Engaging and Disengaging: a Qualitative Study of Middle School Girls and Mathematics

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ENGAGING AND DISENGAGING: A QUALITATIVE STUDY OF MIDDLE SCHOOL GIRLS AND MATHEMATICS

A Dissertation Presented

by

Anita M. Long

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The Faculty of the Graduate College

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ABSTRACT

The purpose of this study was to learn about the underlying factors that might help to explain differences in performance and engagement among middle school girls in mathematics. The study employed a qualitative approach to observe and listen directly to the voices of middle school girls and their parents and math teacher as they reflected on their experiences and thoughts about the girls’ performance in and long-term goals related to mathematics. My goal was to hear what forces were working in and around the girls that might lead them to engagement or disengagement with mathematics.

Through the use of journals, interviews, and classroom observations, I collected data on six adolescent girls attending a middle school in a small New England city. The data collected were viewed through several lenses including the triads created by parent-student-teacher and the triads of “high-performing” and “low-performing” girls.

Six themes emerged: factoring in the algebra class; finding seats; relating to the teacher; social networking and engagement; untangling performance and engagement; and structuring class. These themes helped to explain some of the differences between the girls’ performance in and engagement with mathematics. In addition, they suggested that the concept of engagement was contextual and somewhat elusive. The study raised questions about where engagement was taking place (in school or out, in math or another class), whether it was a solitary endeavor or a social creation, and the complex relationship between engagement and performance. Further longitudinal work with girls and young women as they progress through school will be important to the understanding of how, why and when girls engage or disengage from the study of mathematics.
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This work is the culmination of many years of study and research and also years of life experience. I have had many wonderful math teachers over the years who have inspired and encouraged me. My parents – my father an accountant and then computer programmer/analyst, and my mother a math teacher for over two decades – always encouraged my siblings and me to pursue a strong education in the field of our choosing.

My mother was encouraged by her high school math teachers in 1940 to study mathematics. Although she completed her bachelor’s degree in teacher education with certification in French and a double major in mathematics, she returned to teaching math in the early 1960s. Her master’s thesis was on using calculators in math instruction with an interest toward gifted and talented students. I am so proud of her and I feel blessed to have had a mother as such a strong role model in the field of mathematics education.

My family – siblings, nieces and nephew, in-laws, and partner – have all been so supportive over the years as I’ve delved into solitude for months at a time to read and study the current literature. They have encouraged me even when they didn’t completely understand (I thought you finished that degree years ago!). They love me unconditionally in a world where families are not always so supportive. Thank you all.

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CHAPTER 1: INTRODUCTION

Adolescence is a critical time for the retention and loss of students of mathematics (National Council of Teachers of Mathematics, 1997; National Research Council, 2001). This is especially apparent in underrepresented populations (e.g., women, students of color, students from limited economic backgrounds) (Secada, 1992). By what process are adolescent girls and others feeling left out of mathematics? The purpose of this study was to listen to voices of adolescent girls as they interact with mathematics class and try to hear what forces are working in and around them that leads to engagement or disengagement.

Many researchers have studied issues of gender and mathematics (Cobb & Bauerfeld, 1995; Fennema & Leder, 1990; Leder, 1992; Sadker, Sadker, & Klein, 1991; Sadker, Sadker, & Klein, 1986) over the past 40 years. The National Council of Teachers of Mathematics (NCTM) authored numerous policy handbooks around the decade of the 1990s to try to address various issues in the mathematics classroom, including gender equity (National Council of Teachers of Mathematics, 1989, 1991, 1995, 1997, 2000). NCTM followed with a large project evaluation to understand the implementation of their policy efforts (Ferrini-Mundy & Schram, 1997). As with many policy and reform efforts, these steps were informed by the research at the time (largely quantitative) and the available resources. As new national education policies took hold (most notably No Child Left Behind), funds were shifted in other directions.

In the field of mathematics education, more research into diversity in education started to arise (Lubienski, 2000; Secada, 1992; Tate, 1997) with a focus on mathematics and why some students seemed to be disengaging. Initially this research looked at
curriculum and teacher pedagogy. Later, aspects of anthropology and examination of classroom culture became the focus. As national education policy moved towards testing and accountability for all students, equity research took a back seat to assessment research.

Why is student engagement in mathematics an important issue? Mathematics course selection in high school and subsequent attainment of reasoning skills are critical gateways to one’s college entrance, degree attainment and career path. Elaine Seymour (1995) discovered that women who ‘drop out’ of quantitative majors do not tend to have lower scores on college entrance exams, or lower freshman, grade-point averages than their male peers. In addition, students in science, technology, engineering, or mathematics (STEM) degree programs were more likely to finish the bachelor’s degree and less likely to leave college without degree completion (Chen & Weco, 2009). Moreover, a 2009 U.S. Department of Education report noted that students who took trigonometry, precalculus, or calculus in high school were more likely to enter a college program in the STEM fields. So the link to college degrees, and later careers, in the STEM fields can be traced back in part to high school mathematics course selection.

Sadker and colleagues (1991) reviewed the research on gender equity in education subdividing research into four broad categories: administration, teacher-student interaction, differences in intellectual abilities, and teacher education and reform. Partly due to the era of the research review, the studies they cite were primarily quantitative and led to some reform efforts. They questioned the theory that we needed more men in administration in order to attract men into teaching, noting that at the time, men
dominated higher-level administration while women were either administrative assistants or in the teaching ranks (Sadker, et al., 1991).

The research is substantial on teacher-student interaction (Sadker, et al., 1991, pp. 294 - 307) describing studies showing that teachers interact more with high-achieving boys than high-achieving girls, more with confident boys than confident girls, etc. (Sadker, et al., 1991, p. 298). In general, the research showed that teachers interact more with boys than girls. “The preponderance of study findings at all educational levels indicates that males are both given, and through their behaviors attract, a higher number of teacher interactions” (Sadker, et al., 1991, p. 298).

Additionally, these same researchers (Sadker, et al., 1991) found that teacher interactions are different for boys than girls. Looking at the role of attributions in teacher-student feedback, these researchers found that teachers may give more detailed and valuable responses to boys. Some research suggests this differential might lead to some learned helplessness among girls and other underrepresented groups (e.g., non-white and lower class students). “Females have been reported as entering learning situations with lower expectations of success and with a lack of self-confidence in their ability to accomplish a task” (Sadker, et al., 1991, p. 302).

Research into attitudes in mathematics and mathematical achievement often cites the work of House (1993; 1999). His study (1993) of academically under-prepared adolescent students looked at students’ expectations, attitudes, and achievement. He was surprised to find that “female students earned significantly higher mathematics course grades” (1993, p. 65) and “students with low-academic self-concept earned mathematics
course grades that were significantly lower” (1993, p. 65). He concluded that self-concept in mathematics is extremely important. House suggested that the positive difference in mathematics achievement in his study might indicate that gender gaps in other studies are partly a result of prior school experience and differences in student backgrounds. Because his study focused on under-prepared adolescent students, he noted that these students came from very similar lower-SES backgrounds. His study is important because he noted that both poor academic background and self-concept are determining factors in achievement. In fact, he noted that self-concept is critical to achievement but achievement is dampened by under-preparation. He found that white women who were under-prepared performed more poorly than their own expectations, despite high self-concept. House called for a better understanding of the interconnectedness of these two factors.

House’s work continued to show achievement gaps for women and racially underrepresented groups (House, 2009). He analyzed the Trends in International Mathematics and Science Study (TIMSS) data and found correlations between self-concept, prior academic achievement and persistence. He also linked these concepts with parental education and economic background. These studies showed quantitatively that there are connections between these factors and that they occur prior to high school. As quantitative studies, however, they were unable to uncover the internal processes for students that might affect these outcomes.

At the undergraduate level, Gupta, Harris, Carrier, & Caron (2006) studied students enrolled in entry-level math courses at a small state university. They looked at
final grades and student demographics and discovered that women in this study earned lower grades than men. Other factors they determined contributed to grade disparities included work-load outside of this course (paid work hours or course credit load negatively affected grades), and age of students (older, non-traditional students earned higher grades). Students with more positive attitudes toward math also earned better grades (Gupta, et al., 2006).

As indicated by these studies, the factors affecting academic success of women and others in the study of mathematics are complex and interrelated. Many of these studies used quantitative methods, looked at curricula and/or teacher pedagogy.

Martin (2000) used qualitative methods in his research. His focus was on African-American youth and while he incorporated parents, community members, teachers, and students among his participants, he did not link the participants into triad groups (parent, student, teacher). His work and its relation to this study will be discussed in more detail in the literature review that follows.

This study draws on research from a variety of fields of study; these works used a variety of cultural frameworks and methodologies. The conceptual framework for this study was informed by cultural anthropology (Ogbu, 1987), feminist psychology (Gilligan, Lyons, & Hanmer, 1990), critical theory in sociology (Weis & Fine, 1993), research in education (Delpit, 1988), and identity research specifically with a focus on stereotype threat (Steele, 1997). This study brought these ideas together with a strong tradition of research in mathematics education (Fennema & Leder, 1990; Fennema, Sowder, & Carpenter, 1999; N. i. S. Nasir & Cobb, 2007) and focuses on the voices of
young women students in the classroom, their perceptions of, attitudes about, and
engagement with the study of middle school mathematics.

**Definition of Terms**

Gender. To begin a study on gender issues in mathematics, we must define the use
of the term gender in this study. Gender is very complex and has a field of study to help
us understand the depths and breadths of the impact of a gender binary system on all of
our social systems, including education. For a better understanding of the term “gender”
and related issues of “sex”, “transsexual”, “transgender”, and “genderqueer”, see for
example, Riki Wilchins’ work (2002). Historically, it is important to understand the
gendering of research, most notably psychology (Miller, 1986) and why this conversation
is important to any research project involving gender. Wilchins explained this affect this
way: “Gender originated as a feminist concern; men were the norm and women
considered ‘the gendered sex’. Rather than attacking the binary, feminism emphasized a
redistributing power more equitably between the two sides” (Wilchins, 2002, p. 15).
Wilchin’s work did “attack the binary” and her research and personal narrative described
gender as a continuum rather than a binary variable defined by “male” and “female”. In
this deconstruction of the gender binary, Wilchins separated gender from biological sex.

It is important that I acknowledge here that gender is neither a neutral term nor a
binary category. However, in this study I recruited middle school girls as participants.
These girls were recruited by their teacher and identified by their teacher. The gender of
these students was not “verified” in any way other than the perceived gender of the
participant by the researcher.
Construction of knowledge. The concept of knowledge construction can be traced back to Piaget (1929) and Vygotsky (1962). The impact of this theory on education was further studied by Larochelle, Bednarz, and Garrison (Larochelle & Bednarz, 1998); their work examined the applications of the theory of knowledge construction to the everyday act of teaching for content understanding. Construction of knowledge is the understanding that each individual constructs his/her own knowledge from prior experiences individually and through social interaction. Knowledge is not an abstract collection of things separate from individuals’ understanding. When we teach a content, we are trying to help students construct a socially agreed upon meaning from a collection of experiences in and out of the classroom (Larochelle & Bednarz, 1998). The reform work in mathematics education was built strongly on the foundation of Piaget and Vygotsky. The theoretical framework of the construction of knowledge as defined above has influenced the design and implementation of this study. For example, the choice to interview parents, teachers, and students was based on the concept that knowledge is constructed by each individual and is not a static artifact. As observer in the classroom I used the lens of constructivist theory to see and analyze events as they occurred.

Mathematics reform. This study refers to mathematics reform as the effort by the National Council of Teachers of Mathematics (NCTM). Starting in 1989 and continuing through 2000, NCTM created a set of standards for curriculum, instruction, and assessment with the stated goal of improving mathematics learning for all students (National Council of Teachers of Mathematics, 1989, 1991, 1995, 2000). Following the release of these documents there were several curriculum programs developed according
to the standards set forth by NCTM. These included Connected Math Project, Integrated Math Program, the University of Chicago School Math Project (UCSMP) which led to the Everyday Math materials, Connected Math and Bridges in Mathematics.

Underrepresented groups. Studies into equity in mathematics (Hyde & Mertz, 2009; Lubienski, 2000; Martin, 2000; Secada, 1992) have looked at a variety of student demographics: gender, class, race, and ethnicity. This study looked specifically at gender but throughout the literature and discussion I used the more encompassing term “underrepresented groups” to include class, race, and ethnicity as well as gender. The conceptual framework used in this study identified the uniqueness of individual and group identity as a student interacts with school mathematics. At the same time, the study accepts that members of these group identities are less present in college mathematics and STEM fields.

**Overview of Study**

Using grounded theory as a conceptual framework, my purpose in this study was to listen to adolescent girls as they reflected on their own experiences in school and specifically in mathematics class. I found limited literature specifically focusing on the voices of adolescent girls talking about middle school mathematics. In deciding on the aspect of girls and mathematics I wanted to study, I thought about confidence and performance but chose engagement as what I hoped would be a precursor to persistence. I hoped to shed some light on why women are underrepresented in later mathematics courses and in the STEM career fields. As the literature revealed, some students are meeting course competencies in mathematics and achieving on par with their male peers.
but choose to major in other fields. With fewer women completing degrees in the STEM fields, they are subsequently underrepresented in STEM careers leading to fewer role models and mentors for future women in these fields of study. In summary, this study explored factors that were affecting engagement and disengagement with mathematics among middle school girls.
CHAPTER 2: REVIEW OF THE LITERATURE

The literature review that follows explored these issues in more depth for the purpose of developing a fuller understanding of mathematics performance among women. It begins with an historical overview of studies of women and mathematics, followed by a broad cultural gender context. The economic impact and importance of answering some of the questions around gender equity in mathematics is also explored. Many of these interrelated factors affecting student success are now being studied through various lenses in diverse fields. This review looked at classroom issues of curriculum; identity development; self-concept; and the relationship between race, class, and gender and mathematics performance, followed by an examination of the middle school literature as it pertains to mathematics education and concluding with the literature on engagement.

Historical Data of Under-Representation

Women, students of color, and first-generation / limited-income students are underrepresented in enrollments in certain college majors specifically science, math and technology. According to statistics collected by the National Science Foundation (NSF) (2007), 28% of women completed science or engineering bachelor degrees compared to 38% of men earning the same degrees (overall 32% of undergraduate degrees are in science or engineering). As defined by NSF, science includes the life sciences (biology, genetics, chemistry) as well as mathematics, engineering, physics, etc. Women earn 58% of the bachelor’s degrees but only 50% of the science or engineering degrees. However, when looking at the areas of just mathematics and engineering within science, this gap
was more pronounced. In mathematics, women earned less than 27% of the degrees and in engineering women earned less than 20% of the degrees (National Science Foundation, 2008). Similar disparities exist for minority students. In 2004, “underrepresented minorities” earned less than 17% of the science and engineering bachelor’s degrees conferred (National Science Foundation, 2007).

Sadker et al. (1991; 1986) did groundbreaking, broad scope, quantitative research on gender inequities in education. This research team compiled an overview of gender issues in education in the U.S. (Sadker, et al., 1991). This meta-analysis included a review of content (representations in literature and textbooks of girls or boys), school policy (gender segregation of classes), and administrative structures (more men in school administration, more women as school secretaries and teachers).

These researchers focused mainly on the differential interactions between teachers and boys versus teachers and girls. They found that teachers often called on boys more and interacted more with boys in classroom dialogues. They called for better training of teachers in issues of “sex-equity” in order to help teachers become aware of their own biased behaviors in the classroom. They pointed out in their study that sex-equity benefits all students not just the girls. As they stated, “How can education be excellent if it is not fair?” (p. 219). As a result of this study, these researchers helped raise awareness of gender equity in the classroom that altered preparation for teachers in all subjects (Sadker, et al., 1991).

In the 1970s and 1980s work was done within the field of mathematics education to look at the gender gap in mathematics and suggested initiatives for lessening the gap. Tobias(1978) and Ferrini-Mundy (1987) looked at gender socialization that perhaps
excluded girls from practice with spatial visualization and engineering-type problem-solving. Tobias showed that engineering students (mostly male at the time) had much experience with applications of physics and mechanics from their early childhood toys such as trucks, levers, and mechanical devices. She also showed that engineering students (males) were more likely to begin investigating a problem (working on it) even if they did not have a clear direction. Women given the same exercise were more likely to freeze and not write anything down. Ferrini-Mundy looked specifically at calculus problems and the gender differential in being able to “visualize” the problem presented to students as a function. Males were quicker and more comfortable converting an algebraic expression into a graphic visualization.

Fennema and Leder (1990) worked on teacher preparedness and supportive curriculum changes that might narrow the gender gap in mathematics. These researchers explored differences in development of boys and girls and how that relates to curriculum that promotes independent learning (“equal treatment does not necessarily lead to equal educational outcomes”) (p. 189). The researchers examined participation of boys and girls. They also looked at teacher bias as it relates to participation across gender. For example, Leder (1992) found in a study conducted in Australia that teachers worked three times longer with males they perceived to be having difficulty than with any other group. They concluded that further research is needed on what knowledge students and teachers need to learn.

Fennema’s work with Megan Lef Franke (1992) focused on the impact of the mathematical knowledge of teachers.

No one questions the idea that what a teacher knows is one of the most
important influences on what is done in classrooms and ultimately on what students learn. However, there is no consensus on what critical knowledge is necessary to ensure that students learn mathematics (p. 147).

Research looking at student achievement with respect to gender was mixed. The Trends in International Mathematics and Science Study (TIMSS) reported mathematics scores obtained in 2005 have improved over 1999 scores for all eighth grade groups in the U.S., while scores for fourth graders showed no change. The fourth grade scores for 2005 showed an increased gender gap with U.S. boys outperforming U.S. girls on the 2005 test. In the same time period, Black fourth graders narrowed the gap in scores with their White counterparts. Poverty appeared to account for the largest gap in achievement among fourth graders with a difference of 96 points between schools with the highest poverty levels versus those with the lowest poverty (National Center for Educational Statistics, 2004).

Eighth grade scores reported by TIMSS show the gender gap in scores remained even though both boys and girls improved their scores by 12 points over the eight-year period being examined. In this same period, Black and Hispanic students, whose performance remained below that of White students, demonstrated an increase in their aggregate scores. The gap between Black and Hispanic students and White students decreased from 97 points to 77 points (National Center for Educational Statistics, 2004).

Nosek, Smyth, Sriram, Lindner, Devos, Ayala, et al. (2009) used quantitative techniques to examine the TIMSS scores and the relationship between performance in mathematics and science and stereotypes measured using the Implicit Association Test (IAT). The IAT asked participants to categorize words, thus looking at underlying
assumptions about connections. For example, one item asked participants whether or not they connected “boy” with “physics” and “girl” with “music”; these connections would show a genderizing of content, an expectation that boys do physics and girls do music. Nosek’s group measured correlation between gendered performance on the mathematics and science portion of TIMSS, by country, and the responses, by country, on the IAT. The researchers discovered that while taking into account many potentially confounding variables, in countries where people’s attitudes equated science as a male domain, these same countries had persistent gender gaps in science and math performance. Showing stereotypes equating science as a male domain still persisted and affected achievement test performance. While progress has been made to improve gender equity in the mathematics classroom, this study pointed out that there are still gender differences and suggested they may be partially explained by societal stereotypes. While some might argue that the gender gap in mathematics has been studied by many, these results point out the persistence of the problem.

**Gender Factors Affecting Achievement**

Feminist theory has long asked the question of difference in development between dominant and non-dominant groups. Gilligan (1982), for example, stated: “The elusive mystery of women’s development lies in its recognition of the continuing importance of attachment in the human life cycle. Woman’s place in man’s life cycle is to protect this recognition while the developmental litany intones the celebration of separation, autonomy, individuation, and natural rights” (1982, p. 23). Gilligan argued that male-based measures of psychological development were not always appropriate when studying the development of girls and women. Studies based on male models and
theories based on studies of males used to measure the development of girls and women were inappropriate, she argued. These developmental models identified autonomy and individuation as indicators of ultimate development whereas Gilligan showed that girls often seek out relationship rather than autonomy. When measuring engagement and success in the mathematics classroom we must be careful that we are not using a biased scale.

