

FROM PREFACE TO PRACTICE:
A NARRATIVE STUDY OF WOMEN LEARNING
TO TEACH MATHEMATICS

by

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ABSTRACT

My dissertation research explored the experiences of mathematics anxieties in women elementary preservice teachers while learning mathematics as K-12 students and while learning to teach mathematics. Previous studies conducted in mathematics teacher education have emphasized the importance of preservice teachers' mathematical knowledge for teaching, as a confident and competent mathematics teacher is a vital necessity in the classroom (Beilock, Gunderson, Ramirez, & Levine, 2010; Gavin & Reis, 2003; Huebner, 2009). As evidence of elementary preservice teachers' anxiety, I analyzed three women preservice teachers' oral and written narratives about their experiences with learning mathematics and learning to teach mathematics, which I collected over eighteen months at key moments in their teacher preparation program.

My findings have revealed that for some women elementary preservice teachers, mathematics anxiety may be an issue or concern that remains consistent and recurs for decades. In fact, the multiple stories that the three preservice teachers had to tell indicated that their experiences in learning mathematics led them to develop a unique coping strategy to deal with mathematics anxiety. They continued to utilize their strategy repeatedly across their experiences as a student learning mathematics and learning to teach mathematics, even when the strategy sometimes failed to protect them from stress, embarrassment, and demoralization. Moreover, these coping strategies appeared to become so powerful that when the women confronted situations in which they felt expected to know mathematical content that they did not understand, they used their unique strategies for coping with mathematics anxiety rather than seriously attempting to

learn that content. In this manner, these coping strategies often appeared to have injurious effects on their mathematics learning.

Given that my study only included three participants, I suggest future research that mathematics teacher education researchers may want to consider. I also propose ways in which mathematics teacher educators might address issues of mathematics anxiety in elementary teacher preparation programs.

CHAPTER 1: INTRODUCTION

Foreword

I have had the opportunity to teach mathematics in first through seventh grades. Early on in my teaching career, what became clear to me was that the boys in my various classes tended to be excited about mathematics whereas many of the girls did not seem to feel very confident about their mathematical abilities. During parent teacher conferences a mother of a girl in my class might state that she was not very good in mathematics and that she did not expect her daughter to excel in mathematics either. After all, the mother would add, she has been able to get through life just fine without a strong mathematics background. From my perspective, statements that make mathematics seem not attainable or necessary can give girls permission to exit themselves from being successful in mathematics.

When I taught accelerated middle school mathematics, the girls in my class would enter the room as if they could not quite believe they were there and that somehow they managed to be recommended for the “smart kid” mathematics class. The boys would enter confidently and with a sense of assurance that they had every right to be in the fast tracked class. While working together throughout the year, much effort was needed to convince the girls that they were capable mathematics students and that they had much to offer by sharing their mathematical reasoning and thinking. In other words, I hoped my teaching would send a message that being capable in mathematics did not inherently belong to the boys in the class.

After ten years of teaching children, I began a PhD program in education. I have been given the opportunity to teach preservice teachers, and what I have observed in the

area of mathematics is that many young women seem to suffer from mathematics anxiety and confidence issues. Here I am again, only with the grown up versions of the girls I had taught in my elementary and middle school mathematics classes. One preservice teacher shared with me that for her, she is not sure why but math is just always going to be one of those subjects that makes her tense up a bit and is really, really hard.

As a result of my various teaching experiences, I have become very interested in learning more about gender issues in mathematics and the anxiety and confidence problems I have seen many girls and young women experience. I began a series of pilot studies that examined the mathematics experiences of women who were preservice teachers (Carter & Stoehr, 2012; Stoehr & Carter 2011). I grounded my work in narrative methods that have been utilized in teacher education research since the 1990s (Baddeley & Singer, 2007; Carter, 1993; Clandinin, Davies, Hogan, & Kennard, 1993; Connelly & Clandinin, 1990; Drake, Spillane, Hufferd-Ackles, 2001; Hollingsworth & Dybdahl, 2007; Jurich, 2005). More specifically by using narratives termed “well-remembered events” from Carter’s (2012, 2007, 2003, 1994, 1993) work, preservice candidates described and analyzed particularly salient mathematics events from their own experiences as K-12 students. What has been revealed in recent studies (Carter & Stoehr, 2012; Stoehr & Carter, 2011) is that many young women who are in the process of learning to teach have had negative mathematics experiences as students that years later are still accompanied by strong feelings of pain, embarrassment, and/or anger. In addition, many participants describe their mathematics experiences as being surrounded with anxiety and speak of their confidence in mathematics as something that over time has been progressively chipped away.

Most recently, I have been preoccupied with gaining a better understanding of what happens to women who have experienced mathematics anxiety when they step into their own classrooms and are expected to teach mathematics. I address this important question in my dissertation. Specifically, I hope to know more about the student and preservice mathematics experiences of women who feel anxious and unsure about mathematics as they prepare to become elementary teachers.

Rationale for this Study

Mathematical anxiety in women who are entering the elementary teaching field is a subject that has captured the interest of mathematics teacher educators. Previous research has revealed that women who pursue elementary teaching careers are often individuals who themselves have confronted anxiety in mathematics during their own K-12 experiences (Ball, 1988; Brady & Bowd, 2005; McGlynn-Stewart, 2010; Sloan, 2010). There is great concern, as presently over 90% of all elementary school teachers are women (Beilock, Gunderson, Ramirez & Levine, 2010) and the number continues to increase (NCES, 2010). Much can be learned by listening to the stories of women elementary preservice teachers who have experienced mathematics anxiety and issues of confidence, as they prepare to teach in their own classrooms.

An important point to discuss is that sex and gender are not clearly defined in educational research (Glasser & Smith, 2008). The two terms are often used synonymously when in actuality sex and gender are two different concepts. Glaser & Smith (2008) state that the term gender is used "when considering differences between the educational experiences of male and female students, and the distinction often appears to be based on a traditional understanding of the term sex" (p.343). Sex can be

more clearly defined as the biological differences between males and females. However, the meaning of gender in this dissertation is the socially constructed roles of boys and girls or men and women.

Women with mathematics anxiety is important to study, as such anxiety can have significant implications for how teachers approach mathematics instruction in their own classroom (Ball, 1988; Bursal & Paznokas, 2006). In addition, there is deep concern about whether teachers who experience mathematics anxiety can be successful in teaching mathematics (Bursal & Paznokas, 2006). Previous research suggests that teachers who have mathematics anxiety may pass their anxiety onto their students (Brady & Bowd, 2005; Sloan, 2010). Moreover, what is known is that teachers with mathematics anxiety teach differently than teachers who do not have mathematics anxiety (Sloan, 2010; Swars, Daane, Giesen, 2006). Teachers who have mathematics anxiety are more apt to have students do more seatwork activities such as worksheets, teach more whole group mathematics lessons that focus on basic skills, and spend less time on the concepts of mathematics and strategies for mathematical problem solving (Sloan, 2010; Swars et al., 2006). They may spend less time planning their mathematics lessons and use valuable mathematics teaching time for other activities and content areas (Brady & Bowd, 2005; Swars et al., 2006). Indeed, teachers may “take cover” and protect themselves from struggling with mathematical teaching situations that create anxiety for them.

Among scholars in mathematics education, there is a growing consensus that a confident and competent mathematics teacher is a vital necessity in the classroom (Gavin & Reis, 2003; Huebner, 2009; Marx & Roman, 2002; Oswald, 2008). Performance and confidence in the mathematics classroom can increase for girls when there is a capable

female role model (Marx & Roman, 2002; Oswald, 2008). Girls' performance and beliefs about who can be good in mathematics can be negatively affected by mathematics anxious teachers, as children tend to model the behavior and attitudes of same gender role models (Beilock et al., 2010). The shared sense from these studies seems to be that having strong and confident women elementary mathematics teachers cannot be underestimated, as the impact on the future generation of students learning mathematics in a confident and competent manner is at stake. Creating classrooms that embrace strong mathematics teaching is essential.

