaks another language, there is often a language barrier. Studies show that language barriers are one of several factors contributing to parents' and teachers' inability to communicate (Finders & Lewis, 1994). When this occurs, teachers have to become responsive by providing written documents translated to the parents' language, or have a translator in parent-teacher conferences. These translated documents allow parents to comprehend the given information. In addition, studies show the importance of schools providing interpreters for teachers and parents when they have meetings and/or conferences (Epstein, 2001). Having a productive communication system allows both parties, especially parents, to feel more accepted and pleasant when communicating on matters regarding the students' learning and instruction.

Involvement Type 3: Volunteering

Volunteering allows parents and teachers to work together for the betterment of the students' education. This form of support shows the parents that they can be the cornerstone to their children's school life along with their home life. The support system allows teachers and parents to create a powerful alliance. Having a powerful alliance means that the parents' and teachers' visions are aligned, reinforced and framed which creates a positive and influential role in the students' lives.

Parent volunteerism at school shows commitment to their children's well-being. Hillary Clinton (1996) conveyed concern about children's welfare in the U.S. and how imperative a strong education is for our youth and the nation to excel. Due to her persistent advocacy for education, she is remembered for the prolific phrase, "It takes a village" (Clinton, 1996, p. 1). When Clinton spoke of the word 'village,' she was referring to the productivity of a collective community (Clinton, 1996). Unfortunately, it is sometimes an obstacle for schools to establish a strong community, especially in schools, when there is a lack of parents volunteering within the schools. The recruiting process to attain these volunteers is challenging due to the inability of parents to participate consistently as volunteers. Having parents and schools function as a team offers an incentive for children to remain dedicated to their education.

Involvement Type 4: Learning at Home

In the early years of children's schooling, there would be an excitement at home in both the parents and children in acknowledging learning or exciting events that took place in school. Sometimes it would resemble show-and-tell for children to parents. Parents felt as if they played an intricate role in the early years of their children's

education. Students and parents communicating about school happenings made learning-at-home become an essential component to the educational development of the students. When students shared concerns about their schoolwork, it allowed parents to search for solutions or help that is not associated with the school. Studies reveal that outside help is utilized more as students get older (Epstein, 2001). In many cases, adolescent' schoolwork becomes more intense and results in parents thinking they are incompetent to help their children, unless they hire a tutor.

As a way to encourage learning at home, teachers are sometimes advised by administrators to design homework that makes is easier for parents to help their children in their education. These homework designs include students sharing and discussing schoolwork with their parents. Even though learning at home activities could be challenging, studies show teachers becoming more creative in designing these types of assignments to get parents involved (Padak & Rasinski, 2010).

Involvement Type 5: Decision Making

Parents are the most definitive factor related to decisions that involve their children's livelihood. Since receiving a thorough education is understood to be a critical element in individuals' futures, it is only right for parents to continue to be an advocate for their children's learning. Parents acquiring a leadership role within schools are Epstein's reasoning for decision making to be a parental involvement strategy. This also allows parents to "assist parent representatives to obtain information from and give information to the families that they represent" (Epstein, 2001, p. 463). Parents may begin their decision making within their relationships in parent networks such as parent-

teacher organization (PTO) and parent-teacher association (PTA), and other school organizations which allow the parents to take leadership roles.

In some cases, schools are obligated to have parents contribute to the school community through legislative acts. For instance, the *No Child Left Behind* act addresses schools working with parents to sustain active parental involvement. Parents having a voice for their children's education—whether it relates to school council, parent advisory councils or and safety patrols—builds on the foundation of parental involvement and parental leadership. Of course, when there are a variety of people trying to build some sort of togetherness, there will be some differences that have to be considered. These differences could be an individual's racial, ethnic, socioeconomic, and cultural background. However, as parents become leaders, they learn to respect others' differences to build unity. Parents, who are advocates and leaders within the school realm, are trained to fulfill these positions in order to become a dynamic decision maker for their children.

Involvement Type 6: Collaborating with the Community

The final type of parental involvement is collaboration with the community. The connection schools make with "small and large [businesses]; government agencies; cultural, religious, civic and fraternal organizations; colleges or universities; and other community groups and individuals should benefit students, families or the school" (Epstein, 2001, p. 468) and this is pivotal in children's education and to the community. As mentioned earlier, Clinton was known for that powerful phrase, "It takes a village." This last type of parental involvement is centered on a nation's ability to excel in education by coming together as one unit. Guidance from schools, families and

communities is crucial for students' success both in and out of the classroom, and makes the collaboration well worth it.

This research study will focus on parenting, communicating and learning at home. As previously discussed, research has shown that as students get older, there is less parental involvement. Since communication is considered an obstacle between adolescents and their parents, strategies have been implemented in this research which would help parents become more supportive with their students math education.

Multiple Viewpoints of Parental Involvement

Epstein highlighting the six types of parental involvement helps persuade school programs to exercise these various types of involvement. Studies pertaining to parental involvement tend to focus on the overall kinds of parental involvement that will be used to strengthen the overall school program and assist children's learning (Eccles & Harold, 1993; Fantuzzo et al., 1995). Examples of parental involvement roles that have been found to be effective in students' schooling include: advisory, fundraising, advocacy activities, and helping with homework (Epstein, 2001).

The emphasis of parental involvement is an integral role in student success. As mentioned earlier, educational reform legislation is advocating effective parental involvement programs. In fact, schools that are Title I are required to spend a portion of their money on parental involvement programs in order to receive financial support. The financial support is an incentive to develop efficient parental involvement programs. In some cases, researchers and teachers may begin a program by simply implementing parental involvement strategies without money being the driving force. Comer and Haynes (1991) created a parental involvement program that utilized three levels of

parental involvement strategies. The three parental involvement strategies were: "[level 1] parents elected by the parent group to participate on the School Planning and Management Team, [level 2] helping in classrooms or sponsoring and supporting school programs, [level 3] general participation" (Comer & Haynes, 1991, p. 273). These strategies were believed to be beneficial for children's development, because they were built on an integrated ecological approach.

Ralph McNeal Jr. (2001) constructed his research study focusing on the implementation of four types of parental involvement: (a) parent-child discussion, (b) Parent Teacher Organization (PTOs), (c) monitoring, and (d) educational support strategies. All four types of parental involvement have specific roles. Parent-child discussion centers on the parents and the children being able to converse about schooling events as well as academics. The essence of PTOs is to share information amongst teachers and parents to increase a productive network within the educational realm. Monitoring involves the parents supervising their children's behavior and academics progress. The last type of parental involvement that McNeal concentrated on was educational support strategies, which identified the practices parents had implemented or provided for their children's academics. McNeal found that these strategies produced positive outcomes towards students' schooling.

Cai, Moyer, and Ning (1999) analyzed parental involvement roles in math education. These researchers listed five general types of parental involvement roles: (a) motivators, (b) resource providers, (c) monitors, (d) mathematics content advisors, and (e) mathematics learning counselors. These have a profound effect on the students' ability to learn of mathematics. Parents who assist their children with math education in

their home setting take on the parental roles of mathematics content advisors and mathematics learning counselors. Content advisors are defined as parents who are able to help their children with mathematics content. Learning counselors are characterized as parents who are able to "understand their children's situation, learning difficulties, potential, needs, and demands, and who provide appropriate support to help their children to overcome learning difficulties" (Cai, Moyer, & Ning, 1999, p. 6). As for emotional and resource support, parents can utilize the roles or motivator, resource provider, and monitor. The results from the study showed that parental involvement is significant in regards to children's mathematics achievement.

From these findings "the operational definitions of parental involvement have not been clear and consistent" (Watkins, T. J. 1997, p. 29). Since there is an inconsistency in developing a parental involvement definition, the various research studies mentioned were synthesized in order to provide a definition of parental involvement for this particular study. Parental involvement is when a parent is an active participant in his or her child's academic life through talking to his or her child about school, communicating with the child's teacher to discuss progress, and participating in school activities whether at home or at school, in order to communicate more effectively for the betterment of the child's education. This definition explains how parental involvement is defined in this study.

Possible Barriers of Parental Involvement

Although studies show parental involvement impacts students' academic achievement, the government, researchers and educators tend to focus on other methods to improve the school performances of students. One of the many ways that they attempt

to refine classroom learning is through addressing matters within classrooms. For instance, The National Commission on Excellence in Education (1983) wrote a groundbreaking report entitled, “A Nation at Risk.” This report informed mainstream America that schools in the U.S. were not preparing students to compete against students in other countries thus threatening this nation’s economic and social development. As a result, the report conveys recommendations for the improvement of students’ education. The recommendations are that:

1. "Five new basics" be added to the curriculum of America's schools. The basics include four years of English, three years of mathematics, three years of science, three years of social studies, and half a year of computer science in high school;
2. More rigorous and measurable standards be adopted;
3. The school year be extended to make more time for learning the "New Basics";
4. The teaching be improved with enhanced preparation and professionalization; and
5. Accountability be added to education.

These suggestions become instrumental for students to adopt a positive outlook on education, especially in STEM education. However, there are other factors that affect a students’ academic achievement. These factors include the students’ family characteristics, such as their socioeconomic status or their parents’ education levels. Schools are composed of children and adults with diverse backgrounds. When school officials and teachers have a better understanding about their students, the atmosphere of

the school becomes welcoming for both students and parents (Epstein, 2001). Consequently, this welcoming environment will encourage students to engage in classroom activities and truly value their education. Students will understand that the teacher is there to help them inside and outside the classroom. Unfortunately, it is difficult for students to progress academically if there are obstacles that may prevent success from happening. Studies show that these obstacles could be: (a) single-parent homes, (b) poor performing schools, and (c) living at or below the level of poverty (Epstein, 2001; Lipman, 2004). These circumstances become more unsettling, because schools are not providing the proper support for students to excel in their education (Gonzales-DeHass & Willems, 2003). As a result, these factors continue to work against one another and keep these students in a state of oppression.

"A Nation at Risk" prompted policy makers to construct school reforms that were more assertive in helping students excel in their academics. Hanushek (1997) discloses that school reforms were motivated by economic factors. The qualities of public schools were based on several factors: (a) the position of the economy and (b) the socioeconomic status (SES) of citizens. Within these reforms, education policy makers considered student family characteristics in an attempt to provide opportunities to school systems that need educational resources to help students obtain higher academic achievement. These educational resources include well trained teachers, relevant textbooks and modern technology. Having these resources will allow all students the opportunities to obtain an effective education and elevate this nation to higher innovations.

Socioeconomic Status

As mentioned earlier, students' socioeconomic status is a factor in their academic achievement. In Caldas and Bankston's (1997) study, it was revealed that student mathematical achievement was more likely to be negatively affected if the student was of a low SES. Education is an act or process of knowledge that is significant for the enrichment of a country (U.S. Senate, 2011). Nonetheless, if everyone is not receiving a thorough education, it becomes rather difficult for a country to prosper. Kozol (2005) acknowledges that having an elite education sometimes dictates the economic and educational advantages an individual possesses. The distinction between the people who have a low-economic status and the individuals who have a high-economic status is apparent in this country (Wade, 2004).

Lipman (2004) provides a detailed description of the effects economic restructuring and social differentiation has had in Chicago's Public Schools. Lipman (2004) reveals that there are disadvantages for children attending poor-achieving schools instead of high-performing schools in the city. Most of the students that go to these top-notch schools have parents that are considered either middle class or upper class. They have better resources in their school, such as well trained teachers and materials that students need to enhance their learning. In addition to having better resources, students are offered more opportunities to attend college. Children attending affluent schools are also well prepared for interacting with mainstream society. However, students attending low-income schools continue to be on surveillance for their performance on mandatory state tests. These schools do not have a great deal of resources, and it is unlikely that students are prepared for a promising future.

According to Okpala, Okpala, and Smith, (2001), students' socio-economic status contributes to the shaping of educational prospects. Not only does SES promote promising possibilities for some students, it also affects how teachers include parents in their children's math education. Okpala et al. (2001) proved that having a low SES correlates to students' lack of mathematical achievement. If educational opportunities are not provided for students who are of low economic status, it will be difficult for them to prevail in mainstream society. Many students that are of low SES attend Title I schools. Title I schools are composed of students who are at-risk of academic failure and who are of low-income status. Within Title I programs there is an emphasis of "teacher and paraprofessional requirements, accountability, sanctions for schools designated for improvement, standards and assessments, annual state report cards, professional development, and parent involvement (Title I)." These components, especially parental involvement, will not only help with the child's future but the nation's future as well. It becomes clear that investing in a child's future for the betterment of the nation makes it imperative for parents to be an active part of their children's educational experience.

Research studies continue to reveal the relationship a student's SES has with his or her academic achievement (Conger, Conger, & Elder, 1997; Entwisle & Alexander, 1990; Haveman & Wolfe, 1995; Hill & Duncan, 1987; Patterson, Kupersmidt, & Vaden, 1990). Educators need to be more cognizant of a student's family background and how that background influences availability of opportunities to learn. Jeter-Twilley, Legum, and Norton (2007) conducted a study that revealed that the lower the SES of a child, the less likely their parents and their community, will be to get involved in his or her

schooling. However, when it pertained to parents who were of high SES, their involvement was more common.

Parent's Education Level

A parent's education level plays another in participation in their children's education (Baker & Stevenson, 1986; Laosa, 1980; McGillicuddy-Delisi, 1982, in Watkins, 1997). Parents with less education decrease their chances of helping their children at home (Baker & Stevenson, 1986; Laosa, 1980). These parents may be frustrated, because they want to help their child but feel as if their help will be ineffective in the child's school work (McGillicuddy-Delisi, 1982; Watkins, 1997). However, both parents and educators need to realize that a parent's lack of formal education should not discredit the importance of parental involvement. Both parents and teachers need to communicate better to help their children succeed in school (Ames, 1993). Effective communication is a necessary component for all schools and for parents, but it is especially essential for single mothers; since there are more single mothers than fathers in the United States. According to the U.S. Census Bureau (2007), the typical single parent is a mother, and approximately 84% of custodial parents are mothers. Twenty-seven percent of custodial single mothers and children are in poverty. Fifty-four percent of custodial mothers are raising one child from an absent parent. There are 46% single mothers who are raising two or more children. Having an efficient communication system between parents and schools is necessary for children's education; so the cycle of poverty can be challenged.

Parents and Teachers Alliances

Building an alliance with schools and families can be rather complex; because in some cases, some schools do not know how to encourage participation from their students' families (Epstein, 2001; Feuerstein, 2000). Teachers and school officials may perceive these parents, who do not have a formal education, to be less involved in their children's education. Unfortunately, these negative viewpoints cause educators to view parents as unfit caretakers (Epstein, 2001). Despite the perception that educators may have of parents, they have to come to a realization that parents do want to participate in their children's education. Once teachers realize the parents' stance on their children's education, both the parents and teachers will stand united (de Acosta, 1996; Katz & Bauch, 1999).

Building a parent and teacher alliance is a mission some schools strive for in order to build a constructive relationship between families and schools and create a standard of excellence for students. An approach some schools may use to obtain this type of partnership is to implement parental involvement policies. Policies at these schools, particularly Title I schools, adopt the need for parents and schools to develop an effective communication system that will provide educational support.

Within these policies, there are key elements that are essential in inspiring parents to become involved in their children's education, in particular, math education. One reason why these policies were created was to "assist schools in building capacity for parental involvement and increase academic achievement and school performance by providing coordination, technical assistance, and other support . . ." (CMS, 2004, p. 2). Another reason why these policies were developed was to "build parent capacity for

involvement and leadership by providing materials, activities and training to parents to help them effectively support their children's education at home and at school" (CMS, 2004, p. 2). The development and implementation of these policies is encouraging; however, questions are raised about administrators and teachers having the skills to perform these certain tasks outlined within parental involvement policies.

In an effort to help make these parental involvement policies effective, school administrators attempt to prepare teachers on how to communicate with students and their families. Since school officials are the ones who enforce these parental involvement polices, it is necessary to offer workshops for teachers to be efficient communicators. Despite the perceptions some administrators and educators may have of parents, they must realize parents desire to participate in their children's education; they just do not know how. The joint effort between schools and families will encourage teachers to appreciate the complete existence of their students, and parents will not be left out from their children's education.

Perceptions of Parental Involvement

There continues to be a dichotomy between the distinctive roles of family and school in education. Epstein states that "it assumes that school bureaucracies and family organizations are directed, respectively, by educators and parents, who can best fulfill their different goals, roles and responsibilities independently" (Epstein, 2002, p. 155). This statement alone emphasizes the separation of the two institutions on how they approach student education. Even though teachers and parents want students to excel in their academics by assisting student to learn independently, it is assumed that when parents and teachers collaborate with one another it becomes more beneficial for the

students (Epstein, 2002). With these assumptions conveyed, it is important to know the perceptions parents and teachers have about parental involvement.

Parents' Perceptions

Unfortunately, there are stereotypes that imply parents do not want to be involved with their children's education. However, research studies have shown that such negative images of parents not aspiring to be involved is far from the truth (Barge & Loges, 2003; Epstein 1986). Barge and Loges' (2003) qualitative study showed parents wanting to be involved in students' education. In this study, there were four themes identified through interviews with parents about their perception about parental involvement:
(a) monitoring student academic progress, (b) cultivating personal relationships with teachers, (c) utilizing extracurricular school programs, and (d) developing community support systems.

The first theme focuses on parents monitoring their children's academics "to convey to their child that they value homework as an important task" (Epstein, 2001, p. 455). According to Barge and Loges (2003), monitoring students' academic progress related to inspiring and motivating students to become self-confident in their ability as a learner. Monitoring students also meant that parents would be able to keep up with student academic progress through report cards and progress reports.

The second theme was cultivating personal relationships with teachers. Parents perceived that developing a respectful relationship with their children's teachers will be beneficial for the children's education. In addition to that, parents believed that their children would be treated better if they had a relationship with the teacher. Parents' suggestions on building these relationships with their children's teachers were to:

(a) respond to teacher comments and requests from progress reports, (b) attend parent-teacher conferences, and (c) use technology to obtain information about students' classes.

The third theme highlighted parents being able to locate an extracurricular school program for their children to participate in. Having students become a participant in an appropriate extracurricular school program allows parents to build relationships with various school agencies. Parents believed that this type of participation would be beneficial for them and for their children. They believed students would receive more mentorship in social and academic issues.

The last theme centered on developing a community support system. The goal was to help constitute relationships between parents and school personnel. Parents believed that working with the school system was valuable for educational programs. Schools, families, and communities being able to collaborate will help schools recognize the needs of the parents and students. This generates more unity between parents and schools rather than division. According to Epstein's framework of the six types of involvement this, theme would be parallel to Type 5 – Decision Making and Type 6 – Collaborating with the Community. The key component for this theme is parental inclusion; so each entity can become familiar with one another for the betterment of student education.

Teachers' Perceptions

Research studies show that teachers' perceptions about parental involvement vary. Barge and Loges (2003) examined teacher perceptions about parental involvement. The researchers established four themes from teacher responses when asked about their understanding of parental involvement: (a) communication, (b) participation,

(c) supervision/parenting, and (d) discipline. Communication was based on parents contacting teachers on a consistent level through parent-teacher conference, school visits and phone calls. Teachers perceived that parental involvement consisted of parents communicating with them about their children's behavior and performance in the classroom. This allowed the teachers to see that parents did have an interest in their children's education. Teachers referenced communication being necessary not only between themselves and parents but also between parents and students.

Participation was the second theme that highlighted parents helping their children with their homework. Additionally, parent participation in school sponsored activities such as PTA meetings, school plays and field trips was considered to be a factor that highlighted parental involvement. This helped students see their parents cared about their schooling. Parent participation in their children's academics and school activities builds and increases communication amongst teachers, parents and students. Parenting and discipline were the last two themes that were identified in the Barges and Loges study. Parenting was considered to be the non-communicative way for parental involvement. Teachers looked for parents to "[ensure] good nutrition, [provide] supplies or books to the children and clothes" (Barges & Loges, 2003, p. 154). Discipline was the least frequent theme, and it focused on teachers receiving support from parents when the teachers would discipline their children. Teachers believed this would help students show respect for authority.

Other studies have examined teachers' perceptions about student academic performance when it pertains to single and two-parent homes (Benson, 1993; Epstein, 2001). Epstein examined teachers' perception about parental involvement in students'

homework between single and two-parent homes. Results revealed that teachers' perceptions weighed heavily on their leadership skills. Teachers that lacked the skills to organize parent-involvement activities at home were more likely to have a negative perception towards single-family homes.

Students' Perception

Barge and Loges (2003) revealed three themes that students describe as forms of parental involvement: (a) help with homework, (b) encouragement, and (c) interaction with schools. From the study, students explained how effective parental involvement consisted of their parents helping them with or even simply inquiring about their homework. Students who received parental assistance were encouraged in their academics. One facet of encouragement students informed the researchers about was parents disciplining them for unsatisfactory academic performance. Students believed that when parents limit their access to the telephone and impose a curfew, this displayed positive disciplinary action. According to students, parents setting up boundaries demonstrated that they cared about them. Motivation was the result of parents having concerns about their children's education. The last perception students had about parental involvement was interaction with the school. Even though their parents' presence in the schools would sometimes embarrass them, students still saw the importance of parent participation during the school day and at special events.

Parental Involvement in Mathematics Education

The mathematics community is motivated to embrace families and community members to improve schools (Burrill, 1996; Price, 1996). As a result, there has been an expansion in the literature regarding parental involvement in mathematics education.

Finding ways to have parents become more involved in their children's learning process has been the agenda for many math educators. However, with this increase of research studies reinforcing the need of overall parental involvement in math education, there is still a disconnect between parents and schools. This disconnect has said to be partly due to parents' beliefs about the approach of learning and teaching mathematics (Lubienski, 2003; Benson & Martin, 2003).

The NRC's (1989) report conveyed that there was a need for mathematics education to be reformed; so students can compete against other industrialized countries. However, the report indicates parent beliefs were part of the problem when it came to renewing the math curricular. One of the reasons parents were viewed as an issue was because of their beliefs about math education. According to NRC's report (1989), parents could not overlook the way they were taught mathematics. They believed that there was no need to reform math education since the way it was taught to them was sufficient, so it should be sufficient for their children as well. In addition to being opposed to revising the standards for math education, the NRC also conveyed that parents did not understand the importance of refining math education. The report states:

> As a subject with an extensive and substantial history, mathematics more than any other science has been taught as an ancient discipline . . . Parents who persist in this view deny their children the opportunity to develop and prosper in the information age. (NRC, 1989, p. 76)

This statement expounds on parents complicating their children's ability to succeed in mathematics because of their views about teaching and learning the subject.

As an approach to help parents become more knowledgeable about their children's math education, Civil and Bernier (2006) conducted a study to help parents embrace active roles at their homes and schools. In this 2009 study, parents participated

in a project called *Mathematics and Parent Partnership in the Southwest* (MAPPS). This project was developed mainly for a working-class Latino community in which parents were given the opportunity to become informed and included in what was taught in their children's math class. The project was intended for parents to eventually adopt leadership roles in regards to their children's math education. Parents participated in a math course, which taught them various math topics that their children would be introduced to in their classes. As an extension to the study, parents had the opportunity to observe these math reform classrooms to actually see how their children were being taught.

Anhalt et al. (2002) gave parents a voice by having them introduce their concerns or misunderstandings about the teachers' mathematical practices. Additionally, parents who participated in this study gained understanding of certain math concepts. This study provided another strategy for parents to become effectively involved in their children's math education. Parents' observations were one way to examine their understanding of reformed based mathematical practices. As stated in the *Principles for School Mathematics*, "When parents understand and support the schools' mathematics program they can be invaluable in convincing their daughters and sons of the need to learn mathematics and to take schooling seriously" (NCTM, 2000, p. 378). This quote supports the idea that once parents understand what is appropriate in their children's mathematics class, they are able to be better advocates for the need to learn the subject. Therefore, the exchange of knowledge between math teachers and parents is critical to get parents involved in their children's math education (Civil & Bernier, 2006).

Preparing Educators and Integrating Parental Involvement in STEM Education

In the United States, school districts have actively sought parental involvement as a means to help students achieve academic success. By establishing a partnership between parents and schools, legislators use the Elementary and Secondary Education Act (ESEA) to influence how schools implement parental involvement practices (Kessler-Sklar & Baker, 2000). Within the ESEA, school districts that receive Title I, Part A funds or services are required to construct parental involvement polices in order to obtain federal funds. Utilizing these federal initiatives as a way to gain parent participation in education could also be a strategy to improve math education in schools.