The issue of classroom climate, especially for women, has been studied extensively and across a variety of disciplines and may contribute to an understanding of gender differences with respect to performance in mathematics. Guinier, Fine, and Ballin (1997) showed that the argumentative approach to law school education created an environment where women either adapted to the style or dropped out. Examining the culture of law school through the theoretical framework of cultural production (and reproduction) and resistance, the researchers identified the law school’s attempt to produce “good” lawyers. “Good” lawyers are those able to do combat in the courtroom, through classroom use of the Socratic Method, where students are singled out and confronted about their assertions, as a central element of the culture (Guinier, Fine, & Balin, 1997, pp. 58 - 59).

Holland and Eisenhart (1990) studied undergraduate women at two different institutions, one historically Black college and one historically White. The researchers discovered that a counter-sub-culture emerged among the women students that emphasized their femininity (as defined by the larger culture) focusing on things like dress, social outings, and societally-defined aspects of attractiveness. In interviews the women identified their perceived attractiveness to be a more efficient and achievable path
to success (a career in law) than the average male law students’ path of gaining positive attention from faculty through competitive accomplishment (Holland & Eisenhart, 1990).

Later, Allan and Madden (2006) reviewed research literature suggesting the existence of a “chilly climate” for women in certain fields and reported that women in mathematics and engineering felt invisible, incompetent, and actively discouraged (emphasis added by this author) from further study. Their mixed methods approach identified discouragement coming in a variety of forms, ranging from faculty calling on males more frequently to a perceived lack of support on the part of the women because faculty did not reach out to them. In my study, I focused on engagement and factors identified by the girls as affecting engagement as a way to examine this issue of active discouragement. Are there factors in and outside of the middle school math classroom that are working to actively discourage girls from engaging with the mathematics?

Allan and Madden (2006) also pointed out that research methods had a significant impact on the type of findings in research into classroom climate and that researchers should be wary. Their data showed on the one hand that at least 25% of female undergraduates in their study experienced chilly classroom climates. However, when looking at aggregate data about classrooms, they suggested one could have concluded that chilly classrooms were rare. Finally, qualitative data showed many female undergraduates in their study experienced chilly climates. My study looked specifically at qualitative data to try and uncover this, among other, aspects of classroom climate.

The literature to date showed an ongoing gap in who was present in college mathematics classes and STEM careers but this was based largely on one type of findings (quantitative); more research is needed to fill out the picture by using more qualitative
studies to examine factors affecting the underrepresented groups in mathematics. Research into gender and other identities needs to use a variety of methodologies in order to understand the full picture.

**Factors in the Mathematics Classroom**

*Issues of Identity in the Mathematics Classroom*

Claude Steele’s (1997) research suggested stereotype threat as a factor affecting climate and differentially affecting women and students of color. Pronin, Steele and Ross (2004) joined together to explore the ways undergraduate women coped with stereotypes that suggest women are less qualified to do mathematics than men. Their study examined a “bifurcation” of identity of women in mathematics environments such as the mathematics classroom, engineering classroom, and study groups. Women in these mathematics environments exhibited less feminine attributes (avoided a feminine appearance, avoided flirting, avoided emotionality, and did not discuss any desire to have or raise children) than they did outside of these environments.

Herzig (2004) added to this research with her study of why undergraduate and graduate women and students of color leave the study of mathematics. She pointed to a lack of role models and mentoring for these underrepresented students, a sense of isolation and surprise among the women once these students reached the point of doing dissertation research (after being successful in earlier coursework), and a chilly climate where professors may not be confident in the women’s ability to succeed.

Nasir, Hand, and Taylor (2008) looked at the impact of culture versus the knowledge domain on student access. For example, they asked us to consider whose mathematics we are constructing, what languages are being used and what communities
are represented in the algorithms we use. These researchers presented a triad construct showing the interaction between math knowing, math learning, and math education. They presented an illustrative example of African-American basketball players’ ability to think mathematically when problems were presented to them in the context of basketball compared to the way they got bogged down trying to recall algorithms from math class when the context was more abstract (N. S. Nasir & Cobb, 2002).

Bong and Skaalvak (2003) conducted a meta-analysis of research looking to tease out the similarities and differences in self-concept, self-efficacy, and self-esteem across content areas. They then applied their findings to the relationships between these concepts and motivation and engagement.

We believe that academic self-concept research would also benefit from separating perceived competence components from other elements and examining the specific contributions of each major constituent. This approach should generate specific guidelines for how these components are linked within the broader self-system and for when each of them is most useful for predictive and explanatory purposes. (Bong & Skaalvak, 2003, p. 30)

Martin (2000) examined African-American students in mathematics classes and identified social, cultural, and specific classroom forces influencing students’ engagement in mathematics classrooms. He grouped these influences by community beliefs, school and teacher beliefs, and the students’ sense of self-agency. Martin conducted a year-long ethnographic study of African-American students, their parents
and teachers. Martin used a conceptual framework linking sociohistorical factors for African-Americans, community, and school all impacting the individual.

Cobb, Gresalfi, and Hodge (2009) used Martin’s concept to identify three cases: students who identified with the mathematical activity, students who cooperated with the teacher and classroom activity, and those who resisted engaging. Cobb et al. defined two types of identities, normative and personal, and used these to conduct an empirical analysis of two middle grade classrooms of students. They distinguished between the two types of identities, noting “[n]ormative identity as a doer of mathematics that is established in the classroom and personal identities that individual students develop as they participate in classroom activities” (Cobb, et al., 2009, p. 43). Both classrooms studied had the same 11 students but used two different approaches to the mathematics. One classroom was a classroom constrained by the usual time and curriculum pressures. In this classroom, students needed to focus on procedural problem solving and prepare for a culminating district achievement test. The second classroom was a designed experiment classroom with no such constraints. The researchers found, among other things, that students in the first classroom measured their success by the grades and feedback they received from the teacher. They described their difficulties as being beyond their control. In the second classroom, which used no tests or grades, students described their performance, as well as the performance of their peers, as being successful (Cobb, et al., 2009).

The “culture of power” (a term coined by Lisa Delpit, 1988) in the mathematics classroom is controlled by those who understand the language and symbols used in the classroom. Delpit has focused on students of color, specifically African-American
students, but the issues around language and symbols are important in the mathematics classroom. There is an identified culture in the mathematics classroom complete with a language, symbolism, and behavioral expectations. Delpit’s culture of power for African-American students in a school culture dominated by Whites has a parallel in a mathematics classroom where underrepresented groups encounter a culture dominated by White males. Cobb, Yackel, and McClain (2000) pointed out that identifying as a student who can do mathematics, who can persist at mathematics successfully, who can enjoy mathematics should include those students who come with an understanding of concepts without, perhaps, a strong grasp on the formalities of school mathematics.

Boaler (2002) found that reform efforts in the mathematics classrooms of the 1980s (specifically Cognitively Guided Instruction (CGI) type reform efforts) may have inadvertently reproduced the culture of White middle-class norms. She warned we must be careful that well-intentioned reform efforts do not continue to perpetuate the inequities of the past. Boaler cited Delpit’s (1988) examples of White middle-class children being more comfortable with indirect statements while Black working-class children tend to like facts and direct statements. For example, according to this theory, Black working-class children would be most comfortable learning mathematics through number facts and algorithms and less comfortable constructing knowledge through abstract problem-solving scenarios. White middle-class children, alternatively, would be more comfortable “exploring” mathematical ideas through teacher-constructed problem-solving scenarios.

Cobb et al. (2009) extended the work of Boaler (2002), Delpit (1988), Martin (2000) and others to explore an understanding of these mathematical identities. These
researchers used empirical analysis to document the forms of agency adopted by students, as well as the way in which authority was distributed in the classroom (Cobb, et al., 2009). Their stated goal was to provide a clear definition of mathematical identity (identifying with, complying with or resisting engagement in classroom mathematics) as it relates to mathematics teaching and learning (Cobb, et al., 2009).

In recent years, researchers have become interested in expanding research on mathematics performance to explore the underlying reasons for differences among particular groups of students. Boaler (2002), for example, called upon the mathematics education reform movement to look beyond curriculum and include how the curriculum is brought to life in the classroom. She insisted that we look at teacher practice. She rejected the arguments that open-ended problem-solving classrooms are places where only middle-class students can succeed. Instead, she asked the mathematics research community to look at practices that will ensure success of all students in this environment.

Cobb and Hodge (2002) asked mathematics education researchers to look beyond counting who is joining the conversation in the mathematics classroom. Echoing Boaler’s (2002) work, these researchers called on the field to expand its knowledge base beyond mathematical content alone.

One challenge in attempting to develop useful interpretive frameworks is, therefore, to consider how constructs and strategies developed in other fields might be appropriated and adapted to the concerns and interests of mathematics education. (Cobb & Hodge, 2002, p. 251)
The work of Guay, Marsh, and Boivin (2003) drew upon the psychological literature to explore the link between self-concept and academic achievement. While acknowledging the strong correlation between the two, they emphasized a reciprocal relationship where self-concept affected academic achievement, which affected future self-concept and so on.

**Curriculum Initiatives**

Curriculum was an early focus of mathematics education research reform (Peterson, Fennema, & Carpenter, 1988). Studies explored the effects of the fact driven, isolated way in which mathematics was taught and learned. Textbooks were questioned for the direct approach or “skill and drill” approach used in materials. As other areas of education began looking at the construction of knowledge and pedagogy of teaching, so too did mathematics educators.

In the early 1990s, Fennema’s research in mathematics education focused on Cognitively Guided Instruction (CGI) where classroom teachers were encouraged to create problem-solving environments for students to build their own mathematical knowledge and understanding. Group work was emphasized and a mathematical discourse was envisioned between students and students and the teacher. Research into the effectiveness of CGI showed that young students retained and understood their arithmetic facts better than students from non-CGI classrooms. More pertinent to this review, students in CGI classrooms were more confident about their abilities in mathematics (2008). However, even with this innovative instructional method, gaps between achievement for White males in mathematics and all other students persisted.
In fact, Fennema found that males developed and used more advanced forms of problem solving. She has since been quoted in correspondence with Walter Secada as saying that “she wishes she had insisted the CGI teachers had pressed their female students to use more advanced strategies” (Secada, 2009, p. 464).

Penner and Paret (2008) showed in their longitudinal study of gender difference that the gap in mathematics achievement increased between kindergarten and fifth grade. The CGI reform movement in mathematics was aimed at closing this gap. Unfortunately, after over a decade since the introduction of curriculum materials, textbooks, teacher training courses, this gap still exists.

Persistent Gender Gap

Nasir and Cobb (2002), in the introduction to their 2002 book on diversity and equity in mathematics, maintained that the gender gap still existed in the classroom. They, too, called for further investigation into the processes taking place in and outside the classroom that maintained this relatively stable gap.

Muzzatti and Agnoli (2007) used a quantitative approach to examine stereotype threat as it pertains to gender. Their study of 476 elementary children in Italy found that a gender difference in self-confidence in one’s own mathematical ability was significant. They replicated the study in middle-school aged children and again found the persistent gender gap.

Middle School Research

Along with general studies of mathematics achievement and issues related to gender, race, and class, a growing body of literature has explored mathematics at the middle school level. Lubienski (2000) conducted action research in her own middle
school classroom looking at socio-economic class and students receptiveness to the Chicago Math Project (CMP) curriculum materials being newly introduced by her. CMP follows the guidelines of the CGI reform efforts; students are expected to explore problems and construct understanding. Lubienski noted that the higher-SES students seemed to be more comfortable with the new curriculum adding that lower-SES students wanted more directive teaching and perhaps had weaker prior knowledge.

Vermeer et al. (2000) took a more quantitative approach and looked at sixth-graders’ performance by gender in mathematics. They discovered using Chi-square analysis that girls performed better than boys on computational tasks and boys performed better than girls on problem-solving tasks. They also found, in multivariate analysis, a strong correlation linking tasks, confidence and gender. They concluded that boys were more motivated to attack the problems showing more initial confidence than girls. They were surprised to learn that given more practice, girls participated in the problem solving and did persist. “It is important to know how and when students develop inaccurate beliefs about themselves and why they put in the effort” (p. 314).

Engagement

Marks (2000) examined student engagement. Using a quantitative approach, she surveyed students at three grade levels (grades 5, 8, and 10) and analyzed their responses. She constructed engagement as a combination of four factors: “student effort, attentiveness, lack of boredom in class, and completing assignments” (Marks, 2000, p. 162). In her review of the literature, she confirmed the connection between engagement and achievement, i.e., more engaged students have better grades and perform better on assessments. She also noted that engagement could vary widely within one classroom.
Bronfenbrenner (1986) outlined a theory of alienation and child development. He discussed the “four worlds of childhood”: family, peers, school, and work (p. 432). He described the worlds of childhood as under a lot of pressure in our society today. Families are financially stressed, often distanced geographically from extended family, and parents are most often both working and struggling to have time to be home watching the children, interacting with the children, preparing meals, etc. Bronfenbrenner identified that especially for adolescents it is important for children to interact with people older and younger than themselves. If they only interact with their own age peers, they have no role models or mentors for learning about caring relationships and moral development. In general this led to alienation in the general sense of disengaging from all but their small peer group; this alienation included disengagement from school and homework as these activities happen outside of the peer group activities. School, work, and family could help combat these pressures towards alienation by encouraging students to interact in meaningful activities across age groups: mentors or parents working with children on making time to do homework, families volunteering together in community activities, etc. This larger area of alienation influenced engagement in a specific content area, like mathematics. In addition, specific content area engagement could be encouraged with parental and or school support.

George Kuh (Kuh, Cruce, Shoup, Kinzie, & Gonyea, 2008) studied engagement among first year college students. He and his colleagues defined engagement as time spent studying, time spent in co-curricular activities and a third global engagement factor. This third factor was calculated using student survey responses to 19 separate items ranging from “asked questions in class” to “used e-mail to communicate with an
instructor” (Kuh, et al., 2008). As with Marks’ (2000) work, defining engagement partially in terms of time spent studying creates a circular effect when trying to tease out engagement and performance. Nonetheless, Kuh and colleagues showed that engagement led to persistence among first-year college students.

Mireles-Rios (Mireles-Rios & Romo, 2010) examined engagement among students in middle school mathematics and reading. She conducted surveys and 15-minute interviews with 69 girls in grades 3 through 8. Mireles-Rios found that the more the girls talked with their mothers about grades, the better the girls’ scores in math and reading and the more the students reported liking math. Although she conducted 69 interviews her study did not report any data from the interviews making it difficult to compare to interview data collected in my study. In addition, her definition of engagement was not explicit in her published study.

There were indications across all of these studies that engagement is an important factor in student success generally and potentially in mathematics specifically. However, none of these studies uncovered the voices of the students being studied. All the studies implicitly or explicitly defined engagement as participation with school (and/or specifically math) both in and out of the classroom.

**Economic Inequity of Excluding Some from Well-paying STEM Jobs**

The literature also showed that as women, students of color, and other marginalized students became discouraged from further study in mathematics, these same groups were excluded from the fields of Science, Technology, Engineering, and Mathematics (STEM) and the well paid career paths to which these lead. According to the US Bureau of Labor (US Bureau of Labor Statistics, 2008), 40% of the people in
computer and math occupations were women. These women earned a median weekly salary of $1,088 compared to $1,320 for men (82%). Education and training was a more female dominated field with 73% of the jobs occupied by women earning a median weekly salary of $753 compared to $866 for men (87%). Women in these professional fields were doing better than women overall. Overall women’s median weekly earnings were 77% of that of men’s. However, women in computer and math occupations earn 44.5% more than women in education and training occupations (US Census Bureau, 2008).

Women represented 43% of “householders” (formerly known as heads-of-household) in family households. Since our economy and the health and welfare of our children depend largely on economically successful households, ensuring women are financially successful is of critical importance to our society (US Bureau of Labor Statistics, 2008). Financially successful women and households reduce the burden on government aid programs such as Aid to Families and Dependent Children (AFDC), and various other state supported programs that subsidize children’s health and education costs. Combining this data, we see a majority of our educators (73%) were women teaching our children to enter fields (i.e., computer and math occupations) dominated by men (1995).

**Brief Overview of Research and Reform Efforts in Mathematics Education**

Research in mathematics education in the past 20 years has used a variety of approaches to explore mathematical literacy and the dynamics of the K-12 mathematics classroom. Cobb and Bauerfeld (Cobb, et al., 2009) worked to bring together researchers from different traditions, including activity theory tradition, sociolinguistic tradition, and
neo-piagetian traditions. They pointed out the complexity of examining a particular student’s mathematics learning. These different traditions looked into a classroom with focus on different aspects of the students, i.e., psychological development, linguistic patterning, and interactions among participants. By bringing these different traditions together, these researchers were able to combine some of the traditions to hypothesize more broadly about mathematical learning.

A major approach endorsed by the National Council of Teachers of Mathematics (NCTM)(2000) was to increase opportunities for students to explore mathematical concepts and decrease drilling exercises for memorizing facts. In a Reform classroom students are encouraged to construct their knowledge through exploration, experimentation, and interaction. Teachers using this tradition must create a classroom culture open to discourse and defense of ideas. However, each student in the classroom comes from many cultures: the culture of school, the culture of their family and racial/ethnic history and traditions, the culture of the communities they and their families identify with. These intersections give rise to variation in the construction of concepts that each student creates.

Cobb and Bauerfeld (1995) looked at which students participate in mathematical discourse in the classroom and how students who are not participating are encouraged to access the dialogue or discouraged from participation. Obstacles to participation include differences in community practices. For example, in mathematical discourse there is an expectation of debate and some students come from communities where this form of dialogue is discouraged (Esmonde, 2009). Especially in mathematics classrooms based on constructivist theory, interaction with others is critical to increasing knowledge.
This leads to another aspect of difference: demographics of the classroom and its effect on student success (see for example Grouws, 1992). Secada has been a strong proponent of equity for many years and has criticized the mathematics education research community for marginalizing the research efforts in this area. Some claim that mathematics is without culture and therefore more accessible; however, research has shown that indeed there is a culture built in the classroom. This culture decides who speaks, what language to use, whose answers count, and so on. Students who come from circumstances that lead to poor early mathematical understanding will have a difficult time joining the conversation. It is well documented that school funding strongly correlates with student foundational knowledge (Payne & Biddle, 1999). Students from less well-funded schools and communities had a difficult time keeping up in mathematical discussions with students from better funded schools.

**Summary and Questions**

As many of these researchers have explicitly or implicitly stated, the question of equity in mathematics education is complex. Substantial research has been conducted on the relationship between mathematics achievement in relationship to curriculum content and design, as well as on numerous other factors that may be contributing to and/or interacting with curriculum design. The latter included instructional delivery, classroom climate, mathematics identity, confidence and motivation, and students’ status with respect to race, class and gender. In spite of numerous curriculum reform efforts, an achievement gap in mathematics remains across gender, race, and class. All of the studies reviewed concluded that differences exist in math achievement between White males and all other demographic groups. With respect to gender, the preceding review of
the literature demonstrates that there are inequities in the performance of girls and boys in
the mathematics classroom, and that even high performing girls were leaving the study of
mathematics over time. Engagement has been studied less extensively and its definition
remains complex.

Clear statistical evidence showed the economic disparity that these gaps
perpetuate in the workplace and in the economic stability of households across the U.S.
We must look beyond teaching what we have accepted to this point as the given body of
knowledge and examine what is best for an increasingly diverse classroom and a world of
global problems that need to be solved. The research community needs a better
understanding of the problem before substantive policy or curricular solutions can be
implemented.