One way to better understand the mathematics anxiety that confronts some women elementary preservice teachers is to examine the gender equity research that has been previously conducted in mathematics classrooms, as preservice teachers were once the girls in the classroom. Fennema's groundbreaking work that started in the 1970s led mathematics researchers to seriously begin to consider gender equity issues in mathematics and to investigate what needed to be studied to ensure that girls could reach their full mathematical potential (Fennema, 1974). Unfortunately, as Fennema & Peterson (1985) discovered, gender related issues in mathematics are "some of the most pervasive and persistent educational inequities that exist" (p.17). A short discussion of these key factors will now follow.

Contributing Factors to Gender Related Issues in Mathematics

Stereotyping about girls and mathematics.

Powerful stereotypes still exist that suggest boys are stronger in mathematics than girls (Boaler, 2008). Girls often believe they are not expected to excel in mathematics as they try to make sense of the stereotypical messages they receive from some parents, teachers, and peers (Boaler, 2008; Gavin & Reis, 2003). Stereotypical messages can lead to a detrimental academic affect on girls in mathematics classes (Gavin & Reis, 2003).

Some teachers also help to perpetuate the stereotype that boys are stronger in mathematics than girls as they often overestimate boys' potential in mathematics whereas they underestimate mathematical potential for girls (Goodell & Parker, 2001). One teacher in Garrahy's study (2001) spoke of the innate differences in abilities between boys and girls in which she reported that "because of the way in which different sexes' minds work, boys tend to lean toward more mathematical, concrete types of things whereas girls tend to lean more to the language arts types of tasks" (Garrahy, 2001, p.90). This type of teacher thinking can lead to a significant amount of gender imbalance and gender bias that is destructive to the education of girls and boys (Garrahy, 2001, Sadker, Sadker, & Zittleman, 2009).

Another concern of teachers believing the boys in their class are stronger in mathematics is that teachers may interact differently with the girls and have lower expectations for them. The result can lead to girls having negative feelings about their mathematical abilities (Beilock, 2010; Fennema, Peterson, Carpenter, Lubinski, 1990; Fennema, Carpenter, Jacobs, Franke, & Levi, 1998). In addition, if teachers hold a stereotypical view of girls as being less capable than boys in mathematics and interact

differently with girls than boys, then gender differences in mathematics achievement have a greater likelihood of developing because of the difference in expectations (Fennema et al., 1998).

Early studies in gender equity in mathematics also report that teachers often considered boys' success in mathematics to be due to ability whereas for girls success is the result of how much effort they put forth (Peterson & Fennema, 1985; Fennema et al, 1990). What is critical to consider is that ability is often viewed as "an inherent, unchangeable capacity to learn" (p.65, Fennema et al., 1990) as opposed to effort, which can be seen as something that can be partly attributed to a teacher's control (Fennema et al., 1990). This type of thinking can be harmful and dangerous for girls and lead to a continuance in the belief that boys are better in mathematics than girls.

Previous studies have revealed that although teachers believed they viewed and treated girls as having just as much potential as boys in the classroom, this was often not the case ((Brophy & Good, 1970; Fennema & Leder, 1990, Garrahy, 2001; Hyde & Jaffee, 1998; Sadker, Sadker, & Zittleman, 2009). Teaching behaviors were observed that resulted in boys not only benefitting more than girls throughout the school day but where boys dominated classroom environments (Garrahy, 2001, Sadker, Sadker, & Zittleman, 2009). Moreover, when asked to identify their strongest mathematics students, teachers more often reported boys than girls (Fennema et al, 1990; Sadker et al., 2009). If girls have teachers who view boys as the more interested and stronger mathematics students then there is great concern that girls will interpret this to mean that they cannot be as accomplished or successful as boys in mathematics. Different mathematics interest levels can also lead to girls feeling anxious and inferior in mathematics.

Interests levels in mathematics.

Some studies have suggested that girls and boys differ in their interests in mathematics (Frenzel, Pekrun, & Goetz, 2007; Tobias, 1993). Boys will often continue to pursue mathematics even if they don't really like the subject, as they are more apt to believe their careers depend on liking mathematics and they feel more confident than girls do in their ability to learn mathematics (Tobias, 1993). There is great importance to not only understand what causes the differences in mathematics confidence but to question if the differences in interest levels in mathematics between boys and girls are innate or learned (Tobias, 1993). When asked what they dislike about mathematics, some girls reported the need to have a deeper understanding of mathematics - not just being able to compute a correct answer (Boaler, 2008). Not understanding mathematics can lead to feelings of mathematics anxiety, which can be accompanied by lack of confidence in girls' ability to be successful in mathematics (Frenzel et al., 2007). A lack of confidence in mathematics can be detrimental to girls believing that mathematics success is possible. Another area to examine in mathematics anxiety in girls is how instruction can play a role in the learning of mathematics.

Mathematics instruction.

With full acknowledgement that mathematics instruction is variable in content, expectations, processes and procedures for all students, previous studies have cautioned that traditional practices may have inequitably impacted young women's experiences in the mathematics classroom (Boaler, 2008, Meehan, 2007). For example, when mathematics is taught in a traditional fashion, girls often feel like mathematics seems disconnected with little meaning (Meehan, 2007). In contrast to what boys believe about

learning mathematics, girls often learn mathematics by building connections and relating what they are learning to a tangible concept (Boaler, 2008; Meehan, 2007). Girls prefer more processing time to be able to thoroughly think through concepts so they may be better able to clearly formulate their own foundations of mathematical thinking (Boaler, 2008). In general, girls want to know more about how mathematical answers are derived (Boaler 2008; Meehan, 2007). Girls may forego asking more questions to gain the necessary information for fear of being humiliated or shamed in front of their classmates.

How girls learn mathematics holds important and powerful implications for teachers. If teachers give students the message that girls are inferior to boys in mathematics or they are not expected to do as well, the result may be a self-fulfilling prophecy for some girls. One way in which to help girls move forward and feel more successful in mathematics is to help teachers create learning environments that meet the learning needs of girls (Boaler, 2008; Meehan, 2007). The outcome of this body of research suggests that mathematics classrooms are not always equitable learning environments for some girls. As a result, this may lead to some girls feeling anxious and insecure about their mathematical abilities. Another equally important factor to discuss is what standardized mathematics test scores reveal about girls' performance in mathematics.

Mathematics achievements among girls.

Promising academic progress has been made by girls in the area of mathematics. Recent standardized test scores suggest the equity issue in mathematics between boys and girls is no longer a concern (Corbett, Hill, & St. Rose, 2008; Gresham, 2007; Huebner, 2009, Liu, 2008; Vinson, 2001). National statistics in mathematics show that presently,

girls do very well in mathematics, achieving at equal or even higher levels than boys (Boaler, 2008). There is great optimism for girls in mathematics (Huebner, 2009). However, a closer look at what standardized test scores actually tell us is warranted.

McGraw, Lubienski, & Struchen's (2006) conducted a study where they analyzed the 2003 mathematics data from the National Assessment of Educational Progress (NAEP). Their study revealed that there remain small but persistent gaps that favor boys. Although both boys and girls average scale scores have risen, the gender gap in mathematics remains, with significant differences that favor boys on average at the 4th, 8th, and 12th grade levels (McGraw et al., 2006). In addition, the gender gap is not equally disbursed across the different mathematical content areas but varies as much as 5-7 points, depending on the strand (McGraw et al., 2006). Therefore evaluating how girls are doing in mathematics when compared to boys by the use of a single test score does not tell the whole story.

McGraw et al. (2006) also evaluated student questionnaires that were completed by the test takers during the 2003 NAEP testing period. The results of the evaluation unveiled that boys were more likely to report they liked mathematics and were good at mathematics as compared to the girls' responses (McGraw et al., 2006). More variables than test scores need to be examined in order to have a fuller understanding of why girls are less likely to like mathematics and feel successful in mathematics, as test scores tell only part of the story. Such a study that explores girls' mathematics classroom experiences may lead to a better understanding of the mathematical anxiety that some women experience.

This literature suggests that boys and girls may have variable experiences in the mathematics classroom. This is an important issue to consider as women elementary preservice teachers are preparing to teach mathematics. The documented K-12 experiences of women elementary teachers has provoked the teacher education community to explore how women's experiences have shaped their mathematics experiences and how their experiences might impact their journey of learning to teach. One way to investigate this issue is through a narrative study.