Even though there are parental involvement programs funded by the U.S. Federal government such as the National Coalition of Parent Involvement in Education (NCPIE) and Even Start Family Literacy Program, questions still remain about the effectiveness of these programs. Parental involvement programs are meant to meet the basic needs of children's education; however, parents' may not have the resources to participate in some of these programs. As a result of parents' inability to support these programs, it is most likely the practices from the parental involvement policies are not being fulfilled. In one research study, Kessler-Sklar and Baker (2000) addressed the various types of parental involvement practices that have been sanctioned formally by district-level policy makers. Additionally, district characteristics: " size, location (urban to rural), student/teacher ratio, median income of households with children within the districts catchment area, percentage of minority children in the catchment area, and percentage of children with limited English in the catchment area" (Kessler-Sklar & Baker, 2000, p. 104)

were examined. The study revealed a correlation between the school districts' characteristics and the decision to adopt certain parental involvement practices such as allowing parents to become decision makers within the school system, communicating with parents about children's progress, training staff to work with parents, reaching diverse families, and providing links to social services. However, concerns were raised in regards to the effectiveness of these practices because of the lack of teacher knowledge in how to implement these methods.

In the late 80s and early 90s, adjustments were made in school reforms to prepare teachers for involving parents in their children's academics. These school reforms focused on implementing programs to build collaboration among family, school and community. Programs, such as Head Start, Title I, Even Start, and Goals 2000 were bridges to connect teachers, families, and communities together (Epstein, 2001). Another intervention implemented was the inclusion of teacher preparatory programs at universities and colleges. Courses and workshops were developed solely to build teacher' knowledge and awareness in getting parents involved in schools (de Acosta, 1996; Moll et al., 1992). Some professors at universities and colleges made it a point to include the component of family involvement in their courses for incoming teachers to recognize the relevance of student family backgrounds and education (de Acosta, 1996, Katz & Bauch, 1999). A student's family background is prevalent in his or her education, and educators have to acknowledge this to become more effective instructors in the classroom. National organizations, such as the Interstate New Teacher Assessment and Support Consortium (INTASC) and the National Council for Accreditation of Teacher Education (NCATE), are explicitly established to foster parent involvement (INTASC, 1992; NCATE, 1994).

Fortunately, these organizations show progress has been made to incorporate parents in students' education, especially STEM education (Bermudez & Padron, 1988).

In an effort to increase parental involvement in STEM education, the government organized many projects to have professionals in the STEM fields train teachers to strategize ways for students to improve in their mathematics and science education. Hamos et al. (2009) examined Professional Learning Communities' (PLCs) ability to de-isolate the teaching experience in the fields of science, technology, engineering, and mathematics (STEM). Hamos et al. (2009) elaborate on how today's PLCs are utilized to bring together employees and management in order to discuss concerns and solutions. This strategy seeks to help create a classroom environment that could become a community, as well as enhance the students' learning experience. PLCs in some school communities can be perceived as being a routine, but the authors of this article are trying to disassociate with this perception of educators in order to have more promising professional development from the PLCs. The authors refer to the Math and Science Partnership (MSP) program for the development of PLCs to encompass higher learning in the areas of STEM education. In this article, the authors present various science focused projects that are being incorporated within grades K-12 to improve the depth and quality of these fields of study. This article provided an instrument for the evaluation of effectiveness that is structured around MSP project values identified as key elements of an effective PLC; shared vision and ways of working, collaboration and reflective dialogue. The authors hope to show the significance of having an effective and increased collaboration amongst other professionals to improve teaching and learning.

After reading how systems are organized to help teachers become well-prepared in the classroom, it seems reasonable to wonder, "what if the vision was like that involving the parents and the community?" The purpose of the learning community is to "[include] educators, students, parents and community partners who work together to improve the school and enhance student learning opportunities" (Epstein & Salinas, 2004, p. 12). The impact of creating a strategic plan is to have these individuals partake in student education which will encourage the future leaders of the nation. Also, extra support is needed in the classroom in order to make student learning experiences rewarding. Integrating the parental involvement with the STEM education would increase the odds of students venturing into the careers of science, technology, engineering, and mathematics.

Overlapping "Spheres of Influence"

This research study will use Epstein's theory (Epstein, 2001) "overlapping spheres of influence." Within this theory, Epstein conveys the need for school, family, and community to collaborate on shared goals in order to help children's development as a whole, as well as children's educational development. When these three spheres (school, family and community) embrace the same interest and responsibilities for the children's well-being, it creates a better learning environment and more opportunities for students. However for this study, the focus will be on the school and family spheres.

Having a partnership makes participating members feel as if there is a sense of unity and one mindset in which *caring* is the core concept. The theory of "overlapping spheres of influence" has components that may make it complex for teachers and parents to function in one accord. However, with a well-organized system that values everyone's

input, it is possible for success to be obtained by students, in and out of the classroom. When families and schools collaborate, it becomes rewarding for the parents, teachers, and students, and at the end each group member wins.

Epstein's "overlapping spheres of influence" has six types of involvement which families, community and schools could implement in order to be effective for the children's learning experience. These six types of involvement are: (a) parenting, (b) communication, (c) volunteering, (d) learning at home, (e) decision-making, and (f) collaboration with the community (Epstein, 2001). For this research study, I will be focusing on two out of the six types of involvement: parenting and communicating. These two components will help families and schools build a type of dialogue in which everyone is working together for the betterment of the child. According to Epstein's framework of involvement, the parenting component "[helps] all families establish home environment to support children as students" (Epstein, 2001, p. 409). This is pivotal for this study since it is focused on parental involvement in secondary education.

Summary

Much research has been conducted on parental involvement in the lower grades, elementary school and middle school, but not as much research has been conducted in high school. As children get older, they tend to gravitate to a more independent life. Children lack the need for advice from their parents, because they are finding themselves. As a result, parents are reluctant to intrude, not wanting to upset their child. With drop-out rates decreasing within schools over the past 20 years, especially in urban communities, researchers try to find effective parental involvement methods by which the number of students dropping out of school would decrease even more. The Digest of

Education Statistics (2011) states, "Between 1990 and 2010, the status dropout rate declined from 12.1 percent to 7.4 percent" (p. 3). When children get into more advanced courses, some parents do not know how to help; so they instruct their children to search for online help or ask their teachers for assistance. In cases like these, there has to be a more persuasive way for parents to get involved. Researchers and practitioners attempt to improve parent-school collaboration. By implementing ideas from Epstein's theory "overlapping spheres of influence," the researcher intends to show the significance of parental involvement in improving children's math achievement in secondary education.

Research conducted on parental involvement in student education is extremely vital, because it welcomes "guidance, support, and encouragement for children's learning from parents . . ." (Epstein, 2010, p. 5) and teachers. Consistent parental involvement paradigms provide a more positive school climate and higher levels of academic achievement (Christenson, Rounds, & Gorney, 1992; Godring & Shapira, 1993; Haynes, Comer, & Hamilton-Lee, 1989). A review of the literature shows the need for improvement of parent-school relations. Regardless of contrasting beliefs between parents and teachers, when both groups become open to effectively communicate with one another, there is a positive impact on student academic performance and behavior. Additionally, the relationship between parents and school improves as differences are set aside for what is best for the students.

CHAPTER 3: METHODOLOGY

Restatement of Research Problem

The purpose of this research is to examine and explain the importance of parental involvement in secondary mathematics education. Specifically, I examine parental involvement in two MINDSET (Mathematics Instruction using Decision Science and Engineering Tools) classrooms through mathematical assessment performance, grades, surveys, and interviews. MINDSET is a high school math curriculum created by educators, engineers and mathematicians to enhance students' mathematical knowledge and skills. This curriculum is based on developing mathematical reasoning by using operational research. In addition the applying a scientific approach to analyze problems, MINDSET is also intended to improve students attitude towards mathematics. Quantitative measurements from the assessments, surveys and grades are limited in samples size. As a result, the researcher employs a qualitative method, specifically interviews, to provide a rich description of the data. Additionally, integrating quantitative and qualitative methods provide a portrayal of perceptions parents, teachers and students have about parental involvement rather than utilizing one method. Therefore, a mixed method design will be used to assess student academic performance, as well as the perceptions held by parents, teachers, and students regarding parental involvement in secondary mathematics.

Overlapping Spheres of Influence

The qualitative data will be analyzed by utilizing the theory of overlapping spheres of influence. This theory will help examine parental involvement in secondary mathematics' education through the perceptions of parents, students and teachers. This theory will help provide understanding about parental involvement in math education for high school students.

The theory of overlapping spheres of influence describes different issues about school and family relations. Epstein (2001) played a crucial role in developing this theory. In *School, Family, and Community Partnership: Preparing Educators and Improving Schools*, Epstein thoroughly explained the partnership among these groups and offered ways to improve communication between them. Levine et al. defined Epstein's theory as "[the integration and extension of] ecological, educational, psychological, and sociological theories and perspectives on social organization and relationships" (Epstein & Sheldon, 2006, p. 119). When establishing this theory, Epstein analyzed various perceptions to help shape her understanding of family-school relations. For instance, Epstein examined three presumptions regarding family-school relations: *separate*, *shared* and *sequential responsibilities* (Epstein, 2001).

Separate responsibilities relate to families and schools having their own approaches, goals or standards that will be best fulfilled separately. *Shared responsibilities* focus on schools and families collaborating in order to foster better socialization skills and academic achievement for students. This form of family-school relations allows both affiliations to complement one another for the well-being of the students. *Sequential responsibility* is based on the different phases of children's

development. During early childhood, children begin learning principles and fundamentals at home. Subsequently, they become older and begin formal schooling in which the teachers "assume the major responsibilities for educating them" (Epstein, 2001, p. 23). This model of family-school relations identifies when educational responsibilities are shifted.

As Epstein began to understand the various transitional phases and concepts that form overlapping spheres of influences, she also examined the mechanism of these institutions. Epstein found it effective to investigate this family-school relation by *symbolic interactionism* and *referenced group theory*. In *The Way School Works* (1999), deMarris and LeCompte state that "symbolic interactions are concerned with how the meanings are made . . . they look closely at the processes of human interaction" (p. 22). The way individuals communicate and the different representations of communication, such as "words, gestures, artifacts, signs, or concepts" (p. 22), play an intricate role in symbolic interaction.

Sociologists and researchers subsequently examine social settings and organizations, because the information communicated within these settings can have different meanings based on cultures and social roles. "Social organization enters into action only to the extent to which it shapes situations in which people act, and to the extent which it supplies fixed sets of symbols which people use in interpreting their situations" (Blumer, 1969, p. 190). Accordingly, symbolic interactionists express that an individual's past experiences help elicit expectations of certain behaviors in social settings. With regard to school, family and community relations, these experiences are

one of the core contributors in understanding how teachers and parents communicate with one another.

As a way to increase an understanding on families, schools and community rapport, Epstein also examined the role of reference group theory. The term reference group became eminent when Merton and Kitt (1949) unraveled the dynamics of reference group theory in *The American Soldier*. They addressed issues in non-membership reference groups by shaping values and intellectual perspectives. In regard to applying the theory to the school setting, Epstein believes it is critical to establish what teachers deem as valuable or invaluable when building relations with parents. Whether one is examining family-school relations by separate, shared or sequential responsibilities; symbolic interactionism; reference group theory; or another supplementary theory, the premise of examination is to identify barriers or outlets between the two groups.

Continuous pattern changes between home and school partnership were a factor in the development of the theory overlapping spheres of influences. For instance, in the early 19th century parents were very active in schools. Families, church and schools shared goals to help transition students in the adult community. This form of collaboration gave teachers as well as church officials more control over school relations. However, this type of arrangement started to change. As a result, teachers began to possess more power based on their content knowledge. This caused a divide between schools, families and communities, but that pattern did not last. Eventually, between the 1980s and 1990s, school officials arranged for parents to once again become involved in their children's education. This exertion was suggested and implemented to improve school affairs, allowing "both better-educated and less-educated parents" (Epstein, 2001,

p. 24) to be more informed and involved in their children's schooling. The continuous change the school system has made to integrate school and family relations became critical in the development of overlapping spheres of influence.

This model of overlapping spheres of influence (see Figure 1) shows an overlapping and non-overlapping structure or an external and internal structure of families, schools and communities.

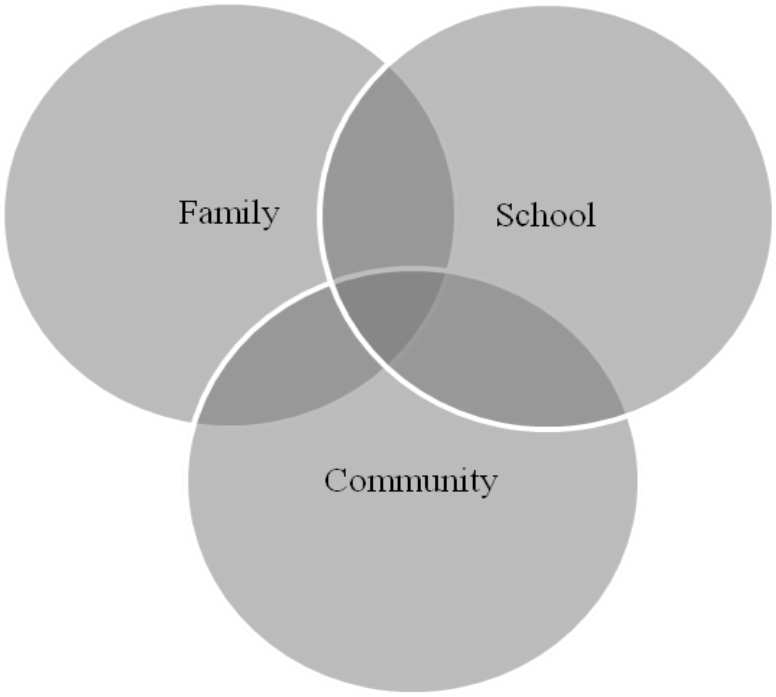

FIGURE 1: Overlapping spheres of influence of family, school and community on children's learning.

The sets—family, school and community—tend to connect or disconnect the spheres of influence due to several components contained in the external and internal structure such as "time, experience in families and experience in schools" (Epstein, 2001, p. 27). The magnitude of these components will be displayed in the overlapping spheres of influence. The external structure consists of essential components such as the backgrounds and philosophies of families, schools and communities. This structure can "create conditions

opportunities, and incentives for more or fewer shared activities in school, family and community context" (Levinson, Cookson, & Sadovnik, 2002, p. 526). The internal structure "specifies institutional and individual lines of communication and locates where and how social interactions occur within and across the boundaries of school, home and community" (Epstein & Sheldon, 2006, p. 526). Time indicates the age, grade levels and social of a child. In the non-overlap realm, there might not be much interaction between parents and schools during infancy. Parents at that time serve as the primarily educator. However, the parent having that main role could change due to an infant having physical, mental or emotional development issues. As a result, parents, schools and even doctors have to collaborate in strategic manners that benefit the child's development. This form of collaboration creates an overlap within the spheres.

Not only is time a major component when it pertains to the overlap of spheres; family and school experiences are also major factors. Family and school spheres will overlap when parents are actively involved in their children's education (Epstein, 2001). There is also an overlap when teachers incorporate parents into their teaching practice. Epstein (2001) states that this could take place in every grade level, despite the unique pattern in parental involvement for middle and secondary schooling. In spite of children's grade levels being a major component for parental involvement, parents can still be involved in the latter grades of their children. This may be due to certain components such as school polices or even teaching practices (Epstein, 2001). These components result in the overlapping of schools and families.

This study acknowledges the impact the theory of "overlapping spheres of influence" has on family-schools relation and the dynamics of parental involvement in

high schools. The implementation of Epstein's (2001) six types of involvement changes the interdependent alliance between parents and schools. Each person who is associated with the schools (e.g., teachers, parents and students) has the ability to improve or hinder parental involvement in the high school setting. School policies and practices have the chance to alter the interaction of parents, schools and students with each other.

This research study examines factors that impacts parental involvement and math achievement of high school students. The types of parental involvement utilized in this study are parenting and communicating. These two components will help families and schools build a type of dialogue in which everyone is working together for the betterment of the child. Qualitative and quantitative data are gathered and evaluated to identify components that influence parental involvement and math achievement. This analysis draws on the theory of the spheres of influence by exploring the effects of family and teacher partnership.

Research Questions

The following research questions will be examined by the researcher:

1. What are the perceptions of students, teachers and parents regarding parental involvement in secondary math education?
2. Does parental involvement in MINDSET influence mathematics performance for students?
3. Do the weekly newsletters and progress reports used in the MINDSET class influence the perception students, teachers and parents have about parental involvement?

Research Design

A mixed-methods design was employed to identify and examine factors that influence parental involvement and math achievement of high school students. Utilizing a mixed method approach for this study provides a bridge between the qualitative and quantitative data (Teddlie & Tashakkori, 2011). This type of research method is beneficial for this research study, because it supplements the data that needs clarification, which in this study is the quantitative data.

Mixed methods have been evolving in the social and behavioral sciences for at least three decades (Klassen, Creswell, Clark, Smith, & Meissner, 2012). Hammersley (1996) calls mixed methods "methodological eclecticism,"

> Which recognizes the balance between quantitative and qualitative method provides. The combination of these two methods involves selecting and then synergistically integrating the most appropriate techniques from a myriad of QUAL, QUAN and mixed methods in order to more thoroughly investigate a phenomenon of interest. (Teddlie & Tashakkori, 2011, p. 286)

Klassen, Creswell, Clark, Smith, and Meissner (2012) define mixed methods research as,

> More than simply collecting multiple forms of qualitative evidence (e.g., observations and interview) or quantitative evidence (e.g., surveys and diagnostic tests). It involves the intentional collection of both quantitative and qualitative data, and the combination of the strengths of each, to answer research questions. (p. 378)

I used both a quantitative and qualitative approach to identify parental involvement factors and to examine math achievement. Subsequently, the qualitative data was employed to help explain the quantitative results.

Settings

The study took place at Middlesex High School (name has been changed), a public high school that is located in a southeastern state. Approximately 178,011 people live in the county and the per capita income was $21,121 at the time of the research. The

state school board has rated this school as an "Honor School of Excellence." A school with this type of label has noticeably 90% of their students performing at grade levels and is making adequate yearly progress (AYP). The student body consists of 1,360 students in grades nine through 12. The school's student-to-teacher ratio of 17:1 is higher than the state average of 14:1. The school's 80% graduation is higher than the NC state average of 74%. The ethnicity of the student population is predominately white (73%), with fewer Black, Hispanic, and Asian students (Black – 21%, Hispanic – 3%, and Asian – 3%).

Sample Selection

The determining factors for participation in this study were:

1. A parent may participate in this project if his or her child is enrolled in a fourth-year math course in which the teacher is implementing the MINDSET curriculum in spring 2013.
2. A teacher may participate in this project if he or she teaches a fourth- year math course in spring 2013 in which he or she is implementing the MINDSET curriculum. Additionally a teacher may participate if he or she has attended a MINDSET workshop or has been trained by a MINDSET teacher-leader.
3. A student may participate in this project if he or she is enrolled in a fourth-year math course in which the teacher is implementing the MINDSET curriculum in spring 2013.

The two teachers from the participating high schools met the criteria to be part of the study. Students who were enrolled in the math classes were randomly placed in these classes by a computer program called NC WISE. NC Wise is a computer program that

allows teachers, administrators and parents to have access to student academic records through the internet. For this study, a total of 39 students and 42 parents participated. The researcher chose which class to be the control group and the experimental group based on the comfort level of the two participating teachers. The parents and students who were interview volunteered to participate in this part of the study.

Participants

Participants in this study were math teachers, students and parents. The students were juniors and seniors who were enrolled in the fourth year math course Advanced Functioning and Modeling. The prerequisite for this class was Algebra II. At least three teachers at this particular high school were teaching this course; however, the two teachers selected for this research study were implementing a STEM curriculum (MINDSET) in this particular course. Both teachers were prepared to teach this curriculum since they completed extensive training at a MINDSET workshop or by being trained by a teacher leader from the MINDSET project. Additionally, before conducting this study, each teacher had at least two-three-years' experience in teaching this particular curriculum. Students who were enrolled in this class were eligible to participate in the research study. The parents of these students automatically met the criteria to be a part of this study because of their children being enrolled in this particular class.

Parents, teachers and students were given consent forms asking for their participation in this research study. Students who were under the age of 18 were given an assent. The consent/assent forms provided a blueprint of what the study was about. Parents, students and teachers were informed that their decision to participate in this study was completely voluntary. They were told they could decide not to participate in

the study or stop participation once they had started. Two teachers, 33 parents, and 39 students participated in the survey component of this study. Nine parents and six students participated in the interview.

Instruments

Pre- and Post-Assessment

MINDSET pre- and post-test problem solving assessment (see Appendix A) consists of 28 items in the following areas: number sense, compound inequality and proportions. The MINDSET pre- and post-test assessments were based on the PISA International Assessment. The MINDSET Project personnel developed items that reinforced student abilities to enhance their mathematical knowledge and skills by formulating and solving multi-step problems and interpreting results. Each item had a scoring rubric to guide the grading process. The rubric was also developed by project personnel as well as doctoral students working on the project. During the process of constructing the rubric, these individuals would meet two or three times a month via phone or face-to-face. Project personnel acquired assessment scorers in which they would score several classroom sets of assessments to determine if the rubric was valid. After reviewing the assessments and rubric repeatedly, the assessment scorers came to a consensus in which the rubric was considered to be credible. Soon after, a meeting was arranged with the assessment scorers and the project personnel. This meeting resulted in the development of a valid and reliable rubric that helped evaluate a student's learning. Sixty-eight percent (68%) of the items were based on a 0 and 1 scale. Twenty-nine percent (29%) of the items were based on a 0, 1, 2 scoring rubric. Within the items rated zero, one, or two, students were required to show their work. If they did not show their

work, they would not receive full credit. There was only one item that was based on a zero, one, two, and three scoring rubric due to it being more complex than the other items.

Parental Involvement Survey

The survey was created by the Center on School, Family, and Community Partnership research team at Johns Hopkins University (Epstein, 2001). *The High School and Family Partnerships: Surveys and Summaries–Questionnaires for Teachers, Parents and Students* were revised by Epstein, et al. in 1993 to help identify high school goals and perspectives with the intention of improving interactions and partnership with schools, families, and communities.

Instrumentation

The *High School and Family Partnerships: Surveys and Summaries–Questionnaires for Teachers Parents and Students* have 125 items that incorporate a variety of Likert-type items. In the teacher survey, there are 17 subscales in which each section has at least 12 questions (see Appendix B). The survey items address information such as: teachers' attitudes and professional judgments about family involvement; school's present practices; and estimates of family involvement. The parent survey has 21 subscales in which each section has 10 questions (see Appendix C). These survey items address information such as family attitudes about high school family practices of involvement in teen education, and how well the school keeps them informed and involved at school and at home. In the student survey, there are 19 subscales in which each section has at least 10 questions (see Appendix D). The student's survey items address information such as: student attitude about the school; how they interact with

their families on school matters; and how the school involves their families (Epstein et al., 1996).

One hundred and fifty teachers (150), 420 parents and 1,300 students in six high schools participated in the original High School and Family Partnership study. For each scale that was reported in the study, they provided the scale name and code, number of items, internal reliability, direction or scoring items, mean, standard deviation, range, and the number of subjects in the sample (*N*). According to Epstein et al. (1996) "the reliability of a scale may be reported in terms of the internal consistency of scores that implies to measure the same concept." The alpha reliability formula reflects the intercorrelation of a set of items, accounting for variations in responses to the items. The alpha (α) is a reliability estimate, because there always is some error associated with survey measures. Mueller (1986) explains that the alpha (α) is as reliability estimate because of the error associated with survey measures.

The reliability of the attitudes of the teachers, parents and students about parental involvement scale was reported by Epstein et al. (1993). They used Cronbach's alpha (α) formula, because the surveys consisted of many Likert-type items (Mueller, 1986). The utilization of the alpha reliability formula allowed Epstein et al. (1993) to indicate the intercorrelation among items within the same set.