Implications

This study explored the area of research with which I am most interested, and
which received little attention in the current literature; namely, the underlying factors that
may help to explain mathematics engagement among middle school girls. While research
is clear about the fact that a mathematics achievement gap persists with respect to gender,
it is less clear about the underlying reasons for differences in performance, and in
particular, differences in the performance of girls at the middle school level. To date,
most studies have employed quantitative measures that focus on differences in
performance without exploring the reasons for those differences. This study listened to
the voices of students, adolescent girls, and their perceptions of engagement and
performance. Numerous questions emerged for me as I reviewed this body of literature.
As students participate in the construction of mathematical knowledge, are they
integrating their new competencies with the other identities they bring to the classroom?
Is the mathematics classroom acknowledging the various communities it is serving? Are middle school girls feeling tension between normative and personal identities in the mathematics classroom? While Bronfenbrenner (1986) and Kuh et al. (2008) have defined engagement in fairly broad terms, what definition can we use to examine engagement in mathematics?

This study defined engagement in a manner similar to Marks (2000): time on task in the classroom, homework completion, and interactions outside of class with the teacher and or other adults (parents, school staff, community homework sessions, etc.)

This qualitative study contributed to the literature base by exploring the process of engagement and disengagement and the factors that contribute to engagement or disengagement. My study was unique in its attempts to explore factors of engagement and disengagement from the perspectives of middle school girls and their parents and teachers. The use of qualitative methods brought to light a complex and interrelated set of variables that contributed to engagement and disengagement and will aid researchers, practitioners and policy makers in addressing this persistent problem. Efforts to reform curriculum and/or teaching methods must be informed by a better understanding of why some female students engaged more fully in pursuits other than mathematics.
CHAPTER 3: METHODS

Problem Statement

The problem is that according to research cited in the previous section there is a gender gap in mathematics engagement. There is limited research listening specifically to the voices of girls and their parents and teachers about the girls’ perception of this problem.

Research Statement

The purpose of this study is to learn about the underlying factors that may help to explain differences in performance and engagement among middle school girls in mathematics.

Research Questions

- How do middle school girls perceive their performance in mathematics?
- What do middle school girls perceive as central messages about their abilities and interest in mathematics (internal and external messages)?
- What role do parents, teachers, and peers play in these girls’ performance and engagement in mathematics?
- How do middle school girls perceive their place in the mathematics classroom, dialogue, and curriculum?

Rationale for Research Methods

As outlined in the previous section, the literature in the areas of gender, mathematics, and equity in the mathematics classroom shows much quantitative evidence that indeed women are leaving mathematics. The data from middle school, high school,
and college show that women are achieving at higher rates than they used to, but leaving mathematics as an area of study and profession.

To answer the process questions underlying the quantitative evidence that young women are less confident in mathematics and are disengaging from the study of mathematics, this study used qualitative methods of interviewing and observations. Maxwell (2005) described the pursuit of process questions as appropriate questions for qualitative research methods. He particularly identified “understanding unanticipated phenomenon” and “the process by which events occur” (2005, p. 75) as more appropriate for study using qualitative methods than quantitative methods. Glesne (2006) stated, “Qualitative studies are best at contributing to a greater understanding of perceptions, attitudes, and processes” (2006, p. 29).

**Overview of Methods**

After choosing the middle school for this study, the principal was asked to identify one math teacher at the middle grades level (6, 7, or 8) to participate. The principal was asked to choose a teacher with a VT Mathematics teaching license who might be willing to participate. In addition, I asked that the principal look for a teacher who could be described as dynamic and engaging. This teacher was then asked to identify three “high performing” and three “low performing” girls in her math class. This teacher was asked to choose among students receiving their primary mathematics instruction in the general classroom. The teacher had some flexibility in determining “high performing” and “low performing” students based on classroom performance, classroom evaluations, homework completion, and observations. This flexibility was intentional on my part; as evident in the interview questions (Appendix A), the reasons
this teacher identified students as “high-” or “low-performing” were another factor explored in the study. The teacher was interviewed twice during the study for approximately one hour each time. The first interview was conducted at the start of the study and the second occurred after the observation period had concluded.

In addition, the teacher kept a journal during the two week observation period. She included her immediate reactions to that day’s teaching, student interactions, and her own experience of the mathematics in the classroom.

The six girls were interviewed twice during the study for 30-60 minutes each time. The first interview provided a baseline and an introduction to me and to the study. The second interview allowed me to follow up on some of the journal entries, the classroom observations, and the teacher and parent interviews.

The parents of each of the six students also participated in the study. The parent the student identified as the one she was most likely to go to with questions about math was interviewed along with the teachers and the students to present a full picture of the students’ sense of themselves as math students. There were six parents in total.

Through the use of interviews, I looked for emergent themes describing the process affecting students’ gain or loss of confidence and/or sense of engagement or disengagement. In addition to interviewing the teacher, the six students, and the six parents, I observed the classroom daily for two weeks.

All six girls were asked to keep a journal throughout the project. Girls were given prompts to choose from to direct their writing (see Appendix C). The purpose of the journal is to help understand some of the girls’ metacognitive thinking and emotional reactions to mathematics. Some of the prompts directly asked the students to reflect on
aspects of their identities in the classroom. Observations and journals provided additional means to triangulate the data obtained through interviews.

Finally, individual New England Common Assessments Program (NECAP) scores on mathematics before the observation period were obtained from the school to provide context to the selection of students and reported academic achievement. Specifically each student’s overall mathematics score and mathematics sub-scores were obtained from the principal.

Table 1 provides an outline of which methods were used to address each of the research questions.

**Table 1. Methods Used in this Study to Address Each of the Research Questions**

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Teachers</th>
<th>Students</th>
<th>Parents</th>
</tr>
</thead>
<tbody>
<tr>
<td>How do middle school girls perceive their own performance in mathematics?</td>
<td>Interviews</td>
<td>Interviews, journals and observations</td>
<td>Interviews</td>
</tr>
<tr>
<td>What do middle school girls perceive as central messages?</td>
<td>Interviews and journals</td>
<td></td>
<td>Interviews</td>
</tr>
<tr>
<td>What role do parents, teachers, and peers play?</td>
<td>Interviews, journal, e-mails</td>
<td>Interviews, journals, and observations</td>
<td>Interviews</td>
</tr>
<tr>
<td>How do middle school girls perceive their place within the mathematics classroom, dialogue, and curriculum?</td>
<td>Interviews</td>
<td>Interviews, journals, observations</td>
<td>Interviews</td>
</tr>
</tbody>
</table>

**Site and Participant Selection**

I chose a local area middle school with a diverse population to be the site for this study. This location was chosen partly for ease of access to the school and the
participants. Because it is located geographically near me, frequent visits were more easily achieved. Similarly, access to parents was easier and I was able to be more flexible in time and place of interviews.

This particular school was also chosen because it has multiple middle-level math teachers and a diverse student population. Approximately 14.18% of students are English Language Learners compared to 1.78% of students in the state (School District, 2008) and 46.84% of students received free- and reduced- lunch, compared to the state average of 29% (State Department of Education, 2008). Racial diversity is limited within New England and in this state, which has a White school population of 93.94%. This particular school represents one of the more racially diverse schools in the area, with a White population of its school district of 74.18% (State Department of Education, 2008). In terms of academic achievement as measured by the NECAP tests, this school has 48% of its pupils performing below the “Proficient” level while statewide 35% of students are performing below “Proficient” (State Department of Education, 2008).

The purposeful sampling method Patton (1990, p. 171) described as “intensity sampling” was used in the selection of participants. As Patton related, intensity sampling allows the researcher to look at variability of experience without necessarily selecting the extremes. Maxwell (2005) explained that this type of sampling has as its goal “to adequately capture the heterogeneity in the population” (2005, p. 89). My hope was that by selecting six students, three “high performers” and three “low performers” (as identified by the teacher), I gathered sufficient information about the girls’ experiences to examine the processes of engagement, confidence, and achievement in mathematics (Patton, 1990).
The principal of the middle school was asked to choose one middle level mathematics teachers for participation. The principal was asked to choose a teacher with a VT Educator’s License in mathematics. In addition, the principal was asked to choose a teacher she perceived to be dynamic and effective and willing to participate in this study. The principal was initially concerned that given current environmental and budget conditions no teacher would want to participate. To solve this concern the principal e-mailed the description of the study to all eligible teachers and asked if anyone was interested. The principal received two volunteers, one male and one female. The principal and I agreed that since the principal felt both met all the criteria we would choose the female teacher to collect richer data regarding girls’ and women’s experiences with mathematics.

The teacher was asked to identify three “high-performing” girls and three “low-performing” girls in her math class. I asked the teacher to choose the girls from among students receiving their primary mathematics instruction in the general education classroom. The teacher was asked to use class participation, performance on classroom assessments, and homework completion as criteria for selection. Within these guidelines, the teacher had some flexibility to make the choice based on her own choice of methods and perceptions. This was intentional so that I could also look at the teacher’s selection method to try to understand how the teacher perceived “high-“ and “low-performance”. This selection process resulted in a total of six students, with two alternate students to be selected in the event that the parents of any of the first six students declined to give consent for their participation or the participation of their daughter in the study. The teacher, with the principal’s assistance, then mailed the approved recruitment letter to all
six households and followed up with the students in receiving the contact information so that I could contact them.

I then contacted one parent of each student. The parents interviewed for the study identified themselves as the parent that was most likely to help their daughter with her mathematics homework. Many of the girls did not do much homework at home but identified this parent as the one they went to with questions.

Parental consent and student assent was obtained at an initial meeting. I arranged times and places to interview these parents one-on-one in one hour semi-structured interviews. I also gave the students a journal with the journal prompts included and asked them to begin writing every day for 10-15 minutes.

The students were interviewed during study hall time at the school. These semi-structured interviews lasted 30-45 minutes each. Each student was interviewed twice: once near the beginning of the study and once after most of the observations had been completed.

**Research Procedures**

**Data Collection**

**Interviews**

One-on-one interviews were conducted with the teacher, all six students, and four of the six students’ parents. These were semi-structured interviews (see Appendix A for interview questions) and were conducted in the school for teachers and students. Parents were interviewed in their homes with the students not present. Interviews were recorded and transcribed. Pseudonyms were mutually agreed upon at the initial meeting and used in all electronic transcriptions.
Two semi-structured one-hour interviews with the participating middle school mathematics teacher were conducted. The focus of these interviews was to understand the teacher’s choice of students, the teacher’s view of the curriculum, and the teacher’s hypothesis as to why girls disengage from the study of mathematics. In these conversations, the teacher was also asked about her own engagement in mathematics and how she acquired or lost that sense of engagement.

The six students were interviewed individually for 30-45 minutes at two different points in the study period. They were interviewed near the start of the study and a second time after several weeks of the study had been completed and the girls had made some entries in their journals. The second interview used each girl’s journal prompts for the conversation as well as observations I had made during my time in the school. The focus of these interviews was two-fold: to build rapport with the students and to better understand the forces affecting the girls’ choices in mathematics. These interview questions are listed in Appendix B.

I arranged one-hour interviews with the parents of each of the six girls. The semi-structured interview questions focused on the parents’ sense of their daughter’s ability, confidence, and future interest in mathematics. In addition, questions were designed to uncover any messages from the parents to the daughter regarding mathematics as a field of study or future career. These interview questions are listed in Appendix D.

Observations

Classroom observations were conducted daily over a two-week period during the portion of class time dedicated to mathematics. I conducted these observations with a focus on how the teacher and selected students interacted, and how the selected students
participated in class, looking for patterns or emergent themes. I took handwritten notes and later coded these.

Each day in the classroom I marked the date and chose an observation method. I chose different behaviors to focus on during each day that I observed the class. For example, I counted teacher-student interactions by gender one day and hands raised by gender another. Some days I marked the time at specific intervals and noted who was speaking at the time and who was working with whom.

**Journals**

Each of the six girls was given a journal with prompts for daily writing about their sense of success and failure in mathematics. These daily entries provided an opportunity over a longer period than the interview to glimpse some of the girls’ thoughts and experiences with mathematics. Girls were provided with a series of prompts to choose from (see Appendix C). The directions for journaling was left open-ended in hopes of providing some insight into any internal conversations that took place while the students are in class or doing mathematics homework. These journals provided more information about these girls. It also provided a check on what Gilligan et al. (1990) described as adolescent girls sense that they cannot always be honest with adults about their feelings. The second interview with each of the girls utilized the journals and my observations as a conversation starter and a focus of the interview.

The girls were given some creative license with the journal and with their pseudonyms. I hoped by allowing them to decorate their journals, name themselves in the study, and choose from among journal prompts they would feel more invested in the study. Combined with the data gathered in the interview and through observations the
journals helped provide more depth to the girls’ perspectives. The journals were
collected at the end of the observation period.

I kept a field journal throughout the study of all observations, interviews,
meetings and interactions with participants and field notes. I noted my own attitudes and
biases while in the school or interviewing participants. I also kept drawings of the
classroom setup and noted the extent to which the identified students participated in class.
The field journal was used sparingly during interviews; I relied on audio recordings and
transcripts for interview notes.

Individual New England Common Assessments Program (NECAP) scores for all
six students were collected. NECAP tests are administered every fall in grades 3 through
8 and 11. 2009 scores from participants were collected from the principal for use in
triangulating other data, no statistical analysis of scores was conducted. I collected the
combined mathematics score and the academic achievement level (Proficient with
Distinction, Proficient, Partially Proficient, and Significantly Below Proficient) for each
student.

Data Analysis

All interviews were transcribed into electronic form. Once all the data were
transcribed, interviews, journals, and field notes were re-read and coded. Initially, codes
identified the category of the participant (student, parent, teacher), general markers
regarding engagement, disengagement, confidence, support, mathematics performance,
future aspirations, and verbal or non-verbal messages. Later, as themes seemed to arise,
these became codes and the data was re-read for incidences of these new themes.
I used Maxwell’s (2005, pp. 96 - 99) descriptions of organizational, substantive, and theoretical categories. Under organizational categories, I coded for statements regarding confidence, engagement, future aspirations, achievement, and identity. Substantive categories developed as the research proceeded, including how seats were negotiated and peer relationships.

Coding began at the start of the observation period and continued throughout the research process. Initial codes were applied and then modified as the transcriptions became available. This process involved reading and re-reading transcripts as new codes emerged.

Using Qualitative Data Analysis (QDA) software, the data were collected and connected along codes. I looked for themes across and within groups (teachers, students, parents). I decided to group my cases around the girls and their teacher and look for themes within and across different groupings (high- and low-performing, family structure). Thus I used seven cases, the six girls and the teacher, and connected all data to one of the seven cases. Within each case I coded journals, interviews and observations. Parent interviews were coded within the case of their daughter.

Six themes arose from the data: classroom seating, relationship with the teacher, social networks, engagement and performance, structuring the class, and the algebra class. I then focused my research questions on each of the six themes. I discussed my observations and emergent themes with the participating teacher for further input and impressions. The teacher was able to provide perspective on school culture and norms and add context to my observations.

Data Security
All notes, permissions, and recordings were kept in a locked filing cabinet in my home. All electronic notes were kept in password protected files on my laptop and back-ups were stored on flash drives which were kept in the locked filing cabinet with the notes and recordings.

**Researcher Bias**

I am a former middle school mathematics teacher and did some substitute teaching in the participant school under the direction of the current principal. Thus I am comfortable with the setting, student population, and teachers. In addition, I have worked with parents through previous experiences in teacher conferences and tutoring sessions.

I am a Highly Qualified Teacher in middle school math and am licensed to teach in this state in grades 7-12. These qualifications made me quite comfortable with the content, curriculum materials, and classroom management techniques used in the classroom.

This comfort may also have led to some researcher bias. I had preconceived opinions about “good math teaching” and opinions about curriculum materials and classroom pedagogy. I worked to raise my awareness of these while observing and interviewing and worked to keep myself as objective an observer as possible. “[W]hat an interviewer asks and hears or an ethnographer records depends in part on the overall context, the immediate situation, and his or her training and theoretical proclivities” (Perakyla, 2005, p. 869). I used my field journal to reflect daily on my own impressions, experiences, and biases while conducting the study.

I am (and was) a good mathematics student. Although I experienced some disengagement and micro-aggressions in graduate school, my elementary school, middle
school, high school, and college mathematics experiences were very positive. I am comfortable in the discussion of mathematics topics and quick to follow many different explanations. As researcher I needed to be particularly aware when students, teachers, or parents were uncomfortable and worked to ameliorate discomfort in the interview settings.

I used my field journal to check these biases during the data collection period. The field journal was also helpful to put apparent themes into perspective and note possible impact of research bias.

In addition, I used several critical friends as readers throughout the process of interpreting data. Every month, I submitted drafts of case studies and data analysis for feedback and reflection. In the early stages, I asked these critical friends to reflect on themes and coding systems as I developed them.

**Limitations of Research Study**

As a qualitative study, the emergent themes cannot be generalized beyond the setting of this study, these girls, this teacher, and this school. This study focused on the goal of providing a rich, deep description of the thinking patterns and behavior that these girls exhibited during the period of study. These descriptions will shed some light on the factors affecting engagement and disengagement in mathematics.

I have chosen gender as a focus of this study despite the fact that some have argued the study of gender in mathematics is overdone. My choice was based partly on the limitations of the demographics of this region. My research interest is on underrepresented students in mathematics. In a school with limited racial and economic diversity, I have chosen to look closely at girls as one of many underrepresented groups.
While these findings cannot be generalized to other groups, this study can contribute to a better understanding of engagement, self-confidence, and achievement and the interrelationships between them. This study provides an opportunity to begin to understand the hidden forces at play within adolescents in the mathematics classroom.

After I had made arrangements to be in this particular school and met this particular teacher, I learned a few things that limited this study. First, the seventh and eighth graders at this school have a tracked curriculum, meaning that students are sorted and grouped by some measure of ability. Eighth graders have students in four different levels (geometry, algebra, main, and remedial). The classroom I observed was deemed the “main level” of mathematics, neither high achievers (those sent to the algebra class) nor low achievers (those in a math class with a slower pace and more support staff). In addition, the classroom I was in had eight girls total so most, but not all, of the girls were part of the study.

Two of the six parents, although they consented promptly to participation in the survey, became very difficult to interview. Both would cancel arranged interviews at the last minute and neither was answering my phone calls. One of the two had the phone disconnected during the time I was trying to establish an interview appointment. I spent six weeks attempting various ways to meet each and conduct an interview (including phone interviews) but neither mother made herself available. Since they did not become “unavailable” until after the observation period I felt I could not replace these participants in the study.
CHAPTER 4: FINDINGS

I organized my findings in two main categories: description and analysis. The description portion sets the context and backdrop for the study. Here I describe, in some detail, the school and the participants. I introduce the students and their parents in alphabetical order by the students’ pseudonyms. I did not assign pseudonyms to the parents or the principal; instead I refer to the parents of each particular student (e.g., Emmy’s parent) and refer to the principal only by title. When other students are mentioned the names used are fictional.

I was in this setting over a period of two months. I met with school personnel prior to the start of the study and then had follow-up interviews and visits after the completion of the observation period. I was in the school every day for at least three hours each day for two weeks.

Description

The School

This school, located in a small city in northern New England, housed grades 6 through 8. A team teaching approach was used throughout the school. There were two sixth grade teams and four teams of seventh and eighth graders. Students came to sixth grade from six elementary schools in the district and are funneled into one of two middle schools in the district. Last year the district converted two of the six elementary schools to magnet schools. Prior to this, all school placements were based on the geographic location of a student’s residence. In the future parents of students in the two magnet schools will have school choice for middle school – those students could attend either middle school regardless of their residence address in the city. Since this change was so
recent, most seventh and eighth graders are here based on the location of their family’s 
primary residence. The city, whose population is approximately 39,000, is roughly 
divided in half geographically by the line determining which school a student will attend. 
The two middle schools serve very similar sized populations, 382 at one school, 395 at 
the school in this study. However, in this middle school 46.84% of students qualify for 
free and reduced lunch while only 39.27% of students in the other middle school qualify 
for free and reduced lunch. The district reported 44.44% of students qualify for free and 
reduced lunch while the state reported 29% of students qualifying for the same program 
(School District, 2008; State Department of Education, 2008). This middle school serves 
a slightly larger population with more students living in poverty.