Narratives and the Study of Mathematics Anxiety Amongst Women Elementary Preservice Teachers

Another way to study gender equity issues in mathematics is to investigate the experiences that women preservice teachers have had in mathematics classroom (Carter & Stoehr 2012; Drake, 2006; Drake & Sherin, 2006; Drake, Spillane, Hufferd-Ackles, 2001; Stoehr & Carter, 2011). Some women elementary preservice teachers have positive mathematical stories to share that exude confidence in and an enjoyment of the subject. Other mathematical stories that preservice teachers recall are steeped in feelings of mathematical anxiety that often arise from operating in a personal safe zone in mathematics (i.e. not taking chances or be willing to take chances), struggles to understand mathematical content, feelings of embarrassment, dealing with continuous competition with others (especially boys), and dealing with self-fulfilling prophecies of being unable to be successful in mathematics (Carter & Stoehr, 2012; Drake & Sherin, 2006; Drake, Spillane, Hufferd-Ackles, 2001; Stoehr & Carter, 2011). In addition, preservice teachers also recall incidents where they felt like they were not viewed as strong mathematics students by others (teachers, parents, other students) and therefore

would never be good in mathematics. These stories were often accompanied by weak histories in mathematics resulting in women having negative feelings about their mathematical abilities (Carter & Stoehr, 2012; Drake & Sherin, 2006; Drake, Spillane, Hufferd-Ackles, 2001; Stoehr & Carter, 2011).

There is not enough known about the stories and experiences that women tell about their mathematics experiences as students and elementary preservice teachers. It is of particular importance to examine the personal experiences that these young women have encountered in their own journey as students of mathematics as well as how they make sense of them as they head into their own classrooms to teach. Listening closely to the stories of young women who have endured situations that have contributed to the erosion of their mathematical confidence and anxiety is of utmost importance for teacher educators to understand. Perhaps then teacher education programs can create a curriculum to meet the educational needs of women preservice teachers who have anxiety in mathematics. In addition, narrative writings can provide a lens that allows preservice teachers the opportunity to better understand themselves so that they can address how their own mathematic experiences may impact their teaching of mathematics (Drake & Sherin, 2006; Drake, Spillane, & Hufferd-Ackles, 2001). Failure to address mathematics anxiety that surround some women elementary preservice teachers may lead to the continuance of them believing they are not good at mathematics. Through the use of narratives, teacher educators gain access to a better understanding of the concerns, doubts, experiences, and questions about teaching mathematics that surround some preservice teachers.

Purpose of This Study

Recently scholars have examined the utility of examining anxiety and confidence in mathematics from a narrative perspective (see, for example Carter & Stoehr, 2012; Drake & Sherwin, 2006; Drake, Spillane, Hufferd-Ackles, 2001; LoPresto & Drake, 2004; Stoehr and Carter, 2011). This follows the groundbreaking work of several feminist scholars whose work suggests collaborative conversations among women can be a powerful means to reflect on issues important to women when told from their point of view (Belenky, Clinchy, Goldberger, Tarule, 1986; Gilligan, 1982). Engaging women in conversations of specific topics of study affords opportunities for themes to emerge that can either propel them forward or move them backwards (Belenky et al., 1986).

Involving students in narrative based Conversations that Matter offers a means to engage students in the intellectual, moral, and complex work of *thinking like a teacher* (Griffin, 1988). These narrative conversations provide a voice and a manner to see how people are shaped by their culture, gender, institution, and profession, as well their own unique and differing experiences (Belenky et al., 1986; Clandinin & Connelly, 1990; Clandinin et al., 1993; Connelly & Clandinin, 1990; Jurich, 2005). However, in the existing body of work on narratives, little is known about the stories and experiences of women elementary preservice teachers who feel anxious about mathematics. There is great importance in understanding how women elementary preservice teachers' stories of anxiety shape their thinking about teaching mathematics. This is important because as they take on the role of elementary teachers, mathematics anxiety can affect how they teach this content area (Bursal & Paznokas, 2006). Moreover, stories can help to inform mathematics teacher educators as to how to create mathematics methods courses for

preservice teachers that address mathematics anxiety. My goal was to unveil a better understanding of the mathematics stories of women preservice teachers in my dissertation.

Research Questions

In this study I examine the narrated mathematical experiences of women elementary preservice teachers who have identified themselves as having anxiety in learning and teaching mathematics in order to answer the following questions:

- 1. What narratives shape women elementary preservice teachers' mathematics anxiety as they prepare to make the transition from student of teaching to practicing teacher?*
- 2. What pivotal and salient experiences do women elementary preservice teachers say propel them forward or move them back relative to their anxiety in learning mathematics and teaching mathematics?*

CHAPTER 2: LITERATURE REVIEW

Introduction

Over the years, teacher education researchers have wrestled with the important and perplexing problem of how to successfully equip elementary preservice teachers to teach mathematics. The teacher education community has responded to this challenge by examining from different perspectives what they believe teachers need to know in order to teach elementary mathematics. A discussion of some of these perspectives follows.

First and foremost, mathematics teacher educators must acknowledge the knowledge, beliefs, and attitudes preservice teachers carry with them into their teacher education programs. Teacher preparation programs can then “develop ways of challenging, changing, and extending what they [preservice teachers] know, believe, and care about (Ball, 1988, p. 46).” Given the complex nature of classrooms, teachers of mathematics need to consistently be able to make decisions regarding what they attend to and make sense of versus what they do not. This becomes of critical importance, as teachers are charged with the task of making sense of students’ mathematical thinking (Sherin, Jacobs, Philipp, 2011). In order to make sense or understand student mathematical thinking, teacher candidates need to possess a solid mathematics content background (Ball & Forzani, 2010; Hill, Ball & Schilling, 2008). Teachers must have a conceptual understanding of the elementary mathematics curriculum they are teaching so that students can develop a rich mathematics background (Ma, 1999). Teachers must be able to accurately identify student mathematical achievements (Spitzer, Phelps, Beyers, Johnson, Sieminski, 2010) as well as be capable of providing mathematical explanations to students (Charalambous, Hill, Ball, 2011).

Teacher education programs need to provide formal opportunities for teachers to analyze and interpret mathematics curriculum materials (Nicol & Crespo, 2006). Some researchers believe that in order to teach in an ambitious and rigorous fashion, a curriculum must be developed that goes beyond formal teacher education programs (Feiman-Nemser, 2001). In other words, once a new teacher graduates and leaves the university behind her, learning to teach must be supported in the schools through consistent, relevant, and practical professional development opportunities (Ball & Cohen, 1999; Feiman-Nemser, 2001; Hammerness, Darling-Hammond, & Bransford, 2005). In addition, an important component of teacher education programs must focus on preparing teachers to teach mathematics in diverse classrooms (Turner, Drake, McDuffie, Aguirre, Bartell, & Foote, 2011).

Taken together, the attributes of teacher knowledge and practice that have been identified by prominent mathematics education researchers are relevant and important to preservice teachers' understanding. However, what has not received enough attention in mathematics education research is the role that anxiety plays in the demographics of some women elementary preservice teachers. Demographics are an important variable that cannot be tossed aside or ignored, as demographics have an impact on preparing preservice teachers to teach mathematics. What is known about the demographics of elementary preservice teachers is that over 90% are White women whom are in their early twenties, speak primarily English, and come from middle class backgrounds. (Beilock, Ramirez, & Levine, 2010; Zumwalt & Craig, 2008). This is a significant point to consider, as race, class, and culture are essential variables when addressing issues of mathematics anxiety (Steele, Spencer, Aronson, 2002). Sadly, the research conducted on

elementary preservice teachers has little to say about the remaining 10% of the teacher population. Therefore a more careful examination of the role that demographics may play in issues of mathematics anxiety requires some attention.

Demographics and Elementary Preservice Teachers

In the 1970s, when gender was initially brought to the forefront of mathematics researchers' attention, research studies carried out by prominent mathematics education researchers (see for example Fennema, 1974; Fennema & Leder, 1990; Peterson & Fennema, 1985; Sadker & Sadker, 1994) resulted in gender issues in mathematics gaining the exposure needed to work towards creating equitable mathematics classrooms for boys and girls. By 2007, standardized tests results revealed that girls were performing nearly as well as boys in mathematics (Huebner, 2009). Initially this was a cause for celebration, as the gender equity issue in mathematics appeared to be solved (Boaler, 2008; Gresham, 2007; Huebner, 2009; Liu, 2008; Sadker, Sadker, & Zittleman, 2009).