Epstein et al. (1993) developed surveys that consisted of "parallel items to identify common and different goals and perspectives of teachers, parents and students" (Epstein, 1996, p. 3). The surveys included open ended questions that requested ideas from participants and greater detail in their suggestions. When Epstein et al. (1996) utilized the reliability statistical procedure in SPSS; they found that in the parent's

survey, there were 14 items that had a reliability coefficient of .86. In the teacher survey there were nine items that had a reliability coefficient of .81. Lastly, the student survey that highlighted a student's perception on parental involvement, their learning abilities and their family background had four items of this scale in which the reliability coefficient was .63. For this research study, only the attitudes of parents, students and teachers were examined; therefore, the other items will not be reported.

In addition to reliability, Epstein reported the validity of their findings after conducting and employing research with the family partnership surveys and questionnaires. In Epstein's (1991) study, she researched school programs and teacher practices of parent involvement in Inner-City Elementary and Middle Schools by employing the surveys from *Surveys and Summaries–Questionnaires for Teachers Parents and Students*. Within the results, there was a weak correlation between communication from school to home and the importance to teachers of this type of practice (.232). Also, neither volunteers at school (-.360) and learning activities at home school level (-.310), on the elementary/middle grade level, had an influence on learning activities at home.

In another study, Epstein and Dauber (1991) utilized the *Questionnaires for Teachers, Parents and Students* to analyze the effects teachers' practices of parental involvement had on student achievement during the school year. Data revealed that there was a weak convergent validity coefficient. There was a weak correlation between the initial fall math scores and teacher leadership in parent involvement at home (-.348) and assigned homework quality (-.334). Since this research is focused on the attitudes students, parents, and teachers have about parental involvement, these numbers did not

raise concerns. Also, within the parental involvement survey, the perception parents, students and teachers have about mathematics and the relevance it has on an individual well-being was measured. This part of the survey was created by the MINDSET Project.

The MINDSET Project utilized the mathematics attitude survey to compare two groups of students: students who were enrolled in a class that implemented the MINDSET curriculum versus students who were not. Data revealed that the curriculum did not have an effect on students attitudes towards mathematics, $F(1, 373) = 1.79$, $p = .18$.

Operationalized Definition of Variables

The parental involvement survey measures five variables. These variables include: (a) parental involvement, (b) mathematics attitude, (c) parent-teacher relationship, (d) parent-student relationship, and (e) parents partnership. Each item is measured using a Likert-type scale that has four responses. The responses are: (a) strongly disagree; (b) disagree; (c) agree; and (d) strongly agree. Parental involvement was operationalized and measured parents' active involvement in their children's math education. Mathematics attitude measured participants' perception about mathematics and the relevance it has on an individual's well-being.

Independent Variables

The independent variables are the background demographics such as, gender, ethnicity, mother's education, mother's work status, and parents' expectation of their children education trajectory. To assess possible association with the dependent variables, this study evaluated the effects of the independent variables.

Interviews

Pre- and post- interviews were conducted with parents, students and teachers. Each interview was recorded and transcribed. The interviews addressed participants' perceptions about parental involvement in secondary math education. Examining the perceptions of the parents, students, and teachers provides insight of how parental involvement is implemented in high schools and the effects it may have on participants' relationship with one another. Additionally, the interviews were utilized to analyze participants perception on the parental involvement interventions employed in this study in order to help improve parents' participation in their teenagers' math education.

Interventions

Weekly Newsletters

The weekly newsletters will be used as a parental involvement strategy. Each newsletter consists of lessons and activities that will happen within the classroom and math strategies that will help parents become involved in their child's math class. In addition, the newsletters emphasize real-life situations children and parents can identify with. This will be a communication strategy that keeps parents informed about the lessons being taught in their children's math class. The information provided in the newsletters (see Appendix E) will also be used to help create dialogue between students and parents when it pertains to their math education.

Weekly Progress Reports

Weekly progress reports will be used as a parental involvement strategy (see Appendix F). At the end of the week, these reports will be distributed to the parents. The information contained in the progress reports will be composed of each student's grades,

missing assignments, upcoming exams, and comments concerning each student's work and general behaviors, and a blank area where parents can sign and respond to the teacher's report. This type of strategy allows parents and teachers to communicate even if both parties are unable to meet. Furthermore, the reports will keep them aware of the children's performance. Students' grades, from both the experimental and control group, will be collected to examine academic achievement.

Data Collection

First Phase

Before collecting data, permission was requested from the school system to conduct the research. The researcher then provided math teachers with a packet of consent/assent forms and parental involvement surveys for students to take home to their parents. The consent/assent forms explained the purpose of the study, and the packet contained an incentive to encourage participation. Parents were informed that if they were selected to be interviewed, contingent on their survey responses, they would be offered the opportunity to win a $15 Wal-Mart gift card. After consent was granted, the parents completed and returned the consent form and survey to the math teacher.

Each packet had student names on the outside of the envelope. On the inside of that envelope, the researcher provided a return envelope for parents to place their completed paperwork in that was to be sealed in order to protect their anonymity. Students returned the sealed envelope to their classroom teacher. Afterwards, the researcher gathered the paperwork from each math teacher and began sorting data. Parents of children who were 17 years old or younger signed the consent form. Students who were 18 years old or older signed their own consent form without the need for their

parents' signature. The signed consent forms allowed parents, teachers and students to participate the study.

Parents, students and teachers who signed the consent/assent form completed the pre-survey as well. The pre-survey was used to measure parental involvement, mathematics attitude, parent-teacher relationship, parent-student relationship, and parents' partnership from the control and experimental groups before the parental involvement interventions were given. Soon after, students who agreed to participate in this study were given the MINDSET pre-assessment. The date the assessment was administered was arranged by both teachers and the researcher. Before completing the assessments, students were given an answer sheet (see Appendix G) to provide their answers and, if necessary, extended written work. The MINDSET pre-assessment was used to determine the mathematical knowledge of students and focused on solving multi-step problems. Additionally, both teachers provided students' weekly math grades. At the end of the study, the researcher conducted a one-way ANOVA for the pre-and post-assessments and surveys, as well as each student's weekly grade report. This was done to determine if weekly progress reports and newsletters influenced parents, students and teachers in terms of their perception about parental involvement and math performance.

Second Phase

In the second phase, semi-structured interviews were conducted with the two mathematics' teachers, six students, and nine parents from the experimental and control class. The selection of six students and nine parents was contingent on if they wanted to participate in the interview. Some parents wanted to complete the survey but did not want to be interviewed. The purpose of each interview was to provide detailed information on

the participant's perspectives about parental involvement. A portion of the interview questions was based on survey responses. Additionally, participants were asked to provide their opinions or suggestions in order to improve parental involvement in secondary schooling.

Third Phase

The third phase was the implementation of the parental involvement interventions. The parental involvement interventions were weekly newsletters and weekly progress reports. These resources were utilized to help parents communicate with their teenager about their schooling and roles as a parent when they were at home. Parenting and communicating are two types of parental involvement Epstein (2001) describes in the theory of "overlapping spheres of influence."

Fourth Phase

In the fourth phase students, parents and teachers who signed the assent/consent form received the post-survey and the post-math assessment. The surveys and assessments were administered at approximately the 8th week of the study. The post-survey responses and the post-math assessment scores were based on the implementation of the parental involvement interventions. The researcher then performed a one-way ANOVA to determine whether there were any statistically significant differences in the pre- and post-survey, as well as the MINDSET pre- and post- assessment between the experimental and control groups.

Fifth Phase

In the fifth stage of the data collection, semi-structured interviews with the two teachers, six students, and nine parents were conducted after the post-survey and post-

assessments were administered. A segment of the interview questions was based on both pre- and post- survey responses. These questions help clarify participants reasoning for choosing certain items. These interviews provided each participant's perspectives about parental involvement after the implementation of the two interventions.

Data Analysis and Management

Data analysis for mixed methods research consists of analyzing both quantitative and qualitative data using quantitative and qualitative methods. Both forms of analysis consist of a multiple-step procedure by the researcher. The steps includes: (a) preparing, (b) exploring and analyzing the data, and (c) describing and interpreting the results.

Quantitative Analysis

In regard to the survey, it has a prepared coding, which list the variables in the survey. Additionally, the variables have abbreviated variable names for SPSS and numeric values for each response (Pallant, 2005). When entered into the SPSS, the data will be checked for errors to see if any values fall outside the range of any particular variable (Pallant, 2005). Once the data is recognized as being clean, the researcher began exploring and analyzing the perceptions parents, students, and teachers have of parental and student math performance after weekly progress reports and newsletters are implemented.

Before scoring the MINDSET pre- and post- assessments, there were two pilot studies conducted to determine the adequacy of the scoring rubric (see Appendix H). The pilot studies helped reduce the occurrence of scoring discrepancies. After constructing a final draft of the rubric, two scorers assessed the pre- and post- assessments. As a result, student assessment scores were consistent. For the purpose of this study on the pre- and

post- assessment, the researcher will score the pre-and post- assessment. Following the scoring of the assessments, the scores will be inputted into SPSS to display the variance of the pre- and post- assessment between the experimental and control classrooms.

An Analysis of Variance (ANOVA) will be conducted to measure students' weekly grades, the MINDSET pre- and post- assessments and the pre-and post-survey between the experimental and control classrooms. Additionally, a two-way and three-way ANOVA will be employed to measure the background of students and their mothers. The quantitative analysis will provide insight on the impact that communication, parenting and learning at homes has on students' math performance and on each group's perception about parental involvement.

Qualitative Analysis

The researcher transcribes each semi-structured interview. Once the interviews are transcribed, the researcher will conduct a thematic analysis of the corresponding responses from the interview questions and the researcher's field notes. The thematic analysis "[moves] beyond counting explicit words or phrases and [focuses] on identifying and describing both implicit and explicit ideas within the data, that is, themes" (Guest, MacQueen, & Namey, 2011, p. 10). Even though the reliability of thematic analysis is questionable, it is considered the most beneficial when obtaining meaning within the complicated textual data set (Guest et al., 2011). The thematic analysis will provide better insight on the development of overlapping spheres of influence as students become older.

The surveys, consent forms, interview questions, and transcripts were kept in a locked file at the university office. Survey data will be entered into the SPSS software

program once all the surveys are collected. Interviews will be transcribed within a month after the interviews are completed.

Summary

In this chapter, the researcher provides the essence of this case study. This is an attempt to understand students, parents, and teachers' perceptions about parental involvement in secondary math education, and ways in which parental involvement can improve parents, students, and teachers' relationships, as well as students' math performance. Chapter 3 begins with the purpose of the study and an overview of Epstein's theory of overlapping spheres of influence, as well as, the rationale for applying the theory to this particular study. Additionally, this chapter presents a description of the research design and the study's procedures. The research procedures portion of this chapter includes: settings, sample selection participants, instruments, data collection, data analysis, and management.

A mixed methodology is used to approach these inquiries because integrating the methods maximize the strengths and minimize the weaknesses of each (Klassen et al., 2012). Survey/questionnaires and math assessments (quantitative) and interviews/questionnaires (qualitative) data were collected from parents, teachers, and students in two high schools in the southeast region of the U.S. during the 2012-2013 school year. Data analysis consists of a multiple step procedure by the researcher. The steps include: (a) preparing, (b) exploring and analyzing the data, and (c) describing and interpreting the results. The following chapter discusses the findings of the study.

CHAPTER 4: ANALYSIS AND DISCUSSION

In this chapter, research findings related to each of the three research questions will be discussed. Pre- and post- survey responses, assessments of MINDSET and interviews were utilized to answer the research questions. Research question one pertains to the perception parents, teachers and students have regarding parental involvement in secondary mathematics. Then, there is a discussion of research question two, which provides an insight on parental-involvement contributions to the math performances of students. Lastly, research question three discusses each group's perception about the influence of parental involvement.

Discussion of Question One

Research Question 1: What are the perceptions of students, teachers and parents regarding parental involvement in secondary math education?

The first question is based on the perceptions students, teachers and parents have about parental involvement in secondary math education. An open-coding method was used to code any responses from the interviews and surveys which addressed the research questions. Line-by-line coding of the parents', students' and teachers' responses was implemented to construct the most coherent meaning. Selecting the codes produced the most significant information for this study. Open coding helped define perspectives related to four areas: strategies for parental involvement; parental involvement barriers; transitional roles of parents and students, and student independence. For each finding,

parents' viewpoints will be presented first, followed by the students' perception and teachers' point of view (see Table 4.1).

TABLE 4.1: Coded interview survey responses

Mid-level category Gender Experimental/Control Parent/Student/Teacher		Sub-codes Female/Male	Total Parents	Total Students	Total Teachers
Strategies teachers employed for parental involvement	Technology	Emails	57	8	28
		Teacher Website	8	2	0
		Newsletters	4	0	0
		Parent Assistant Module (PAM)	11	3	2
	Face-to-face meetings	Phone calls	18	0	8
		Parent teacher conference	15	0	2
		Open house	8	0	1
		Parent workshops	3	0	0
		PTA	7	0	0
		Send progress reports	8	1	2
			0	0	0
Barriers of parental Involvement	Lack of communication	Lack communication with teachers	35	6	3
		Expectation from teacher or understanding expectation	34	4	8
		Lack of communication from teenagers	18	13	4
	Parent's Mis-understanding	School not welcoming	15	0	0
		Teacher parent relationship	5	0	0
		Teaching methods	15	0	0

TABLE 4.1: Coded interview survey responses

Mid-level category		Sub-codes			
Gender		Female/Male			
Experimental/Control Parent/Student/Teacher			Total Parents	Total Students	Total Teachers
	of Higher-level math	Understanding the curriculum	10	2	0
		Change of curriculum	3	0	0
		No understanding of the higher math courses	6	6	0
		Altercation with students/parents	1	2	0
		Lack of parents' availability	13	0	6
		Lack of access (parent or teacher)	4	0	4
		Parent student relationship	0	1	0
		Lack of understanding children's math work	16	6	0
		Open house	5	5	4
		Dislike mathematics	3	4	0
	Prior experience with Math education	Traditional teaching	15	3	3
		Lack of technology	2	0	0
		Lack of engaging	4	3	0
		Prior interaction with former teachers	21	0	7
		Parents' pressure students	1	0	0
			0	7	0

TABLE 4.1: Coded interview survey responses

Mid-level category	Sub-codes			
Gender		Female/Male		
Experimental/Control Parent/Student/Teacher		Total Parents	Total Students	Total Teachers
Transitional Roles		0	0	0
	Monitor	22	15	4
	Supporter	23	11	3
	Optional resource	20	5	6
		1	0	0
Student's Independence	Student's future	21	5	5
	Student personality	37	7	6
		2	0	0
	Academic achievement	2	0	2
		1	0	0
	Building a relationship with teachers	12	1	0
	Building relationships with other parents	7	0	0
	Supporting teachers more		0	0

Note. Open-coding method used to code interview and survey responses.

Strategies of Parental Involvement

In this section, parents, students and teachers described the various strategies teachers employed to get parents involved in their teenage students' math education. An analysis of survey responses and interviews provided a clear perception of parental involvement in secondary math education. Within the interviews and survey responses, teachers expressed the various ways they contact parents. The data analysis revealed two

primary strategies teachers employed to help parental involvement, technology and parent-teacher conferences (see Figure 2).

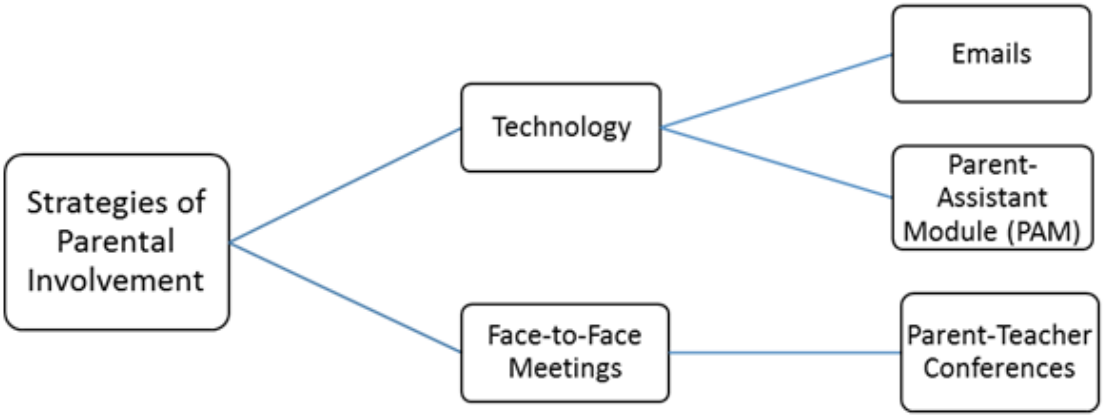

FIGURE 2: Strategies of parental involvement.

Discussion of Strategy One: Technology

According to parents, students and teachers, technology plays an intricate role in getting parents involved in their children's math education. From the analysis, participants construed that emails and the school district's management system Parent Assistant Module (PAM), were very useful. Parents and students also expressed that teacher websites gave parents the opportunity to become aware of the academic progress of the students. In this section, the discussion of emails and PAM will be presented to disclose the perceptions of parents, teachers and students regarding how technological tools influenced parental involvement.

Emails

Parents' Perception of Emails

The primary parental involvement strategy parents spoke about was emails. Analysis of the pre-survey revealed 55% of the parents participating in this study recognized email as the prominent strategy teachers utilize to communicate with them.

Mrs. Hanson, a mother of a high school senior, stated, “Email has been a great invention, as far as keeping in contact with the teachers. If there's any issues or problems, or if I have questions . . . That's just been my communication with teachers.” In a later interview, she stated that technology overall has helped with her relationship with her son’s math teacher. When asked how, she explained,

> It made it a much easier process, just drop an email, versus having to pick up the phone and make that phone call. Plus, they can send out updates to math parents, versus one-on-one picking up the phone and making that phone call, which I felt some of his teachers did a lot. They would give us periodic updates and say they have a test, this project's due on such-and-such date, and it kept us in the loop.

Mrs. Everett, another parent, spoke about the positive effects that she and her daughter experienced when she began communicating with the math teacher via email. She first mentioned that at the beginning, her daughter did not speak highly of her previous math teachers. Not only did her daughter did not care for this teacher, Mrs. Everett remembered that other parents did not have a positive view of this particular math teacher. However, to address this matter, Mrs. Everett decided to contact the math teacher. Mrs. Everett stated that once she started communicating with this teacher via email, her perception about the math teacher changed. When asked if emails were helpful, she states:

> Oh yes, absolutely. That is fantastic, and a good way to stay on top of things, because I very much look at that versus, say, Sam lays out what she's done at school, and the older she gets, the less you do that. It's less hands-on; so if there is an issue, then yes, it's very helpful for me to have the teacher email me and say, ‘Hey, look, we need to do this.’

When Mrs. Everett was asked if technology has helped her relationship with her child’s math teacher, she explained that “technology in many ways can be helpful; however, both parties have to use it properly.” She said she believes technology can

produce positive results; however, both parties need to know how to use the appropriate tone and words to get his or her point across. Mrs. Everett states "you're only as good as the person who receives or sends the email. If I am not on my game and not paying attention to the emails that I receive from the teacher, and if I don't do anything about whatever it is she tells me about, then I'm shooting myself and my kid in the foot." This quote reiterates technology, such as email, when properly used, is an effective strategy that teachers use to get parents involved and knowledgeable of their students' education. Mrs. Everett relays that when technology, such as email, is utilized as a source to help build relationships, both parents and teachers play a role. No one can assume that it is a one-sided communication outlet. Both parents and teachers have to be proactive in communicating when it pertains to their students' math education.

Students' Perception of Emails

Forty-nine percent of students expressed emails to be very beneficial in keeping their parents informed of what is going on at their school and in their classrooms. When asked what strategies teachers used to get their parents involved, many students stated emails. Rachel states, "They try to send out an email at the beginning, to just build the relationship . . . where they can email me if they need to." In a later interview, Rachel reiterates the advantage of technology, "I think it helps, because when my teachers send out an email, then my mom just knows what's going on." Hannah states,

> They email my parents weekly or something, saying, 'Okay, we have a test coming up,' or they update their website regularly. My parents actually have the resource that says, 'Okay, you have a test coming up soon, are you ready for it? Are you prepared? If not, then we need to prepare you for it; so you're not freaking out, the day of the test.'

Tiffany is another student who spoke about teachers strategically sending emails to her parents to help them become involved in her math education. She stated, “They email our [parents] our assignments and stuff.” In a later interview, Tiffany reiterated the value of email when it pertains to getting parents involved. Even though she does not see her parents interact much with her teachers, she said knows that email is one strategy that is used consistently.

Teachers’ Perception of Emails

Communication through technology was a core element of obtaining parental involvement in the classroom. Both teachers said that emails were a technological resource that they exercise to encourage parents to become more involved in their children’s math. Both teachers in this study spoke about making sure that they occasionally email parents on what is going on in their children’s class. Mrs. Douglas stated:

> I like to send out—they're not always weekly, so let's say bi-weekly—emails, just updating them, and the subject will be AFM update, and I'll just update them about what their students just did or what they're about to do, what topic they're learning about and when they're going to have kind of a test or a quiz–reminding them that I have tutoring on Mondays. It's just reminder emails to let them know what's going on in my class. I do that about every other week, I'd say.

Mrs. Middleton also spoke about email being a strategy she uses to get parents involved. Even though she stated in her interview that she does not email parents as much as she used to, she still finds it to be helpful. Both teachers stated that emails were resourceful when notifying parents about their children’s math performance and classroom behavior. Both teachers believed emailing parents about their children’s academic progress, especially if they were not doing well, resulted in positive changes. Mrs. Douglas stated:

> If a student has a 70 or below, I will make sure to contact their parents and say, 'so and so has this [grade] in my class; I'm very concerned.' I let them know my tutoring and other things that they could be doing to get their grades up. I work back and forth with the parent, if the student is struggling.

Mrs. Douglas and Mrs. Middleton understood the power of communication via email. They realized that contacting parents via email was an approach they successfully utilized to help parents become involved in their students' math performance.

Parent Assistant Module (PAM)

Parents' Perceptions of PAM

Parents emphasized the effectiveness of the school district's data management system Parent Assistant Module (PAM). PAM was implemented to allow parents to have 24-hour access to their children's school information. This type of access allows parents to check student grades, class attendance and other important data. Mrs. Hanson stated, "They have implemented this PAM system, which does give us more access into their daily records, which I have found helpful, because before you would get the progress report or the report card, and you're going, "What's going on here?" Mrs. Hanson continued, "With PAM, they just started that this year. There's a parent access system of some sort, and you can go in and look at your child's grades and see where they are for the semester." Other parents continued to elaborate on the positive effects PAM had on their ability to keep up with their children's academic progress. Mrs. Mack stated,

> I love that parent assist, where now it's on the computer, and I can pull it up any time I want to and know her grades and say, 'Why'd you get a 79 today? What did you do? Did you not study? Were you up too late? What's the problem?' So, I love that.

Mrs. Stevenson also spoke about the benefit of using PAM. She stated "Keeping up on the PAM, the minute I pop it up, if I see Darryl falling short somewhere, I'm like,

‘Darryl, what's up with all that? You'd better get that done.’” From these statements, it can be deduced that the PAM is an effective resource that helps parents become involved in their children’s secondary math education.

Students’ Perceptions of PAM

Students communicated that Parent Assistant Module (PAM) has also helped their parents become more involved. Hannah expressed that her parents’ access and usage of PAM has allowed them to be more cognizant in her academic progress. As a result, her parents “don’t have to go to school and have conference with them just to ask simple questions.”

Travis conveys that the PAM system helped his parents become more involved; however, he did not care for it. He states, “. . . I didn’t like it.” When asked why, he simply said “. . . because she can see my grades at any time. Or she could see it before I saw it.” He later expressed that his mom’s ability to access his academic progress all the time had caused him to be more conscious of doing well in school.

Teachers’ Perceptions of PAM

Mrs. Douglas and Mrs. Middleton found PAM to be resourceful. For instance, when their school had open house at the beginning of the semester, both teachers created presentations for parents. Within these presentations, both teachers disclosed information and strongly suggested parents use PAM. They informed parents that PAM would allow them to know the current academic status of their children without having to wait for progress reports.

Summary of Technology

Parents, students, and teachers perceived technology, such as emails and the Parent Assistant Module (PAM), as being a prominent strategy teachers use to encourage parental involvement in secondary education. Among these two strategies, parents, teachers and students expressed that emails were the most common parental involvement strategy used. The data supported that teachers were able to directly contact parents to address student progress. Parents, students and teachers reported various scenarios indicating that when parents and teachers communicated, specifically via email, students improved in their schooling. Whether information is being sent via email or PAM, technology is perceived as a prominent parental involvement strategy. Data analysis showed that among the two technological resources, all groups thought email to be the most effective parental involvement strategy by all.