Seventh and eighth grades had a two-year curriculum so that most classes 
(language arts, social studies, and science) were composed of students in both seventh 
and eighth grade. In math, however, students were tracked beginning in sixth grade. 
Sixth graders studying math had three levels: advanced students could accelerate into 
algebra; main group students received standard sixth grade curriculum; lower achieving 
students (often students with learning or developmental disabilities) had curriculum 
support with special educators in their classroom. By seventh grade a fourth level 
emerged. The sixth grade main group is divided into the students who took algebra and 
the rest of the students. Scores on an assessment test ostensibly determined a student’s 
eligibility for algebra. However, other factors, most notably parent advocacy, also 
contributed to a student’s access to taking algebra. These factors affecting a student’s 
enrollment in algebra versus “the regular eighth grade math” class will be examined more 
fully later.
The Principal

The principal of this school had worked here for over 20 years, first as a teacher in seventh and eighth grade and then as its principal. She was retiring at the end of this school year. When I approached her regarding this study she had two primary concerns: 1) the budget had recently been defeated, cuts were imminent, and 2) her teachers were in a time of transition of leadership (a search was underway for the new principal). She worried that her teachers would feel burdened if asked to participate. We agreed that she would send out a summary of my research proposal and see if she had interested teachers. Two teachers volunteered, one male, one female. I asked the principal if she would describe one as more dynamic or more appropriate for the study. She hesitated, clearly not wanting to make the choice, and conceded that though they had different styles they were both good teachers. I chose to ask the female teacher to participate thinking it would add an interesting layer to the study. By choosing the female teacher, this study also reflected on her background with mathematics. In addition, this teacher was mathematically competent as measured by obtaining her Bachelor’s of Science degree in mathematics and through my observations of the class and discussions with her of the material. This competence provided a female role model for the female students in the class.

The Teacher

I met the teacher, Ms. Versace, in her classroom on a Friday afternoon after classes were dismissed. She was a petite woman with wiry red hair that she wore tamed into a bun. She wore fashionable glasses and busily scrubbed down the student tables,
which I later learned she did at the end of each school day. She was dressed in designer jeans and a top. I noticed her eyes quavered rapidly as we talked.

She showed genuine interest in the study, talked of her unconventional background, and displayed enthusiasm. She immediately peppered me with questions about the study: when will the students be told, who tells them, do they get to choose their own pseudonyms, do they get to sign a consent form or only their parents. She wondered aloud about the definition of high and low performing and the nature of the study. We discussed her range of classes and which would be the most appropriate for me to observe and from which to choose the students. We ironed out the details of the study and I explained the consent process for students and parents alike.

The following week, again on a Friday, I returned to interview Ms. Versace. In answer to my question about her own experiences with mathematics she offered me this:

I never intended to be a math teacher, let alone teach. My father is a teacher, so I grew up seeing a lot of things that I thought I’d never do. He always worked hard. He was always at meetings, on the phone, etc., and I thought it looked very draining. I wanted to do something for a lot more money, less work, and less stress. I always wanted to be an artist. I was going to go to RISD [Rhode Island School of Design], and that’s what I pursued. The course of my life never went where I thought it would. Around age 18 my whole life completely changed.

Around the age of 18, I started taking classes at the community college. I intended to go to college eventually. When I had an associate’s degree
from the community college and was applying to [university], I had to pick a major but I had no idea what to pick. I thought, math has always been really challenging, maybe that would be something to pursue. I checked the math box only because it seemed challenging and prestigious. How impressed would people be if I got a degree in math! I wanted to impress people. So that’s how I got my math degree, but I never intended on teaching it.

Ms. Versace’s story provides a contrast to my own. She never intended to study math; did not engage in middle school. Today she is a middle school math teacher after earning a bachelor’s degree in mathematics. My own story is very different. I loved math from an early age, both of my parents had careers connected to math: my mother a math teacher and my father a computer programmer/analyst. I, too, saw the hard work my mother put in as a teacher and swore to pursue some different aspect of math. There our paths diverged: I had a more-traditional and much less rebellious time in middle and high school and went on to attend a women’s college majoring in mathematics. Ms. Versace had a more tumultuous time in middle and high school and took an unconventional route to arrive at a bachelor’s degree in mathematics, attending part-time and working her way through school.

Her perception of what derailed her was clear: “boys.”

I wanted to go hang out with my boyfriends, not do my math homework. I was always capable of doing it, though. Middle school math, in my experience, was more computational. Algebra is more straightforward
than deriving equations and explaining meaning, which is what we do now. You get in a rhythm plugging things in. But I didn’t want to spend time doing it outside of school, no thank you!

Ms. Versace taught five classes a day, three preps. One class was a small group of students with special needs receiving intensive math support. She also taught two classes of seventh graders and two of eighth graders. The eighth grade class I observed met sixth period, immediately following the lunch period.

**The Students**

The students and I agreed on pseudonyms at the time of their first interview. Some girls decided easily, others kept hesitating so I assigned them names and then asked for their agreement. I called the six girls Brittany, Chiquita, Emmy, Felicity, Lily, and Mosie. They made up six of the eight girls in the classroom and occupied the seats shown in the diagram below (Figure 1). I also marked the gender and placement of each of the other students in the classroom. Students stayed in these positions throughout my observation period.
I remained intentionally unaware of which girls were “high-performing” and which were “low-performing” until I completed my classroom observations. I identified Lily as “high-performing” and Mosie as “low-performing” from their behavior in class. The other four students took longer to identify. At the end of the observation period, Ms. Versace identified the “high-performers” as Emmy, Lily, and Felicity and the “low-performers” as Brittany, Chiquita, and Mosie. It is interesting to note where they sat in the classroom relative to each other and the front of the room. Note that the three “high-performers” sat at the front of the room and the three “low-performers” more to the back. Mosie, who sat the furthest back, appeared to me to be the least engaged of all six
students in the study. I have also marked the gender of each student in the class. As Figure 1 indicates, boys and girls were dispersed equally from front to back and in gender matched and gender different pairings. As I learned more during the study, I found the seating arrangement to be an important theme. It is discussed in more detail later in this study.

**Brittany**

I sat directly behind Brittany while I was observing the class. She seemed as interested in me as in anything else occurring in class. She was one of the taller girls in class and entered the room with lots of energy. She greeted many students in the hallway and in the class. She looked at me and when I told her why I was there she replied, “I know.” During our interviews she was friendly and a little sassy but did not make much eye contact. She opened up more in our second interview. I am not sure why although the observation period was over and I had already interviewed her mother. I wonder if she was influenced by the knowledge that I would not be reporting things about her to anyone. She seemed to love being noticed by her peers and surrounded by friends. I observed her during the breakfast break that students get between second and third period. Unlike the other students who quickly found their friends and sat together at a table, Brittany circulated the room stopping at three or four tables to say hello to her peers and greet the staff monitors of the room.

She made no pretense of liking school; she told me she hated getting up early, hated doing work outside of school, and generally spent time in classes doing other things (texting, writing notes, listening discreetly to music, etc.).

*AL: What do you think about first thing in the morning when you walk*
Brittany: I want to go home. School isn’t my favorite place to be. I don’t mind school, I just don’t like my first class, which is Spanish. I’m good at it, but I don’t like it because it’s first in the morning and I’m tired. Sometimes I’m late and I get yelled at. I like science, language arts, study hall, and healthy living.

Like many adolescents, Brittany’s mood varied from day to day. She appeared to be a fun-loving student and noticed when math class gave her some space to play. Ms. Versace referred to Brittany in her journal one day with the following entry:

Brittany left a note on her table today. It read: “Dear Math Person!

Brittany was here. I got to play w/ blocks! Well be a good math student. – Anonymous”

**Chiquita**

Chiquita greeted me every day with a smile and a nod. She was slow to respond to questions but her answers were always thoughtful. I asked her some general questions about her middle school during the first interview and she overwhelmed me with her thoughtful response about diversity.

We have a community that has all different types of nationalities. We have different cultures from Africa, China, Japan. So I think this middle school is one of the schools where it doesn’t matter what your race, gender, or sexuality is. You’re accepted for who you are.
In class, Chiquita sat in the middle of the room and participated actively. She worked with students around her easily and seemed confident in her work. She raised her hand regularly and offered correct answers or interesting additions. Her sense of humor was generally fun, but on one occasion I saw her annoy the teacher. Chiquita thought it was funny to repeat a mistake because it got a rise out of the teacher and she was confident in the right answer so throwing out the wrong answer seemed like fun. Ms. Versace responded to that day’s class in her journal this way:

Learning things incorrectly is so frustrating to me. I admit that I do it too.

Sometimes I see kids do it purposely to be cute or funny and all of a sudden, they have taught themselves how to do it wrong or remember it wrong.

Chiquita was clearly engaged in class and mostly appeared to understand the material. Throughout the study I was puzzled by whether the teacher thought she was high or low performing. Chiquita participated actively in class discussion, made insightful comments and raised good questions. She worked in class with and without partners. She accomplished a lot of in-class work in the time provided. From my observations she seemed very engaged, confident, and had a solid understanding of the material.

Outside of class I frequently saw Chiquita with other students around her. Most of her friends were smaller than she was. At the breakfast break she sat at a table of her friends and laughed and talked freely. In the hallways, Chiquita was quick to say hello to me and to members of the school staff.
Emmy

Emmy was one of the tallest girls in class. She was quiet with adults and in class. She sat up front and only looked forward at the teacher, at her tablemate, Lily or out the window. Emmy seemed disinterested in most things. Her responses to many interview questions were one or two words or nods of her head. She made little or no eye contact and paid special attention to a couple of points of disagreement in our conversation during our interviews, e.g., “That’s the wrong book.” “No one uses zone defense anymore.” Whether correct or not, she seemed disdainful of my perspective and opinion.

She spoke easily of her role in her family. She was the youngest of two children, and the only girl. She described her brother as brighter and better at school, and herself as working hard. She talked about working to stay on the honor roll and comparing grades with others to understand her success or failure. I asked who the strong math students were in her class and she included herself. When I asked how she knew that she told me, “That’s who gets good grades.” Her main focus seemed to be sports and staying out of trouble. She talked about wanting to get into algebra because her friends were in algebra. She had asked to be moved up front in the class because her best friend in the class sat there. She reported doing as much of her homework in school as she could because her evenings were full with organized sports activities.

Although she was tall she was not a student I saw frequently in the hallways. When I went into a study hall to meet with her for an interview I had trouble finding her; she was sitting with her head bowed reading a book or completing a homework assignment. In social studies class the day I observed that room she was clearly doing homework from a different class. Emmy has mastered the art of disappearing in a class.
She could go through the school day using her time to listen when she needed to (which she did a lot of in math class) and tuning out when she felt confident in her abilities. She prioritized getting homework done in school and so she managed to use class time in the classes she is doing well in and study hall to complete the rest. Her attention in school was on homework completion, she saw this as her job and she worked diligently to complete it. She did not reflect on the learning and was usually unable to articulate the meaning of the work.

**Felicity**

Felicity was excited about the study and worked hard to make sure she could participate. I had to find a translator to communicate with her parents and to translate the consent form but she immediately returned all the forms. She was chronologically older than her classmates due largely to her transition from another language and country four years ago. She and her father did not really seem to understand why anyone would study engagement in mathematics and why there would be a gender component. Both expressed the sentiment that there are things, like mathematics, that all students should know and do. They also both expressed family pride about their own and their ancestors’ abilities in math and science.

Felicity was clear that math is important and that she wanted to be successful at it. Math is the most important subject that I think you should be able to be comfortable with and know if you want to go on to college. Math is the subject you need.
She was less clear about her own abilities in math, although she knew that she was working hard. “Math isn’t that easy. I can’t say I’m good at math, but when I practice more I get better. It makes it easier.”

She also noticed connections between math and her other classes, most notably science class.

Right now we’re doing motion and speed.

In order to figure out the speed or time, you have to delete certain numbers to find what you’re looking for. We did that yesterday.

Felicity was social and told me she did not have many friends but that she chose friends who were serious about their studies.

I usually try to be friends with students who care about their educational future. When I’m with people who don’t care about their future, I kind of stop thinking about it, too. But when I’m with students who care about school, I get my work done.

She said she enjoyed sports and was glad she would be able to participate in them in high school. She was thoughtful in her interview and in her journal. She wrote the most of all the girls in her journal.

Although the other five girls identified her as one of the high performing students in class she was reticent to identify herself or others. She told me who works hard and who she works with. In her journal she said:

We don’t have a smartest person in our class, at least I think that way, because not everyone knows what they’re supposed to do unless they were taught to do it. Everyone has a weak and a strong point.
Lily

Lily was a little shy around adults but opened up pretty quickly. She was one of the shorter girls in class and wore her blonde hair short. My observations and interviews with Lily and her mother suggested that Lily performed well in math and in school but also loved her social life and her sports. She talked easily about the books she has read and how she was feeling ready to be done with middle school. She admitted that she preferred working alone at first and then joining with others to puzzle out problems. She said she wanted to know she was right before raising her hand. She was quick to smile and had a bounce in her step. She fit right in with her classmates.

Lily, like Brittany, was not fond of the early mornings but unlike Brittany she liked school. “I like to play sports: soccer, field hockey, etc. I like coming to school and learning things, but sometimes I don’t feel like waking up early in the morning.”

Lily entered the classroom each day with a sense of purpose. She proceeded directly to her seat and greeted others as they passed her chair. She got prepared for class by pulling out her work and checking her folder. During class she sat attentively but rarely raised her hand. When called on, she produced answers that were usually correct.

During times that students were doing group work, Lily worked well with her tablemate, Emmy. In fact, I saw her encourage Emmy at one point to go to the teacher’s desk to ask a question. Emmy seemed reticent so Lily got up and began walking towards the teacher’s desk; on her way she turned and beckoned to Emmy to join her.

In the hallways outside of class Lily was energetic and surrounded by friends. She moved with her friends from class to class laughing and giggling along the way.
I asked Lily (and all the girls) about their favorite character in a book. Among many books Lily picked the Harry Potter series as one of her favorites. I expected her to tell me that the female character, Hermione, was the one she would like to be so her response surprised me. “In “Harry Potter” I’d obviously be Harry Potter. I don’t know if I’d be any of the characters in “Twilight,” but I think I’d be a werewolf.”

She was confident about her abilities in math and just as sure that tests did not always show what she knew. “I think I’m good at math but I’m bad at studying for it. I don’t know how to make my own problems, but I’m ok at math.” As far as her future aspirations, she seemed pretty open to many possibilities, “I don’t know what I’m going to focus on in high school, but I know I’ll be taking math classes.”

Mosie

Mosie was very shy. She rarely made eye contact and giggled when expressing an opinion. She often contradicted herself. She was aware of her seat in the very back of the classroom, but did not want to make any waves to move forward. She told me she would like to be an anesthesiologist during our first interview, but in the second interview she seemed to have forgotten all about that, noting instead that she thought she should become a nurse.

She told me that she really only had one very good friend in school. This student was on a different team. When I pointed out that I had observed her walking and talking in the hallway with others she explained that this other student had lots of friends and, “if you’re friends with [Anna] then you get me as part of the package.”

Mosie seemed aware of the environment around her. She described the math classroom as “colorful” but remarked that the Language Arts room was more comfortable
“because it has carpet.” Mosie talked most when she could talk about relationships with students and adults or about the visual feel of a space (carpet, color, layout, etc.) When I asked her why she might or might not be engaged in math she said this:

I’m not interested in math that much. It doesn’t really amuse me. It’s not all that interesting to me. I think if my math teacher was [Ms. Happy] I’d be interested enough to learn it well, or better than I do now.

She did not seem very invested or engaged in school and especially in math (as she said it “doesn’t amuse her”). Her grades, though apparently a bit of a shock to Mosie, were low. When I asked about her last report card grade she hesitated and then admitted that she failed math class for that marking period:

I turn in my homework, but in the beginning I wasn’t turning in any and I had to make up a lot. I’ve been trying really hard lately to do all my homework, which I’ve been doing.

I didn’t pass. I thought I was going to get higher but I didn’t. My mom set up a conference to talk with the teacher.

Mosie had no sense of urgency about her work. During the observation period the class was given a set of 22 problems for factoring polynomials. They began the worksheet in class and would be working on them over a few days. They were not specifically assigned for homework but it was clear that the worksheet would need to be completed in a timely manner.

There was only 22. I only have 11 of them ‘cause it wasn’t homework so I stopped after class.

So whenever it’s homework you still only have 11 of them left.
Yeah.

*Were there ones that you were especially proud to get?*

There was this one that [Glenn] couldn’t get, and I consider [Glenn] a pretty smart person and I was happy that I got it before he did. I don’t remember which one it was.

*You said you did the 11 questions in class and figured you were doing fine, so you didn’t do them for homework. What about other classes and homework? Do you do a lot of homework?*

I usually don’t have to do work at home. I do my reading for language arts at home. I have a study hall, so if I don’t have a lot of homework I’ll do it in study hall. If I have a lot of homework I’ll do some at home.

Like the adolescents in Carol Gilligan’s (1990) study at the Emma Willard School, Mosie seemed to give me three different answers to the homework question (she doesn’t do it at home, she does only reading at home, she does it at home when she can’t get it all done in school).

Ms. Versace watched Mosie lose focus in class but still saw signs of her mathematical ability:

[Mosie] hasn’t performed well in two years in terms of her grades and seems lazy. She’ll often turn in things that don’t make sense. But she has these sparks of intelligence, which makes you think she’s very capable. She’s just in another world. You can often see her not paying attention.
The Parents

Parents were sent letters from the school asking them if they would be willing to participate in this study. They returned the recruitment forms with contact information for me if they agreed. All six parents agreed and I met each one in their homes and obtained consent for the study including the classroom observation, one parent interview, and two interviews with each of the girls. At the time of consent, I set up an appointment with each parent for the one-hour interview. Of the six families, three were intact parents of the student in the study (mother and father both living in the same house.) Two of these sets lived in single-family homes in a suburban neighborhood within a half-mile of the school. The third set of intact parents was in an apartment in an older section of town; these parents did not speak English and were fairly recent (four years) immigrants.

The remaining three parents lived in apartments with some government subsidies. All three were single women and two of them were receiving disability income. Two of the three women repeatedly agreed to meet with me and then cancelled their interviews at the last minute or simply were not home when I arrived. One woman had met me outside to fill out the consent forms and so I never entered her home. One of the six students had two homes and spent time in both her father’s and mother’s homes.

The parents interviewed for the study identified themselves as the parent that was most likely to help their daughter with her mathematics homework. Many of the girls did not do much homework at home but identified this parent as the one they go to with questions.

Brittany’s Mother
I interviewed Brittany’s mother in her apartment. She was at home during the day and welcomed me into her home. Brittany was her only daughter and the only child still living at home. Brittany had two older half-brothers, both of whom lived outside of the country and communicated with Brittany’s mother infrequently. Brittany’s mother had a degree in accounting and had worked in that field prior to being home on disability.

Brittany’s mother expressed frustration with Brittany’s declining grades in school. She said she was concerned that Brittany was not trying but when she tried to confront Brittany she would find herself embroiled in arguments she would rather not have. Instead, she would remind Brittany gently when she could to do her homework or asked her if there were any messages or papers from school that she needed to sign. She told me that she learned of Brittany’s late arrivals to school or missing homework only when the school sent home notes that she “finds”.

I see the papers, but I don’t see her working on it. That’s my biggest complaint. Why aren’t you doing your homework? She’ll say, ‘I did in study hall’, or ‘at Megan’s house’. But why are you not turning in your homework? Why are your grades sliding? I always get an excuse. I talk to her teachers and the school social workers. The school social worker would instill that she has to be more responsible in turning out the paper work. I’d find it in stacks here, completed. I don’t know if it was correct, but it would be two or three weeks after it was due. Now they’re saying they won’t let her hand it in for partial credit.