Fortunately there are some scholars whose work has a gender focus on the demographics of the elementary preservice teacher population (Beilock et al., 2010; Bursal & Paznokas, 2006). Beilock et al. (2010) reports that elementary education candidates are primarily women and have the highest levels of mathematics anxiety of all college majors. This information provides the mathematics teacher education community with the perspective that the gender equity problem in mathematics is not completely solved, as women can pursue a career in elementary education while feeling anxious and unsure about mathematics (Beilock et al., 2010). The personal mathematics experiences of women in elementary preservice education programs matters. We know these mathematics experiences are important because of the work that has been done around

anxiety and narrative stories of women in preservice teacher preparation programs (Carter, 2012, 2010; Drake, 2006; Drake, Spillane, & Hufferd-Ackles, 2001; Stoehr & Carter, 2011). Often when women elementary preservice teachers reflect upon their K-12 mathematics experiences, their narratives reveal that problems remain in how they view their mathematical abilities. The statistics and the stories that some women elementary preservice teachers have to tell present us with a mixed picture of gender equity in mathematics (Carter & Stoehr, 2012; Stoehr & Carter, 2011). Standardized mathematics scores show comparable results for boys and girls (Huebner, 2009). Yet women's narratives include stories of mathematics anxiety and low confidence.

To better understand this mixed picture of gender equity in mathematics, I am going to review two areas and the contributions set forward to preparing women to teach mathematics. The first area to be reviewed is the literature on mathematic anxiety and issues of confidence that some women experience. Then I will look at the pivotal pieces of research that have been done on narratives and their importance in the study of teacher education. I will start by defining mathematics anxiety.

Mathematics Anxiety

Mathematics researchers have defined mathematics anxiety in multiple ways (Brady & Bowd, 2005). Swars, Daane, and Giesen (2006) refer to Vinson's (2001) definition of mathematics anxiety as being more than just not liking mathematics. Bursal and Paznokas (2006) explain mathematics anxiety by using Trujillo and Hadfield's (1999) definition as "a state of discomfort that occurs in response to situations involving mathematical tasks that are perceived as threatening to self-esteem" (p.173). Some researchers push further arguing that mathematics anxiety can be viewed as a disease

(Hembree, 1990; Luo, Wang, & Luo, 2009). “Mathematics anxiety refers to such unhealthy mood responses which occur when some students come upon mathematics problems and manifest themselves as being panicky and losing one’s head, depressed and helpless, nervous and fearful, and so on” (Luo et al., 2009, pp. 12-13). Physiological reactions such as sweaty palms, tight fists, being sick, vomiting, having dry lips, and a pale face can also occur which can result in students losing not only their interest in mathematics but their confidence in their ability to learn mathematics (Luo et al., 2009). A lack of confidence can then lead to more feelings of mathematical anxiety. This in turn can then lead to dodging mathematics, which reinforces more mathematical anxiety (McGlynn-Stewart, 2010). Studies that have examined women’s anxiety in mathematics are important to review, as they provide critical insight into how debilitating this issue can be for some women.

Anxiety and its Role with Women and Mathematics

Cadinu, Maass, Rosabianca, and Kiesner (2005) conducted a study to examine what effect the stereotype that women are less talented than men in mathematics has on women’s anxiety and/or performance in mathematics. This study questioned not only what the effects of this preconception might have on women themselves but whether in a testing situation, women’s attention might actually be diverted from the test itself to worrying and becoming anxious about confirming the existing negative stereotype. It was hypothesized that the increased anxiety would lead to a reduction in the women’s cognitive abilities, which would lead to a performance deficit. To investigate this point, participants in the study conducted by Cadinu et al. (2005) were divided into two groups of women. Before giving one group of women a challenging mathematics test, they were

told that recent research had shown there were clear differences between men and women in logical-mathematical tasks. The other group of women were told there were no differences in logical-mathematical tasks between men and women. Following the administration of a mathematics exam that focused on logic, the women in the stereotype threat condition had a significantly lower number of correct answers than the women in the other group. The findings of the Cadinu et al. (2005) study also supported the earlier research done by Steele et al. (2002) that suggested there is a link between negative thinking and performance deficits. The Cadinu et al. (2005) study only identified the participants as being women. Acknowledging women preservice teachers' racial, ethnic, and linguistic backgrounds is important, for stereotypes about women may be affected by other stereotypes about race, class, and language. These multi-layered stereotypes may also influence preservice teachers in an even more powerful manner, especially insofar as they relate to women preservice teachers' mathematics anxiety.

A second pertinent study attempted to determine if informing women about stereotype threat might be a useful technique to improve their performance in a threatening testing situation (Johns, Schmander, & Martens, 2005). In this study, three groups of White men and White women were given challenging mathematics problems to complete. The participants in group one, the problem-solving group, were asked to complete a problem-solving exercise while the participants in group two, the mathematics-test group, were asked to complete a mathematics test that was being given to determine mathematical aptitude. The mathematics test-group was told that their performance would be used to make gender comparisons. The participants in group three, the teaching-intervention group, were told the same thing as the mathematics-test

condition group. However, the participants in the teaching-intervention group were also provided with a short explanation of stereotype threat. The women were told by the researchers:

It is important to keep in mind that if you are feeling anxious while taking this test, this anxiety could be the result of these negative stereotypes that are widely known in society and have nothing to do with your actual ability to do well on the test (Johns et al., p. 176).

Johns et al. (2005) anticipated that by teaching women about stereotype threat that they might be freed from its effects. The results of the study showed that women scored lower than men when the problems were described as a mathematics test and stereotype threat was not discussed. The women's results did not differ from the men's results when they were told to complete a problem-solving task or when they were told they were being given a mathematics test but were taught about stereotype threat in mathematics testing situations.

Johns et al. (2005) suggest that teaching about stereotype threat might be one way of reducing its detrimental effects. This was consistent with the researchers' hypothesis, which was knowing about stereotype threat improves performance by supplying a way of externalizing arousal. Women who were in the teaching-intervention group exhibited greater mathematics performance as they were able to attribute their anxiety to gender stereotypes as opposed to their ability. Women in the mathematics test group were more inclined to do worse as they attributed their anxiety to gender stereotypes.

Johns et al.'s (2005) study seems to have implications for mathematics teacher educators. For example, if mathematics teacher educators could teach women elementary

preservice teachers that stereotype may be a factor that can contribute to women's anxiety in mathematics, then perhaps the mathematics anxiety that some women preservice teachers experience could be reduced. The Johns et al. (2005) study revealed that "teaching stigmatized individuals about stereotype threat might be a simple approach to counteracting the detrimental effects that negative stereotypes have on performance" (Johns et al., 2005, p.178). I will now review several studies that have specifically examined women elementary preservice teachers' anxiety in teaching mathematics.

Mathematical Anxiety in Women Preservice Teachers

Multiple studies have been done that examine mathematics anxiety in women elementary teacher candidates (Brady & Bowd, 2005; Bursal & Paznokas, 2006; Gresham, 2007; & McGlynn-Stewart, 2010). Bursal and Paznokas (2006) conducted a study of elementary preservice teachers primarily consisting of women and investigated their mathematical anxiety and confidence levels. No other specific demographics were provided in the study. Participants were given nine key statements from the Math Teaching Efficacy Belief Instrument (MTEB: Enochs, Smith, & Hunter, 2000) to assess their beliefs about teaching mathematics. These key statements focused on participants' responses about such things as believing if they could teach mathematics effectively, have the necessary skills to teach mathematics, and welcome students' questions about math. The Revised Mathematics Anxiety Survey (R-MANX) was administered as well. The participants were asked to estimate the amount of anxiety they believed they would experience in hypothetical situations that involved everyday life and academics that required mathematical thoughts or tasks.

The results of the study revealed that more than two-thirds of the preservice teachers had moderate or high mathematics anxiety. In addition, the moderate and higher anxiety level participants had less confident responses in regards to teaching mathematics. The results of Bursal and Paznokas's (2006) study support previous studies (Harper & Daane, 1998; Hembree, 1990; Sloan et.al, 2002) that report that elementary preservice teachers' lack of confidence is attributed to their mathematics anxiety. Bursal & Paznokas's (2006) study points out that although significant number of women who are preservice elementary teachers have great anxiety about mathematics, they will still be expected to be teach mathematics in their own classrooms.