Discussion of Strategy Two

Parent-Teacher Conference

Parents' Perception of Parent-Teacher Conferences

Parent-Teacher Rapport

Parents suggested that parent teacher conferences were a familiar approach that was beneficial to help them become involved in their children's math education, as well as build a rapport with the teachers. One parent shared, "the conferences enabled me to get a better assessment as to how [my] child [was] doing." Mrs. Thomas spoke about why parent teacher conferences are beneficial not only for parent-teacher relationships, but also for opportunities to teach teenagers about how to conduct professional relationships with others. She stated,

> I would have loved to have had–which I know is probably almost impossible, the way things are required, but–at least one conference with my kids' group of teachers, especially with their course subjects during this semester. Just one, unless there was a problem. If there was a problem, obviously, but I think a one-on-one with your course teacher to really know, and to know that—like I said, you can learn a lot about someone in a face-to-face meeting—about their personality, which is huge. Each teacher's personality is huge. Not that they all need to be the same, or that you're going to like them all, but just to know what that personality is like is huge. One might be a talker and a laughing kind of person, and one may be very strict and stern, and I think you can tell that by meeting and talking to them, and then you'd have a better opportunity on how to encourage your student to deal with those different personalities that they will address in life.

This quote supports that parent-teacher conferences are not only for teachers and parents to build a rapport with one another, but they also serve as a learning opportunity for students. Students are able to see their parents and teachers collaborate with one another in a professional setting.

PTC Unnecessary in the High School Level

Parents from this study expressed that parent-teacher conferences were not needed as much in the high school level as in the lower grades. However, parents realized that parent-teacher conferences were necessary only if matters regarding the student's behavior or academics became unmanageable. Akin states,

> I don't 100 percent agree with technology, or 100 percent agree with face-to-face. It depends on the situation. You've got to really know when to use it, and some people try to use it for situations that it's not warranted. You know? You really need to sit down and speak and talk about grades and stuff like that. If it's just an update, like I said, an email is fine.

Mrs. Avery also preferred to have face-to-face parent-teacher conferences; however, she believed that it is more convenient to communicate via email. Many parents perceived that parent-teacher conferences are more inclined in the lower grade levels. However, if a parent has serious concerns, he or she prefers having a PTC.

Summary of Strategies of Parental Involvement

The data analysis suggested that parents, students and teachers perceived technology to be the most substantial parental involvement strategy in secondary education. Many of the parents interviewed and surveyed expressed that emails, websites, and PAM, were vital when it pertained to keeping them involved in their teenagers' education. Parents realized that they have less time to show up at their children's school and consult with teachers. If parents wanted to check students' grades, many of them would use the PAM system or email teachers. The PAM system allowed parents to have 24-hour access to their children's school records. Teachers would update this web system on a regular basis. This helped notify parents of the decline or growth of their children's academic progress.

Data suggest that teachers' websites were another useful technology resource which parents valued. Parents expressed that the websites provided more details of certain assignments and/or tests that were approaching. Parents also conveyed that emails were another strategy teachers utilized to get them involved. Teachers would generally email parents to initiate dialogue from parents or ask for assistance when it pertained to students' math performance. Both parents and teachers stated that once parents were contacted, they saw an instantaneous change in either students' behavior or academic progress. Students also communicated that teachers used emails more frequently to communicate with parents.

Parents also reported that conducting parent-teacher conferences was a beneficial parental involvement strategy in secondary education. Many parents reflected on parent-teacher conferences as being helpful in updating them on their students' progression or

regression. They also conveyed that these conferences helped form a rapport with teachers. Parents realized that once students entered high school, it was less probable for them to have frequent parent-teacher conferences. However, when these parents-teacher conferences took place, they were perceived to be valuable.

Barriers of Parental Involvement

When analyzing the data parents, students and teachers disclosed: parents' lack of communication with teachers and students, students' lack of communication with parents, prior experience, parents' misunderstanding of higher-level math, and parents' availability played a significant role in the lack of parental involvement in secondary math education and were parental involvement barriers. This section will present the discussion of perceptions parents, students and teachers have of barriers of parental involvement. The data sources related to this category had five primary subcategories (see Figure 3).

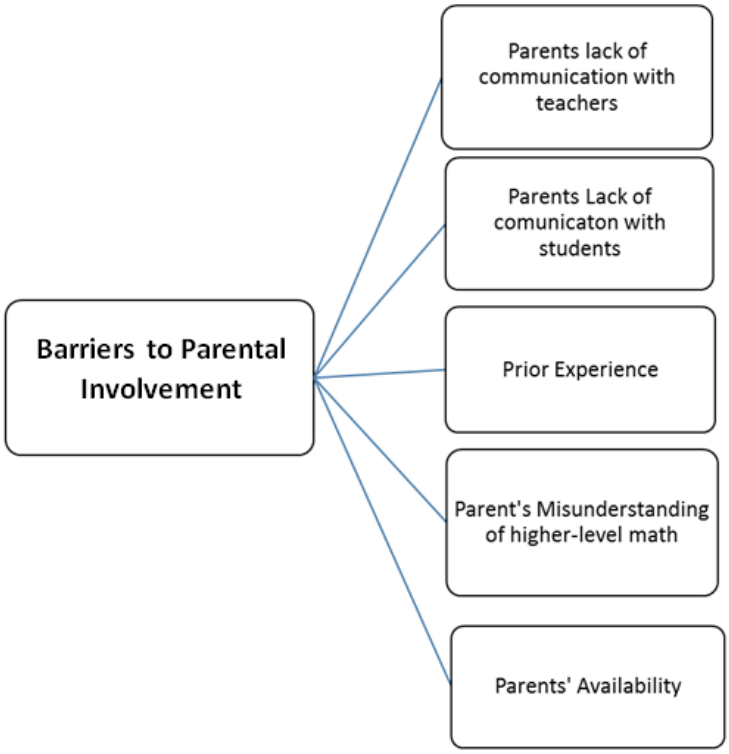

FIGURE 3: Barriers of parental involvement.

Discussion of Barrier One

Parents' Lack of Communication with Teachers

Parents' Perception of Lack of Communication with Teachers

Within the interviews, parents conveyed that the lack of communication with teachers was a major parental involvement barrier. Sixty-seven percent of parents who were interviewed expressed that their students' math teachers do not communicate with them about what is occurring in the classes. As a result, parents seem not as involved in their children's schooling, because there is no communication taking place between teachers and parents. As a result, parents began to question their contribution to their children's math education. Mrs. Scott spoke about being disappointed in the lack of communication between her and her child's math teacher. She stated,

> When my son moved from middle school into high school, what was the biggest shocker for me was there was no parent-teacher conferences in high school, unless you called them . . . If I don't call a parent-teacher's conference, just to get a footing for kind of what's going on in the classroom, I have no idea what my kid's doing in school.

This quote reiterates that when teachers do not communicate with parents on what is happening in the classroom, parents become frustrated. With some parents not having a thorough understanding of what to do, they begin to inquire for solutions. In Mrs. Scott's case, she attempted to search for options to help her son with his classes. Her reasoning to pursue guidance was to rectify the situation before it got too late. She did not want her son to repeat his math class. Mrs. Scott seemed to become frustrated when speaking about communication with her son's math teachers. She spoke about inexcusable late notification of her son's progress. She stated,

> If I've got to wait for a progress report, you know he's already been graded for four weeks. By the time the progress report gets to me, you're probably on your fifth, maybe sixth week, and you've only got a nine-week session. I'm like, 'Okay, why didn't I get an email prior to this, if my kid is not passing?' Because a lot of the teachers aren't going to keep the websites updated, you're not getting a progress report. If my son fails, he takes his piece of paper and hides it. If he fails on a test, I have no way of knowing that, if that teacher doesn't communicate with me.

As Mrs. Scott continued to speak about the lack of communication between herself and her son's teacher, she seemed to become more disturbed. During her interview, Mrs. Scott emphasized that when her child's teacher and she did not communicate productively, she became dismayed. She conveyed, "I was very discouraged." Parents expressed that they began to lose confidence in their children's teachers. Mrs. Avery stated,

> Communication barriers—once you wreck the communication—I don't even want to trust in the school, in the classroom, in anything, and then I'm going to have to go through somebody else, and it turns [into] somebody else [in] administration,

> whether it be [the County School Systems], the superintendent's office or your office, and you just go up like that. To me, that escalates into a huge problem.

In this quote, Mrs. Avery spoke about the detrimental results of limited communication between teachers and parents. A parent not having trust in his or her child's education can lead to an immense dilemma. In an interview, Mrs. Thomas spoke about how the lack of communication between parents and teachers affects parental involvement.

Mrs. Thomas explained,

> The barrier is that, as parents, we tend to just feel like, well, the teachers just need to handle it. As teachers, sometimes I feel like maybe they feel that way. They just need to handle it, and so therefore, they don't communicate it.

This statement reveals the effects of parents and teachers not communicating. Parents begin to think that teachers do not need their assistance at the high school level. The parents who once played a major role in the students' academics are now outsiders in the education realm. Mrs. Avery described how lack of communication caused her to feel somewhat alienated from her child's education. She stated, "It's almost like a foreign world, that we don't really know what's going on in the classroom." Even if there is limited communication between parents and teachers, parents state they are in dire need of some form of communication, whether it is good or bad.

Mr. Davis suggested that there needs to be some type of communication between the parents and teachers regardless of whether it is positive or negative. He stated,

> Even if I get a call about a bad thing, it's just that the teacher has reached out to me, letting me know that they've listened to what I've said to them. If my child is doing great, let me know. If my child is doing bad, let me know. Either way, I would rather communication be one of the greatest things that any teacher can give to me, for my child, good or bad.

At one point, parents began to get used to not hearing anything from teachers and settled for very little communication. Mr. Davis stated,

> As she gradually got into tenth and eleventh grade, [the] less interaction with teachers became. It [became] more or less, I guess, the technology stages–email, internet and things of that nature. There was rarely any phone calls, just technology, emails. There wasn't a lot of contact . . . I don't think [teachers] really did a great effort to reach out to us, other than when they needed to, as far as informing us. I didn't like that as a system.

One parent spoke about her experience with communication with her child's math teacher. Mrs. Avery stated, "For me, that's been very, very minimal this last semester." When asked if she was okay with that, her response was "Well, no, but people are people. I can't change anyone but myself. We just took it as, let's get you through this class, get out of this class, and move you into a different situation." This statement shows that at a certain point parents establish a certain viewpoint on how their children's math teachers communicate with them. Eventually, parents conform to the communication practices of the school system.

When teachers are not communicating with parents, they are unaware of what is expected from not only them but also from their teenagers. Mrs. Scott stated,

> Why wouldn't a teacher you know take that initiative? I mean, I get that you've got, say, a hundred kids or more a day, but how long does it really take to send out an email to the parent, to say, "Here's what we're studying for the week, you know what I'm saying? Because what they do is you get all my information at the beginning of the school year, with everybody's email, because you say, "If I need to email you," then why not take that same email, create a group, and then just send it out with a newsletter, on your own, versus waiting for someone to come in and do a study?

Parents became troubled, because they were unaware of what to do. They desired to know teachers' expectations for their children and for them. Parents' awareness of

these expectations allows them and their students to become more accountable in their schooling. Mrs. Thomas stated,

> I want to support their umm . . . whatever kind of discipline plan that there needs to be, as long as it is discussed or communicated with the parent. We have really tried, through our span, to uphold and agree and work as a team with the teachers to say, "Okay, this is what is expected." Maybe we didn't necessarily agree, but this is what is expected, but we also feel like that needs to be communicated with the parent and just not assumed that they're going to be right all the time."

Mrs. Thomas reiterated the need for teachers to communicate these expectations, because that will help them support their child. Parents clearly want to feel as if they have some input in their child's education. They understand that teachers provide students with school information. However, parents conveyed that teachers should keep them informed; since both parties want students to become successful.

If teachers do not communicate the expectations they have of parents and students, it becomes difficult for parents to know what teachers will expect from their children. Mrs. Avery spoke about her daughter's teacher communicating her class expectations. This form of communication became beneficial, because the student, parent and teacher were each held accountable in playing their roles. Mrs. Avery stated,

> The expectations were sent home; the syllabus was sent home; and if you know what somebody expects, then you can be held accountable. If she's sent none of that, if things were changing day-to-day, something which I have witnessed in a math class before, then we've got a problem.

The data shows the positive effects of communication and readdresses the outcome of lack of communication.

In addition to the lack of communication between parents and teachers being a barrier in parental involvement, parents also expressed that the lack of communication between students and parents is an obstacle.

Discussion of Barrier Two

Parents' Lack of Communication with Students

Parents' Perception of Lack of Communication with Students

In 78% of the parents' interview responses, parents spoke about how students do not communicate with them about their school. This lack of communication affected how they involved themselves in their children's math education. Parents conveyed that their teenagers did not want them involved in their education. Mrs. Avery blamed her lack of involvement on the fact that her kids were teenagers, which meant having an ambiguous relationship with them. At this point, Mrs. Avery concluded her son did not value her input on anything. Mrs. Avery stated,

> Well, they don't want me anymore. The kids didn't. They wanted to go off and do their own thing, and no longer wanted me around. It can be hard to be involved, but I think they need to know that we're here. Right now, my son is 17 and going through the typical 17 year old attitude that he knows everything, and I know nothing. He's givin' the attitude to me.

Another parent also said in her interview that at that age group, students do not want to be bothered. Mrs. Thomas stated,

> The kids don't want you involved. They do not want their parents seen at school. Yeah, I'm not kidding. 'Mom, really, don't come over there.' Now, if they're in sports, if we're in sports, you can absolutely come and cheer them on, but don't come through the day. I wanted to come and have lunch. No, 'Please, no, Mom.' I think it just changes the way they feel, like they'll be looked at, from their peers.

With the pressure of not embarrassing their children, parents tend to back off in becoming involved in their teen's math education. So instead of going to the school, they would attempt to ask their teenagers general questions about their day. However, parents reported this method to be even more difficult. One parent reported becoming frustrated in attempting to obtain some type of dialogue from her teenager. Mrs. Mack stated, "Kids

don't involve their parents. ‘How was your day?’ ‘Fine.’ ‘What did you do?’ ‘Nothing.’ I mean, that's about the two-worded sentence you can get.” The data shows that parents felt that if having small talk with their children was going to be difficult, speaking specifically about their schooling would be equally troublesome. Mrs. Mack also stated,

> My daughter doesn't want me at school at all, unless it's a major reason, because I'm just an embarrassment; I'm her mother. They just don't want you around. They don't want you talking to their teachers, unless it's necessary. I think a lot of it has to do with lack [of] communication from the kids. Kids don't want their parents involved.

The parents’ comments reveal that there is a communication barrier between parents and students. Students are not making an effort to notify parents of their academic progress. Students not wanting to communicate with parents affect their perception about parental involvement. If parents feel as if they are not welcome, or no one wants to communicate with them, they become hesitant in involving themselves. They then begin to question how they need to presume their role in their children’s math education. At one point they were hands on with their children’s education, but as soon as students enrolled in high school, parents recounted that their roles changed. This eventually leaves them in an isolated situation. Based on the interviews, a lack of communication between parent and student affects parental involvement in a negative way in secondary math education.

Students’ Perception of Lack of Communication with Parents

Parent and Student Relationship

Fifty-percent of students interviewed spoke about limiting their communication with their parents when it pertained to their schooling. When Hannah was asked on a scale from one to 10, with 10 being the highest, to rate her relationship with her parents,

she stated, “When it comes to education, it would probably be a six, probably.” When asked why, she stated,

> Because they ask me, ‘Oh, how was your day at school?’ But it's just changed. I think, because the classes get harder, and it's hard for them to understand what I'm learning. I ask them for help and they don't really know; so we just get mad at each other and stop doing it. I said a six probably just because we don't really talk about it a lot anymore, and we just leave it alone. ‘Oh, how was your day at school? Do you have any homework?’ ‘Yeah.’ ‘Okay, well, get it done before school tomorrow,’ and that's the end of our education conversation.

When asked what things could happen to improve the rating Hannah had with her parents, she said,

> Probably if I was more open, it'd probably be more often. I don't really like for them to pry and be like, ‘Okay, so what do you have for homework? Do you have English? Do you have Chemistry? Do you have AFM homework?’ ‘Yeah, I do.’ ‘Okay, did you get it done?’ ‘No, not yet. I'll do it later.’ I guess I'm just not really open to them about, yes, I have a test tomorrow and all that stuff. I think it's my fault that it's a six, but if I was more open, and we all sat down and talked about it and studied and stuff, I think it would become a 10.

When Hannah was asked if there were other barriers that would cause her parents to be less involved she stated,

> I don't think so. I think it's just really how either the child talks to the parent about it, or how the parent talks to the child about it. Sometimes kids want to be open with their parents about it, but they don't, because their parents don't want to talk to them about it. I feel like it's either the child or the parent that isn't as open about it.”

Clearly Hannah realizes she plays a significant part on how her parents are involved in her academia; yet, in the information she communicated, it seemed she only restricted her parents’ involvement. As Hannah reflected, she saw that not only did she play a part of the problem; but, she plays a big part in the solution. She understood that the communication barrier would eventually diminish if she would talk more to her parents about her academic progress.

Another student, Tiffany, expressed that she does not communicate with her parents, because she feels pressured.

> Interviewer: Okay. You said in, "I want my parents to be more involved in my education;" you said disagree. Why did you say disagree?"
>
> Tiffany: Because it's a lot of pressure, when they're more involved.
>
> Interviewer: Can you explain that?
>
> Tiffany: They're more involved, and they're constantly asking what assignments do you have, and is it done, or what kind of grades are you getting, and why is this grade like that, and it's just a lot of questions. All this stuff, since I'm a senior right now, I kind of don't need extra pressure. It would just be more stressful.

Tiffany's remarks show that she believes that the more information her parents know, the more stressed out they will make her. This causes her to not want her parents to be as involved in her education.

Travis provided a slightly different reasoning for not wanting to communicate as much with his parents about his schooling. He stated that his parents would not understand his schoolwork.

> Interviewer: Do you talk to your parents a lot about schoolwork, or school period?
>
> Travis: No.
>
> Interviewer: Why not?
> Travis: They won't really understand what goes on.

Students felt disconnected with their parents. As a result, students did not feel the need to communicate as much with their parents. This lack of communication with their parents affected parental involvement.

Teachers' Perception of Parents' Lack of Communication with Students

Mrs. Douglas and Mrs. Middleton also spoke about students not wanting to communicate with parents. Both teachers shared that their perspectives stemmed from their own personal experiences as well conversations they have had with their students. Mrs. Douglas stated, "I feel like sometimes a parent, especially at the high school level, their kids don't want them to get involved, and they're like, 'No, don't,' they don't want them to contact their teacher." Here Mrs. Douglas actually had a conversation with students, pleading for her not to inform parents of what is taking place in the classroom.

Mrs. Middleton spoke about her own experience of not wanting her parents involved. She identified with her teenage students not wanting to communicate much with their parents.

> Mrs. Middleton: I think my seniors, and I think also myself a senior, I didn't want my parents involved, and I was at a level of math that they couldn't help me anyway, but I really–at that point, and I was almost too [near] the far end of independence. I was way independent.
>
> Interviewer: You're looking at through how you went through it, too.
>
> Mrs. Middleton: I think I am, because that's the only lens I know. Now, I have one of my children—who is incredibly independent and does not want me involved at all—would really prefer that I not know who his teachers are. I mean really, at 12, he enjoys me going on field trips and that kind of thing. He doesn't really like it when I ask, 'Do you have homework?' And so then I have the other child, who does want me very involved. And so I'm happy to get more involved, because that's her preference, as opposed to mine. And so most of my seniors, my interpretation, my impression of them is they don't really. They're ready for independence. They are within a year of being out of the house.

From Mrs. Middleton's perspective, she believed that since many high school students would be leaving their house to go to college or the work force, they need to endure school matters by themselves. Since these students are entering adulthood, that means they have to accept more responsibility, starting with their schooling.

Unfortunately, this contributes to parents being out of the education circle which makes it difficult for parents to become involved in their teenager's education.

Prior experience was another barrier that affected parental involvement.

Discussion of Barrier Three

Prior Experience

Parents' Perception of Prior Experience

Effects of Imminent Parent-Teacher Relationship

Throughout the interviews, parents reflected on their prior experiences with their children's high school math teachers. These experiences seemed to affect their viewpoint on how to involve themselves in their children's math education. Parents expressed great enthusiasm when communicating the days in which they were extremely involved in their children's education. Some parents spoke about the times they would volunteer at their children's school to assist teachers. Nevertheless, parental involvement began to dwindle when students entered high school. Mrs. Everett spoke about her prior experience with her child's teacher that led her to feel unwanted in the classroom. Mrs. Everett stated,

> Communication, parent's parental involvement. This is her final semester before school's out, and I just haven't been involved with her teachers. I don't want to say time, because that's not really–access, perhaps–but with email, you really should have the access. That should be the access. That should be available there. I can speak to last semester, in Sarah's class, that the impression was that the desire was not to be involved.

Mrs. Everett's prior experiences with her teenager's teacher left a bad impression on her. Prior encounters became a contributing factor in how she approached relationships with present or future teachers.

Mr. Davis was another parent whose prior experiences made him wonder if the school wanted him involved. He states "[The School] made it easy for me not to, even

though I wanted to, because there wasn't a lot of follow [up] from them, to say, “Hey, this is going on.” He continued on to speak about his disappointment in his prior experience of the schools not persuading him to get involved. He stated,

> Even when she (his daughter) went to [The School], there has not been any. Which like I said, I would like to, but at [the high school], for some reason, that [connection] didn't happen. [In middle school], my son, I had that involvement, but not when I sent her to [high school], no.

Mr. Davis appears to want to involve himself more with his daughter’s school; however, he expressed that opportunity did not present itself. Another parent stated her experience of parental involvement decreased when her son entered high school. Mrs. Scott stated,

> It didn't drop at the home level, but in the school level, because what I thought was, when he entered the ninth grade, I had no idea that there were not parent-teacher conferences, you know? So I got a progress report, and I was like, ‘What in the world?’ Here's a progress report. Aren't we supposed to have parent-teacher conferences before progress reports come out?

Mrs. Scott conveyed that she was unaware that she was not going to have regular parent-teacher conferences. She based her relationship and involvement with her son’s present teachers on how her relationship and involvement was with her son’s past teachers. When she realized there was going to be change in how the high school communicated with her, she became baffled. She continued to express how her prior experience affected how she views her son’s high school teachers today.

> So I called and set up a parent-teacher's conference, not knowing that I had to do a parent-teacher's conference with all four teachers and a guidance counselor. If my concern is with my son in your class, I don't understand why I need to meet with the other four teachers . . . three teachers and a guidance counselor, because what's going on in your class may not be going on in another class, because it could be your methodology of teaching, which is why you're getting the reaction that you're getting from him, versus in another class.

Mrs. Scott remained frustrated as she spoke about meeting with her son’s teacher and guidance counselor to talk about her son’s academic progress. In the previous quote, Mrs.

Scott communicated that she did not care to meet with all of her son's teachers. She wanted to set a parent-teacher conference with a particular teacher. She later expressed her concerns of having all of her son's teachers at the conference meeting. Mrs. Scott stated,

> Once you're in there and that teacher expresses the nay or the yays, and the other teachers hear it, then they, to me, develop a perception of this kid, no matter what they have already had. Now, all they hear is, 'Oh, he's acting out in that class? I'm going to have to watch him little bit more.' Now, to me, he's set up as a target, and then when I even went to these, they were so rushed that it was just like, Why did I just drive 45 minutes in here for [a] 20-minute conference? Nothing got accomplished.

This experience Mrs. Scott is relaying leaves a negative viewpoint on teachers in the high school level. She became disheartened and disappointed not only with the teachers but with the school as a whole.

> I was very discouraged. Because . . . my son's guidance counselor doesn't know him from any of the other kids. The only thing that she sees about this kid is what's on that piece of paper, which is mostly what I saw when she came in. So the few conferences that I've called is grades that he had, and standardized test scores from the state, nothing else. So I was like, I'm not taking 45 minutes or two hours off of work to come in for a 20-minute conference, for you to tell me that I've only got 20 minutes, because I've got to go pick up my kid or I've got another function or another job that I've got to go to by 3:15. Really?