She described a family dynamic that was difficult and that she hoped would turn around for the better if she waited it out.
There were fights before. Math class was first in the morning at that time and she did not want to go to school. It took me a while to find out that it was the homework issue. She’d lock herself in the room and wouldn’t come out. It took getting the first warning letter, and I posted it on the refrigerator. She would say, I haven’t been late that many times. I said, Brittany, it says it right there. She’d want me to make excuses for her and I said I won’t lie for you. We can mark you unexcused or we can have them come here. I have to be tough with her. It breaks my heart. You want to protect your child, but it doesn’t do kids any good in life to do that.

She expressed to me that she felt Brittany listens more to her friends than to her mother. She told the story of an outfit that she bought for Brittany that Brittany said she liked. After wearing the outfit to school, Brittany came home saying it was an awful outfit and she would never wear it again.

She’s a little too swayed by friends, which surprises me because she was always a leader. They push her around, and I don’t like it. I’ll buy her a new outfit, she’ll wear it one day and she won’t wear it again because people said it looks awful. Even if she picks it out, same thing! So now she goes shopping with her friends and comes back with things I don’t like or won’t let her wear. They’re inappropriate and she gets mad. The power of her friends is too much in her life.

*Chiquita’s Mother*
Chiquita’s mother sat on her couch in the living room when I met her. Chiquita was in the room and we were reviewing the components of the study and I was obtaining consent from Chiquita’s mother and assent from Chiquita. It was a Sunday afternoon and there were other children moving in and out of the room. Chiquita’s mother explained to me that we could meet any day for the interview because she is at home on disability. She revealed that she did not like to leave the house and that when her children were in elementary school, the teachers and staff would sometimes conduct school meetings with her in her home. She also complained that the middle school had not been so accommodating. She told me she had never stepped foot in the school. Chiquita had four siblings: an older brother, a younger sister, and a younger set of twins who have been diagnosed with special needs. I arranged a day and time to interview Chiquita’s mother during that initial meeting but when I arrived for the interview no one answered the door. I called the house from my car and no one answered the phone. I worked for six weeks, calling and leaving messages and sometimes stopping by but I did not manage to conduct an interview.

**Emmy’s Father**

Emmy’s father and I met one evening at their home for the interview. Emmy’s mother left to drive Emmy to a basketball practice. Emmy’s older brother, who was introduced to me, was sitting at a computer adjacent to the kitchen. Emmy’s father and I walked into another room where he shut the glass doors, giving us some privacy.

Emmy’s father was a dentist. Both he and his wife, Emmy’s mom, had completed college. He had a professional degree in the field of medicine and his wife was a teacher in English. He and his wife both told me that the wife does not do well in mathematics
and so math homework questions were posed to the dad. Emmy’s father described his concerns about his daughter’s mathematical abilities. He noted times when he had used a current situation to ask some mathematical or arithmetic questions. One time they were talking about saving for college and another time about Emmy’s free throw percentages in basketball. Both times he was disappointed by Emmy’s lack of facility with problem solving skills.

He confirmed that both he and his wife had sought out the teachers at school if they felt the need. He described a recent time they were at the school to determine why their daughter had not been selected for the algebra class for eighth grade. Both parents told me that their son was better at math and in general smarter but that their daughter worked harder and had better study habits.

Emmy’s father discussed Emmy’s relationship with the math teacher and Emmy’s own struggles with confidence.

Last year she definitely struggled with this math teacher. This year she’s done much better through this teacher. I’m not sure what all the reasons are, I think there are a lot. But there were comments on her report card last year that she should’ve come for help more, and other things like that. There were some personality conflicts going on. Now it’s better - she’s gone to help a little more when she’s needed to.

She was intimidated through a lot of it last year and she wouldn’t go for help because she’s not very bold. Most of her friends are more bold, so if they went with her she would go.
Felicity’s Father

I met Felicity’s father on a Saturday afternoon in their home. A translator accompanied me as Felicity’s parents do not speak English. Felicity’s mother was present during the interview but she sat in the nearby kitchen preparing food. Felicity was the oldest of three children: two girls and one boy, the boy was the youngest. Felicity’s father expressed pride in his own and his family’s (brothers, father, uncles) math abilities. When I asked what his background in mathematics was he told me that he was “the best” and he came from a family of people who excelled in mathematics.

Felicity’s father expressed disappointment in the “elementary” level of mathematics that his children were learning in school and explained that he supplemented their learning at home with topics he considered important. He said he found it difficult to help Felicity with her math homework because he did not understand the curriculum and asked Felicity to translate the materials but something gets lost in the translation. When confronted with an arithmetic or algebraic equation or calculation he could easily guide her but the vocabulary heavy word problems confused him.

When I asked him what he thought might be some of the factors affecting girls’ engagement in mathematics he was completely confused by the question. He looked at me puzzled and said that students just have to do what they are presented with and study hard.

Both of Felicity’s parents were professionals in their former country and were doing blue-collar labor work in this country in order to get by. They came to this country to provide opportunity for their children and school was very important to both parents. However, the American school system is a different institution than they were familiar
with and when they wanted to talk with any school personnel they needed to have an interpreter present (which the district provided). The translator allowed them to cross the basic communication barrier but there were still cultural differences they did not necessarily understand. For example, while I was meeting with Felicity’s father he had one of the children bring me the most recent “High Honor Roll” certificate that Felicity had received and he asked me what it meant. “Does this mean she is the best, the top student?”

_Lily’s Mother_

Lily’s mother agreed quickly to the consent form and process and invited me to her home during the day. She told me that she discussed the study with Lily and both were interested in the study, the topic of girls in math, and the outcome. Lily’s mother had a college degree in environmental science and biology. Her husband, Lily’s father, was a teacher. Lily’s mother told me that her father was an engineer, a programmer, and “math whiz,” and that she felt “encouraged to the point of tears” when he would help her with her homework.

According to her mother, Lily and her sister were both good students but they were different. Lily’s mother told me, Lily’s “older sister is an honors student and star athlete, so there’s more than just math.” When describing Lily she said, “If she puts her effort into it, she’s going to do it. …She’s comfortable and capable where she is. She doesn’t need to be way up here or way down there. She’s comfortable being average.” Lily’s mother described herself as involved in the school but at the same time trying to leave space for her daughter to build some independence. She said she was not entirely comfortable with what she sensed as a barrier between her and the school:
I want to add that having been a parent around my kid’s school careers, the transition to middle school is a karate chop. You have to start letting go and there aren’t a lot of ways to be involved in those schools as a parent. It’s not encouraged. … I’ve met with the math teacher over the past two years. But it’s different and it’s a hard transition.

**Mosie’s Mother**

Mosie’s mother worked outside the home at a day care. I arranged to meet her on a Saturday morning to discuss the study and obtain consent. When I arrived at the home at the agreed upon time there was a note on the door apologizing and asking me to “Please contact her after 4pm.” I called and arranged to go out to the house the next day. That time Mosie’s mother met me outside in the yard. We discussed the study and her involvement as I juggled my paperwork and notebook on the trashcan. She consented to the study and we arranged a time for the interview. She requested that we schedule two weeks out in order to meet on a weekend when the children were at their father’s house. I arrived on the appointed morning for the interview and knocked on the door. No one answered. I called and left a message on the phone answering machine. I called back 30 minutes later and a man answered the phone and told me, “She’s not here.” Over the next three weeks I called on and off leaving messages with my name and phone number but was unable to contact her. I let some time go by and called again a month later, this time I was told, “She’s in the shower right now.” I drove out to her home one more time, a month later and, again, she was not available. A man met me in the parking lot and told me that he had relayed all the prior messages. That was my last attempt to contact her.
Mosie’s mother had not been to the middle school for any kind of school meeting until after I began my study. At some point early in the study, she contacted the school and asked for a meeting with the math teacher. The math teacher reflected on this request for a meeting in her journal:

[Mosie’s] parents have requested a conference. Huh? She has been performing poorly for two years and they have declined every invitation for a conference. Suddenly, with approximately five weeks of school [remaining] they want to meet.

I wonder if the study and my presence at Mosie’s mother’s house may have inspired Mosie’s mother to call for a conference or if the recent report cards spurred the meeting. Either way, Ms. Versace had expressed frustration that they had been unable to contact Mosie’s parents before and wondered aloud what they were thinking could change in the last few weeks of middle school.

The Classroom

The room had colorful bulletin boards and was neatly organized, with clean table desks. One window at the front of the room faced onto the school yard but because of its position most students were unable to see out the window. The teacher wore a voice amplifier so that one could hear clearly from all corners of the room. The clock was painted with bright colors and even the notes on the front board had artistic lettering declaring “Warm-Ups” or “GPAs” or “Homework”.

Students filed in at the start of class and headed directly to their seats. With no more noise than necessary, students took their seats, got out paper, and began working on the warm-up problems on the board. After five minutes, Ms. Versace asked who had the
answer to the first question. Students raised hands, got called on and explained their answers. Lily described the expectations of the start of class this way:

There will be warm-ups on the board, and she’ll have a note to check your mailbox. On test days there’s a whole list of what we’re supposed to do, where our tests are. She’ll be at her desk the whole time, because we’re supposed to be quiet. Recently you have to stay in your seat unless you have to get something.

Most classes contained a mini-lecture where Ms. Versace explained a new concept. The day she introduced the algebra tiles she used this time to lead the students in an exploration of the algebra tiles. She asked questions like “what do you see in this collection of tiles, how many different types of tiles are there (colors and shapes)”, and so on. Students called out responses and pushed tiles around their tabletops. Some students raised their hands; others just called out. Some students made towers of tiles until the tower fell over. Brittany was building a house. Other students arranged the tiles into neat piles by type: squares, rows, single units, yellow, and blue. “Hands off blocks,” Ms. Versace called out, and student hands shot up in the air to show they were following directions.

Ms. Versace went on and wrote some vocabulary on the board: polynomial, terms, multiplying polynomials. She wrote an example problem on the ELMO document camera \([(x+1)(2x+2)]\) and sets up the blocks on her tabletop which was projected for all students to see. Students were then instructed to try and finish the exercise by filling in the blocks. She asked students to check the work of their tablemate. Lily and Emmy began chatting after completing the exercise. Brittany passed a paper over to Lenny and
to Glenn, her tablemate. Glenn worked on the task and when Brittany got no response, Brittany too completed the task.

On days when Ms. Versace was explaining an algorithm or helping students discover a formula (like the formula for area, or discovering the method for multiplying binomials) she would write the discoveries on the white board or on the ELMO projector. She would pause and encourage the students to write these things in their notes.

Most classes had time for students to practice with the content that was presented. Ms. Versace sometimes circulated the room but mostly stayed at her desk until a student raised her hand. Then she would go over to assist that student or pair of students.

At the end of class, students returned papers and materials to their proper places, cleaned up their areas, pushed in their chairs and left the room in an orderly fashion. The next class of students filed in and repeated the same procedure.

Discussion of the Six Themes

In the following section, I discuss each of the six themes that I identified as being important to engagement or disengagement in mathematics class: factoring in the algebra class; finding a seat; relating to the teacher; social networking and engagement; untangling performance and engagement; and structuring class. These themes arose out of the coding of all the data: interviews, journals, observations, and field notes. In the discussion of each theme, I consider how it relates to my research questions. The research questions are also addressed in more detail in Chapter 5, Analysis.

Factoring in the Algebra Class

In 2000, NCTM identified the curriculum standard of algebra this way: “Students in the middle grades should learn algebra both as a set of concepts and competencies tied
to the representation of quantitative relationships and as a style of mathematical thinking for formalizing patterns, functions, and generalizations (p. 223).” This policy document encouraged all students in eighth grade to be exposed to algebra and some of the foundations of algebra and higher-level mathematics. The middle school in this district has adopted this policy for all of the eighth graders. In practice, this meant that all the students in eighth grade had a curriculum unit that included working with positive and negative numbers, understanding and using variables, solving simple linear equations, and multiplying and dividing polynomials. However, some students were selected for a separate year-long class on algebra that is the curriculum equivalent of the Algebra I course taught in high school. The decisions and politics around placement into “the algebra class” were complex. Ms. Versace, in response to my question, explained her part of the placement process.

I definitely decide where they go for 8th grade. Currently, they take a test for the algebra placement. As it’s stated, if they perform and score 85% or higher on the [New England Common Assessment Protocol] NECAPs and have a recommendation from their math teacher, they’ll be in algebra for 8th grade. I had 7 students last year who didn’t perform on the test who were placed in algebra, even though they didn’t have the test scores and I didn’t give them the recommendation. Parents will bypass me and go to the principal. Then the kids fail and they miss a whole year of 8th grade math! I don’t push for kids to be in algebra in 8th grade because it’s the last chance to get your hands on stuff.
An undercurrent in several of the interviews with parents and students was the question of whether or not the student could “get into” algebra in eighth grade. Since I was observing the non-Algebra eighth grade class, these were the students that had not “made it” into algebra. Emmy’s father speculated as to why or why not some parents might want their child in the algebra class.

Some of them wanted a certain teacher, for example. I know one parent who had a tutor so their son could be in algebra. The district had a tutor this summer that was paid for by some grant, and I think her friend did it, but she refused. She didn’t want to do any school over the summer.

For the students who wanted to get into the algebra class, whether or not their friends were in the class was a major element for each of them. For parents, it did not seem to be just about the social aspect of being with their friends but also a mark of mathematics achievement. Lily’s test scores were too low for her to be placed into the algebra class. Her mother discussed this in our interview.

There was some trouble in 7th grade math where the teacher wasn’t giving a lot of tests; therefore the tests had a lot of weight. If you did poorly on a test it really damaged your grade. She [Lily] took that very hard and we were frustrated. I think that’s what’s behind the piece is that she would be too uncomfortable being challenged in algebra.

Ms. Versace reflected on the students in the study and who wanted into the algebra class. She had received pressure from many parents for their student to be recommended for algebra. For example, despite her parents’ requests, Ms. Versace did not recommend Emmy for the algebra class. Ms. Versace remembered some of the
conversation with Emmy’s parents and Emmy’s father remembered his perception of

Emmy’s feelings about not getting into the algebra class.

Ms. Versace was certain Emmy received influence from home but was not sure whether to interpret it as a positive or negative influence:

Emmy gets a lot of pressure to do well. Or it’s a lot of encouragement.

She wants to please. They were mentioning algebra right out of the gate.

But she works so hard.

Emmy’s father focused on Emmy’s perceived place among her peers, noting that Emmy ultimately consented to not pushing herself to get into the algebra class.

She’s a little bit on the lower end of most of her teammates, especially in algebra this year. She[Emmy] has one other friend who’s not. I think she knew that she wasn’t there, so she didn’t fight it.

Emmy recalled the testing and placement this way. She also told me some of her reasoning around wanting to be in the algebra class.

*And you took a placement test for algebra last year?*

Yeah. You have to take it, everyone does it.

*And getting into algebra was based on your scores?*

You got into algebra if you got a 70 or higher. It was 80, but she lowered it. I got a 50 or a 60, and Lily got the same.

*Were you upset about that?*

At first, because I wanted a different math teacher. My brother had this other math teacher and everyone loves her. There’s two now, Mr. Ferris, but I wanted Ms. Smiles. Mr. Ferris is hard. Ms. Smiles helps you get it if
you don’t get it, and she’s really nice.

Emmy also told me about her schedule for next year, high school. It turned out that some of her friends who were in the eighth grade algebra class would be repeating algebra next year in high school. Here was Emmy’s perception of those events.

A lot of my friends are taking honors language arts and social studies, so I’ll probably be together with them. A lot of my friends take Spanish, so they’ll take Spanish II with me. Lily will still be in my math, but two of my friends are in algebra and might want to take it again, so they might be with me.

Did they not like it here, or feel like they didn’t learn it well enough?

Yeah, they were struggling and didn’t get it. They always got a C or lower.

So in some sense you’ll be in a similar place as they are.

Yeah. But that’s only 2 out of 10.

The two weeks that I was observing Ms. Versace’s class the students were, in fact, learning algebra. They had already learned about positive and negative numbers and variables and the two weeks I was in class they were multiplying binomials and factoring trinomials. The content was more than just pre-algebra; it was a strong foundation for the first part of the algebra class they will have in high school. So these students did learn algebra (or at least have the opportunity to learn algebra) even though they were not selected for the algebra class.

It is possible that a student’s motivation could have been hampered by not getting into the algebra class. A student’s math identity could have been hampered. However,
the students in the class I observed did not identify the fact that they were now studying algebra or that they did not get into the algebra class as a factor in their engagement or lack thereof in the current math class.

There was a sense of status associated with getting into the algebra class. I wondered if not getting into the class sent a message to students that they were less good at math. No one expressed this directly but all the high-performing girls were aware that there was a “higher” math class available that they did not get into. This set-up seemed to create an elite class for some math students and might send the message to others that their level of engagement might be more rewarded in other pursuits. It was not clear to the students at this grade level what, if anything, being in algebra would mean to the future of their studies in mathematics and science. It was only clear that they had not made the cut.

Ms. Versace identified the absence of those students who have moved onto algebra as a positive for the remaining students. She referred to these algebra students as “the high flyers”:

I don’t know if I pointed this out to you or if you’ve seen this on your own, but the dynamics in 7th grade were different. Those high flyers were in that class. Once they leave, kids like Lily are like, ‘oh my god, they left! I want that opportunity, too.’ Suddenly they’re in a new position. They weren’t last year.

Finding Seats

After observing the class and noting that the students who appeared to me to be “high-performing” sat near the front and the ones that appeared to be “low-performing”
sat near the back, I began asking the girls and the teacher about how seating was assigned in the room. All but one of the six girls was aware of the seating and had either requested to be moved or been moved in response to someone else’s request to shift. The teacher identified the front row as “prime real estate” and expressed some regret that she was legally bound by some Individualized Education Plans (IEPs and 504s) to seat students with special attention needs up front where she thought others might benefit more.

Seating is a tricky business! Kids who want to do well will fight tooth and nail to get closer. They can’t stand it when someone has to sit up front. They’ll be livid. They have their parents email me. They won’t wear their glasses on purpose so they can’t see. Those three (pointing to the spots where Lily, Emmy, and Felicity sit) are a prime example of that. They want to be up front. They’ll fight for it. I do give it to those students who are really that intent on having it.

While Ms. Versace was fully supportive of all of her students, she liked to reward students who “work hard”. She also liked order in her classroom and the two students who were in the front seat because of IEPs had difficulty staying focused, quiet, and on task. Ms. Versace struggled with balancing her need to attend to all students and her need to address these two students who sat right in front.

Students were aware of the movement of student seating and had their own interpretations of its effects. Some students chose to move forward and made the request of the teacher. The three low-performing girls accepted the seat that was given to them, even when they were moved back. One difficult boy in the class, Lenny, sat in the far
back. Lenny missed a lot of class for one reason or another and therefore his “table mate” was left sitting alone on the days he was absent. Emmy began the year in the back of the room, near Lenny.

*Have you always sat up front?*

Emmy: No, I sat in the back. I moved because I didn’t like the back. I sat alone and Lenny is there and always in my way. I could never see when I was taking notes. ... Yeah. Lily would always come back and sit with me. The teacher moved Kurt back one so I could sit there. ...

Mosie sits where I used to sit, somewhere in the middle.

When Emmy was moved forward someone had to be shifted backward. It turned out to be another student in the study: Mosie. Here was Mosie’s perception of the events leading up to the move and of her current seating arrangement.

*In math class, you sit in the back. Did you choose that seat?*

No.

*Would you choose that seat?*

No. I asked if I could be moved but I wasn’t allowed to. You can only do that for projects.

*So it’s not your favorite seat. Do you think it affects what you do in class?*

No, I just don’t like it. I feel by myself.

*You sit next to Lenny. Do you two work together?*

No.

*Even though you’re supposed to work at your table sometimes.*

We don’t work together. He argues a lot and he always has to think he’s
right.

In answer to my question in the next interview about her seat and the classroom arrangement in general Mosie added these observations:

There’s a bunch of tables. I’m way in the back with Lenny, and there’s tables here. Then way, way, way up front there’s a board.

*Can you see?*

Sometimes. But the person in front of me (Chiquita) is kind of tall, so she’s in the way sometimes.