Preservice Teachers' Student Experiences in Mathematics

Brady and Bowd (2005) explored the connection between preservice teachers' experiences in mathematics as students and the role in which their experiences influenced their attitudes about mathematics and their confidence towards teaching mathematics. Participants were asked to answer questions to gather information about mathematics courses they had taken, their mathematics experiences and perceptions, and their level of confidence in teaching as well as in teaching mathematics. Participants were also given the Mathematics Anxiety Rating Scale (MARS) to assess mathematics anxiety in academic and nonacademic settings. The results of the study revealed that the women preservice teachers had significantly higher MARS scores than the men, suggesting comparatively high levels of anxiety. Open-ended comments made by women in the study summarized specific themes regarding their mathematics anxiety. These themes included enjoying mathematics in elementary school but finding success in mathematics to be out of reach in the higher grades, finding mathematics to be distressing and often

humiliating, feeling extreme pressure when confronted with mathematics tests, and having teachers that did not believe they were capable of doing well in mathematics.

Data from this study revealed another important outcome; many of the participants in Brady and Bowd's (2005) study who had negative mathematical experiences as K-12 students opted out of taking more than the necessary mathematics classes to meet university admission requirements. Some participants stated that as a result, they felt unprepared to teach mathematics confidently to their own students. Some of the women preservice teachers reported they worried about not being able to correctly teach their students mathematics and that they would confuse them, rather than being able to help them with mathematics. One prospective teacher noted that she routinely felt nauseous when she thought about teaching an algebra unit. Other participants discussed that even though they spent a lot of time getting ready to teach a mathematics lesson to young children, they still felt extremely nervous. These findings indicate that the mathematical anxiety that some women have experienced as students may follow them into the classroom as teachers. Indeed, these studies raise important questions as to what can be done to reduce the mathematic anxiety that some women elementary preservice teachers experience so they can feel more confident about teaching mathematics.

Addressing Preservice Teachers' Mathematics Anxiety

Fortunately, several recent studies have focused on constructing learning opportunities for women elementary preservice teachers that address anxiety associated with teaching mathematics (Gresham, 2007; McGlynn-Stewart, 2010). These studies, Gresham (2007) and McGlynn-Stewart (2010) created mathematics methods courses that provided preservice elementary teachers with the opportunity to reexamine elementary

mathematics content in supportive and collaborative ways. Surveys, interviews, reflections, informal observations and discussions were conducted throughout the mathematics method semester that examined how participants felt about mathematics as well as teaching mathematics. In addition, Gresham's (2007) participants completed a pre and post Mathematics Anxiety Rating Scale (MARS) as a quantitative measurement.

The mathematics methods courses concentrated on the use of manipulatives, cooperative learning experiences, and employing multiple teaching strategies as opposed to the more teacher directed experiences that many of the preservice teachers had experienced themselves. Both studies revealed that overall, preservice teachers' mathematics anxiety was reduced. The researchers attribute the decrease in anxiety to opportunities to clearly address and talk about learning and teaching mathematics. Moreover, they argued relearning elementary mathematics content in a collaborative fashion that involved hands-on manipulatives while planning and presenting mathematics lessons decreased mathematics anxiety.

In addition, narratives that women preservice teachers tell about their mathematics anxiety offer another valuable methodology for addressing mathematics anxiety that plague some women elementary preservice teachers (Carter, 1993, 1994; Carter & Stoehr, 2012, Stoehr & Carter 2011). Of particular importance is how narratives are shared and with whom. Moreover, understanding the role that narratives play in issues important in teacher education is essential.

Narrative Inquiry

One aspect of narrative inquiry that I am particularly interested in investigating in this dissertation is what women have to say about their own mathematics experiences as

students and preservice teachers, especially relative to mathematics anxiety. This is important to study for little is known about the stories that surround some women's mathematics anxiety. Understanding how women make sense of their mathematics experiences can help to serve as a guide for teacher education programs to address this issue, specifically as it relates to women.

Well-remembered events narrated by preservice teachers.

Carter's work (1993) gave credence to the use of narrative stories as an authentic research tool for teacher educators by paying specific attention to how stories support women's understandings and knowledge in the realm of teacher and teacher education. As other education researchers were beginning to use stories as a viable method for studying what teachers know about teaching (see for example Clandinin & Connelly, 1990; Connelly & Clandinin, 1990; Gudmundsdottir, 1991), Carter's (1993) analysis of the use of stories helped to create a permanent place for stories to be considered in teacher education research. Carter (1993) pointed out that through the use of narratives, stories offer a way to authentically capture the complexities of what it means to teach from the voices of teachers as well as offer a way for preservice teachers to capture a glimpse of teaching.

Carter (1993) carefully analyzed the use of story in teacher education research by addressing narrative stories from different perspectives. One perspective she reported is that stories have events, characters, and settings that hold significance for the storyteller. However, when story is viewed "as a mode of knowing" (Carter, 1993, p.6) the transfer of knowledge and understanding can come from the telling of stories. Equally important, stories come as a result of experience upon which a model of understanding is built.

Carter (1993) adds that teachers have “storied knowledge” (p.7). As teachers spend more time in the classroom, a variety of experiences in curriculum, classroom processes, students’ behavior and understandings become storied. New teachers, who gain their situated knowledge over time, tend to base their stories on events, which Carter (1993) refers to as a “well-remembered events.” These well-remember events are occurrences that are derived from an individual’s experiences that revolve around a specific school event or situation that is especially salient or memorable to the person observing the event. Preservice teachers and new teachers who don’t yet possess a wealth of situated knowledge may find it challenging to understand classroom events. Therefore they may concentrate on learning to understand a specific teaching event in an effort to create meaning. Teacher educator researchers whose attention focuses on the well-remembered events of preservice or new teachers may gain significant insight into the process of new teachers learning to teach (Carter, 2007).

Carter (2012, 2007, 2003, 1993) suggests that teacher’s stories have the possibility to be valuable teaching tools for preservice teachers. She states that by using authentic teachers’ stories as case studies in teacher education classes, they have the potential to provide more vivid, realistic, and meaningful examples of teaching. In addition, teachers’ stories can serve as powerful instruments for teaching preservice teachers because they communicate the various facets, demands, and rewards of teaching. Carter’s (2012, 2007, 2003, 1993) work illustrates that the use of story can offer teacher educators the opportunity to gather a better understanding from teachers in all stages of teaching of what it means to teach. More specifically for this study, narratives offers a

way in which to gain a greater understanding of the experiences of the women elementary preservice teachers who struggle with mathematics anxiety.

Experiential narratives.

Connolly and Clandinin's (1988) narrative work made a significant contribution to teacher education through their focused examination of what teachers experience in the classrooms as opposed to what they do in the classroom. They make the claim that by using narratives, teachers are able to talk about how they construct their work in the classroom, recount stories of classroom events, and most importantly, describe the experiences that occur in their professional lives. The authors argue that teachers' narratives offer more pertinent information about teaching and learning than quantitative measures, for narratives provide a means of understanding that goes beyond a numerical measurement.

Personal knowledge is derived from pieces of the past, present and the future. When put altogether, the whole is created (Connelly & Clandinin, 1988). The authors explain that a person's "whole" or the sum of their personal experiences can best be expressed through narratives. By telling and retelling stories about their pasts, teachers can discover new and different ways of acting in the future (Connelly & Clandinin, 1988). Specific to this study, such narratives could capture greater understandings for teacher educators of the anxiety that surrounds some women elementary preservice teachers' mathematics experiences. These understandings are important because they can help to inform teacher educators of how to address mathematics anxiety in women elementary preservice teacher candidates.

Teachers' life history narratives.

Hollingsworth & Dybdahl (2007) and Hollingsworth (1992) studies suggest that much can be learned about teaching when teachers are given the opportunity to engage in extended, narrative-based conversations with trusted colleagues. Hollingsworth & Dybdahl's (2007) longitudinal research illustrates that conversations between teachers that occur outside of traditional teacher education programs offer a platform for unanswered questions and concerns to be addressed, even when the issues to be discussed address specific types of anxiety and confidence. In their work, Hollingsworth & Dybdahl (2007) studied a group of teachers that met each month for eighteen years. What they discovered was that conversational narratives provided a meaningful exchange of ideas, concerns, disagreements, and feedback for issues the participants were experiencing in their teaching lives. Using conversational narratives as a research methodology can serve as a means to support, challenge, and increase teachers' understanding of learning to teach (Hollingsworth & Dybdahl, 2007).