Mrs. Scott's prior experience of attending PTCs left her feeling unsatisfied. As a result, she expressed that she did not want to attend another unproductive conference, because it took away from her job. As the interview continued, she realized that her prior experience with her son's teachers affected her outlook on his present math teacher. She stated,

> I haven't called to ask her [the math teacher] for an after-school conference . . . because the prior experience has been I drive 45 minutes, I'm in for a 20 minute conference, and now my whole work day is shot, you know.

As Mrs. Scott continued with the interview, she realized her past experience prohibited her from moving forward with her son's present teachers. She stated,

> If I could change anything, maybe I should probably let go of the past experiences, and move forward, and let each new teacher that he encounters kind of, I guess, set the relationship up that he or she and I have, you know what I'm saying? During that school year, versus what happened [in] ninth and tenth grade. That would be . . . I would take the hit on that, you know what I'm saying? That was my hang-up, and I have probably let that affect the relationships that I probably should have built with his teachers.

Parents spoke about their prior experience and how it has affected their outlook on parental involvement. From the interviews, one's prior experiences sometimes interfere with future relationships. At one point, many of these parents were very much involved in their children's educations; however, research shows that as soon as their children got older and enrolled in high school, their perspective of parental involvement changed partly due to prior negative experiences with their children's teachers.

Discussion of Barrier Four

Parent's Misunderstanding of Higher-Level Math

Parents' Perception of Misunderstanding Higher-Level Math

Another barrier that parents spoke about was misunderstanding of higher-level math. Parents expressed that they were unfamiliar with the higher-level math, which made it difficult for them to help their children in their math work. Mrs. Thomas conveyed that her attempt to help her daughter with math became difficult during the early days of her schooling. She found it troublesome to not have the ability to help her daughter because of the way she learned math. Mrs. Thomas stated,

> I could not do it with her, because of the way they were teaching it, going from left to right, instead of right to left. It was just ridiculous, trying to change math curriculum, in my opinion, for basic math. And now we see her struggle with higher-level mathematics . . . And it was difficult for us, too, because in third

> grade, they were coming home with homework and different things, and they need assistance, but when the parents are unable to do a high-level division problem, because of [the way] they [were taught], It's just difficult.

Mrs. Thomas then realized that in order to help her daughter, she had to relearn math herself. She revealed, "We had to go back and learn third grade math, and we didn't do very well. We didn't. It was beyond our learning capabilities, let me just tell you." The data shows that these feelings often resulted in parents becoming uncertain in assisting children.

Mrs. Avery was another parent who expressed the difficulty of not helping her son, because she did not understand the math. She stated,

> I couldn't help much with homework, even though I love that subject, because it's taught a different way. They came to the answer in a different respect. I could say, 'Okay, I know the answer's three, but now you have to figure out how to get there.' It's taught in a different way, I think.

Mrs. Avery wanted to help her son with his math assignment but was unable to assist, because she was taught differently. Seventy-five percent of parents interviewed found that their knowledge of their children's math made it difficult for them to help. Mrs. Mack, another parent, talked about the difficulty of helping her child, because she did not remember how to do it. She stated,

> My children have both been in honors math, and sometimes the honors math is a little tough for us 40 year old something people to remember, and sometimes I would take these adult classes, just to refresh my memory on how do you do geometry, or I don't remember this step in algebra–whatever.

Mrs. Mack continues to address parents being uncomfortable when helping their children who are in these higher-level math courses. She wants her children to enroll in higher-level math courses, but she also realizes that she probably will not be able to help her children in these advanced math classes. Mrs. Mack stated,

> A lot of parents are just not comfortable with the curriculum or how it's taught or the work that's being done. There's a lot of people that can't do the math. They can't do calculus; they can't do statistics. Those were just not offered, when we were in school, back in the old days. I think that's another thing that they're not involved in, because the work is just above where we were.

Mrs. Mack spoke about the uncomfortable feeling of not conceptualizing the math that is taught in her child's math class. She expressed that higher-level math is beyond many parents capability.

Students' Perception of Parents' Misunderstanding of Higher-Level Math

Students also conveyed that when their parents did not understand their math class it caused them to become less involved in their math education. When asked why she would not want to ask her parents for help in her math class, Tiffany stated, "Because sometimes it can be frustrating; if they try to tell me one way, and I know it's supposed to be done another. It's just to save some time from arguing." Tiffany found it difficult to speak to her parents about her math homework, because they did not know the correct procedures to solve the problem. Since her parents did not know what to do, it led to an argument. Therefore, to avoid altercation, Tiffany chose not to involve her parents in her math education.

Students desired to receive help from their parents on their math work; however, since they often do not have the math background to help, they are unable to do so. Rachel expressed that one way to improve her parents' involvement in her math education is for them to know mathematics better. She stated ". . . if they knew math better, because they don't really know math; so even though they're involved, they can't really do anything about that. They don't do math." Hannah also expressed that she wanted her parents to support her by actually knowing the math material. She stated,

> Well, I guess sometimes I will ask them for help, and they don't exactly know what they're doing. It's just like they sit there, and they're just like, 'Well, I'll try and help you, but I have no idea if I can do this or not.'

Sixty-seven percent of the students interviewed became discouraged with reaching out to their parents, because they knew they could not help. As a result, they did not bother to ask for guidance. Darryl stated he would not want his mom to become more involved in his math work, because that is not her strong subject. He stated,

> Because with my math, like I said, I feel pretty comfortable with that, and to be completely honest, my mom is not a math person, and she never will be. I mean, I can ask her for help, and she'll look at it like it's Hebrew.

Darryl realized that he was okay with his mom not helping him with his math work. He adapted to finding assistance somewhere else.

The interviews revealed that students did indeed want to ask their parents for math assistance. However, since students knew that their parents did not understand the math material, they avoided getting their parents involved, especially if it led to conflict. Therefore parents' lack of knowledge in mathematics negatively affected parental involvement.

Discussion of Barrier Five

Parents' Availability

Parents' Perception of Parents' Availability

The next major theme that emerged regarding parental involvement barriers was parents' lack of availability. Some parents spoke about wanting to become more involved; however, they found it difficult to find the time to do so. For instance, when asked about parental involvement in high school, Mrs. Thomas stated,

> Well, honestly, I have not been as involved with the high school, and I would say that's probably both being requested by the teachers, and then my availability, as a

> parent. I always felt like, when they were younger, I really tried to be involved in their school. However, as they got older, I worked more and just not been available through the day.

Mrs. Mack also spoke about having a busy schedule which causes her to not participate as much as she would like to. Mrs. Mack stated,

> I guess change–I would love to have more time to volunteer at the school for different activities. I miss that, back in the day, where I had more time, where I could commit to come in and do volunteer stuff.

She then expressed the lack of availability, "Well, right now, my life's kind of hairy. I don't have time to think and brush my teeth and eat dinner. It's kind of crazy." Another mother also spoke about the dilemma of balancing her life out in order to become involved in her children's academics. Mrs. Akin stated, "Like I said, when you're juggling a whole household and work, you don't have as much time."

Parents' responses clarified that their lack of availability affected how they themselves become involved in their children's math education. On a positive note, parents still wanted to be involved in their children's math education, even in the secondary level.

Teachers' Perception of Parents' Availability

Both teachers perceived that parents lack of availability effect parental involvement. They both encountered difficulty in contacting parents in regards to their children's grades or behavior. Mrs. Middleton expressed that parents would convey to her that they did not have the time to help their children with their school work. She stated, "Well, I will say this, some parents are simply too busy, especially at the high school level." She continued, "I've had other situations like that, where I have gotten in touch with a parent and they say, "I do understand my child's failing. I simply don't have time,"

or “My child is 16, 17, and 18 years old. He will have to understand the consequences of his actions.” She is empathetic with the parent as evidenced in her feedback:

> That, to be honest, I can understand a little bit. An 18-year-old does need to understand the consequences of his actions, but in today's day and age, it is sometimes time on the parent's part. It's an effort. I mean, it's hard. It's hard, watching over them, making sure the homework is done. There's times that I want to. I mean, it's hard, and you hope, as they get older–mine are seventh grade and fifth grade. I'm still pretty involved.
>
> As they get older, I should be backing off, and I think some parents are very frustrated that they can't back off. Their kid, without their direct involvement, wouldn't do what they need to do, and as a parent, that's got to be really frustrating. I'm not there, but I can just imagine. I've tried to teach you all these things throughout the year, and here you are, 17 years old, and you still haven't gotten it, and you're supposed to go to college? I think that's really part of it.

Mrs. Douglas also expressed that she had difficulty contacting parents. There were times where she did not have parents’ contact information which becomes an obstacle. She stated,

> Some I don’t have an email address from the parent, and then the phone number I try to call, no one answers ever, or they don’t call back, and so there are sometimes–not necessarily in that class that you did the survey on–but I had a instance [in which] I could not get a hold of the parent at all . . . some of them don’t have an email address, but there’s a phone number I can call the parent at; so in that case I mostly do, but there are some cases that I may not.

In the previous quote, Mrs. Douglas disclosed the challenges of contacting parents. As she continues to discuss about her students’ parents, she expressed that parents usually do not have the time to help students. She states “at the high school level, especially with seniors, a lot of the parents don’t care to be involved. They are kind of at that point where you know they are working. They’re busy they’re doing their own thing.” Mrs. Douglas and Mrs. Middleton recognized that parents are very busy; and that business makes it harder for parents to get involved. Both teachers found that not being able to contact parents and parents’ lack of availability affected parental involvement.

Summary of Barriers of Parental Involvement

Parents believed that their lack of communication with their children's teachers seemed to affect parental involvement. The parents realized that since their children are in high school, teachers communicate with the students rather than with the parents. Parents understood that their children must learn responsibility, but keeping parents out of the picture does not help. Mr. Davis reiterated that it does not matter if it is good or bad communication, but there should be some type of dialogue taking place between parents and teachers. Parents conveyed that in high school they are not supposed to communicate as much with teachers. Eventually, parents begin to have a negative perspective about their children's teachers.

Parents, students and teachers also spoke on how the lack of communication between parents and students affected parental involvement. Many of the parents spoke about their teenager not wanting to talk to them. Even in cases where parents reported attempts to have a casual conversation, 50% of students interviewed often do not want to participate. Sixty-seven percent of students expressed that they do not want to have any dialogue, especially about school, because it sometimes leads to an argument. In order to avoid confrontation, students choose not to be bothered. One student spoke about the pressure she feels when talking to her parents about school. Whether it is preventing an argument or abstaining from stress, students choose not to speak to parents, and this affects parental involvement.

The data analysis revealed prior experience as being another barrier that affected parental involvement. Parents expressed that the conflict they had with their children's prior teachers affected their relationship with present teachers. At one point in the

interview, Mrs. Scott realized she had restricted herself from building a relationship with her son's present teachers because of past experiences.

Teachers also spoke about how their own prior experiences affected how they welcomed parents. Both teachers reflected on their high school days. They recognized that their parents were not as involved in their math education. As a result, that became their norm when it pertained to getting parents involved in their teenagers' math education. Teachers were not strongly motivated to gladly receive parents' contributions in education. Subsequently, the prior experiences of both parents and teachers affected their perception about parental involvement in secondary schooling.

Parent's misunderstanding of the higher-level math was also identified as another barrier. Both parents and students addressed parents' inabilities to help out with teenagers' math. Parents insisted that mathematics is taught differently today than it was when they were in school. In fact, some parents expressed their frustration in not understanding their children's math work. Since higher-level math classes are rather difficult to grasp, parents tend to not get involved. Students eventually sought help elsewhere when they realized their parents were unable to understand the math as it was currently taught in high school. As a result, students did not talk to their parents about their math classes. As students stopped communicating with parents, the parents in turn became unaware and uninvolved in their students' math education.

The last barrier identified was parents' lack of availability. Both parents and teachers spoke about parents not having much time to participate in their teenagers' schooling. Teachers also spoke about attempting to contact parents and not being able to

do so. Many parents recognized that their lack of availability hindered their involvement in their children's math education.

Shift of Parental Roles: Monitoring/Support System

When analyzing the data, discussion of shifting parental roles as students enter higher grades became a prominent theme within the parent and teacher interviews.

Discussion of the Shift of Parental Roles

Parents' Perception of Parental Role Shift

Another finding was that parents' roles shift in when it pertains to their high school students. Within the data, parents recognized that as their children become older, they have to discontinue hovering over their every move. Parents want to allow their teenagers to become more independent by holding them more accountable in their academics. Assigning students the responsibility to monitor their academic progress contributes to parents' role shift in their children's education. Mr. Davis spoke about his outlook on being more involved in his daughter's education. He stated,

> Yeah, we have in the past. I'm very involved with my daughter and my son. One, more less now my son, because, actually, my daughter—after the years—I've let her be more independent and handle a lot of her situation, just preparing her for life skills and to go to college; so I didn't really step in as much.

All of the parents who were interviewed expressed that they would become more involved if it is requested or necessary. One parent spoke about her experience in having to step in and help her daughter, because her daughter was being bullied. Mrs. Everett stated,

> We're kind of going through the whole issue right now, with this bullying thing. What do you call bullying? And, when are you going too far with the bullying thing? Again, for me, the better part of wisdom is to remove yourself from the situation, if you can, first, rather than to simply try and fight against it . . . and that's what we did in that instance.

Mrs. Everett believed that at that point in time, it was mandatory for her to step in and take action. She became her daughter's voice when she needed help. However, regardless of those circumstances, she still is less involved. She stated, "I've gotten less and less involved, and more involved in what's the next step. Where are they going to college?" All of the parents who were interviewed found it essential for students to be self-sufficient. Since the time for high school graduation is quickly approaching many of these teens' lives, parental involvement is now heavily focused on students' futures.

Regardless if high school is coming to an end, all of the parents interviewed stated that, if necessary, they would become vocal. They also expressed that their parental role in their students' academia was at times to monitor and support them. In her interview, Mrs. Mack said she wants teachers to assist her in monitoring her daughter academic progress. She stated,

> Let me know that something strange is going on; let me know she didn't do her homework or she bombed a test and that's normal for her. Let me know, because I'm very active in my child's school, and what goes on at my house, and I want to know, because I want to know what's going on that's happened. Was it lack of homework? Was it lack of not understanding the concept, and maybe we need to get some tutoring?

Mrs. Mack expressed that this type of monitoring would help her hold her daughter accountable of her schooling. Mrs. Avery conveyed that regardless of whether or not it is school-related, she wants to support her son. She stated,

> I try really hard to push them to do things, not just schoolwork, but to join organizations and do other things, even though they don't want me now. I still have to drive them places, because they don't have a license yet. Pushing them to be involved is hard on me sometimes, to be in so many different places, but that's okay. That's what I'm here for.

Mrs. Avery said she realizes her parental role as a supporter is crucial for the success of her children's education and their lives. Therefore, parents conveyed that

monitoring was the primary role for their high school students. Considering that this is their primary role, this affected how they involved themselves in their teenagers' education.

Teachers' Perception of Parental Role Shift

Mrs. Douglas and Mrs. Middleton suggested that parents should become involved in their teenagers' education by monitoring their academic progress. Mrs. Middleton stated "I believe that parental involvement is more of a (pause) at this stage a monitoring. It's not as involved as it was in the elementary and middle school years." Mrs. Middleton envisions monitoring being the main form of parental involvement. However, she considers as students are entering high school, the students, as well as parents are experiencing a new life transition.

Under those circumstances, she advises lessening monitoring in a gradual manner. She stated,

> I think that it is more hands-on for freshmen, and as the student progresses, the parents need to be stepping back and be monitoring, and maybe not as directly involved as they use to be and also talking to the student and encouraging them.

Mrs. Middleton continues to express that if she needs parents to become more hands-on, she will reach out to them. However, she will only ask if it is necessary. She reaffirmed her wanting their support by stating, "I want the parents involved if necessary . . . I've given out my cell phone number to some parents, who their kid was in danger of not graduating because of my class."

Mrs. Middleton continued to reflect on her own experience of urging a parent to monitor her son more than usual in order for him to graduate. She stated,

> I've given out my personal cell phone number and said, 'Call me at any time, and we will discuss.' I had one parent who took me up on that offer, because she

> didn't have email. She also worked two jobs, and so when she was able to discuss her son's progress, it was about 8:30, 9:00 at night. She called me, and she did, and he graduated, and this was a single mom, her only son. We got him out. She had to be very involved, and that's what it took. That, I don't mind at all.

In this scenario, Mrs. Middleton realized that the mother played an intricate role in encouraging her son to complete his math work. Recognizing the influence this mother had over her son allowed her to become more accessible to the mother. As a result, the son graduated because of the teamwork of the parent and student.

Mrs. Douglas also acknowledged parental involvement to be heavily based on monitoring students' progress. During the interview, she provided her definition of parental involvement. She stated,

> I mean parental involvement, in general, [it] is just parents being involved in their students' education and making sure that they understand what's going on in the class and making sure that their son or daughter is on top of her school work.

Mrs. Douglas continued to express that parental involvement is seldom seen in high school. She stated, "As for high school, I don't think that parental involvement is as important as in the earlier age groups."

Even though Mrs. Douglas perceived that there is a limited amount of parental involvement in high school, she still acknowledged it is important for parents to monitor students. She stated,

> I think it's really important for parents to make sure their son or daughter are on top of their school work and making sure that they're being involved and making sure they are doing what they are supposed to be doing or contacting the teacher or the teacher contacting them if there is a problem that arises.

Similar to Mrs. Middleton, Mrs. Douglas suggests that reaching out to parents is vital if students are having problems. She stated,

> Well, when I individually contact parents, it's because they're not doing well in my class; so it seems like, when I do contact the parent and say, "Hey, so and so isn't doing their homework; they aren't studying for their test," then it seems like their grade starts to go up, because then their parents are at their back, saying, "Go do your work, go study," you know what I mean? Their parents know that they need to give them a little push and motivation, and so it seems like at that point, then they start trying to turn it around, but then sometimes it's almost too late, you know?

Both teachers indicated monitoring is one of the best forms of active parental involvement for high school students.

Summary of the Shift of Parental Roles

Teachers and parents acknowledge that there is a transition in the way parents involve themselves in their teenager's education. Parents expressed that their teenagers did not need them to hover over their lives as much. Instead of always volunteering and assisting teachers, parents expressed that monitoring students' progress is more appropriate at this level. Some parents spoke about their students' future being their primary focuses rather than what is occurring in the classroom.

Teachers perceived that monitoring was a type of active parental involvement in secondary schooling. Both teachers believe that the students' ages play a major part in determining parents' roles. Despite a student's age being a determining factor in how much parents are involved, teachers still felt the need to welcome parents to support their children more if needed. Both teachers did not completely waive other parental roles in secondary education; however, they felt monitoring or being a part of the students' support system was the more suitable role.

Student Independence

Discussion of Student Independence

Parents' Perception of Student Independence

Expecting independency from their high school children was a finding that affected parents' participation in their teenagers' math education. Many parents held students accountable for their academics. Parents expected their teenager to take more initiative in their education. If students had an issue with their teacher, parents expected their teenager to first resolve it themselves, and then, if necessary, they would be there to help out. Mrs. Akin spoke about offering Rachel more independence between ninth and tenth grade. She stated,

> Because you want to micromanage somewhat, while they're still at home, but you want to give them a little bit of independence. I started that about the ninth grade, between ninth and tenth. In the eleventh grade, I didn't do much micromanaging at all." In an earlier interview, she expressed '. . . honestly [I]think that Rachel will do the work, because she's already been taught, and she already has a focus for what she wants. It's not my life. I'm not able to do hers. She wants to go college, you know what it takes to get into college; you know what scores you need in college; then do it. I've been in the 11th grade.' Mrs. Akin expects her daughter to be more responsible for her own future.

Mrs. Hanson expected more from her son at the beginning of high school. When asked when it was, she realized she had to start allowing Peyton to be more independent in his schoolwork, she stated, "Basically his freshman year." When asked why, she expressed "Because that's where they start taking more responsibility; they start changing classes at that point, and he needed to learn his study habits." In an earlier interview, she spoke about her son's responsibility,

> He has always been very independent when it comes to schoolwork, because he played sports, and he knew he had to manage his time and get his work done, in order to play sports, and he had to keep his grades up. That was his motivation, and he's always been very good at time management.

She continued later on to say, “Well, you know, at this age, I feel like if they're going to go off to school, they have to be able to manage their time and their homework, and—only if they're having some type of issue—get me involved.”

Some of the parents stated they wanted to prepare their children to be more independent with their school work while in middle school. Mr. Davis expressed that he began expecting his daughter to be more independent with her school work between fifth and sixth grade. He said his reasoning was, “Somewhat partly due to my hours. Others [were] just for her to be a little more–just giving her independence, and just more or less trying to get her to manage her time better.” Parents’ expectations of their children to become more independent affected parental involvement, because they become less involved in their children education. Students also conveyed that their independence plays a role in how much parents are involved in their education.

Students’ Perception of Student Independence

Students’ interviews revealed that they desired to have more independence which in turn affected parental involvement. Travis expressed that he started to become more independent of his school work at the beginning of high school. His reasoning was “It was becoming my life, and I thought I could do whatever I want with it, in school and everything else.” Tiffany wanted more independence, because she saw attending college was in her future. She said, “I knew that college was coming up soon; so I had to get used to being more involved and independent and get more serious about my schoolwork.” Students knew that they had to be held more accountable in their schooling. They believed that in high school things would be different. Rachel stated,

> When I entered high school, because in middle school and elementary school, the teachers usually send out little reports and stuff, and tell your parents what you

> have to do. In high school, it's all up to you, your parents don't really know much about what's due and what's not.
>
> Interviewer: Okay. Now, I know that you were in the band – what were you, the flag?
>
> Rachel: Yes, I was in color guard.
>
> Interviewer: Do you think that's helped out a lot with your being more independent and more responsible?
>
> Rachel: Yes, it did, because you have to have extreme time management to be in band, because we spend all week in the band room, and then we spend all Saturdays at competitions and stuff, so you have to fit in your work.

Rachel and the other students realized that their independence affected how much their parents were involved in their education and life. Students also understood that teachers communicate about their academic progress with them more than with their parents. This contributes to parents becoming less aware of what is occurring in their academics. Students' independence frequently resulted in less communication with parents. Subsequently, this effected parental involvement.

Teachers' Perception of Student Independence

Responsibility

Both teachers expressed that students' independence affected parental involvement. They expressed that at that age students need to be more responsible. They should not rely on their parents as much. Mrs. Douglas stated,

> Again, I think it's because the students are so old now, that the parents think, 'Okay, they're at the age where they should be independent, and they should be doing this whole education thing themselves.' I think the parents put up a barrier, because they don't want to get involved, because they think it should be their son or daughter's responsibility. Especially as a junior or senior, they're about to go either to college or wherever they go, and this is their practice, to be that independent and make sure that they can handle their classes and teachers on their own. I think that that really puts up a barrier for high school teachers, for

communication.

Here Mrs. Douglas spoke about how the lack of involvement is partly due to parents having the mindset of their teenagers becoming more responsible. At one point Mrs. Douglas reflected on her upbringing. She stated,

> Yes, and I know that when I was in school, growing up, if I went home and I said, 'My teacher did this and this,' my parents would be like, 'Well, go talk to them, then.' My parents never talked to my teachers, because they wanted me to be able to do it on my own. I feel like a lot of parents with high school students are like that.

Mrs. Douglas' personal experiences have impacted her perspective on how much parents should be involved in their teenagers' education.

Mrs. Middleton also acknowledges parents want their students to become more independent in their schooling. She addressed two seniors who were on the verge of failing her class. One of two seniors actually passed her class; however, the other did not pass. The failing student's parents respected Mrs. Middleton decision about her daughter's final grade. The parent believed that her daughter had to start taking more responsibility for her actions. Mrs. Middleton stated,

> I would say that it was probably last year that I had two students – actually, more than two–but I had two in particular that didn't pass my class. They were both seniors, graduating. One of them had what was called a back-up plan, which meant that he didn't really need to pass my class. He could go to a two-year college—he'd taken a lot of band or something like that—and so he was fine to graduate. I think he got a 67, at the end of all things.
>
> Then there was another girl that was misplaced in my class, and the boy was, too. He was misplaced, but both of them were misplaced in the class, but it is what it is. There they are, but the girl did not have a backup plan; so if I failed her, she literally wouldn't walk. She wouldn't graduate. She ended up with a 66, one point below the void. Well, she had not done all that she needed to do. I had done extra help for her; we had a parent conference. The parent was very supportive of her and of me, a very good parent. The parent did say, 'You're old enough that you've got to do this. I can't be following after you. You're going to have to decide

> whether or not you want to graduate. I will back the teacher in whatever she decides.' At the end of all things, I had said no, I am done.