Felicity, a new American, has a very different attitude toward the work, the class, and achievement. When I asked her where she would like to sit, she commented that:

I wouldn’t care. We’re still in the same class, and if I need help I would ask anyone. The teacher wouldn’t mind that. I would like to sit next to Lily and Brittany. … I’m probably closer to them than anyone else in the class.

Felicity made another observation about the classroom arrangement that I had missed during my observations. Reviewing my notes confirmed her report that:

I noticed that most of the people who sit in the front at the tables sit close together. The ones in the back are separate from each other. They (the ones near the front) like to work with each other and ask questions during class.

Felicity was accurate in her description of the distance between students growing as the tables are farther from the front board. Gender was not at issue as there were mixed gender tables and same gender tables both near the front and near the back. It is
possible that people at the tables in the back moved to have a better view of the front board. During times when students were asked to work together all of the pairs of students did cooperate and discussed the problems they were given.

Mosie’s behavior in class was low-key and like her seat, did not attract much attention from the teacher.

*Here’s your picture of what the class looks like. What do you look like in math class?*

Mosie: A little blob that sits in the back. Lenny is this little star that has to make a lot of noise. … Tara is a blob that doesn’t make a noise. Glenn and Brittany are stars that make a lot of noise. Felicity and Kurt are pretty quiet. Everyone else are blobs. Sometimes Lily is a star, too. If they’re a star, they talk a lot and answer a lot of questions.

The actual geographic position of student seats and the active or passive attempt to change seats was not all that was going on in this location battle. Students also had very different perceptions of the room from the front and from the back. Some were more focused on their classmates, others only on themselves relative to the teacher.

Figures 2-5 are four different drawings of the classroom from four of the students. Lily marked only herself in a room full of empty tables; Emmy marked only herself, her tablemate (Lily), and the teacher. Felicity noted not only her own position in the classroom amongst her peers but also noticed the students relative to each other in the classroom. Finally, Mosie, who sat in the very back seat in the class, noted the “stars” and the “blobs” in the room. “Stars”, according to Mosie, were the students who spoke
up, raised their hands, and had the right answers. The “blobs”, including herself, sat quietly and watched class happen around them.

The students Mosie identified as “stars” were not necessarily high performers but instead students who sought out and received more teacher attention. They raised their hands more or called out more or misbehaved more. “Blobs” were very quiet students who generally did not raise their hands or their voices. It was difficult to read the engagement of the “blobs” because they were so quiet as to be nearly invisible in classroom observations.

_Lily’s Perspective_

Lily drew herself as an asterisk in the middle of a room of rectangular desks (see Figure 2). Her drawing was geometrically accurate but it was interesting that she did not draw anyone else in the picture. I asked her where the teacher was and she noted, “Ms. [Versace’s] desk” on the drawing.

![Figure 2. Lily’s drawing of the classroom.](image)

_Emmy’s Perspective_
Emmy sat adjacent to Lily but her drawing showed a different perception of the classroom. Emmy’s picture (Figure 3) showed only herself, her tablemate Lily, and the teacher. In the drawing, Emmy and Lily were given big ears to hear as the teacher talked to them.

![Emmy's drawing](image)

**Figure 3. Emmy’s drawing of the classroom.**

*Felicity’s Perspective*

Felicity’s drawing showed the teacher and students at their tables (Figure 4). Felicity noted that the students in the front of the room sat closer to each other than the ones towards the back of the room. She drew the teacher twice: once at the front and once at her desk. All of the students diagramed in Felicity’s drawing looked alike. The teacher in the front of the room was distinguished slightly by her larger size.
Mosie’s Perspective

Mosie’s drawing took place as we talked. She continued to fill in the tables and sketch more “blobs” and “stars” as she talked about the class. Her drawing was busy and the teacher was not drawn in anywhere. I asked her about the teacher and she said the teacher walked around and she is everywhere. She described herself as a blob in the back of the room (which is actually at the top of her drawing) and next to her sat Lenny, the star.
Students’ proximity to the front of the room appeared to have some bearing on engagement. Students who wanted to be engaged with the teacher and the class and felt distracted in the back of the room requested to move forward. However, the two students at the front table closest to the door were closest to the teacher but, during observations, still managed to remain disengaged.

I had asked the students to “draw themselves in the classroom” as a prompt to open our conversation about seating. The resultant diagrams, as described above, contained some fascinating observations. The high-performing students sat closer to the front. The lowest performing student, Mosie, sat the farthest back and referred to herself as a “blob.” Mosie also expressed her sense of disempowerment when she said that she asked to move up but she was not allowed. This is in strong contrast to Emmy who seemed to feel entitled to a seat upfront and didn’t notice (or worry about) the affect of the changing of seats on other students. The two front row students from the study
(Emmy and Lily) are also the most economically comfortable of the six students and the two from intact families living in single-family homes. Delpit’s culture of power (1995) in the classroom and Weis and Fine’s research on the “structuring of silence” (1993, p. 1) are embodied in these drawings and the students’ discussion of their sense of place in the room. The culture in this classroom had the teacher assigning seats with a sense that the front row was “prime real estate” and then not circulating in the room so that her presence and availability was predominantly in the front of the room privileges the front row seats which don’t seem equally accessible to all students.

Relating to the Teacher

None of the students identified Ms. Versace as their favorite or their least favorite teacher. Some students mentioned her yelling. Some parents mentioned that students had to adjust to this teacher. The teacher definitely liked things neat, organized, and quiet and she managed her class and her room so that she maintained these things most of the time. Often when I entered the room and class was not in session, Ms. Versace was cleaning desks. The times that she was not cleaning desks she was grading papers or entering grades into the computer. Each of the 10 days of observation, the room was very clean even though my observation did not start until 12:30 pm. There was little or no litter and I never saw graffiti. Ms. Versace liked an orderly classroom and was successful in achieving that order. She also had some specific goals in mind for these students and realized that some of the students achieved those goals and others did not.

The three high performers I chose I’ve had since seventh grade. They’ve astounded me with the leaps and bounds they’ve made since then. One even started in a below grade level class and said I want to move up and
up. They moved her up at the beginning of the year and she’s outshined everybody. All of them came in really shaky. There were a lot of tears, but now at the end of eighth grade they’re solid. Somewhere along the line over these years, they’ve figured out something that works for them. I think they learn how to work with me. You know how you adjust to teachers and how they want you to do things? I think that’s part of it.

I also think they realized what effort you need to put in to be successful. They’ve all done that. They figured out what works with them probably around the end of seventh grade. They took it and ran with it. They’d be ready to go to college now. They’re engaged, ask questions, and ask for help. But they didn’t start that way.

The students in the study each felt more or less comfortable (or aware) of these goals and the classroom structure.

Brittany articulated her feelings about the teacher this way:

I don’t know her that well. I’ve had her for two years, but I used to hate her. There was something about her that I didn’t like last year, and I didn’t like her at the beginning of this year. But now I don’t really mind her.

Chiquita saw things differently. She described her ideal teacher as “strong minded” and then noted that this was similar to how she would describe Ms. Versace.

Strong minded about everything. I’m used to our teacher being strong minded about everything. Someone who gets on your case, because then
you strive to do better. Someone who knows how to explain a lot without
books, or someone who can explain it and comprehend what we're doing.
Someone who can do examples of what we’re supposed to do.

This description is reminiscent of Delpit’s (1995) writing about teaching across
cultural difference. Chiquita’s definition of a teacher that is “strong minded about
everything” has echoes of Delpit’s example of the African-American student who was
“proud of his teacher’s ‘meanness’ (p. 37).”

Emmy has a third perspective on what kind of a teacher would be best for her:
Math hasn’t always been a good subject for me. I struggled in it last year
but I’m doing good in it now. Last year I didn’t really like my teacher’s
personality, but I guess this year it’s gotten better.

Emmy’s father also had thoughts about the match between this teacher and his
daughter. He acknowledged that his daughter might have gained some confidence since
last year:

I guess the third thing is having confidence. I’ve noticed that’s made a
difference this year because she wasn’t confident.

I think the teacher probably had to change. She probably lost some of the
brighter kids to algebra. Here she’s with a smaller group of the kids that
weren’t quite getting it enough to get into algebra.

Lily’s mother, too, had an opinion and a sense of change from one year to the
next:

We said if you’re going to get through this you have to see the teacher. I
know she’s scary but you have to advocate for yourself. She did, and she
got her other friends to do it, and she felt really proud about that. I think she gained a lot of respect from the teacher. It’s a skill you have to learn.

Brittany, Emmy, and Lily all recognized there was some aspect of last year that was difficult for them and Emmy and Lily seem to have picked up some sense of self-advocacy from their efforts last year.

Not all the students experienced a change in confidence. Mosie described her sense of the teacher in a manner that seemed removed from herself. Mosie noticed an emotional sense in the classroom. She told me who made her laugh, who yelled. She told me she liked the Language Arts room because it had a carpet and a rocking chair. She liked the science room because the teacher sat among the students and not separate. She noticed colorful walls, bulletin boards, and quiet spaces. Here she liked when the teacher yelled because it makes others calm down:

*What do you like about math class?*

I like how the teacher yells at other people because it’s fun.

*What’s fun about that?*

She yells at Lenny a lot and that makes other people laugh, so people calm down. The room isn’t really inviting, it’s just really colorful.

These students’ sense of math and math class was intrinsically tied to their feelings about the teacher. Yet students and parents alike were unable, or unwilling, to articulate what about the teacher made them uncomfortable. I observed for two weeks and never once heard the teacher raise her voice or even seem angry in any way. The students claimed that that is probably because I was there. Ms. Versace’s class was well
organized, structured, and ran effectively. She liked order in the classroom and the
students all cooperated in achieving order. This order did not seem to hamper or interfere
with opportunities to engage with manipulatives and discussion; in fact, all the students
spent the class time on task and, for the most part, participating. One point of
clarification, the order and structure pertained to student behavior when it came to
instruction Ms. Versace did not prescribe the rules of mathematics.

When I asked Ms. Versace about her goals for her students besides the math goals
we had this exchange:

*Are there things outside of math that you choose to emphasize?*

Cleanliness. Hand washing, the benefits of exercise and fresh air. It’s
ture. If you ask the kids what I talk about, they say going outside and
washing your hands. Those are things they hear me say constantly. It
drives them nuts.

All of the students in this study had made a decision about the teacher’s
personality. For some of the students (Emmy, Brittany, and Mosie) this seemed to
interfere with their ability to motivate themselves in this class. For the other three (Lily,
Felicity, and Chiquita), the teacher was one part of engaging in school and they were
aware of Ms. Versace being different from their other teachers but did not see this as an
impediment to learning. My observation of the class and Ms. Versace’s interaction with
students was that she liked structure and imposed structure on the class. Some students
thrived in the structure; others struggled with the sameness of the routine. Ms. Versace
seemed to care deeply about her students when she spoke with me but none of the
students described her as one of their caring teachers (there were other teachers the
students described this way.)

In my observations, I noticed that all the students were mostly engaged in
classroom activities. In the social studies class that I observed students were having off-
topic conversations with their tablemates, reading material other than the social studies
material, or writing homework or notes. Here, in the math class, students were primarily
engaged in the task at hand.

**Social Networking and Engagement**

Students, parents, and the teacher all spoke of the priority of socializing at this
age. Brittany’s mother articulated the power of socializing this way:

This is the terrible puberty age. Everything is about social life. Anything
with work, responsibility - not interested. ... She never ends a friendship.
She collects friends, and that bothers me. I like that she’s social, but I tell
her you can move on. You find that you don’t have the same interests
anymore and you develop new interests. She’s a little too swayed by
friends, which surprises me because she was always a leader. They push
her around, and I don’t like it. …The power of her friends is too much in
her life.

Ms. Versace identified a gender difference about the dangers of disengagement at
this age, especially for girls. I had already turned off the recorder when she shared her
theory about this. At the next interview two weeks later I asked if she remembered that
conversation.

It was based on gut reaction. I feel that when girls disengage at this age I
worry about them more. I feel like it’s more permanent. For the boys, they’ll disengage, and then they’ll engage again.

Boy, it just doesn’t seem as easy [for girls]. I’m trying to picture them. If they started performing really well, I don’t really know. It seems like more of a hurdle. I can’t really put my finger on it, but it seems like it could be more difficult.

These six girls varied in how and who they each chose to socialize with. These choices were influenced by their parents in some cases but also by each girl’s sense of where they saw themselves fitting in. If Ms. Versace’s theory is correct and girls will have a more difficult time re-engaging after exploring this relational aspect of their identities, then does this put girls more at risk for disengaging from mathematics? Another perspective maybe provided by Carol Gilligan’s work. Gilligan (1990) showed that girls are more interested in building relationships than boys. Adding this to Ms. Versace’s theory of re-engagement being more difficult, it is possible to conclude that girls are at risk of disengagement from mathematics while in search of relational identity and then find it more difficult to re-engage in mathematics than in other content because of something in the mathematics curriculum that makes it less forgiving of this “dropping out” period.

**Untangling Performance and Engagement**

By the end of the two-week period, and process of elimination, I decided Chiquita must be in the “low-performing” category. I asked Ms. Versace about that:

Chiquita impresses me all the time because she just gets things!

*She’s on top of it.*
She’s probably intrinsically smarter than I am. I wonder how her brain does that.

So, why then was she ultimately in the “low-performing” group? She did not turn in homework and what she turned in was done poorly. According to Ms. Versace:

And they [all three “low performers”] also don’t do particularly good work. They write garbage on their papers. Isn’t that weird? But all three of them are very bright girls. I would even go so far to say that they’re purely intelligent and capable. They’re probably higher than those three [the high performers] in terms of their brain. They’ve got this spark that’s really interesting, but you couldn’t prove it.

Chiquita appeared very engaged in class. She raised her hand, she worked with other students around her, she worked on the assigned problems. Her contributions in class were on topic, yet she was identified as “low-performing”. She was engaged during class but not inspired or engaged enough to work on math outside of class. She did have this level of engagement with her music. She explained to me that she spends hours each week after school and on weekends practicing and performing music. She had after school support from a local church group to do her homework and she did homework in that environment. She got low grades in math class because she failed to turn in good work on time. According to her teacher:

[Chiquita] really wants to do well, wants to go to college, has a lot of ambition to do well, and comes from a personal place. She doesn’t have parents or teachers who say you have to do this and that. She wants to go
to college and do well, but she’s never done well in the two years that I’ve known her.

Chiquita was engaged in mathematics while in class. She was engaged in many things outside of math class. She had aspirations and ambitions to go onto college (and study music) but she did not see math as a part of those aspirations. In addition, her outside of school network had not managed to show her the connections between math and college aspirations.

Ms. Versace realized that all of the “low-performing” girls struggle with engagement with mathematics outside of the classroom and she wanted to continue to challenge them.

When I was talking about the three non performing girls and said they’ve never performed, I meant that in all the years I’ve had them, they’ve never been low performing. They’re all bright and capable, and I wouldn’t move them down out of this higher level class as much as they’d want me to.

This engagement and performance conundrum is reflected in the NECAP scores I obtained for each of the six students. The NECAP score is a three digit score. The first digit represents the grade level of the student, in this case eight for eighth grade. The next two digits combine to show where they stand relative to other students in their school, district and in the state. Scores in the 40s represent the “Proficient” level and scores in the 30s represent the “Partially Proficient” level. Table 2 shows the six students
in the study, their NECAP scaled mathematics score and which category the teacher had put them in.

Table 2. Performance on NECAP and Teacher’s Assessment of Performance.

<table>
<thead>
<tr>
<th>Name</th>
<th>NECAP Scale Score</th>
<th>NECAP proficiency level</th>
<th>Teacher’s assessment of performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brittany</td>
<td>838</td>
<td>Partially Proficient</td>
<td>Low Performing</td>
</tr>
<tr>
<td>Chiquita</td>
<td>841</td>
<td>Proficient</td>
<td>Low Performing</td>
</tr>
<tr>
<td>Emmy</td>
<td>838</td>
<td>Partially Proficient</td>
<td>High Performing</td>
</tr>
<tr>
<td>Felicity</td>
<td>841</td>
<td>Proficient</td>
<td>High Performing</td>
</tr>
<tr>
<td>Lily</td>
<td>843</td>
<td>Proficient</td>
<td>High Performing</td>
</tr>
<tr>
<td>Mosie</td>
<td>838</td>
<td>Partially Proficient</td>
<td>Low Performing</td>
</tr>
</tbody>
</table>

The girls’ scores on the NECAP tests were all close to each other (see Table 2). However, the teacher’s assessment of “high performing” and “low performing” did not align with the NECAP assessment of “proficient” and “partially proficient” as one might expect. It appeared that engagement was connected to the performance that the teacher was assessing but not necessarily to the performance the NECAP’s were assessing. If we define engagement as attention in class, completing work on time and turning it in, and achieving good grades, the teacher’s sense of performance is linked directly with engagement. However, if the NECAP’s measure a student’s understanding or mathematical ability, it showed that for some (Chiquita and Emmy) their engagement was not linked to their performance.
Chiquita is the best example of the student who was very engaged in class. She spent most of her time “on task”, doing what was assigned and working with others to understand. She raised her hand regularly and participated frequently and accurately. She asked questions that were on topic and seemed to help clarify content for herself and others. Her NECAP scores suggested she was “proficient” in the content. However, her work outside of class was lacking. She did not turn in homework on time and her work was often “garbage” according to Ms. Versace. Chiquita appeared to be engaged in class and not engaged with mathematics outside of class. Her other interests kept her engaged after school. She spent many hours a week practicing her music alone or with others or performing.

Emmy participates minimally in class. She rarely raised her hand or offered insight in the conversations. She did work on the tasks given and completed all of her homework on time. By these measures of engagement she was engaged; however her NECAP’s report she was only partially proficient in mathematics. Her father’s experience of her ability to problem-solve in “real life” situations also supported this assessment.

My daughter is much more different. She has to work a lot harder to get decent grades. But she’s never done poorly because she’s very competitive, like in sports. … A lot of her friends are pretty good students, like on the basketball team. She’s a little bit on the lower end of most of her teammates, especially in algebra this year.

Marks (2000) studied classroom engagement and student achievement. In her study she defined engagement as “the attention, interest, investment, and effort students
expend in the work of learning” (p. 155). In the classroom, both Chiquita and Emmy are engaged. Chiquita seemed more engaged in the classroom than Emmy did. I observed Emmy gazing out the window at times but never saw Chiquita drift her attention. Out of the classroom, on homework, Emmy was much more engaged. Emmy took pride in being a “hard worker”. Chiquita sometimes got her homework done and sometimes did not. She knew it affected her grade but still she waited until the end of the marking period to be sure she had turned in her work. Ms. Versace’s grades emphasized homework completion and accuracy so Emmy’s grade was bolstered by this while Chiquita’s grade suffered. On the NECAP test, which did not take into account effort but just performance on a given day, Chiquita outscored Emmy. Grading that includes assessment of effort (homework and classroom participation) obviously is affected by engagement in and out of the classroom. However, this does not clearly and directly result in higher performance on common assessments. Including homework and class participation in the grading scheme probably helps students learn a work ethic that involves “expend effort in the work of learning” but it does not directly result in improved achievement. An additional effect of including homework and class participation in the grading scheme would be to bolster a student’s self-esteem with regards to the subject even if she did poorly on tests. This might lead to a more positive attitude toward the teacher and the subject which might lead to more engagement.

_Structuring Class_

“Take a second to remember back to Friday…” says Ms. Versace and the main lesson portion of class has begun. Each day of my observation is similar. Students come in, sit at their desks, and if not working on the warm-up problems they are getting settled
into class and into their seats. These students have had Ms. Versace as a math teacher for two years and they have clearly come to understand the system that she employs.