Hollingsworth (1992) also conducted research using a feminist epistemology. A primary goal of Hollingsworth's (1992) study was to use gender specific conversations to explain how beginning women elementary teachers come to understand the process of teaching and learning and to widen the theories of what it means to learn to teach. In addition, Hollingsworth (1992) examined the gender based needs and values of women elementary teachers as a means to create support for learning to teach. Participants met once a month with Hollingsworth to address questions that the participants had about their new roles as teachers. Using conversations between trusted colleagues, participants posed questions that revolved around issues of learning to teach. In the study, specific

features were embraced that centered on what Hollingsworth's (2007) referred to as "women's values" which are not typically taken into account in school or university based support models. These features included participants' commitment to meeting on a regular basis so that trusting relationships between participants could develop, discussing issues of concern to all participants, chances to question and reflect upon information from wide and welcoming concerns, attaching value to experiences and emotions as a form of knowledge, respecting each participant's backgrounds and differences, establishing a supported critical point of view, emphasizing that learning to teach is a process, and being able to express a feminist voice in a narrative format with the goal of having an effect on personal, political, and social changes in schools. By doing so, women's experiences served as a resource for finding new ways of making sense of learning and teaching.

The results of Hollingsworth's (1992) study support the use of collaborative, narrative focused conversations as a means for new career teachers to begin to understand the relational, personal, and political issues involved in learning to teach. "The continuous cycles of critique, knowledge construction, and social action were both method and result" (Hollingsworth, 1992, p.398). The participants were better equipped to find resources and create personal support systems to learn more about specific classroom issues as they became more adept at expressing their practice-based questions about action and equity. Moreover the conversations led to participants being able to formulate and examine their own widening knowledge about teaching.

Hollingsworth's (1992) study demonstrated that collaborative conversations offer the opportunity for women beginning teachers to undergo transformations that can lead to

a clear, narrative structured, and action-oriented voice. The development of this voice from the viewpoint of feminist epistemology allows teachers to advance from a compliant position of received knowledge to a position of self-constructed knowledge (Belenky et al., 1986). Hollingsworth (1992) argues that collaborative conversations between women that are interconnected and sustaining can result in meaningful epistemological change. Therefore collaborative and meaningful conversations can serve as a support for women preservice teachers as they prepare to teach mathematics in their own classrooms as well as provide a better understanding for teacher educators of the issues of mathematics anxiety that some women preservice teachers experience.

Narratives and preservice teachers' previous experiences.

Now it is only fair to review of a selected body of research that uses a narrative perspective as a means to direct attention to serious issues that surround some women elementary preservice teachers' experiences and preconceptions. Experiences and perceptions of women preservice teachers are crucial to understand as they can impact their development as teachers.

Taking into account that teacher education programs needed to address the role that prior experiences play in teacher education candidates, Carter's (2012, 2007, 2003, 1993) work acknowledges Lortie's (1975) ideas of preconceptions and how they affect learning as students in their K-12 schooling years engage in an "apprenticeship of observation" (p.61). Lortie (1975) maintains that many beliefs teachers have about teaching come from personal experiences as students. If preservice teachers have sat in classrooms and endured a negative "apprenticeship of observation" (Lortie, 1975, p.61), then they may have a negative preconceived notion of their capabilities. Sadly, this belief

may follow them into their classrooms as they begin to teach.

Over the past ten years Carter's (2012, 2011, 2007, 2003) work with preservice teachers' narrative writings of well-remembered events have led to numerous accounts of great humiliation and shame. These powerful narrative stories have been based on inequities stemming from language, race, issues of gender differences, and socioeconomic status. Carter (2010) reports that another prominent theme that has remained constant over the past ten years has revolved around women's stories of mathematics. The stories that many women elementary preservice teachers have told are often filled with feelings of anxiety, nervousness and sadness related to mathematics.

Through the continued use of mathematics well-remembered events, Stoehr & Carter (2011) have sought to know more about why some women encountered such sadness in their K-12 mathematics classrooms. These studies have been helpful and yet beg to be more carefully and thoroughly researched so that more can be understood about mathematics anxiety that plague some women preservice teachers. What is yet to be explored is a more complete and rich understanding of the experiences that some women preservice teachers encountered as K-12 students and practicing teachers that create mathematics anxiety. This is important because encouraging women to voice their own stories of mathematics anxiety is essential in order to create a meaningful understanding of this problem. My hope is that this study offers some answers to important questions that surround some women elementary preservice teachers' anxiety issues in mathematics. These questions focus on addressing the narratives that shape women elementary preservice teachers' mathematics anxiety as they prepare to make the transition from student of teaching to practicing teacher and the pivotal and salient

experiences women elementary preservice teachers say propel them forward or move them back as it relates to their anxiety and in doing mathematics and teaching mathematics.

CHAPTER 3: METHODOLOGY

Introduction

This chapter describes the methodology I used for my qualitative study that investigated women elementary preservice teachers who had identified themselves as having mathematics anxiety. The goal of this dissertation was to gain a better understanding of what experiences shape women elementary preservice teachers' mathematics anxiety as they prepare to make the transition from student of teaching to practicing teacher. In this chapter, I demonstrate how the use of narratives helped me to explore how women elementary preservice teachers talked about their mathematics experiences as K-12 students and as elementary preservice teachers learning to teach mathematics. The experiences of this particular group of women is important to understand, as the results of this research may inform the manner in which teacher educators address mathematics anxiety in future elementary teacher candidates.

For more than twenty years, scholars have successfully used narratives as a research framework to provide a clear focus on how new teachers make sense of teaching, including how teaching relates to their own school experiences (see, for example Atkinson, 2007; Bruner, 1990; Carter, 2012, 2007, 2003, 1994, 1993; Clandinin, 1989, 1993; Clandinin & Connelly, 1990; Connelly & Clandinin, 1990; Drake, 2006; Drake, Spillane, & Hufferd-Ackles, 2001; Doyle & Carter, 2003; Goodson & Sikes, 2001; Hollingsworth & Dybdahl, 2007; LoPresto & Drake, 2005; Stoehr & Carter, 2011). Narrative inquiry provides a research tool for education researchers that goes beyond explanations of standards, percentages, skills, and strategies or trying to capture what one has to say through the use of a number (Atkinson, 2007; Carter, 1993;

Clandinin and Connelly, 1993, Clandinin and Connelly, 2000; Drake, 2006; Hollingsworth & Dybdahl, 2007; Seidman, 1991). Instead, narratives create avenues for teachers to talk and write about their storied lives while making connections to teaching (Atkinson, 2007; Carter, 1993, 1994; Carter & Stoehr, 2012; Clandinin and Connelly, 2000; Clandinin and Connelly, 1993; Drake, 2006; Drake, Spillane, & Hufferd-Ackles, 2001; Hollingsworth & Dybdahl, 2007; LoPresto & Drake, 2005; Stoehr & Carter, 2011). Narratives offer a context for preservice teachers to reflect on what they are learning in their teacher education programs and their prior experiences in schools (Knowles & Cole, 1996). Without this reflection, preservice teachers run the risk of being unable to make sense of what they thought teaching was about and the reality they are experiencing in their teacher education programs.

Narratives shape teachers' identities as they help to construct who they are and point to the direction they are headed in their lives (Gudmundsdottir, 1991). Classrooms are places where stories are created and told (Gudmundsdottir 1991). Gudmundsdottir (1991) compares teaching to writing a story, as narrative stories help to explain the ways in which teachers make meaning of the world and communicate that meaning to others. Listening to the stories that other teachers tell and interpreting them can lead teachers to have a better understanding of what it means to teach. Mathematics stories of women elementary preservice teachers provide an opportunity for preservice teachers to understand, explain, and gather meaning from their experiences as students and preservice teachers. These narratives also create a means for education researchers to gain a better understanding of the mathematics experiences of women preservice teachers through the stories they tell. By way of introduction, I now discuss the narrative based

methods (life history, and particular kinds of interviews) that are central to modes of inquiry in my study. Following this introduction, I will explain the context of the study, participant selection, narrative sources, narrative generation, and narrative analysis procedures that are part of this dissertation.