Students' independence affected the amount of support that they received from their parents. Both teachers' perceived that parents want students to accept the consequences for their actions whether it is good or bad. The decision parents make to allow their adolescents to become independent limits the degree of parental involvement. Despite the decline of parental involvement as students get older, both teachers consider it to be beneficial for the students.

Summary of Student Independence

The last finding for the first research question was how parents, students and teachers perceived students' independence affected parental involvement. Parents understood that their children had to start being held more accountable with their schooling. As a result, parents tend to be less involved than usual.

Students spoke about wanting more independence; since they were close to graduating school and thinking about college. They realized that they had to become responsible. Students learning to become more independent caused them to not communicate much with their parents. Students believed that if they have a problem with one of their teachers, it was their obligation to settle the matter as young adults.

Teachers also believed that students' independence is vital for them to become productive citizens in this society. They desired students to take control over their lives, particularly education. This sets the foundation for them to become responsible individuals. As a result, students' independence affects parental involvement in secondary education.

Discussion of Question Two

Research question 2: Does parental involvement in MINDSET influence mathematics performance for students?

For the second research question, analysis revealed that the different interventions of parental involvement did not influence students' mathematics performance. Students' math performance was based on a MINDSET pre-and post-assessment and students' weekly-grade reports. Analysis involved determining whether student achievement, gender, ethnicity, mother's education, mother's work between parent expectation, correlated. Also, student perspectives about parental involvement were measured in the pre-survey and post-survey, as well as by student mean grade across the seven weeks.

Pre- and Post-Assessment

A two-way ANOVA revealed there is a statistically significant difference between the treatment and control groups. The means and standard deviations for the pre- and post- assessment scores are reported in Table 4.2. The gender effect, regarding the pre- and post- assessment, is $F(1, 20) = 6.05$, $p = .02$, partial $\eta^2 = .23$. The control group had a lower mean (M = 16.75, *SD* =4.33) than those from the treatment group (M = 23.19, *SD* = 5.72). Results also suggested that the time between administering the pre- and post-assessment did not have any impact on students' scores, $F(1, 20) = .07$, $p = .79$, partial $\eta^2 = .004$.

TABLE 4.2: Pre- and post-assessment data

	Groups	Gender	*Mean*	*SD*	*N*
Sumpre	Control	Male	17.6667	3.78594	3
		Female	16.2000	4.96991	5
		Total	16.7500	4.33425	8
	Experimental	Male	24.1667	7.08284	6

		Female	22.6000	5.05964	10
		Total	23.1875	5.71803	16
	Total	Male	22.0000	6.74537	9
		Female	20.4667	5.76773	15
		Total	21.0417	6.05395	24
	Control	Male	19.0000	8.54400	3
		Female	17.2000	1.78885	5
Sumpost		Total	17.8750	4.85320	8
	Experimental	Male	24.0000	5.72713	6
		Female	21.6000	6.04060	10
		Total	22.5000	5.85377	16

Weekly Grade Reports

A one-way within repeated measures ANOVA was conducted to analyze students' achievement was based on weekly-grade reports. The means and standard deviations for the scores across all eight weeks are reported in Table 4.3. The results suggested that there was no statistically significant difference across the seven weeks, $F(6, 288) = 1.11$, $p = .36$, partial $\eta^2 = .02$, which is small effect size (Cohen, 1988). Week-three data were removed due to missing data from 27 out of 49 participants. As a result, the mean score of all seven weeks was used for further analyses. Descriptive statistics for the mean grade of weekly assessments in mathematics were reported in Table 4.3.

TABLE 4.3: Weekly grade reports

	Mean	*SD*	*N*
Week1	83.93	20.180	49
Week2	81.80	13.933	49
Week4	82.22	10.156	49
Week5	82.33	9.780	49
Week6	83.31	10.040	49
Week7	82.53	10.374	49
Week8	84.67	8.649	49

Gender, Ethnicity, and Weekly Grades

The distribution of student ethnicity is not statistically significantly different between the experimental and control groups, χ^2 (3) = 1.37, p = .71. Similar results were found for the distribution of gender between these two groups, χ^2 (2) = 0.54, p = .76 (see Table 4.4).

TABLE 4.4: Comparisons of gender, ethnicity, and weekly mean grades

Gender	Groups	Ethnicity	*Mean*	*SD*	*N*
Male	Control	AA	57.8750	.	1
		White	84.5313	11.80985	4
		Unknown	71.3750	.	1
		Total	77.8958	14.40755	6
	Experimental	AA	72.0000	.	1
		White	88.8810	3.25441	6
		Unknown	77.3333	13.91837	3
		Total	83.7286	9.77489	10
	Total	AA	64.9375	9.98788	2
		White	87.1411	7.57761	10
		Unknown	75.8438	11.74831	4
		Total	81.5413	11.62011	16
Female	Control	AA	83.6667	5.50899	3
		White	86.5417	11.67173	6
		Unknown	88.8125	13.34664	2
		Total	86.1705	9.76510	11
	Experimental	AA	80.7857	2.32335	2
		White	87.6429	7.63413	8
		Unknown	90.5714	8.68731	2
		Total	86.9881	7.35388	12
	Total	AA	82.5143	4.36050	5
		White	87.1709	9.17045	14
		Unknown	89.6920	9.25015	4
		Total	86.5970	8.39990	23
Total	Control	AA	77.2188	13.65779	4
		White	85.7375	11.10187	10
		Unknown	83.0000	13.79934	3
		Total	83.2500	11.87771	17
	Experimental	AA	77.8571	5.33185	3
		White	88.1735	5.98826	14
		Unknown	82.6286	12.97313	5
		Total	85.5065	8.48743	22
		AA	77.4923	10.14200	7
		White	87.1585	8.36673	24
		Unknown	82.7679	12.27256	8
		Total	84.5229	10.02480	39

Three-way ANOVA revealed no statistically significant differences between the treatment and control groups, $F(1, 27) = 1.21$, $p = .28$, partial $\eta^2 = .04$. However, there is a statistically significant gender effect, $F(1, 27) = 8.84$, $p = .01$, partial $\eta^2 = .25$. Statistically significant differences were also observed among ethnicity groups, $F(2, 27) = 4.93$, $p = .02$, partial $\eta^2 = .27$. However, post-hoc multiple comparisons failed to identify which group was statistically significantly different from other groups ($p > .05$).

All two-way and three-way interaction effects turned out to be statistically insignificant ($p > .05$). The homogeneity of variance assumption for the error variance of the dependent variable across groups was found to be met, $F(11, 27) = 1.68$, $p = .13$.

Mother's Education Background and Work Status and Grades

Two-way ANOVA suggested that mother's educational background and work status did not have any impact on student mean grade across the seven weeks, $F(5, 37) = .41$, $p = .84$, partial $\eta^2 = .05$. There was also no statistically significant mother work effect, $F(3, 37) = .27$, $p = .85$, partial $\eta^2 = .02$. Post-hoc multiple comparisons failed to identify which group was statistically significantly different from other groups ($p > .05$).

All two-way interaction effects turned out to be statistically insignificant ($p > .05$). The homogeneity of variance assumption for the error variance of the dependent variable across groups was found to be met, $F(11, 37) = .81$, $p = .63$ (see Table 4.5).

TABLE 4.5: Comparisons of mother's education, work, and weekly mean grades

Education	Mother Work	*Mean*	*SD*	*N*
HS	No Work	89.5000	.	1
	Full-time	94.0179	6.69226	2
	Total	92.5119	5.40341	3
Trade/Vocational	No Work	84.1250	.	1
	Full-time	78.1250	1.06066	2
	Total	80.1250	3.54436	3
Some College	No Work	93.1429	.	1
	Part-time	91.6012	7.31403	3
	Full-time	80.0298	9.68088	3
	Unknown	86.0000	.	1
	Total	86.7545	8.79892	8
College	Part-time	85.4286	16.16244	2
	Full-time	83.9245	11.88083	13
	Total	84.1250	11.82913	15
Advanced Degree	Full-time	85.7143	2.01525	3
	Total	85.7143	2.01525	3
Unknown	Unknown	78.4398	11.79633	17
	Total	78.4398	11.79633	17
Total	No Work	88.9226	4.53657	3
	Part-time	89.1321	10.17271	5
	Full-time	84.0233	10.13821	23
	Unknown	78.8598	11.58203	18
	Total	82.9478	10.82292	49

Parents' Expectation Pre-and Post-Survey and Weekly Grade Reports

The relationships between parent expectation, student perspectives about parental involvement measured in the pre-survey and post-survey, and student mean grade across the seven weeks were reported in Table 4.6.

TABLE 4.6: Comparison of weekly mean grades, parents' expectations, and survey

		Meangrade	Pretotal	Posttotal	Expectation
Meangrade	Pearson Correlation	1	.257	.209	-.147
	Sig. (2-tailed)		.155	.287	.424
	N		32	28	32
Pretotal	Pearson Correlation		1	.859**	-.359
	Sig. (2-tailed)			.000	.078
	N			24	25
Posttotal	Pearson Correlation			1	-.277
	Sig. (2-tailed)				.201
	N				23
Expectation	Pearson Correlation				1
	Sig. (2-tailed)				
	N				32

Note. **. Correlation is significant at the 0.01 level (2-tailed).

A statistically significant relationship was noticed between student responses in the pre- and post- surveys, $r = .86$, $p < .001$, which indicates consistency of responses from pre-survey and post-survey, but all other bi-variate relationships were not statistically significant ($p > .05$).

Parents' Perception of the Interventions and Students' Math Progress

Qualitative data revealed that parents perceived they have an influence on their students' math achievement when they are involved. Eighty percent of parents who were in the experimental group shared, during the post-interviews, that the weekly progress reports and newsletters were beneficial when it pertained to students' academics. Mrs. Avery expressed that the interventions weekly progress reports and newsletters, helped her monitor her teenager's progress. She conveyed that she appreciated knowing about

his class, and she stated "I did remind him, 'hey, you worked on this, or I enjoyed that, how are you doing with it?' Another parent perceived the newsletters and progress reports to be helpful with her child's math performance, because she was able to help if needed. From the survey responses, she wrote, "Yes, we discuss her progress and where she needs help . . . My child feels more comfortable talking to the teacher about the assignments . . . [and] it shows her [the student] the benefits of doing the work and sharing learning strategies." Parents expressed that if they were notified about students' work, it was easier for them to monitor their progress. Parents conveyed that if they are aware of their children performing poorly in their math class, they would be able help them find ways to improve.

Students' Perception of the Interventions and Students' Math Progress

Students' acknowledged that interventions were helpful in their academic progress. One student stated, "It has helped me work harder and understand what I need to do to improve." With many of the students, the progress reports were the most helpful strategy, because it helped them become accountable in maintaining their grades. One young lady stated, "It helped me to be sure all my work was turned in." Another student expressed that not only were the progress reports helpful, but the newsletters were also helpful. One student expressed that the interventions were beneficial, because "I am actually trying now [more] than I did before the newsletter and weekly progress reports." Students believe that parental involvement interventions, primarily the progress reports, positively affected their academic progress.

Teachers' Perception of the Interventions and Students' Math Progress

Mrs. Middleton, the teacher who was part of the experimental group, did not believe that parental involvement interventions impacted students' academic progress. One reason was because of the length of the study. She stated, "I see no real impact to my students' achievement; especially considering the time it would take me to implement this program myself." She also conveyed that student's final grades were heavily curved based on the final exam students had to take. She stated,

> Well, what they did was they curved it so much, and each county decided its own curve, but for AFM and actually all of Cabarrus county math the tests were curved so much that of my 26 test takers 24 of them got a 'A,' and I'm a fabulous teacher, but I'm not that good.

She continued to say,

> Out of 26 that took the test, 24 of my students got a 93 or above. Curved score. But when I say curve score, what that means–a 93 there were 34 possible total points on the MSL, that is I think 7 free response points, and then that would be 27–I would think–multiple choice questions. If you got 11 points in any way shape or form, 11 out of 34 curved score was a 93.

Mrs. Middleton found it difficult to see growth in the academics of her students, because their final grades had to be heavily curved according to the district.

Summary of Question Two

The finding for research question two was that according to Analysis of Variance (ANOVA), the parental involvement interventions implemented in this study did not influence students' academic achievement. However, qualitative analysis revealed that parents and students perceived the weekly progress reports and newsletters affected the academic progress of students. Parents stated that being notified about what was taking place in class helped them monitor their students' academic progress. Students also perceived that progress reports were very valuable. The progress reports notified students

of their classroom status and helped them maintain or improve on their level of performance.

Discussion of Question Three

Research question 3: Do the weekly newsletters and progress reports used in the MINDSET class influence the perception students, teachers and parents have about parental involvement?

For the third research question, a one-way ANOVA analysis revealed that the different interventions of parental involvement did not influence the perceptions parents, students and teachers had regarding parental involvement. Student, teacher' and parent perceptions about parental involvement were based on the pre- and post- survey. The means, standard deviations and p-values of the survey scores for the control and experimental group are reported in Table 4.7.

TABLE 4.7: Survey results

		Pre-survey		Post-survey		
	N	*M*	*SD*	*M*	*SD*	*P*
Student	28	2.98	0.31	3.00	0.46	.74
Teacher	2	2.78	0.16	2.58	0.12	.09
Parent	25	2.80	0.28	2.80	0.34	.91

Note. SD = Standard Deviation, N = number of participants

Increase in Communication Between Parents and Students

Qualitative data revealed that the parental involvement strategies did have a positive effect on parents' perceptions about parental involvement.

Parents' Perspective of Parent-Student Math Education Dialogue

Parents conveyed that receiving weekly newsletters and progress reports helped with the way they communicated with their teenage children. Parents stated there was an increase of communication between parents and students after the parental involvement interventions were implemented. Eighty-three percent of parents in the experimental group expressed that interventions encouraged them to ask their children about their math classes. When asked if the newsletters and progress reports were helpful, Mrs. Mack stated,

> Yes, because it gave me something to talk and have a conversation with her about. I felt like I knew more about what was going on . . . It's a way to open up the conversation, 'Hey, I hear you're doing this, or how did that go for you today,' or whatever. I felt like I knew what was going on from her saying, 'Oh, we did this in math today.' At least I could [converse] a little bit more about it. It opened up the communication . . . Sometimes, the kids are real short about it; sometimes they're not. I mean, this allowed me to actually strike up the conversation first and let them know that, you know what? I care what's going on in school, and tell me a little bit more about it, because I'm aware of it. I enjoy that.

Mrs. Mack, as well as other parents, believed that the exposure of what was going on in their teenagers' math classes gave them access to hold a modest conversation with their children. Mrs. Stevenson expressed the benefits newsletters and progress reports had on her relationship with her child. She stated,

> Oh yes, absolutely. It helped everyone be on the same page to know that things are going well. I didn't have to not actually nag Darryl like before . . . 'Are you doing your work? How's your grades? Blah, blah, blah . . . ' It was all right there.

Mrs. Stevenson relayed that parental involvement helped her not to bother her son, because she was provided information from the teacher. She stated, "So I didn't have to go to him and get the 'I don't knows' or 'I think I'm doing alright.' I knew factual information. So it was great."

Parents agreed the communication between the parents and teachers allowed them to monitor and communicate with their children better.

Summary of Question Three

The finding for research question three was that according to the results of one-way ANOVA analysis, the parental involvement interventions implemented in this study did not influence the perceptions held by students, parents and teachers regarding parental involvement. However, according to qualitative data, parents had a positive outlook on parental involvement when interventions were implemented. Parents expressed that the interventions helped them communicate with their children.

Both teachers believed that interventions did not influence the way they perceived parental involvement. In fact, one teacher felt employing the parental involvement interventions was more time consuming. Within the interviews and survey responses, students' perceptions about parental involvement did not change. There were a couple of students who found that the interventions helped with the way they communicated with their parents. Overall, according to quantitative data, the interventions did not have an influence on the perceptions students, parents and teachers have of parental involvement.

Summary

In conclusion, this chapter provided a description of each theme and an overview of the collected qualitative and quantitative data.

For question one, four categories were revealed. These categories are: strategies for parental involvement; barriers of parental involvement; parents' and students' transitional roles; and students' independence. Within each category, findings were provided that highlighted the perspectives held by parents, students and teachers. The

findings of strategies for parental involvement included technology and parent-teacher conferences. Parents, students and teachers perceived technology, such as emails and the Parent Assistant Module (PAM), as being a prominent strategy that teachers used to encourage parental involvement in secondary education. Among these two strategies, each group expressed that emails were the most common parental involvement strategy used. When it pertained to the technological resources, parents expressed that emails, websites and the school districts management system (PAM) were vital when it pertained to keeping them involved in their teenagers' education. Parents also reported that parent-teacher conferences were a beneficial parental involvement strategy in secondary education. However, parents expressed that parent-teacher conferences were not needed as much at the high school level than as they were needed in the lower grade levels.

The findings regarding barriers of parental involvement are: parents' lack of communication with teachers and students; students' lack of communication with parents; prior experience; parents' misunderstanding of higher-level math; and parents' availability. These findings played a significant role in the lack of parental involvement in secondary math education and were parental involvement barriers. In barriers one and two, parents conveyed that when students entered into high school, communication lessened between parents and teachers, as well as between parents and students. Since there was a decrease in communication between parents and teachers, as well as parents and students, the amount of parental involvement was affected. In barrier three, both parents and teachers spoke about how their prior experiences with parental involvement in the secondary education level had affected the way parents were involved in their teenagers' education. The prior experiences of parents and teachers became a

contributing factor in the way parents and teachers framed their relationships. In barrier four, parents and students expressed that parents were unfamiliar with the higher-level math, which made it difficult for them to help their children in their math assignments. In the last barrier, parents and teachers perceived that parents' lack of availability affected parental involvement. Parents' lack of availability made it hard for them to help their students if needed, and it also made it difficult for teachers to contact them.

The findings for Question One also revealed that the transitional roles of parents and students affected parental involvement. Teachers and parents acknowledged there is a transition in the way parents involve themselves in their teenager's education. Parents and teachers expressed that monitoring students' progress was the more appropriate role for parents in the secondary education level. The last finding was regarding how students' independence affected parental involvement. Parents, students and teachers conveyed that students need to become more responsible. Therefore, parents retreated to allow their students to become more independent.

The finding for research Question Two was that according to the Analysis of Variance (ANOVA), the parental involvement interventions implemented in this study did not improve students' academic achievement. However, qualitative analysis revealed that parents and students perceived parental involvement interventions as though they helped improved students' grades because of accountability. Since parents had a continuous update of their children's progress, they were able to monitor their children in their class. Teachers, however, perceived the weekly progress reports and newsletters did not influence students' math achievement.

The finding for research Question Three was that, according to ANOVA results, the parental involvement interventions implemented in this study did not influence the perceptions students, parents and teachers had of parental involvement. However, according to qualitative data, parents perceived to have a positive outlook in involving themselves with their teenagers' math education once the interventions were implemented. The newsletters gave parents more confidence in discussing math with their teenagers. As a result, students expected their parents to inquire about their math class, which improved the way parents and students communicated with one another.

The next chapter provides a discussion of the findings. Chapter 5 also includes implications for actions and recommendations for further research.

CHAPTER 5: CONCLUSIONS AND IMPLICATIONS

In this study, I sought to examine the effects and perceptions of parental involvement on the mathematical achievement of students in a high school STEM course. I also wanted to analyze students' academic performance, as well as the perceptions held by parents, teachers and students perceptions regarding parental involvement after several specific parental involvement interventions were implemented–namely weekly newsletters and progress reports. These interventions were utilized to help build communication between parents, students and teachers, in regard to children's math education.

In an attempt to provide insight on strategies that will help schools promote parental engagement in their high school children's mathematics education, my case study examined the following questions:

1. What are the perceptions of students, teachers and parents regarding parental involvement in secondary math education?
2. Does parental involvement in MINDSET influence mathematics performance for students?
3. Do the weekly newsletters and progress reports used in the MINDSET class influence the perception students, teachers and parents have about parental involvement?

Data was collected over a period of 12 weeks in a fourth-year math course that consisted of 11th and 12th graders. Data included students' weekly grades, the MINDSET pre-and post-assessments to analyze students' academic achievement, pre- and post-surveys to evaluate participants' background (i.e. gender, ethnicity, students' mother's education, parents' educational expectations of student, and mother's employment status), and the perceptions of students, teachers, and parents about parental involvement. Several categories were created based on the findings from the data: (a) strategies for parental involvement; (b) barriers of parental involvement; (c) parents and students' transitional roles; and (d) students' independence (see Figure 4).

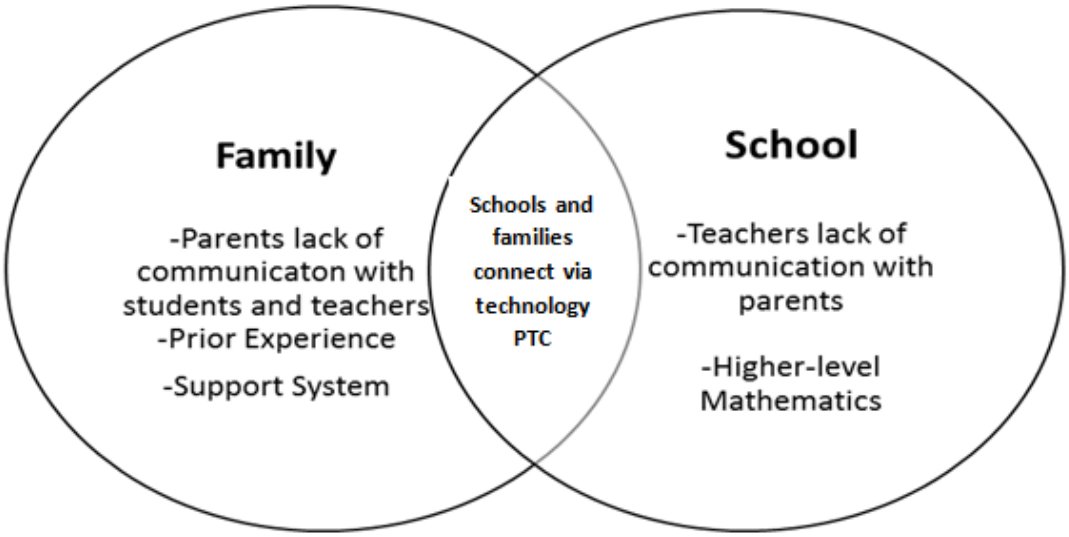

FIGURE 4: Findings from data.

Conclusions

1. In this case study, parents, students and teachers conveyed a variety of strategies that helped them become involved in their children's math education, as well as a way to communicate with teachers. Parents, students and teachers perceived

technology, such as emails and the Parent Assistant Module (PAM), and parent-teacher conferences (PTC) as helpful strategies that teachers used to encourage parental involvement. All three groups stated email to be the most frequently used and convenient parental involvement strategy. The data supports that the lines of communication were open more via email, and this allowed parents and teachers to address students' progress. This form of interaction between parents and teachers contributes to the internal component of Epstein's theory of "overlapping spheres of influence." The internal component concerns the *individual* level of the theory in which communication occurs between parents and teachers. When these two groups communicate with one another about students' mental and social development, there is a greater overlap between the two spheres of families and schools.

2. Data also revealed the perceptions held by parents, students and teachers on various barriers of parental involvement. Parents, students and teachers disclosed: parents' lack of communication with teachers and students, students' lack of communication with parents, prior experience, parents' misunderstanding of higher-level math, and parents' availability played a significant role in the lack of parental involvement in secondary math education and were parental involvement barriers. These barriers pulled the spheres apart, and they became part of the non-overlapping areas of the three spheres of influences.

All three groups expressed that when student's entered high school, teachers and parents communicated less with one another, and that students communicated less with their parents. The lack of communication between the three groups contributed to a decrease of parental involvement in high school. This finding supported previous

research that found parental involvement decreasing in secondary education (Muller, 1998; Steinberg et al. 1992). The lack of communication contributed to parents' negative perspective about their children's teachers. Parents, students and teachers also spoke about the lack of communication between parents and students and how it affected parental involvement. Many of the parents spoke about their teenagers not wanting to talk to them. Even in cases where parents attempted to have a casual conversation, 50% of students interviewed often did not want to participate. Due to students not communicating with parents, they become unaware and uninvolved in their students' math education.