The class is so organized that I could almost predict each day. Warm-up problems on the board, students walk in and begin working. One day Ms. Versace is using algebra tiles to build the concepts of variables, polynomials, factoring, and multiplying. She begins getting bags of algebra tiles from a bin in the back of the room and passes them to students nearby. Students jump up to help. They quickly distribute the bags so that every student has one. The students who helped her return to their respective seats and Ms. Versace moves to the ELMO projector to explain the task ahead. It is choreographed and performed so smoothly I sensed they have done this before and yet I know this is the first time the algebra tiles have been used. The students and Ms. Versace have a non-verbal communication routine that has this classroom running smoothly. I am surprised by what I do not see: little or no calling out, little random wandering, no off-topic questions.

At the end of the class period no one moved until Ms. Versace gave the “go ahead” that it was time to leave (although sometimes a student points out the time). When she did signal that class was over, students quickly returned materials to their correct place, packed up their books and filed out. Nothing was left out of place on the tables or left behind.

At first I thought perhaps this was Ms. Versace's doing; her training of this group over two years but I am not sure. I observed a social studies class that behaved similarly. Here students were less engaged, many were whispering while the teacher read. Other students were doing other work while the teacher read, including reading a different book
inside the text the teacher was reading. Although they were not engaged they did not call out. The main difference here was that students were noisy when entering and exiting, they did whisper with others at their tables, and they did leave stuff behind when they left the room.

I asked Ms. Versace directly about what she expected of students in her classroom.

They have to learn what to write down and when; they have to learn what they need as individuals to write down and when to write it; and they need to understand when assignments need to be done and don’t come in without understanding it. They need to be able to come in for help and not come in for help. It doesn’t go over well when you come in and say you didn’t understand what’s gone on for the last six weeks. They need to know that you can’t memorize things that mean nothing to you. Use your logic. You have to understand what you’re doing. That’s really it.

There’s no plug and chug. The algebra unit is the most plug and chug they’re getting in two years. If they don’t understand what’s happening they never will.

This structure and predictability worked well for some students, including Chiquita and Felicity. However, the predictable structure of each day was more difficult for some students, including Brittany and Mosie, who sought out change. Brittany explained her experience of math class this way:

Math. We get work packets and we can do it on our own. What doesn’t work for me in math is that I get some of the stuff, but I don’t really try. I
care, but I don’t try that much. It’s not that I don’t mean to. Math used to be my best subject.

What does Brittany mean by “it’s not that I don’t mean to”? I suspect she would have liked to behave, do what was expected but she could not motivate herself to do that for some reason. She was not engaged in math or school. She saw herself as having the ability, “math used to be my best subject,” but not the motivation. Ms. Versace did care and observed this about Brittany:

[Brittany] has a lot of social things going on. She wants to do well, but less for personal reasons. My impression is that she wants to do well so people can get off her case.

The structure included the stability of the seating arrangement. Would engagement for some students be improved by moving their seating placement and varying the lesson plan from time to time? Could Ms. Versace improve student engagement by sitting or standing among the students more often? Do they perceive her as separate and therefore easier to disconnect from?
CHAPTER 5: DISCUSSION

Like any qualitative analysis, I did not find any nice, neat answers to girls’ engagement in mathematics in middle school. I did, however, hear some important elements from these six girls. The three girls who were identified by their teacher as “high-performing” all had support and role models at home to stay engaged in school, to aspire to college, and to understand the necessary academic achievement required to reach those aspirations. The three “low-performing” girls all came from homes headed by a single mom. These families were challenged financially and none of these three mothers had made contact with the school in some time. Two of the three mothers gave initial consent but then failed to follow through with the interview appointment. The third mother seemed overwhelmed and without a partner to help her sort out the challenges of raising an adolescent girl and seemed on the verge of disengaging as well.

This section is organized with a brief summary of the six themes followed by a discussion of my findings. This discussion includes my reflections on this study in relation to prior studies. After the themes and findings I present my thoughts on the implications for practice and future research. I conclude this section with some final thoughts on this study and my learning.

Summary of Themes

Factoring in the Algebra Class

“Factoring in the algebra class” was one of the six themes that emerged from the data. Some students were chosen from seventh grade to go on to an algebra class in eighth grade. This resulted in a smaller eighth grade math class for the remaining students, however, many students were aware that they had not “made it” into the algebra
class. The three “high-performing” girls had all advocated for being in the algebra class. In some cases, their parents seemed more interested in their daughter being in algebra than their daughter did but in all three cases they had contacted the teacher to clarify the reasons their daughter had not been placed there. The three “low-performing” girls did not focus on the algebra class, and none of their parents advocated for them to be in the algebra class. They were aware of its existence partly by noting that their current class was smaller than their seventh grade class and the group of students was different. Ms. Versace felt that the “high-performers” were better able to “shine” now that the students who went on to the algebra class were no longer with the group. Lily’s mother alluded to this factor for Lily as accepting her place in the hierarchy of student mathematical ability. “She’s average and she’s content with that.” Emmy had chosen not to work over the summer to try to achieve placement in the algebra class. Felicity’s parents had arranged a teacher conference to discuss the possibility of Felicity being placed in algebra. When the teachers (the team was present for the conversation) assured them that Felicity was better placed in the regular eighth grade math class they accepted that decision. Felicity expressed the desire to do the best at whatever tasks were placed before her. She did not express longing for the algebra class that she did not get placed into.

Finding Seats

Here the power of the teacher to place a student geographically in the room was unmistakable. Ms. Versace was clearly aware of the importance of sitting up front in what she termed the “prime real estate” and seemed to admire students who “fought” to be up there. On the other hand, she regretted the fact that some of the seats were assigned by powers outside of herself (compliance with Section 504 and ADA for example.)
Ultimately, she chose who was given the front seats and who was denied. The fact that seating remained constant throughout the observation (and I believe from conversations with the students and teacher they remained constant throughout the year) led to a win-lose situation with who was able to procure those front seats. Emmy and Mosie exemplified this as Emmy was seated in the back of the room and asked for and received permission to sit up front. Mosie was originally closer to the front of the room but was moved back. She perceived this new position as permanent and felt that she was not allowed to ask to move back.

Emmy: I sat in the way back behind Lenny, and I couldn’t really see. So she said, you work well with Lily, so she put me there.

Mosie: I asked if I could be moved but I wasn’t allowed to. You can only do that for projects. … I just don’t like it. I feel by myself.

**Relating to the Teacher**

This theme discussed the many ways the students and their parents interact with the teacher. Some students were apprehensive about approaching the teacher, while other students saw the teacher as part of the learning process and felt that approaching her was just a part of the school day. Brittany and Mosie both feel indifferent at best about approaching this teacher in particular and said that kept them from seeking her out for additional help. During the observation period, I watched as Emmy and Lily seemed confused about a concept and Lily encouraged Emmy to go and ask the teacher. Emmy hesitated so Lily got up and started walking towards the teacher’s desk. She stopped part way there and again gestured for Emmy to join her, slowly Emmy rose and joined Lily.
Felicity felt that she could ask the teacher questions at any time and that the teacher responded.

**Social Networking and Engagement**

This theme, too, emerged from the voices of the girls and their parents. Fitting in was an important factor for all six girls and did enhance or lessen their engagement in mathematics class and on mathematics work, especially homework. When the girls sought out or surrounded themselves with other peers who worked outside of class on homework (Felicity and Lily in particular), their homework completion and quality and self-reported understanding was better than the girls who did not. Emmy and Chiquita both found social networks outside of school that were not academically focused. For Emmy this was sports and for Chiquita it was music. Emmy managed, with the strong encouragement from her parents, to also complete homework on time and mostly accurately. Chiquita did not always complete her homework and this negatively affected her grades. The last two girls, Brittany and Mosie, found social networks that emphasized non-academic activities and they received no other support or encouragement to complete work outside of class.

**Untangling Performance and Engagement**

As the study progressed, I was faced with the challenge to better understand what was meant by engagement and how engagement affected performance and how its definition was reflected in performance. Homework completion can be an indicator of engagement as in Marks’ (2000) definition “the attention, interest, investment and effort students expend in the work of learning” (p. 154). However, if homework completion is also used as an important factor in determining a student’s grade and grades are used to
indicate performance, then homework completion is a confounding variable to the measure of engagement. This complexity made it difficult to sort out some of the girls’ thinking into neat categories, like their sense of confidence, a student’s engagement was context specific. Engagement was influenced by parental support and encouragement, by the affective relationship students had with the teacher, and by a student’s sense of success and motivation to persist. All six students were engaged in mathematical activities in math class. Ms. Versace agreed that all six students had the innate ability to comprehend the mathematics.

Another element was the NECAP scores for the six students in the study. These scores did not align with the teacher’s evaluation of “high-performing” and “low-performing”. Ms. Versace’s heavy emphasis on homework completion affected her sense of student performance emphasizing work completion over concept understanding. As I will discuss later in more detail, Ms. Versace’s heavy emphasis on homework completion was different than the snapshot sense of performance that the NECAP tests measured. In some cases, Ms. Versace’s use of homework completion as a key indicator of performance led to a different sense of high or low performance than the one indicated by NECAP scores.

*Structuring Class*

The class was well organized and well managed. Ms. Versace’s organization and class goals were clear and consistent with her behavior. The six students each responded differently to this structure. Lily and Felicity accepted the structure and adapted with some flexibility to meet the expectations of each of their teachers and this teacher in particular. Chiquita liked the structure and it appeared that within the structure she was
able to engage with the mathematics. Once Chiquita left the classroom and its structure she was less able to follow through on her homework. Brittany resisted the structure and knowingly bent class rules about texting, chatting, and writing notes. She could and did engage with the mathematics when others were not available to engage with her socially. Emmy was mostly engaged in class and with parental supervision worked to complete homework in time and turn it in. Mosie was least engaged in class and spent little to no time thinking about mathematics (or school for that matter) once she left the school building. The structure was beneficial for most of the students.

**Discussion of Findings**

This study looked at engagement among adolescent girls. I discovered that engagement is a messy concept that has many different aspects. The initial goal of this study was to consider engagement in mathematics and my original concept of that was engagement in the mathematics classroom. I discovered that all six are engaged with different aspects of their lives. None of the six seems to have a passion for the mathematics they are learning in the classroom; however, all engaged in the activities of math class. In the 10 days I observed the class, only one of the six students missed any class. Chiquita missed one class because she was injured earlier in the day and sent home. This type engagement might be best characterized by Cobb’s (Cobb, et al., 2009) category of cooperating with the classroom mathematics as opposed to identifying with or resisting it.

The six girls engaged in a variety of things during the school day. Brittany engaged in trying to feel connected to her peers, collecting friends, and having a boy friend. Mosie engaged in some kind of survival; she came to school and quietly sat
through class after class. Her one friend provided her with a peer group where she could also hide out. Chiquita was very engaged in her music and her church group and reported that it was in those settings that she experienced a sense of accomplishment and belonging. While at school she engaged in the tasks at hand; in math class she participated with the content and her peers. She seemed to learn quickly and absorbed the ideas into a larger context. However, mathematics is not where she saw her future, her aspirations.

The three “high-performing” girls engaged in following the rules and expectations. All three did their homework and participated in class. Lily said she was ready for high school; she was ready to be done with middle school. Math class, honor roll, sports are all her work and she engaged in doing them well. Felicity was clear that academics were important to her, her parents, and her future. She engaged with the mathematics because it is connected to her aspirations for work in the medical field. She chose to engage with friends who have similar goals and are serious about their academic future. She saw school as a tool to reach her goals and she made the most of her opportunities there academically. Emmy was the least engaged of the three “high-performers”. She was also the one of the three that is only “partially proficient” according to her NECAP scores. She was clear that her friends were doing well in school and that she needed to work to keep up. She was engaged in basketball to an extent. When I asked her what she had learned recently in basketball she had difficulty articulating it. She did not like the coach who she thought favored the coach’s daughter. She preferred a younger coach who had had success on the basketball court; perhaps Emmy saw her as a role model for the sport. Emmy was engaged in finding, building,
and maintaining her relationships with her peers. Keeping her grades up and doing her homework kept her within her group.

**Research Question 1**

This question asked how middle school girls perceive their performance. Five of the students (all but Mosie) responded that they were confident in math and that they mostly did what was asked of them. All six were able to articulate what was expected of them, primarily in terms of work completion (i.e., participate in class, stay on task in class, do your homework and turn it in, do the tests and quizzes). Lily told me that she was sure she understood the math but that she did poorly on tests. Here I saw that gauging their own performance and engagement was difficult for these girls. Emmy compared her grades with the grades of students around her to see if she was meeting the expectations. Brittany and Chiquita noticed who was producing right answers in class and whether or not they were in that group. Felicity came closest to being able to articulate engagement with the subject: “You have to try your best. Even if you don’t know, you have to try your best. You can’t just leave it the way it is and expect it to be what you want.” The other five students engaged mechanically with the tasks presented to them but did not seem to reflect much on their own understanding of the material.

**Research Question 2**

This question asked about the central messages these girls received about their abilities and interest in mathematics. These girls received lots of messages from their parents, peers, and teacher about their abilities and the value of doing well in math. I was very surprised to hear Emmy’s mother dismiss math as something she was never good at. I did not expect a female teacher today (Emmy’s mother is a teacher) to be so cavalier
about her poor mathematical abilities. Ms. Versace believed that girls, in particular, were in danger of disengaging from math at this age and that once they disengaged, they might not be able to re-engage with the subject. The students talked about whether or not their friends worked on math homework and whether or not they were friends with students in the algebra class. The school, by having an algebra class and a system of tracking students, also sent a message about the hierarchical nature of math ability. The students in algebra were good math students, the other students just needed to study math in order to complete school.

**Research Question 3**

The question asked about what role do parents, teachers, and peers play in these girls’ performance and engagement in mathematics. Parents, teachers, and peers all contributed to the messages students received about their abilities and interests in math. In addition, the three “high-performing” girls had parents who were actively involved in supporting their success in math. Emmy and Felicity’s fathers helped them at home with homework questions and by stretching the curriculum to include real life applications in Emmy’s case and other advanced math and science topics in Felicity’s case. Lily’s parents both supported Lily and her sister to be engaged in academics, in reflection and critical thinking at home, and in working within the school structure for success. The parents of the three “low-performers” were less engaged with their daughter’s school work. None of the three were aware of any specifics about school. Brittany’s mother responded to notes from school about Brittany’s struggles and Mosie’s parents came in for a parent conference for the first time after the start of this study and a failing grade on Mosie’s report card.
Research Question 4

This question about how do middle school girls perceive their place in the classroom yielded the richest responses. The process of who sits where and when you can speak to the teacher and each other are all constructed in the context of the classroom. Mosie perceived herself as a “blob” in the back of the room who was unable or unworthy of moving up to the front of the class. Chiquita perceived herself as a part of a community, a class. She interacted easily with the students around her and felt confident that her contributions were worthwhile. Lily was quiet but also acknowledged her place as one of the better math students in the class. She sat up front and focused on the teacher. She seemed almost unaware of her classmates, emotionally shielded from them. Emmy, too, separated herself somewhat from her classmates. Her sense of accomplishment, however, was always measured against others: Lily, her brother, the algebra students who were on her basketball team. Emmy acted bored and disinterested but was always measuring herself against the successes of others. Felicity sat among her peers and felt that while everyone had equal opportunity and ability, some chose to work and focus more on math than others. She described herself as wanting to learn more and do better. This was set against a personal standard and perhaps her father’s opinion; it was not something she measured against other students in the class. Brittany went to class because all her friends were in class somewhere anyway. She did not perceive herself as being among a community of learners. She liked some of the activities and preferred to participate rather than to be bored. These girls all constructed their
perceptions of their own engagement from the perceptions of others. They reflected on whether they were engaged enough to satisfy others, e.g., the teacher, their parents, etc.

**Unexpected Findings**

*Homework as a Measure of Performance or Engagement*

Ms. Versace proved to be a very competent teacher. She believed strongly in empowering her students. She had a well-managed classroom with lots of structure. She gave the students lots of opportunities to discover foundational concepts through experimentation. She felt some pressure to hurry by the Common Assessments that measure student achievement at the end of each unit. The entire district tests on the same schedule so she felt a strong need to meet these benchmarks. Sometimes she felt that she was hurrying a portion of the unit because of the pressure to meet those timelines. To Ms. Versace, homework completion (and accuracy) was an essential element of performance. The differentiation she made between “high”- and “low-performing” girls in her class came down primarily to a difference in their discipline about completing homework accurately and on time.

My observations suggested that Ms. Versace neither sparked the passions of her students nor angered them to disappointment. Her quest for order was paramount, but did not obscure her sense of respect for all students. She kept the class moving forward: all students knew what was expected of them and they each chose how much to participate within those parameters. The three “low-performing” students, for the most part, did not do math homework or did it poorly. The three “high-performing” students consistently did homework and did seek out Ms. Versace if they had questions, unlike the “low-performers”. The issue of tracking engagement and performance was complicated
because homework completion was a part of the definition of performance and similarly a part of the definition of engagement.

**The Rigid Order of the Math Sequence**

The curriculum used by Ms. Versace in the classroom was a curriculum based in constructivist theory of students building their own knowledge. This is one of the curriculums endorsed by NCTM and the reform movement in mathematics. Ms. Versace liked the curriculum for the most part but felt pressured by the testing schedule of the district and state necessary to comply with provisions of the No Child Left Behind Act. The aspect of the curriculum that came up in this study was the chronological, linear, progression of topics especially as students entered middle school and high school.

There was an element of the math curriculum that appeared to be unforgiving. It was what Ms. Versace related about her own experience: “I wanted to go hang out with my boyfriends, not do my math homework. I was always capable of doing it, though.”

Ms. Versace started disengaging in high school algebra. By the time she was less interested in boys and more interested in her education she was older than students taking Algebra 1 in high school. The curriculum had passed her by. Ms. Versace left school and returned to math later taking courses at the community college. Here students were a variety of ages and entering the math curriculum at a variety of levels. Ms. Versace could pick up where she left off with Algebra 1. It is not clear how Ms. Versace knew she “was always capable of doing it”. Later Ms. Versace not only completed the minimum level of mathematics courses but went on to major in mathematics as an undergraduate student. Perhaps she is an example of how students can disengage and
later re-engage with mathematics. Could we do a better job of making this possible within the high school setting?

Once a student misses a year of the curriculum because of disengagement there is no easy entrance back in to the program. If you were busy focusing on your relationships with boys while you were in ninth grade, for example, then you could easily have missed all of Algebra I. Without Algebra I you could not move on to Geometry or Algebra II, you would have to repeat Algebra I with students who are not your chronologically aged peers. NCTM suggested in their 1989 document on curriculum standards that the curriculum in high school should become more integrated (algebra with geometry and all with probability and statistics). Even in this environment, the NCTM principles suggest a hierarchy of material.

A school curriculum in line with these standards should be organized so as to permit all students to progress as far into the mathematics proposed here as their achievement with the topic allows. In particular, students with exceptional mathematical talent who advance through the material more quickly than others may continue to college-level work in the mathematical sciences. (National Council of Teachers of Mathematics, 1989, p. 124)

Regardless of the actual name of the courses, students who miss a year of mathematics have left the fast track to college-level mathematics. By 2000, NCTM has modified this hierarchy to address a more heterogeneous mathematics class.

High school students with particular interests could study mathematics that extends beyond what is recommended here in various ways. One
approach is to include in the program material that extends these ideas in depth or sophistication. Students who encounter these kinds of enriched curricula in heterogeneous classes will tend to seek different levels of understanding (p. 289).

This movement towards a more heterogeneous classroom with differentiated instruction is important to maintaining access for students even after they may have disengaged for a period of time.

In the classroom in this study, tracking exaggerated this sense of predetermined position in mathematics ability. In addition, perhaps the fact that students were tracked allowed teachers to feel less of a need for differentiated instruction. Whatever the reason, the instruction I observed was whole class focused on common tasks. There were few opportunities for enrichment or remediation.

**Evaluating Homework and Measuring Achievement**

Why did Ms. Versace choose to weigh homework completion as she did in the grading of her current students? What were her goals? Was she trying to formulate good study habits among her students? She believed that doing homework helped students stay engaged with the material outside of class. When she was evaluating “high”- and “low-performers” she was evaluating performance as an action: completing work. She believed that hard workers eventually outperform the others.