Life Story Narratives

One specific narrative research tool is the life story narrative. Life story narratives are a “collection of personal narratives that reveal how a specific human life is constructed and reconstructed in representing that life as a story” (Atkinson, 2007, p.224). Life story narratives can be used to investigate all types of research questions (Atkinson, 2007). In education, life story narratives provide the means to investigate new ways of knowing in teaching and learning (Connelly & Clandinin, 1999). Carter (1993) observes that life stories that center on “feelings, purposes, images, aspirations, and personal meaning” (p.7)... are often told for research purposes. Life story narratives can be unfolded through mathematics autobiographies, personal interviews and small group interviews. Utilizing life story narratives for research studies with women can be invaluable, as women are more apt to remember and describe life events in a clearer, more vivid and detailed manner (Baddeley & Singer, 2007). Therefore using life story narratives in this dissertation provides a means to understand the mathematical experiences of the women who chose to participate in this study.

Interviews

Education researchers who want to explore the experiences that individuals have had in classrooms often find interviews to be an effective tool, as interviews provide “the lived experience of other people and the meaning they make of it” (Seidman, 2006, p.9). Interviews used within a narrative framework such as exploratory interview prompts from semi-structured interviews can capture stories that individuals have to tell. Interview questions that are personal and reflective and that are based on the narratives that are part of my work, are not meant to capture answers but to tell stories. In addition, interviews can provide a means to develop a better understanding of educational issues that specific individuals have experienced and that are reflected in their lives (Seidman, 2006; Wood, Jilk, & Paine, 2012). In other words, researchers hope to draw meaning from people’s account of events and individual experiences. Next I describe the specific details of my study, starting with the context.

Context of the Study

I collected my dissertation data from participants from a well-established College of Education that is part of a large public Research 1 University located in the southwestern United States.

Estelle, Phoebe, and Roxanne

The three participants in my study were derived from a larger cohort of fourteen women preservice teachers who were participating in an eighteen-month elementary teacher preparation professional sequence. All participants were members of an ESL/bilingual cohort whose fieldwork and student teaching experiences took place in schools that served low socioeconomic and culturally diverse communities. Many of the

students at the school sites spoke two languages (i.e. English and Spanish), with some students classified as English Language Learners.

The cohort of fourteen women preservice teachers at this site were all participants in a longitudinal project called Teachers Empowered to Advance Change in Mathematics (TEACH MATH). The primary goal of TEACH MATH “is to transform preK-8 mathematics teacher preparation so that teachers will be equipped with powerful strategies to increase mathematics learning in our nation’s increasingly diverse public schools” (Turner et al., 2012, p.68). As a result of their participation in the TEACH MATH project, this particular cohort received additional contact and support throughout the eighteen-month period including multiple individual interviews, focus group interviews and meetings, and up to three mathematics teaching observations during student teaching. I was one of the TEACH MATH researchers involved in the narrative collection of this project over the eighteen-month period.

Over the course of the time spent together in their small cohort and as TEACH MATH participants, a formative and generative setting was created that was built on characteristics of collaboration, spontaneity, and trust. Students’ evaluative comments shared throughout the math methods semester and formally collected at the end of the course suggested that having a small cohort created a close bond among the fourteen preservice teachers. This bond appeared to lead to my participants feeling confident in sharing their thoughts and concerns about their own experiences as students of mathematics as well as their experiences in learning to teach mathematics. When provided with the opportunity to engage in extended conversations with trusted colleagues, teachers stand a greater chance of understanding different facets of teaching

(Hollingsworth 1992; Hollingsworth & Dybdahl, 2007). Moreover, with a smaller cohort, there were more chances for the preservice teachers to participate in class discussions and elicit everyone's ideas and concerns about becoming teachers. Therefore the confidence in sharing that the participants appeared to have with each other supports the research surrounding the promise of extended conversations (Hollingsworth 1992; Hollingsworth & Dybdahl, 2007). This leads me to feel sanguine that my research methods based on narratives hold promise.

I began the selection of the participants for my dissertation by reviewing the fourteen preservice teachers' mathematics autobiographies that were written as part of the math methods course requirement. There were nine potential participants that I identified as being strong candidates for my study, as their mathematics autobiographies spoke clearly and powerfully about feelings of mathematics anxiety. These feelings of anxiety in mathematics included descriptions and thoughts of an intense dislike and dread of mathematics time at school, memories of never being "a math person," assumptions of not being "math smart," scars created from continuous low test scores, and not understanding the relevance of mathematics. Upon review of the nine potential participants, I looked for the stories of mathematics anxiety that were disparate in nature. I identified four overarching themes of mathematics anxiety and confidence. They included 1) struggles in mathematics from early on, 2) teachers viewing them as incapable mathematics students, 3) negative mathematics turning point situations, and 4) not being able to connect mathematics to their lives. I believe these distinct perspectives on mathematics anxiety are important because they can provide mathematics researchers and teacher educators with a greater understanding of possible sources of mathematics

anxiety and confidence issues that some women preservice teachers experience as students of mathematics and as soon to be elementary teachers.

Five of the nine potential participants had mathematics autobiographical stories that reflected one or more of the four overarching themes as described above. Four of the five participants accepted the invitation to be in my study. The fifth potential participant who was invited to participate in the study declined because of feeling overwhelmed with time commitments as a participant in the TEACH MATH project and a full-time preservice teacher candidate. I chose three of the four participants to analyze for my dissertation. I plan to analyze the fourth participant in the near future.

The data collection for this study began when the women were college juniors (age twenty-one) in January 2011 and ended when they graduated with their Bachelor's degree in Elementary Education in May 2012. All three women were White. One participant spoke fluent English and spoke some Spanish while the other two were monolingual and spoke only English.

Working with the three participants over an eighteen-month period allowed for a deeper relationship to develop between the participants and me, as the researcher. A great sense of trust was created as the participants progressed through the different phases of the teacher education program, as they experienced moments of success, hope, uncertainty, and fear while at the same time working to make sense of what it means to teach mathematics. As a result, participants appeared to share through their narratives, their genuine experiences and stories about being students of mathematics and practicing teachers of mathematics.

Narrative Sources

I designed a study that encompassed data collection from three different timeframes. I used specific types of interviews (i.e. individual and group) and semi-structured prompts to direct the participants to narrate mathematics stories as both as students and as student teachers. Collecting data over eighteen months allowed me to theorize the mathematics experiences that women preservice teachers share as they make the shift from student to teacher. It should be noted that during the eighteen-month research period, my dissertation participants continued to be part of the larger TEACH MATH project. Some of the data collection instruments used in this dissertation were specifically designed for the TEACH MATH project but contained questions that prompted the participants to talk about their narrative stories of mathematics anxiety. Other data instruments were specifically designed for this dissertation. The origin of all data collection instruments will be clearly identified in the following sections. All data collection instruments can be found in the appendices of this dissertation (see Appendices A, B, C, D, E, F, G, H and I).

The first data collection point occurred in the Spring 2011 semester when the participants were enrolled in their elementary math methods course. The second data collection period occurred at the end of the Fall 2011 semester when the participants were taking methods courses other than math methods and were involved in an additional classroom fieldwork experience. The last data collection occurred during the Spring 2012 semester, from January 2012 - May 2012 when the participants were student teaching. Next I discuss details about the data collected during the three different phases of the study.

Narrative Generation - Spring 2011 Semester

Mathematics autobiography.

The participants each wrote a mathematics autobiography as part of the math methods course. In addition, the mathematics autobiography was also used as a TEACH MATH data collection source. The participants were asked to write a three page “math life story” that reflected on specific individual experiences that occurred when they were students of mathematics and to reflect upon how their experiences impacted their attitude towards and understanding of mathematics. In addition, the participants were asked to think about how their own mathematics experiences might impact their role as teachers. The participants were given a specific set of questions to help guide their mathematics autobiography. These questions included prompts such as how do you feel about math; how have your feelings changed over time; how do you think your school math experiences impacted your attitude towards math; and what experiences made learning mathematics easier/harder for you. These prompts are relevant to the focus of my study because they help to target issues of mathematics anxiety that some women preservice teachers may experience. (See Appendix A for a complete set of mathematics autobiography questions).

Individual interviews.