The data analysis revealed prior experience as a barrier that affected parental involvement. Prior experiences hindered the possibility of any type of rapport that could be made between parents and teachers. Parents and teachers expressed that experiences from their childhood or prior conflicts had shaped their perception about parental involvement in secondary education. Parent's misunderstanding of the higher-level math courses was also identified as another barrier. Both parents and students address parents' inabilities to help out with teenagers' math. In some instances, parents' misunderstanding of the higher-level math created altercations. Students would want their parents to teach them a certain math concept the way their teacher taught them. Unfortunately, the parents were unaware of that method, and it would lead to conflict between the parents and students. The last barrier identified was parents' lack of availability. Both parents and teachers spoke about parents not having much time to participate in their teenagers' schooling. Teachers also spoke about attempting to contact parents and not being able to do so. Many parents recognized that their lack of availability hinders their involvement.

3. Parents realized that as their children became older, their roles shifted because they were not available as much, and their students became more responsible of their own education. In the "overlapping spheres of influence," this would be considered the parenting component in the family sphere. The interaction between students and parents appears on the internal model, because it shows interpersonal relationships. Epstein conveyed that when parents support their children's intellectual development, this is defined as parenting, which is one of the six different practices of parental involvement (Epstein, 2001). Many of these MINDSET parents were less-hands on with their children. Parents, students and teachers expressed that when parents released more responsibilities to their students, this helped prepare students to become more mature. As a result, parents roles change, and they became more of their children's support system and mainly monitored their children's academic progress. Parents and teachers conveyed that monitoring was an active form of parental involvement. Parents realized that monitoring their students was the main form of parental involvement. Even with parents being less hands-on, students still expressed that if it was necessary, they felt comfortable to ask their parents for help.

This finding also revealed that high school students play a major role in how parents are involved. Many of the juniors and seniors from this study realized that one reason why parents do not know much about their schooling is because they are not communicating with their parents. If parents are expecting their students to take more of a responsible role with their schooling, then they should be responsible enough to let parents know what is going on in the classroom. High school is one of the pivotal times where students establish their independence. Therefore, this is an excellent opportunity

for them to learn how to disclose information to their parents. As students gain independence, it will help students and parents adjust to their parents' role shift.

4. According to ANOVA, there is no statistical significance between parental involvement and students' math performance with regard students' weekly grades and the MINDSET pre- and post-assessments. However, according to the interviews and survey responses, parents, students, and teachers reveal that parental involvement does affect students' math performance. Parents, students and teachers expressed that once parents are notified about their students' academic progress, they are able to monitor them more. Subsequently, parents urge students to become more conscious about their math performance. As a result, parents, students and teachers, believe this improves students' math performances.

These results embodied Epstein's "overlapping spheres of influences," because they identified the importance of the interpersonal relationships between parents and students. Parents were able to monitor their students, because they were aware of what was happening in their students' math class. Hence, students were encouraged by their parents to complete their math work which increased their chances for success in the math classroom. This in turn, merges the family and school's spheres.

5. According to ANOVA, parental involvement interventions did not affect the perceptions about parental involvement held by parents, students and teachers. However, qualitative data revealed that the interventions did change way parents and students perceive parental involvement. According to the qualitative data, parents and students were able to communicate more when the interventions were implemented. As a result, the interventions helped create more of a school-like family (Epstein, 2001).

Implications

Communication became a major factor in the way parents were involved in their teenagers' math education. Parents, students, and teachers recognized that they contributed in how much parental involvement is employed in schools. In the study, communication can be beneficial when it pertains to the parents, students, and teachers relationships, as well as, the academic and behavior status of the students.

The findings in this study have important implications for classroom teachers and school administrators. As educators and researchers search for ways to help students become more motivated and successful in mathematics, they should acknowledge that they cannot do it alone. Parents and schools need to work together in order for students to obtain high academic achievement (Epstein, 2001; Knipping et al., 2008). Developing forums such as parent math workshops, parent support groups and professional development for teachers should be a priority (see Figure 5). These organizations are an approach to develop positive relationships between schools and families as well as help students become more successfully in the classroom.

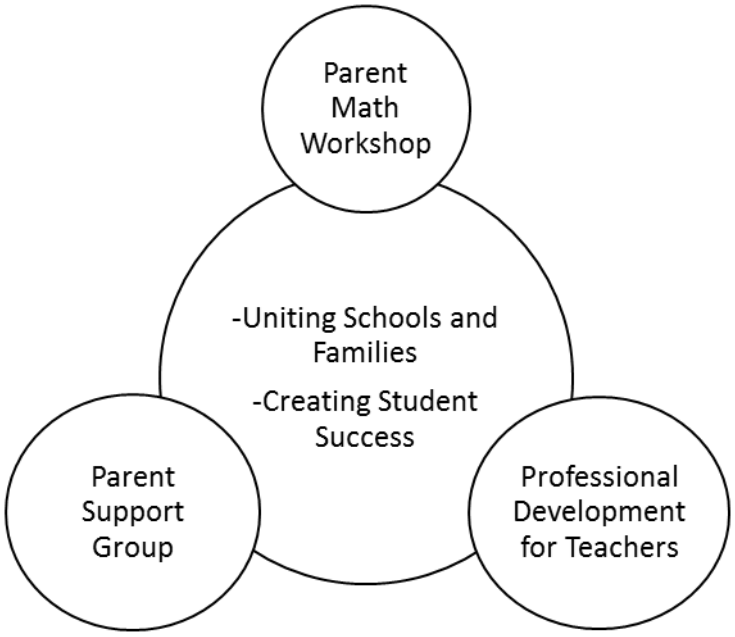

FIGURE 5: Implication 1. Parent support group.

Implication 1. Parent Support Group

Parents from this study addressed that there is a lack of communication from teachers and students in regards to their math education. The parents expressed that once their students were enrolled in high school, the school rarely advocated for parental involvement. As a result, the parents did not know who to consult with in regards to their teenagers' education. These results suggest that parents need to establish their own support group which will provide parents an opportunity to discuss shared concerns and strategies that they may have in regards to their students' education. Creating a supportive group will allow parents to learn and understand how to become better advocates for their students. In this study, parents perceived that connecting with other parents during students' earlier schooling encouraged them to become and stay involved. Furthermore, parents stated that parent-to-parent interaction allowed them to become

more informed of what was occurring with their students' education. This implication will help parents build an alliance with another as well as identify their parental roles.

Implication 2. Parent Math Workshop

Participants from this study stated that parents did not understand higher-level mathematics. Parents lack of understanding caused a disconnect between parents and teachers, as well as parents and students when it pertained to math education. These results suggest that school administrators and teachers should establish math workshops for parents. These workshops will help parents gain a better understanding and value for the higher-level math courses (Civil & Bernier, 2006). Additionally, the math workshops will help parents become educational resources and help parents develop a better relationship with their students' math teachers (Civil & Bernier, 2006).

In the study, students expressed that they would want their parents to assist them with their math work. Data revealed that when students asked for their parents' assistance, it sometimes lead to arguments because parents were attempting to help their students incorrectly. As a result, students did not bother to ask parents for help in order to avoid conflict. Providing the math workshop for parents will expose parents to the higher-level mathematics in which they would be able to communicate more effectively with their students. Furthermore, parents would have a better understanding of what the teachers expect from them and the students. Subsequently, this will help break down communication barriers between parents, students, and teachers. The implication behind this notion will help employ three of the six types of Epstein's parental involvement: parenting, communicating, and learning at home.

Implication 3. Professional Development for Teachers

In order for teachers to effectively communicate with parents and students, there needs to be a professional development for teachers that address valuable communication between teachers and parents. The findings from this study suggested that parents, students, and teachers have to improve on their communications skills. Parents desired to know teachers' expectations for their students and for them. Knowing what the teachers and schools expect from the parents and students allows them to become more accountable. One way to assist this matter is by cultivating teachers to become skillful communicators (Kessler-Sklar & Baker, 2000). School administrators should acknowledge that building a rapport with parents is essential for students' academic achievement (Epstein, 2001; Knipping et al., 2008). Since school administrators have the ability to advocate for parental involvement, they should provide workshops for teachers to be efficient communicators. Despite the perception that some teachers may have of parents due to prior experience, they have to realize that parents intend on participating in their students' education. These workshops should focus on the different types of communication teachers can employ with parents such as, emails, phone calls, newsletters, progress reports, or parent teacher conferences. Exercising appropriate parental involvement strategies will help improve how parents, students, and teachers interact with one another.

Recommendations

Educators and practitioners have to continue to advocate for parents to stay involved in their children's education, regardless if they are in the first grade or in twelfth grade. Parental involvement is an important ingredient that allows parents and teachers to

work together as partners. In this study, when weekly progress reports and newsletters were implemented for eight weeks, the lines of communications opened, and it improved parent- student relationships. These results from both parents and students suggest this study should be replicated over an extended period of time in order to identify more specific forms of communications that can help improve parental involvement and math achievement. Another recommendation is to conduct this study in other school districts. This study lacked diversity when it pertained to individuals' ethnicity, which suggests further research needs to be conducted on schools that have a more diverse population. This type of research will be beneficial, because it will help establish effective parental involvement strategies for different school districts.

As mentioned earlier, raising a child takes a village, and it is a long-term investment. Educators and parents have to realize that they cannot continue to expect children to grow to their fullest potential without the two spheres, families and schools, working as partners. These individual spheres have to realize that the school system consists of teachers, school administrators, students, families, and communities. Furthermore, this partnership does not stop when students enter high school. To separate families and communities from this social system at a later age causes a disunion which may lead to conflict. The first schools students attended were their homes, and their first teachers were their parents or guardians. Considering that parents and families are the foundation for many students, schools need to value parental involvement.

However, when it comes to the high school level, there needs to be more research conducted regarding parental involvement to help provide parental involvement programs and practices that will become effective for parents, students and teachers to implement.

By developing practical parental involvement practices and programs, this will help teachers create more of a positive learning environment.

Summary

In this study, I sought to understand the effects of parental involvement in secondary, math education. Weekly progress reports and newsletters were used as ways to advocate parental involvement in high school. Quantitative data revealed that the weekly progress reports and newsletters did not influence the math performance, nor did it influence perceptions held by students, parents and teachers. However, qualitative data showed that the interventions affected the way parents and students perceived parental involvement in secondary education. The implications of this study suggest that when parents are aware of their students schooling they are able to monitor and hold the students more accountable in their own education. Studies similar to this can be conducted to develop other parental involvement practices that will improve students' math performances, as well as the perceptions of students, parents and teachers regarding parental involvement in secondary education. Improvements in incorporating parental involvement into students' education is an essential addition that the United States needs to enforce, because it is evident that factors outside of the classroom, such as one's family background and individual responsibilities, influence the work and progress that is made within the classroom to will enable the students to be successful throughout life.

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APPENDIX A: PROBLEM SOLVING ASSESSMENT

MINDSET
Problem Solving Assessment
School Year 2011-2012

INSTRUCTIONS: PLEASE WRITE YOUR ANSWERS ON THE ANSWER SHEET PROVIDED.

APPENDIX A (Continued)

Problem 1

Skaters, Inc. sells skateboards and parts. A complete kit consists of a deck, set of 4 wheels, set of 2 trucks, and set of hardware. Part prices depend on quality.

Product	Prices			
Complete Skateboard	Low Quality		High Quality	
	$82		$84	
Deck	Low Quality	Medium Quality	High Quality	
	$20	$45	$50	
One set of 4 Wheels	Low Quality		High Quality	
	$24		$36	
One set of 2 Trucks	$16			
One set of hardware (bearings, rubber pads, bolts and nuts)	Low Quality		High Quality	
	$10		$20	

Question 1a

What are the minimum price and the maximum price in this shop for self-assembled skateboards?

Question 1b

The shop offers three different decks, two different sets of wheels and two different sets of hardware. There is only one choice for a set of trucks.
How many different skateboards can be constructed from this arrangement?

A. 6
B. 8
C. 10
D. 12

Question 1c

What are the parts used and the total price of the most expensive skateboard that can be constructed within a $120 budget?

Question 1d

Notice that currently there is only one option for the "truck" of the skateboard. Suppose that a second truck option is available. What would the price of the new truck option have to be to enable Eric to spend his entire $120?

APPENDIX A (Continued)

Problem 2

Caloric Information for Adults

		Male	Female
Age (years)	Activity level	Energy needed (calories)	Energy needed (calories)
From 18 to 29	Light	2,550	2,000
	Moderate	2,650	2,100
	Heavy	3,450	2,350
From 30 to 59	Light	2,500	2,050
	Moderate	2,900	2,150
	Heavy	3,400	2,340
60 and above	Light	2,100	1,790
	Moderate	2,450	1,900
	Heavy	2,850	2,100

Activity level according to occupation

Light:	*Moderate:*	*Heavy:*
Indoor sales person	Teacher	Construction worker
Office worker	Outdoor salesperson	Laborer
Housewife	Nurse	Sportsperson

Question 2a

What is a 45-year-old male teacher's recommended daily caloric intake?

Question 2b

A 19-year-old female high jumper has the following restaurant menu:

	Menu	*Calories per serving*
Soups:	Tomato Soup	85
	Cream of Mushroom Soup	140
Main courses:	Mexican Chicken	230
	Caribbean Ginger Chicken	190
	Pork and Sage Kebabs	920
Salads	Potato salad	180
	Spinach, Apricot and Hazelnut Salad	80
	Couscous Salad	115
Desserts:	Apple and Raspberry Crumble	330
	Ginger Cheesecake	240
	Carrot Cake	135
Milkshakes:	Chocolate	380
	Vanilla	350

The restaurant also has a special fixed price menu.

Fixed Price Menu
$30.00
Tomato Soup
Caribbean Ginger Chicken
Carrot Cake

APPENDIX A (Continued)

Before dinner on that day the intake of energy had been 1800 calories. The total energy intake should not go *below or above her recommended daily amount* by more than 120 calories.

Will the special "Fixed Price Menu" allow her to stay within ±120 calories of her recommended energy needs? Show the work you did to find the answer.

Question 2c

Suppose the female 19 year old decides to have Spinach, Apricot and Hazelnut Salad with her Fixed price Meal. Will doing so affect whether she stays within ±120 cal of her recommended energy needs? Show the work you did to find the answer.

APPENDIX A (Continued)

Problem 3

A 15-year-old boy wants to organize a cinema outing with two of his friends, who are of the same age, during the one-week school vacation. The vacation begins on Saturday, 24th March and ends on Sunday, 1st April.

His parents insist that he only goes to movies suitable for his age and does not walk home. They will pick up the boys at any time up to 10 p.m.

The first friend must stay home on Monday and Wednesday afternoons for music practice between 2:30 and 3:30.
The second friend must visit his grandmother on Sundays, and has already seen the movie Pokamin and doesn't want to see it again.

Here is the movie information:

	Advance Booking Number:423-3000		
GREENVILLE CINEMA	24 hour phone number: 423-0071 Bargain Day Tuesdays: All films $8		
	Films showing from Fri 23rd March for two weeks:		
Children in the Net 113 mins 2:00pm (Mon-Fri only) 8:35pm (Sat/Sun only)	Suitable only for persons of 12 years and over	**Pokamin** 105 mins 1:40pm (Daily) 4:35pm (Daily)	Parental Guidance. General viewing, but some scenes may be unsuitable for young Children
Monsters from the Deep 164 mins 7:55pm (Fri/Sat only)	Suitable only for persons of 18 years and over	**Enigma** 144 mins 3:00pm (Mon-Fri only) 6:00pm (Sat/Sun only)	Suitable only for persons of 12 years and over
Carnivore 148 mins 6:30pm (Daily)	Suitable only for persons of 18 years and over	**King of the Wild** 117 mins 2:35pm (Mon-Fri only) 6:30pm (Sat/Sun only)	Suitable for persons of all ages

Question 3a

Determine which movies the 3 boys should consider watching.

Question 3b

If the three boys decided on going to "Children in the Net," which of the following dates is suitable for them?

A. Monday, 26th March

B. Wednesday, 28th March

C. Friday, 30th March

D. Saturday, 31st March

E. Sunday, 1st April

Question 3c

The boy learns that the show time for Monsters from the Deep has been moved up to 7:00 p.m. (Fri/Sat only). Should he add this movie to the list they are considering?

APPENDIX A (Continued)

Problem 4

Figures 1 and 2 show a map of the area and the distances between towns.

Figure 1. Map of roads between towns

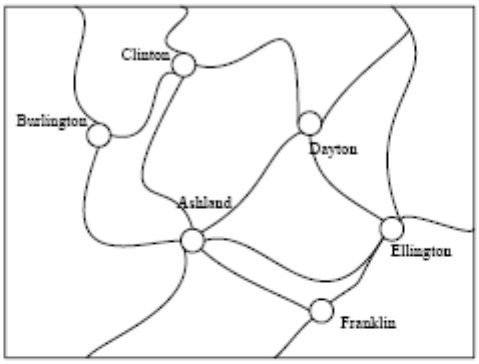


Table 2. Shortest road distance of towns from each other in kilometers.

Ashland						
Burlington	550					
Clinton	500	300				
Dayton	300	850	550			
Ellington	500		1000	450		
Franklin	300	850	800	600	250	
	Ashland	Burlington	Clinton	Dayton	Ellington	Franklin

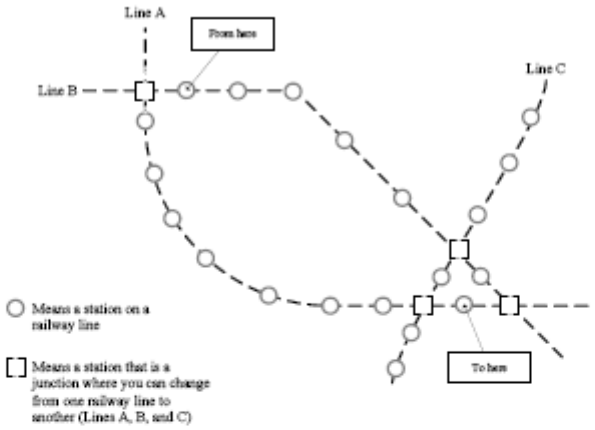
Question 4

What is the shortest distance by road in kilometers between Ellington and Burlington?

APPENDIX A (Continued)

Problem 5

The following diagram shows part of the transport system of a city, with three railway lines. It shows where you are at present, and where you have to go.



The fare is based on the number of stations traveled (not counting the station where you start your journey). Each station and each junction traveled costs $1.

The time taken to travel between two adjacent consecutive stations is about 2 minutes.

The time taken to change from one railway line to another at a junction is about 5 minutes. These extra 5 minutes are only needed when you need to switch railway lines (that is, if you stay on the same line, you do not need to include this time). In addition, this 5-minute change does not include the time it takes to travel between stations.

One possible path to go from the beginning to the end is to take the Subway Line B to Line A and then stay on Line A to the desired endpoint.

Question 5a

For this route, what is the fare you have to pay?

Question 5b

What is the approximate time for this route?

Question 5c

Trace on the diagram the best route in terms of cost and time. It may or may not be the path from Question 5A and 5b.

APPENDIX A (Continued)

Problem 6

A technical college offers the following 12 subjects for a three-year course, where the length of each subject is one year:

	Subject Code	Subject Name
1	M1	Mechanics Level 1
2	M2	Mechanics Level 2
3	E1	Electronics Level 1
4	E2	Electronics Level 2
5	B1	Business Studies Level 1
6	B2	Business Studies Level 2
7	B3	Business Studies Level 3
8	C1	Computer Systems Level 1
9	C2	Computer Systems Level 2
10	C3	Computer Systems Level 3
11	T1	Technology and Information Management Level 1
12	T2	Technology and Information Management Level 2

Question 6

Each student will take four subjects per year, completing the degree in three years.

Higher level courses may only be taken if the student has completed the lower level(s) of the same subject in a previous year.

In addition, Electronics Level 1 can only be taken after completing Mechanics Level 1, and Electronics Level 2 can only be taken after completing Mechanics Level 2.

Decide which subjects should be offered for which year, by completing the table on the answer sheet. Write the subject codes in the table.

APPENDIX A (Continued)

Problem 7

A five-day Children's Camp is being developed. Forty-six children (26 girls and 20 boys) have signed up for the camp, and 8 adults (4 men and 4 women) have volunteered to attend and organize the camp.

Table 1. *Adults*

Female
Female
Female
Female
Male
Male
Male
Male

Table 2. *Dormitories*

Name	Number of beds
Red	12
Blue	8
Green	8
Purple	8
Orange	8
Yellow	6
White	6

Dormitory rules:

1. Boys and girls must sleep in separate dormitories.
2. At least one adult must sleep in each dormitory.
3. The adult(s) in a dormitory must be of the same gender as the children.
4. The number of people should not exceed the cabin capacity.

Question 7

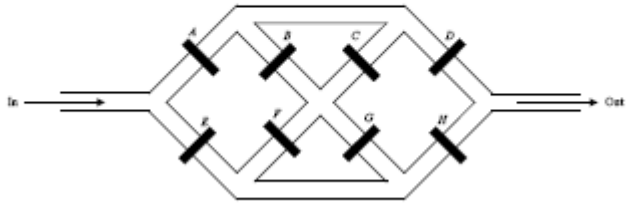
Dormitory Allocation

Fill the table to allocate the 46 children and 8 adults to dormitories, keeping to all the rules.

Problem 8

Below is a diagram of a system of irrigation channels for watering sections of crops. Gates *A* to *H* can be opened and closed to let the water go where it is needed. When a gate is closed no water can pass through it.

In the diagram below, all of the gates are closed.



Question 8a

Water is not always going where it is supposed to go. It could be that one of the gates is stuck closed, so that when it is switched to open, it does not open. The following settings given in Table 1 are used to test the gates.

Table 1. Gate Settings

A	B	C	D	E	F	G	H
Open	Closed	Open	Open	Closed	Open	Closed	Open

With the gate settings as given in Table 1, draw all the possible paths for the flow of water. Assume that all gates are working according to the settings.

Question 8b

When the gates have the Table 1 settings, no water flows through, indicating that at least one of the gates set to open is stuck closed. Decide for each problem case listed on the answer sheet whether the water will flow through all the way.

APPENDIX A (Continued)

Problem 9

The marketing manager for a beverage company needs to decide how many TV spots and magazine ads to run during the next quarter.

Each 30 second TV spot costs $5,000 and is expected to create sales of 500,000 cans. Each one page magazine ad costs $2,000 and is expected to create sales of 300,000 cans.

A total of $100,000 may be spent on TV spots and magazine ads; however, the company wants to spend no more than $70,000 on TV spots and no more than $50,000 on magazine ads.

Let x_1 represent the number of TV spots run. Let x_2 represent the number of magazine ads run.

Question 9a

Write a function using x_1 and x_2 that expresses the total cost of advertising for the beverage company.

Question 9b

Explain the meaning of the expression $300{,}000x_1 + 500{,}000x_2$ in terms of this situation.

Question 9c

Explain the meaning of the following constraint (inequalities) on the advertising cost.

$$5{,}000x_1 + 2{,}000x_2 \leq 100{,}000$$

Question 10

Joe knows from experience that there is a70% chance that he will have to wait in line to purchase concert tickets if he visits Tics R Us during his lunch hour. On four consecutive days, he went to the Tics R Us, saw there was a line, and left. When he goes to Tics R Us on the fifth day, which of the following is true?

A. He is certain to have to wait in line.

B. There is greater than a 70% chance that he will have to wait in line.

C. There is a 70% chance that he will have to wait in line.

D. There is less than a 70% chance that he will have to wait in line.

APPENDIX A (Continued)

Question 11

Ms. Jones teaches two classes of 12th grade math, 1st and 4th periods. There are 30 students in 1st period, and 20 in 4th period. On the final exam, the average grade in 1st period was 85, and the average grade in 4th period was 80. Which of the following statements is true about the average grade for all of Ms. Jones students in the 1st and 4th periods?

A. The average grade of the two periods combined is closer to 85 than 80.

B. The average grade of the two periods combined is closer to 80 than 85.

C. The average grade of the two periods combined is 82.5.

D. None of the above is true.

Question 12

In a certain factory, 75% of a particular part that is made are useable (U) and 25% are defective (D). A quality control inspector randomly selects 12 of these parts to inspect. Which of the following is the most likely sequence?