I can also see students who weren’t born bright but work their tails off, and they’ll outperform the students who were born bright but are lazy. At the end of two years, the students that I wouldn’t consider born intrinsically brilliant but work their tails off are more advanced than the
others. I’ll always talk about it at the beginning of the year, saying that it’s all about work ethic and that comes from you. Nobody can make you learn anything unless you want to.

Do educational leaders need to think about this issue of measuring performance by including homework completion as an integral part of student grades? Can we “teach” students to engage by incentivizing homework? What is the goal of homework?

Why are mathematics classes still being “tracked” by ability levels? Do mathematics teachers need more support in differentiated instruction? Is there room in this era of high-stakes achievement testing to allow students to progress at different paces through the curriculum?

**The Complexity of Engagement**

I discovered that engagement was a somewhat elusive concept. It was contextual and raised questions about where engagement was taking place (in school or out, in math or another class), and whether it was a solitary endeavor or a social creation (as in Felicity choosing to surround herself with friends who were more serious about school). In addition, this study looked at engagement in mathematics in a short specific period of time. What does engagement with mathematics look like for these girls over a longer period of time? What effect does aptitude have on engagement and how is that affected by the aptitudes of all the other students in the classroom? Marks (2000) discussed this concept of selective engagement:

Developmentally, engagement is a growth-producing activity through which the individual allocates attention in active response to the environment. … How children and adolescents choose to allocate their
attention depends on the interaction of several factors: their natural inclinations, the satisfaction they have derived from paying attention in other settings, and the value they attach to the activity based on its relevance to a future they anticipate. (Marks, 2000, p. 155)

This study supported Marks’ (2000) findings about personal background and orientation towards school affecting engagement. Students whose parents were more connected with school were more engaged in school generally. Students who had family who were successful in school and career were generally more focused on and engaged in school. At the middle school level, Marks’ study did not find a difference in engagement between math class and social studies class. My observations in this short period showed that in this case students were more engaged during math class than during social studies class. Students reported that social studies was “easy” and they could manage to complete the necessary work to get good grades. Thus, their performance in social studies and their grades appeared better than in math but they seemed less engaged during class in social studies than in math.

All six of these girls felt that they could succeed in social studies because there was room to fall behind and catch up. There was time within the class structure to learn the material (which was reported to be slow and boring for some girls) and turn in the necessary work. Five of the six girls (all but Mosie) felt successful in mathematics class. These five felt they understood the work and did not identify any specific problems. However, two of the five girls were failing or nearly failing the course, mostly due to poor homework completion and quality. This raises issues of how we can accurately measure and reflect achievement. What does it mean to be doing mathematics
successfully? The three high-performing girls measured their success mainly by their grades, which were strongly influenced by their compliance: completing homework, turning it in on time, participating in class. All three high-performing girls achieved in the average range on the NECAP, and were high-performing in relation to this year’s class peers. Last year, with the students who ultimately went on to the algebra class present in class, these three girls worked hard to keep up with the material and classmates. What does it mean to be earning better grades in a class with a lower median performance? Can these students, performing well in this class, continue to achieve in mathematics and will they stay engaged? Does the opportunity to earn better grades relative to a lower performing cohort influence engagement over time?

**Parental Involvement**

Parental involvement and support was an important factor in the engagement of the three “high-performing” girls. All three of these parents expressed interest in their daughter’s success at school; all had been in contact with the school multiple times during the year. Some of these contacts were e-mail or phone calls, some were attending events, like the honor roll assembly, and sometimes the contact was with other parents or school staff to better understand the school culture. All three of these parents had various obstacles to their own involvement: language, time commitments, and conflicts, but all had overcome these obstacles to attend at least some school meetings. The three low-performing students’ parents had little contact with the school. Two of the three parents had no contact with the school this year prior to this study and no contact last year. The third parent had some contact with the school but felt insecure in seeking out contact. This parent talked about the school as being “right there” geographically but that she had
not attended. Her daughter had made honor roll in sixth grade and she had attended the assembly. She displayed her daughter’s artwork around the home and had the “My student is an Honor Roll student at ___” bumper sticker still on a bookshelf in the living room. The disengagement of this student was more influenced by her peer group.

**Implications for Practice**

*Varying the Classroom Structure*

The theme of seating shed some light on the construction of engagement, at least as the students defined it. Students near the front had less distractions, more access to the teacher and would be more noticed if they disengaged. Students towards the back were more invisible and could engage less with the mathematics and more with other things. Regardless of where these girls sat, they all appeared engaged in class. The structure of the class was predictable and did not allow for easy opportunities for distraction. That said, occasionally changing the seating arrangement and/or the teacher’s position when explaining things (Ms. Versace was usually in the front of the room) would probably have encouraged more engagement more consistently from students in the back. Students were aware of whether they were “allowed” to move up front or not and this sent a message, though I think it was unintentional, of the student’s worth in the teacher’s eye. The teacher herself referred to the “prime real estate” at the front of the room and was very judicious in determining who got to sit there. Mosie was not happy with her seat in the back, had been moved back from a seat further front, but felt that she could not ask to be moved toward the front or that her request would be denied.

The two students in the study who had front row seats came from middle-class intact two-parent households and lived in single family houses owned by their parents.
The two students in the study who had seats in the back row came from families with less resources. Brittany was from a household headed by a single mom on disability living in a government-subsidized apartment. Mosie came from a two homes, her mom living in a government-subsidized apartment. Ogbu discussed the assumptions and interactions that school personnel can have with students from minority groups (in this case students from a lower socio-economic group) (Ogbu, 1987). He noted that school personnel can very subtly express lower expectations for some students. When Ms. Versace moved Mosie to the back row and subsequently not allow her to move forward indicate one of these subtle expressions of lower expectations?

Felicity comes from a group that Ogbu refers to as “voluntary immigrants” and true to his research findings, Felicity and her family believe in school and hard work as means to get ahead. As Ogbu’s work suggests Felicity and her family interpret any setbacks (e.g. not getting into the algebra class) as simply a system in a new country that they have yet to understand completely.

In addition, changing the order of the lesson might also add some variety that could help engage those students who seemed more easily bored. Adolescence is a difficult and turbulent time. Some students need structure and some students are ready for more independence. Changing the order and structure periodically would help give access to more students who need structure but are not thriving within the current structure.

The importance of relevance to students of the content raises some concerns about the mathematical content and the instructional activity. Ms. Versace talked about the “plug and chug” aspects of algebra that she as a student could do without really
understanding what she was doing it for. Brittany spoke in her interview about “this stuff with the alphabet” which was new but she was sure she would get it. The relation of algebraic notation, manipulation, and function was removed from a tangible sense of the real world except as a gateway to future study. Tristan Needham (1997) related this:

Imagine a society in which the citizens are encouraged, indeed compelled up to a certain age, to read (and sometimes write) musical scores. All quite admirable. However, this society also has a very curious -- few remember how it all started -- and disturbing law: *Music must never be listened to or performed!*

Though its importance is universally acknowledged, for some reason music is not widely appreciated in this society. …

But in our society of mathematicians we *have* such a law. It is not a written law, and those who flout it may yet prosper, but it says, *Mathematics must not be visualized!*

More likely than not, when one opens a random modern mathematics text on a random subject, one is confronted by abstract symbolic reasoning that is divorced from one's sensory experience of the world, *despite* the fact that the very phenomena one is studying were often discovered by appealing to geometric (and perhaps physical) intuition. (Needham, 1997, p. vii)

Would changing the instructional pedagogy to include a lot more visualization increase engagement? Mosie sought out visual cues and perhaps for her more visual mathematics would have made the content seem, if not more relevant at least less boring.
The existence of tracking and the limited amount of differentiated instruction in this classroom is important to mention. All of these students were in a narrow range of achievement, no one student stood out on the NECAP scores or in classroom activities as much more or much less capable of understanding the material. Most were aware of the existence of another group of students who were smarter than they were (the algebra group) and a group who was slower than they were. These students mathematical aspirations were limited somewhat by the track in which they found themselves. They would not be taking geometry next year and were highly unlikely to have the option of taking any Advanced Placement mathematics courses.

**Future Research**

These girls were all balancing the four worlds of alienation that Bronfenbrenner (1986) researched. As each girl felt more or less engaged at home, work, with friends, and at school, their engagement was affected in the other realms. The girls who experienced order and support at home and with friends were more engaged in school in general and mathematics in particular. Girls struggling with issues at home or with friends had more difficulty in school. This study showed me that engagement is multifaceted and complex. To examine engagement with a particular curriculum still raises questions about where and when. For example, all of these girls were engaged in the mathematics classroom but for many their engagement ended when they left the room. Also, engagement is temporal; this study looked at engagement during a two-week snapshot in time. What would engagement look like for each of these girls over a one-year, five-year, or ten-year period?
Parental involvement and support was an important factor in the engagement of the three “high-performing” girls. All three of these parents expressed interest in their daughter’s success at school; all had been in contact with the school multiple times during the year. Some of these contacts were e-mail or phone calls, some were attending events, like the honor roll assembly, and sometimes the contact was with other parents or school staff to better understand the school culture. All three of these parents had various obstacles to their own involvement – language, time commitments and conflicts – but all had overcome these obstacles to attend at least some school meetings. The three low-performing students’ parents had little contact with the school. Two of the three parents had no contact with the school this year prior to this study and no contact last year. The third parent had some contact with the school but felt insecure in seeking out contact. This parent talked about the school as being “right there” geographically but that she had not attended. Her daughter had made honor roll in sixth grade and she had attended the assembly. This parent had been much less engaged with the school since then.

George Kuh and colleagues (Kuh, et al., 2008), who studied engagement in post-secondary schools, looked quantitatively at engagement and success in college. He and his colleagues defined engagement as having three parameters: “time spent studying, time spent on co-curricular activities, and a global measure of engagement…” (2008, p. 545). While their study was on post-secondary students, we see some of the complexities of engagement and performance unveiled. In the current study, I defined performance as including homework completion similar to the time spent studying parameter that Kuh et al. used. However, when the teacher selected “high-performing” girls she included homework completion as an element in her selection, thus confusing the variable. In
middle school, including homework completion in grading helps students learn the importance of time spent studying; however, it does not in and of itself lead to engagement or understanding.

Further study might include more precise, separate, and delineated definitions of engagement and performance. While NECAP scores are problematic for use as a standardized performance measure they do give a sense of performance within this cohort at this grade level. The aspect of engagement that I was hoping to observe was not a work ethic measure but an interest level. Further work to identify observable and measurable parameters of engagement is needed.

**Limitations of this Study**

Data collection for this study took place in a short period of time toward the end of these students’ eighth grade year of middle school. Students were distracted by this impending transition to high school. For some students they had concerns about whether or not they would be graduating. For other students they were focused on what courses and teachers they would have next year. In addition, an early spring had arrived and the weather was beautiful. It was difficult for students and teachers alike not to notice the warm sunshine outside the window. A study in a different grade (e.g., seventh grade) or at an early point in the school year would not have had the same kind of distractions.

The tracking of math classes led to a narrow pool from which to draw students for the study. This was mixed in the effect on my data. On the one hand, all six girls seemed to have very similar ability and so focusing on engagement allowed me to look at factors other than ability. On the other hand, there were not a lot of female students in any one math class to choose from. The particular class that was studied had a total of eight
female students. Because of this I felt some pressure to be sure I could get consent from the original six. The consent came easily but I then struggled with the two parents who were difficult to contact for the parent interview. Ultimately, I had to write up the study without these interviews. If I had interviewed all six parents before the classroom observation and student interviews I would have identified the need to replace those two students in the study. As it turned out by the time I was certain I could not reach those parents the school year was nearly over and the time for replacing subjects was long past.

There was some time pressure also introduced by some of the administrative cycles of the school year. I was squeezing my study in between school breaks (winter and spring) and hoping to finish observing before the month of May when the school schedule is interrupted regularly for assemblies and school-wide testing.

**Final Thoughts**

I have engaged in the preparing, conducting, and writing up of this study for the past year. I have learned a lot about research. Many warned me that the IRB was a difficult process; I did not find this to be the case. Instead, I found the clarification that the IRB requested to be important for my own understanding of the breadth and scope of the study. Their attention to the security of data and protection of subjects was not overbearing but appropriate.

My weeks in the school with the school personnel and the students were delightful. There is a skill to good interviewing and I have much to learn. The voices of the students, teacher, and parents, however, did shine through in the data and for that I am grateful. I found myself drawn to this teacher and instantly comfortable with her. That
led to some bias on my part that I needed to keep in check through written reflection and conversations with my advisor.

I was also aware that there were many lenses on the data I was collecting: the principal had expressed her interest that the school not look bad, the teacher was very curious about the data but I think also wanted to understand her part in this engagement process better, and the parents hoped for an extra set of eyes looking at the school that might have given them a glimpse into the world they felt a little cut off from.

In the end, I am left with the voices of the six students. They gladly spent time talking with me although they did not all completely understand what I was doing. When I asked them what they thought would encourage a person to engage with mathematics or lead them to disengage, they each offered a suggestion:

Lily: They may think, I don’t really want to do this right now so I’ll do it later, or this doesn’t really matter because I’ll just get a zero on it. If they tried and gave up on it, the people who try it are the ones who get it and don't want to do it later.

Brittany: Yeah. People get distracted in math when they’re in a relationship. … Sometimes I listen to my iPod in class. I’ll text people during math class if I have my phone, but I lost it.

Chiquita: Depending on who’s in my math class, homework, class projects, etc. If you can’t focus and you’re there with your friends, it’s hard to engage. If you knew someone who’s an acquaintance, it wouldn’t
be as bad.

Emmy: Learning. I can make my own choices about learning. I don’t really get to do that now. We get to pick our classes and how hard we want them in high school. There are longer class periods.

Felicity: I think high school has more things you can do. They might get into sports after school and maybe not get their math done. During school there are other subjects you can take, so they might like those better than math. They might think it’s challenging.

Mosie: If they had slower people in one class and faster people in another class, that would be better. But then people might think they’re slow because they’re with all these other people. I don’t know if that would work so well. I think that’s what they do now, but I’m not sure. If they had people who are a little shyer in one class?

Engagement is complex and I look forward to working in future studies to better define it, better understand it, and help students and teachers better achieve it.
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APPENDIX A: TEACHER INTERVIEW QUESTIONS

1. As you remember your own experiences in middle school, what factors do you think contributed to you becoming a math teacher?

2. How would you rate your own math abilities?

3. Why did you choose the students you did as “high performers” or “low performers” in math class?

4. Do you think these students would have the same self-assessment of their performance? What makes you think so?

5. When the students you chose (name students) need help where do they get that support?

6. Without regard for gender, who are your high performing and low performing math students?

7. What are your impressions of the effectiveness of the current mathematics curriculum in teaching your students mathematics?

8. What would you keep and what would you change if you could?

9. I am studying girls’ engagement with mathematics and what influences a stronger or weaker sense of engagement. If you were to hypothesize about engagement in girls in mathematics, what would you suggest were the most important factors?

10. What do you think contributes most to student success in mathematics?
APPENDIX B: STUDENT INTERVIEW QUESTIONS

Warm-up Questions:

What is your favorite school subject to study?
What do you think is the school subject you are best at?
How do you know?
If you were a character in a movie (e.g. Harry Potter), what character would you be?

Direct toward Mathematics:

If mathematics had a color associated with it, what color would it be?
Describe your strengths and weaknesses in mathematics.
When you think about high school and college, what subjects do you think you will study?
What jobs do you think you will have as an adult?
You told me about your strengths and weaknesses in math (re-iterate response from above.) How do you know this about yourself?

Perception of teacher’s evaluation:

How would your teacher describe your math abilities?
How does she(he) know these things about you?

Parents and home environment:

Do you ever talk about math at home?
What kind of conversations do you have? What do you talk about?
Do you get help from anyone with your homework? Who do you talk to if you get stuck on some homework problems or don’t understand?

Perceptions of other’s mathematics abilities:

Who do you think are the best math students in your class?
What are you basing that on?
What would other students say about your math abilities?
APPENDIX C: STUDENT JOURNAL PROMPTS

Please write in your journal every day. You can write about your experiences in class or while doing your math homework. Choose one of these questions each time you write to focus on. Be sure to choose each one at least twice.

1. What was your greatest success in mathematics class today? Describe.

2. (If you had mathematics homework…) How long did you work on your mathematics homework? How would you describe your work?

3. Pretend you are about to get your first adult job, describe what you will be doing on a typical day.

4. Pretend you could have one super-power to be used in school for the next week, what would it be.

5. (If you talked with anyone about your math work today…) What did you talk about? Who did most of the talking? How did you feel about the conversation?

6. Think about the smartest person in your math class. Describe that person.

7. If you could create your own math teacher describe what that person would be like.

8. When do you use math outside of the math classroom?
**APPENDIX D: PARENT INTERVIEW QUESTIONS**

Introduce study. Ask general demographics (career, number of children, in school, older/younger).

1. What was your own experience(s) with mathematics?
2. How would you rate your own math abilities?
3. How would you describe your daughter as a student (in general and in math)?
4. Do you think she would have the same self-assessment of her performance? What makes you think so?
5. When your daughter needs help with her math homework where does she go?
6. (If there are other children) How would you compare this daughter to the rest of your children in terms of school performance?
7. Do you see books and/or materials for mathematics that come home? What is your impression of these things?
8. I am studying girls’ engagement with mathematics and what influences a stronger or weaker sense of engagement (interest). If you were to hypothesize about engagement in girls in mathematics, what would you suggest were the most important factors?
9. What do you think contributes most to student success in mathematics?
I would like to talk with you about a study from a student at the University of Vermont. Anita Long, a doctoral student in the Education Department at the University of Vermont is studying the underlying factors that may help to explain mathematics engagement and disengagement among middle school girls. This research will hopefully lead to a better understanding of underrepresented groups in mathematics and suggest ways to improve teaching and reaching these populations.

If you volunteer as a participant in this study, you will be asked to choose three high performing and three low performing girls from one of your math classes. Anita will be interviewing you for about 45 minutes to an hour two times during a three week period. In addition, she would observe your math class for a two week period.

This study has been reviewed and approved by the Committee on Human Research at the University of Vermont. However, the final decision about participation is yours.

If you are interested in participating, please fill out one of your contact information below and Anita will be in touch with you. She will explain the study in more detail at that time and allow you to ask questions before obtaining your informed consent to participate. Agreeing to talk with her at this time does not commit you to participation in the study. Thank you.

Name  Email  Phone Number  Best Day and Times
APPENDIX F: RECRUITMENT LETTER TO PARENTS

Recruitment Letter

Education Department
University of Vermont

Date

Dear Parent/Guardian:

I am a doctoral student in the Department of Education at the University of Vermont conducting research under the supervision of Dr. Katharine Shepherd on middle school girls and mathematics. Your daughter has been identified by your mathematics teacher as a student who might be interested in participating.

This is a local study, taking place at your child’s middle school. The participants will include six girls, their parents, and their teacher participating. The girls will be interviewed twice for 30 minutes at school and I will be observing their classroom for two weeks. I would be asking you to meet with me for a one-hour interview.

I would like to assure you that this study has been reviewed and approved by the Committee on Human Research at the University of Vermont. However, the final decision about participation is yours.

If you are interested in meeting with me and learning more about the study, please fill out the form below and return to your daughter’s math teacher. This will allow me to set up a time to meet with you either at the school or at your home, whichever is more convenient for you. At that meeting I will explain the study in more detail and answer any questions you may have.

Thank you in advance for your interest in this project.

Yours sincerely,

Anita M. Long, M.S.
University of Vermont
along@uvm.edu

*PLEASE COMPLETE, DETACH at this LINE, and RETURN to your Math Teacher*

I would like to learn more about this study. Please contact me at the place provided below to set up a time to meet.

Name: ________________________________
Daughter’s Name: ________________________________
Phone Number: ________________________________
Best Day/Time to reach me: ________________________________