A. UUUDUUUDUUUD

B. UDUUDUUUUDUU

C. DDDUUUUUUUUU

D. A,B, and C are equally likely.

Question 13

In a certain Federal jurisdiction, one-third of the population eligible to serve on Federal juries is minorities. Which of the following is more likely?

A. Exactly 4 out of the 12 people selected to serve on a regular jury are minorities.

B. Exactly 7 out of the 21 people selected to serve on a grand jury are minorities.

C. Exactly 32 out of the 96 people selected to serve in a jury pool are minorities.

D. A, B, and C are equally likely.

Question 14

Suppose that automobile accidents occur independently and are evenly distributed over the course of the year. If the probability that a male driver aged 16-18 years has an automobile accident during any 6-month period is 30%, what is the probability that a particular 17 year-old male driver would have had two separate automobile accidents between January 1 and June 30 of the same year?

A. 60%

B. 30%

C. 9%

D. 6%

APPENDIX B: TEACHER SURVEY

Q-1. This question asks for your professional judgment about parent involvement. Please circle one choice for each item that best represents your opinion and experience.				
	Strongly Disagree	Disagree	Agree	Strongly Agree
a. It is important to involve parents in their children's math education.	SD	D	A	SA
b. I provide information for my students' parents so they could talk to them about their math work at home.	SD	D	A	SA
c. My students' parents are actively involved in their math education.	SD	D	A	SA
d. I often talk with parents about their schoolwork.	SD	D	A	SA
e. I only reach out to my student's parents when there are problems.	SD	D	A	SA
f. Parent involvement can increase teacher effectiveness.	SD	D	A	SA
g. My students' parents want to be more involved in their math work.	SD	D	A	SA
h. I make time to involve parents in their children's schoolwork	SD	D	A	SA
i. I need in-service education to implement effective parent involvement practices.	SD	D	A	SA
j. Parent involvement is important for student success in high school.	SD	D	A	SA
k. I view parents as important partners.	SD	D	A	SA
l. Involving families is one of my responsibilities as a teacher.	SD	D	A	SA

Your Experience and Background

A. What is your experience?

_____ (a) Years in teaching

_____ (b) Years at this high school

B. What is your gender?

_____ (a) Male

_____ (b) Female

APPENDIX B (Continued)

C. What is your highest education?

_____ (a) Bachelors

_____ (b) Masters

_____(c) Doctorate

_____ (d) Other (Describe)

D. How do you describe yourself?

_____ (a) African American

_____ (b) Asian American

_____ (c) Hispanic American

_____ (d) White

_____ (e) Other (Describe)

To conclude, I would very much like your opinions on a few questions.

a. What is the most effective parental involvement practice that you have used?

b. What obstacles do you see in building a stronger relationship with your children's parents?

c. Any other ideas or suggestions that you would like to add?

APPENDIX C: PARENT SURVEY

Parent Survey				
Q-1. We would like to know how you feel about this your child's math education right now. Please circle one choice for each item that best represents your opinion and experience.				
	Strongly Disagree	Disagree	Agree	Strongly Agree
a. My teen's math teacher makes me feel welcome in his or her classroom.	SD	D	A	SA
b. My teen's math teacher care about him or her.	SD	D	A	SA
c. I am able to help my child with his or her math homework	SD	D	A	SA
d. I am available to help my child with his or her math homework	SD	D	A	SA
d. My teen should get more math homework.	SD	D	A	SA
e. My teen's math teacher works hard to get me involved.	SD	D	A	SA
f. I am involved in my teen's math education.	SD	D	A	SA
g. Parents need to be involved in their twelfth grader's education.	SD	D	A	SA
h. I only hear from my teen's math teacher when there are problems.	SD	D	A	SA
i. I often talk with other parents about our teenagers related to the math education at the high school.	SD	D	A	SA
j. My teen talks with me about school at home.	SD	D	A	SA
k. I want to be more involved than I am now in my teen's math education.	SD	D	A	SA
l. My teen's math teacher wants to learn what I know about my teen.	SD	D	A	SA
m. Mathematics is important for a good career.	SD	D	A	SA
n. Mathematics is valuable for making decisions	SD	D	A	SA

APPENDIX C (Continued)

How far do you want your child to go in school? (Circle only one.)	
	Answer
Will not finish high school	1
High School diploma	2
Trade or vocational school	3
Some college, but no degree	4
2-year degree	5
4-year degree	6
Master's degree	7
MD, PhD, JD or other Advanced Degree	8
Don't know	9

About your family

a. How many adults live at home _____ (include yourself)

b. How many children live at home? _____ (include your twelfth grader)

c. What is your education? (Circle one)

(1) Did not complete high school
(2) High school diploma
(3) Other training or education
(4) Some college
(5) College degree
(6) Advanced degree

d. How did you like mathematics when you were a teen? (Circle one)

(1) Like it a lot
(2) Like it some
(3) Like it a little
(4) Did not like it much
(5) Did not like it at all

e. Are you employed now?

(1) Employed full-time
(2) Employed part-time
(3) Not employed now

APPENDIX C (Continued)

f. How do you describe yourself?

(1) African American
(2) Asian American
(3) Hispanic American
(4) White
(5) Other (please specify)

To conclude, I would very much like your opinions on a few questions.

a. What was the most effective parental involvement that your children's teachers used, and why?

b. What is the best thing that your child's math teacher could do to help you become more involved in his or her school work?

c. Any other ideas or suggestions that you would like to add?

APPENDIX D: STUDENT SURVEY

Student Survey				
Q-1. These questions ask for your opinion, about your school, and about how families and high schools work together right now. Please circle one choice for each item to tell how you feel about the following.				
	Strongly Disagree	Disagree	Agree	Strongly Agree
a. My math teacher makes my parents feel welcome in my classroom.	SD	D	A	SA
b. My math teacher cares about me.	SD	D	A	SA
c. My parent is able to help me with my math homework.	SD	D	A	SA
d. My parent helps me with my math homework.	SD	D	A	SA
e. I have been able to lean math when I worked hard.	SD	D	A	SA
f. My math teacher only calls home if there are problems.	SD	D	A	SA
g. I want my parents to be more involved in my math education.	SD	D	A	SA
h. I talk to my parents about school at home.	SD	D	A	SA
i. My parent keeps close watch on how I am doing in school.	SD	D	A	SA
j. My math teacher has a good relationship with my parents.	SD	D	A	SA
k. Mathematics is important for a good career.	SD	D	A	SA
l. Mathematics is valuable for making decisions	SD	D	A	SA
m. I want my parent to be more involved in my education.	SD	D	A	SA
n. I work hard with mathematics in school.	SD	D	A	SA

APPENDIX D (Continued)

How far do you want to go in school? (Circle only one.)

	Answer
Will not finish high school	1
High School diploma	2
Trade or vocational school	3
Some college, but no degree	4
2-year degree	5
4-year degree	6
Master's degree	7
MD, PhD, JD or other Advanced Degree	8
Don't know	9

About your family

a. Are you: ___ male ___ female

b. How many adults live at home with you? ___

c. How many children live at home in all? ___ (include yourself)

d. (1) Did any of your older brothers or sisters go to this high school?
(2) If yes, how many went here?

e. Which of these items do you have at home that could help you in your studying? (circle all that you have)

(1) Telephone
(2) Television
(3) Cable TV
(4) Daily newspaper
(5) Encyclopedia
(6) Computer
(7) DVD player
(8) 50 books or more
(9) A quiet place where you study or do homework
(10) Calculator

APPENDIX D (Continued)

f. How do you describe yourself?

(1) African American
(2) Asian American
(3) Hispanic American
(4) White
(5) Other (please specify)

g. How far in school did your mother go?

(1) Less than high school
(2) High school diploma
(3) Some college or other training
(4) College degree
(5) Advanced degree
(6) Don't know

h. How far in school did your father go?

(1) Less than high school

(2) High school diploma

(3) Some college or other training

(4) College degree

(5) Advanced degree

(6) Don't know

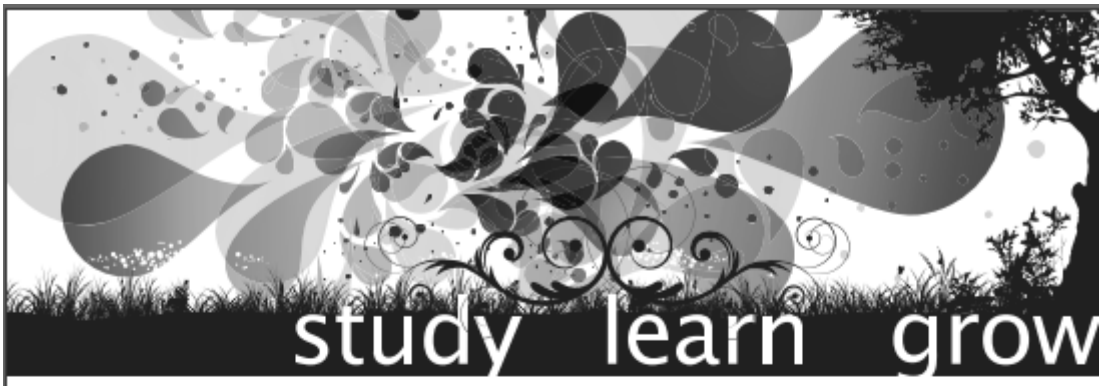
To conclude, I would very much like your opinions on a few questions.

a. What school activity to involve parents has worked best for you and your family? Why was it useful or enjoyable?

b. What is the best thing your math teacher could do to help your family become more involved in your math education?

c. Any other ideas or suggestions that you would like to add?

APPENDIX E: NEWSLETTER



"What's Going On?"

Week 1

Greetings Parents,

This week your child will be taught exponents and exponential functions. As your child learns the foundation of exponents, he or she will discover how to write and solve exponential functions through real-world applications. Your child's understanding of exponential functions is important if he or she contemplates various careers such as scientists, census readers, economists, bank specialists, investors, and certain government jobs. Even if your child does not consider pursuing those careers, he or she will still experience exponential functions in his or her daily life. For instance, if your child has a checking or savings account that allows him or her to earn interest or if he or she plans to invest in his or her future, your child will need to know how to calculate the amount of money gained over a certain amount of time. So as you can see, having an understanding of exponents is not only good for them in the present but also beneficial for their future.

TIPS

One way to help your child understand exponential functions is by talking about interest rates with him or even taking him or her to a bank near your home. Ask to talk with an employee who can explain investments and interest rates. This will allow your child to see the relationship between exponential functions and interest rates.

Fun Family Events in the Charlotte area that focus in Science, Technology, Mathematics, and Engineering.
Walk a Mile in my shoes: http://www.ncsciencefestival.org/2013_event/walk-a-mile/
The Science of Baseball: http://www.ncsciencefestival.org/2013_event/science-of-baseball/
Carowinds Education Days: http://www.ncsciencefestival.org/2013_event/carowinds/

To view more events go to: http://www.ncsciencefestival.org/

Tutorial Links on Exponents and exponential functions
Exponents - http://www.purplemath.com/modules/exponent.htm
Exponential functions - http://www.purplemath.com/modules/expofcns.htm
Graphing Exponential functions - http://www.purplemath.com/modules/graphexp3.htm
Decay and Growth - http://www.purplemath.com/modules/expoprob2.htm

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
wk 1	4/8 - Mindset Assessment - Common Core Questions	4/9 - Go over Common Core questions - Station Activity - HW: PL 11.5	4/10 - Day 1 notes - HW: unit 5 day 1	4/11 - Warm Up: Tribbles - Day 2 notes - HW: unit 5 day 2	4/12 - Warm Up: Spam email - Day 3 notes - HW: unit 5 day 3
wk 2	4/15 - Day 4 - HW: unit 5 day 4 and interest sheet	4/16 - cont'd day 4 - Talk Power Functions even, odd & even beh. - HW: word problem ex.	4/17 - Review activity - Review worksheet	4/18 - TEST! - calc active & calc inactive	4/19 - Car lab

Activities may change due to schooling events

APPENDIX F: PROGRESS REPORT

STUDENT PROGRESS REPORT

SCHOOL:

STUDENT NAME: GRADE:

HOMEROOM/COUNSELOR: PERIOD/YEAR:

COURSE	TEACHER	GRADE
COMMENTS:		
COMMENTS:		
COMMENTS:		
COMMENTS:		
COMMENTS:		
COMMENTS:		

FINAL AVERAGE:

DAYS ABSENT: TOTAL DAYS ABSENT: TARDES: TOTAL TARDES:

Please sign and have your student return this Progress Report to me. If you have any questions or concerns, please write them in the "notes" section provided or call me at _____. Thank you.

Notes:

Parent signature/Date: Teacher signature/Date:

APPENDIX G: ANSWER SHEET

ANSWER SHEET - MINDSET PSA 8/2011 STUDENT _____

Question 1a

A. $_____

B. $_____

Question 1b (circle one)

A.

B.

C.

D.

Question 1c

Part	Amount (dollars)
Deck	
Wheels	
Trucks	
Hardware	
TOTAL	

Question 1d

Answer_____

Question 2a

Answer_____

APPENDIX H: RUBRIC

Question 1a

A. $ 70 **1 point**

B. $ 122 **1 point**

Question 1b (circle one)

C. **1 point**

Question 1c **1 point**

Part	**Amount (dollars)**
Deck	45
Wheels	36
Trucks	16
Hardware	20
TOTAL	117

Note: Look at Total, and if it is 117, student earns the point.

Question 1d

$19 1 point(unit not required for full credit)

Question 2a

2900 calories 1 point(unit not required for full credit)

APPENDIX H (Continued)

Question 2b

NO

Example of work:

2350+120 = 2470
2350-120 = 2230
2230 ≤ calories ≤ 2470

85+190+135 = 410
1800+410 = 2210

2210 is not between the inequality 2230 ≤ calories ≤ 2470; therefore, the "Fixed Price Menu" will not allow the athlete to be within her recommended daily amount.

Note: These calculations do not have to be in the exact order presented in this example.

Rubric 2b

2 if answer is No and a correct work explanation.

1 if answer is No and no explanation or incorrect explanation.

0 if answer is Yes or left blank.

Question 2c

YES

APPENDIX H (Continued)

Example of Calculations

2350+120 = 2470
2350-120 = 2230
2230 ≤ calories ≤ 2470

85+190+135+**80** = 490 (add 80)
1800+490 = 2290

2290 is between the inequality 2230 ≤ calories ≤ 2470; therefore, adding the Spinach, Apricote, and Hazelnut salad would allow the athlete to be within her recommended daily amount.

Note: These calculations do not have to be in the exact order presented in this example.

Rubric 2c

2 if answer is Yes and a correct work explanation.

1 if answer is Yes and no explanation or incorrect explanation.

0 if answer is No or left blank.

Question 3a

Children in the Net	Yes / No	**Answer Yes**
Monsters from the Deep	Yes / No	**Answer No**
Carnivore	Yes / No	**Answer No**
Pokamin	Yes / No	**Answer No**
Enigma	Yes / No	**Answer Yes**
King of the Wild	Yes / No	**Answer Yes**

APPENDIX H (Continued)

Rubric 3a.

2 points for 5-6 correct

1 point for 3-4 correct

0 points otherwise.

Question 3b

C — 1 point

Question 3c

NO — 1 point

Question 4

1,050 kilometers — 1 point (unit not required for full credit)

Question 5a

$8 — 1 point (unit not required for full credit)

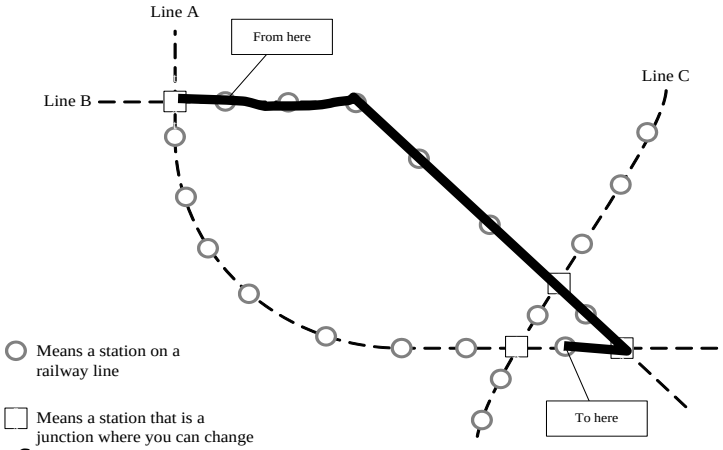
Question 5b

21 minutes — 1 point (unit not required for full credit)

Question 5c:

1 point

APPENDIX H (Continued)



Question 6

	Subject 1	Subject 2	Subject 3	Subject 4
Year 1	**B1**	**M1**	**T1**	**C1**
Year 2	**B2**	**M2**	**E1**	**C2**
Year 3	**B3**	**T2**	**E2**	**C3**

Rubric 6

1 point for each year if it is correct, and 0 if not correct, for a total of 3 points. The order of the four courses in each of the years is not relevant. Each year must have the four courses listed, however.

APPENDIX H (Continued)

Question 7

One possible answer, but there are many.

Name	**Number of boys**	**Number of girls**	**Adult**
Red	8	0	M,M
Blue	0	7	F
Green	0	7	F
Purple	0	7	F
Orange	7	0	M
Yellow	0	5	F
White	5	0	M

Rubric 7

2 points if all rules are followed and the response correctly locates all children and adults.

1 point if response fails to correctly locate all children and adults, OR if response fails to follow all rules.

0 points otherwise.

APPENDIX H (Continued)

Here are the rules:

Forty-six children (26 girls and 20 boys) and 8 adults (4 men and 4 women) must be placed

Table 1. ***Adults***

Female
Female
Female
Female
Male
Male
Male
Male

Table 2. ***Dormitories***

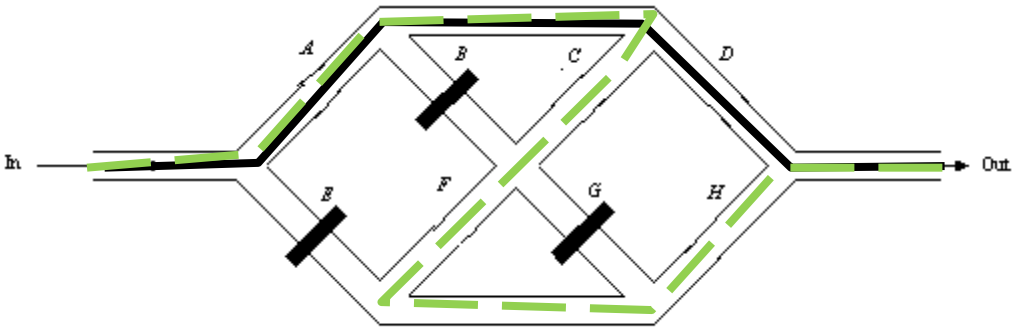
Name	**Number of beds**
Red	12
Blue	8
Green	8
Purple	8
Orange	8
Yellow	6
White	6

Dormitory rules:

1. Boys and girls must sleep in separate dormitories.
2. At least one adult must sleep in each dormitory.
3. The adult(s) in a dormitory must be of the same gender as the children.
4. The number of people should not exceed the cabin capacity.

APPENDIX H (Continued)

Question 8a



Rubric 8a

1 point for each path (shown as a solid and a dotted line)- 2 points possible.

Question 8b

Gate *A* is stuck closed. All other gates are working properly as set in Table 1.	Yes / No **Answer is No**	Rubric 8b 2 points for 4-5 correct 1 point for 2-3 correct 0 points otherwise.
Gate *D* is stuck closed. All other gates are working properly as set in Table 1.	Yes / No **Answer is Yes**	
Gate *F* is stuck closed. All other gates are working properly as set in Table 1.	Yes / No **Answer is Yes**	
Gate *C* is stuck closed. All other gates are working properly as set in Table 1.	Yes / No **Answer is Yes**	
Gate *H* is stuck closed. All other gates are working properly as set in Table 1.	Yes / No **Answer is Yes**	

APPENDIX H (Continued)

Question 9a

$Z = 5000x_1 + 2000x_2$

Rubric 9a

1 point if answer shows the right side of the above equation.

0 points if there is an inequality (constraint) in the answer

Question 9b

The total number of cans expected to be sold.

Rubric 9b

2 points if response indicates cans to be sold (in some way it has to mean totals).
1 point if they use the numbers 300000 and 500000 to talk about the number of cans correctly but do not talk about total number.
0 points for other responses.

Question 9c

The total cost of TV spots and magazine ads cannot exceed $100,000.

Rubric 9c

2 points if response indicates amount to be spent on ads is $100,000 or no more than $100,000.
1 point if they use the numbers $5000 and $2000 to talk about the numbers of cans correctly, but do not talk about the total number.
1 point if the response indicates the amount to be spent on ads (in some way it implies the total is 100,000 but does not have a dollar sign or use the word dollar.
0 points if there is no talk about money and they do not talk about the $100,000.

APPENDIX H (Continued)

Question 10

D **1 point**

Question 11

A **1 point**

Question 12

D **1 point**

Question 13

C **1 point**

Question 14

C **1 point**

APPENDIX H (Continued)

ANSWER SHEET - MINDSET PSA 8/2011 STUDENT _____

Question 2b

Answer _____

Work:

Question 2c

Answer_____

Work:

Question 3a

Circle "Yes" or "No" for each movie.

Children in the Net	Yes / No
Monsters from the Deep	Yes / No
Carnivore	Yes / No
Pokamin	Yes / No
Enigma	Yes / No
King of the Wild	Yes / No

APPENDIX H (Continued)

ANSWER SHEET - MINDSET PSA 8/2011 STUDENT _____

Question 3b (circle one)

A.

B.

C.

D.

Question 3c

Answer_____ **(Yes or No)**

Question 4

Answer_____

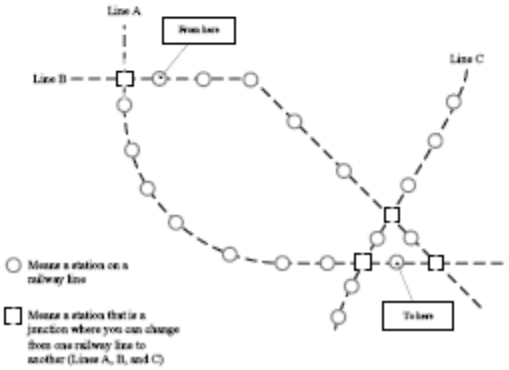
Question 5a

Answer_____

Question 5b

Answer_____

Question 5c: Trace on the diagram the best route in terms of cost and time. It may or may not be the path from Question 5A and 5b



APPENDIX H (Continued)

ANSWER SHEET - MINDSET PSA 8/2011 STUDENT _____

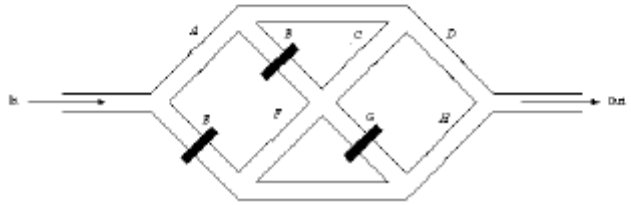
Question 6

	Subject 1	Subject 2	Subject 3	Subject 4
Year 1				
Year 2				
Year 3				

Question 7

Name	Number of boys	Number of girls	Adult
Red			
Blue			
Green			
Purple			
Orange			
Yellow			
White			

Question 8a



APPENDIX H (Continued)

ANSWER SHEET - MINDSET PSA 8/2011 STUDENT _____

Question 8b

Gate *A* is stuck closed. All other gates are working properly as set in Table 1.	Yes / No
Gate *D* is stuck closed. All other gates are working properly as set in Table 1.	Yes / No
Gate *F* is stuck closed. All other gates are working properly as set in Table 1.	Yes / No
Gate *C* is stuck closed. All other gates are working properly as set in Table 1.	Yes / No
Gate *H* is stuck closed. All other gates are working properly as set in Table 1.	Yes / No

Question 9a

Answer_____

Question 9b

Answer_____

Question 9c

Answer_____

Question 10 (Circle one)

A.

B.

C.

D.

APPENDIX H (Continued)

ANSWER SHEET - MINDSET PSA 8/2011 STUDENT _____

Question 11 (Circle one)

A.

B.

C.

D.

Question 12 (Circle one)

A.

B.

C.

D.

Question 13 (Circle one)

A.

B.

C.

D.

Question 14 (Circle one)

A.

B.

C.

D.

APPENDIX H (Continued)

ANSWER SHEET - MINDSET PSA 8/2011 STUDENT _____