Two individual interviews for each participant were conducted in person during phase one. One interview occurred at the beginning of the math methods semester and the other interview took place at the end of the semester. These interviews were part of the larger TEACH MATH study and were used to explore participants’ thinking about teaching mathematics to diverse populations of students. These conversational interviews

were 30-45 minutes in duration and were arranged at times convenient for the participants. The interviews were conducted by one of the three research members of the TEACH MATH project, which included me. All interviews were audio recorded.

These interviews focused on the participants' experiences working with children in diverse linguistic and cultural settings as well as the roles that children's mathematical thinking play in learning mathematics. Sample questions included describing the mathematics classrooms participants envisioned teaching; what it means to teach for understanding; and what the participants thought about adapting curriculum materials to meet the needs of students. End-of-semester interviews included the same set of questions that were asked during the first interview but also included reflective questions related to the course activities. For example, preservice teachers were asked to describe connections and differences between what participants learned in their math methods course and the mathematics instruction they experienced in their mentor teachers' classroom.

Although these two interviews were not specifically focused on issues of mathematics anxiety of women elementary preservice candidates, a number of questions served to capture potential feelings of mathematics anxiety. Sample questions that elicited narratives that revolved around mathematics anxiety included concerns they had about teaching mathematics, why some students do well in mathematics, what is hard about learning mathematics, and why some students have difficulties in learning mathematics. These questions are relevant to my study as they elicited conversations of mathematics anxiety (See Appendix B for a complete set of questions).

Narrative Generation - Fall 2011 Semester

Focus group interview.

The fall focus group interview took place at the methods school site. This focus group interview was part of the larger TEACH MATH study and was used to explore participants' thinking about teaching mathematics to diverse populations of students. Two focus groups were conducted to allow for smaller group size so there were more opportunities for participation. Two researchers conducted one focus group interview and I conducted the other. They took place on different days and times to accommodate the scheduling needs of the participants. Each focus group interview was slightly over one hour long. Twelve of the fourteen participants from the cohort participated in the focus group interview. All three of my dissertation participants took part in one of the two interviews. Both interviews were audio recorded.

The goal of the focus group interviews was to explore the narratives of the participants' experiences and understandings of their methods courses and fieldwork experiences that occurred during the fall 2011 semester. Of particular interest for the TEACH MATH study was how the participants thought about children's mathematical thinking and the role that children's languages, families, and communities play in children learning mathematics. Sample interview topics included how experiences with teaching mathematics that semester connected to ideas or topics that were explored during math methods, what helped participants think about how to connect to a child's home and community knowledge and/or their mathematical thinking while teaching mathematics, and how their mentor teacher supported them in learning to teach mathematics. In addition, questions were asked to generate discussions and stories about

what the participants envisioned their student teaching experiences and their future mathematics classes would be like. The responses to some of these questions elicited without prompting, concerns of mathematics anxiety. Sample questions that generated stories of mathematics anxiety and low confidence asked about concerns the participants had about teaching mathematics during student teaching, how the methods classes prepared them for teaching mathematics during student teaching, and how they envisioned their student teaching mathematics class. The storied responses from these questions are relevant to the focus for my study because they have the potential to identify and provide insight to issues of mathematics anxiety that some women elementary preservice teachers experience (See Appendix C for a complete set of questions).

Narrative Generation - Spring 2012 Semester

Student teaching pre/post observation interviews.

Three pre-observation student teaching interviews and three post observation student teaching interviews for each participant occurred during the Spring 2012 student teaching semester. The interviews took place primarily by telephone and were 15-35 minutes in length. The pre-observation interview was conducted one day prior to the mathematics lesson being observed. The post observation interview took place immediately after the lesson was taught or later in the same day. Some of the student teaching post observation interviews included the preservice teacher and her mentor teacher. I conducted all six interviews. All interviews were audio recorded.

The student teaching pre/post observation interviews were part of the larger TEACH MATH study and were utilized to investigate how the preservice teachers

embedded children's mathematical thinking and children's languages, families, and communities into their mathematics lessons. Sample pre-observation questions included asking the preservice teacher to describe the mathematics lesson that was to be observed, the goals of the lesson, how the mentor teacher helped the preservice teacher prepare for the lesson, considerations of students' prior mathematics knowledge and their out of school and family/ community experiences, and language proficiency. Sample post observation questions asked the preservice teacher and the mentor teacher how they thought the lesson went, the strengths of the lesson, what they learned about children's mathematical thinking during the lesson, what they learned about children's home and community-based knowledge and experiences during the lesson, and what they might do differently if they taught the lesson again.

In addition to the TEACH MATH questions that were posed to the preservice teachers, two questions that directly related to mathematics anxiety were added to the pre-observation interview and three such questions were asked at the post observation interview. The pre-observation questions included asking each participant how she felt about teaching the lesson that was going to be observed and to describe the lesson content that she felt the most confident teaching, as well as the content she had the least confidence teaching. The questions posed at the post observation interview asked each preservice teacher what she felt most and least confident about in teaching the lesson, what parts of the lesson challenged her teaching ability the most, and what if anything, made her feel anxious about teaching the lesson. At the third and final post observation interview, the participants were asked to consider overall, what during their student teaching experience, they felt the most and least confident about in teaching mathematics.

All of these questions were relevant to my study, as together they directly and indirectly offered opportunities for women preservice teachers to talk about mathematics anxiety.

(See Appendix D for a complete set of questions).

Student teaching interview.

One individual student teaching interview for each participant was conducted in person during the Spring 2012 semester of student teaching. The interview occurred while each participant had full responsibility for teaching mathematics in her student teaching placement. This conversational interview was specifically created for this dissertation study. The duration of each participant's interview was 30-45 minutes long and was arranged at a time that was convenient for each participant. All interviews were audio recorded.

The purpose of this interview was to learn more about the narrative stories of the participants' own backgrounds as mathematics students, as well as their mathematics student teaching experiences, especially as those experiences related to issues of mathematics anxiety. Sample questions included recalling a mathematics teacher from the participant's K-12 years and describing why that teacher was memorable for the participant, talking about a student from the participant's K-12 years and a student encountered during the participant's student teaching that the participant thought was good at mathematics and a student that she thought struggled with mathematics, rewarding and challenging student teaching experiences, and questions and worries about teaching mathematics. These questions were relevant to my study, in that they helped to pinpoint issues of mathematics anxiety that some women preservice teachers experience (See Appendix E for a complete set of questions).

End of the semester interview.

The end of the semester interview took place in person at the Research 1 University that has been identified in this study. This end of student teaching individual interview was part of the larger TEACH MATH project and was designed to gain an understanding of each participant's experiences in teaching mathematics during student teaching, in particular teaching mathematics to diverse students. I conducted each interview at the end of the Spring 2012 semester and at a time that was convenient for the participants. All three interviews were audio recorded.

Sample questions included participants describing their future mathematics class, identifying aspects in teaching mathematics of importance to them; what they thought the most rewarding parts of teaching mathematics was; the impact their own language, culture, gender, and race had on their teaching of mathematics; the role that children's families and communities played in the participants' planning and teaching of mathematics; and the role that children's mathematical thinking played in the participants' mathematics teaching during their student teaching experience.

Although the aim of the end of student teaching interview was not specifically focused on issues of mathematics anxiety of women elementary preservice teachers, a number of the narrative questions elicited feelings of mathematics anxiety in the participants. Sample questions that some participants responded to with narratives that involving mathematics anxiety included asking the participants what they found to be the most challenging parts of teaching mathematics; identifying areas to work on relative to teaching mathematics to diverse groups of students; how well they thought their mathematics methods course prepared them for teaching mathematics; how their own

background informed their mathematics teaching; and their teaching plans for the next year. (See Appendix F for a complete set of questions). The answers to these questions helped me to have a better understanding of mathematics anxiety that plague some women elementary preservice teachers, which is the focus of my study.

Reader's theatre.

Teacher education researchers may not traditionally think of Reader's Theatre as a data gathering technique that captures the narrative stories of preservice teachers. However, when stories are being performed in a purposeful manner, many types of stories can be narrated through interactive talk or dialogue. The Reader's Theatre data collection used in this study was developed by Carter (in press) and was specifically designed to frame the stories derived from the participants' mathematics autobiography that were written in January 2011. As previously discussed, the mathematics autobiography was part of the math methods course. However, using Reader's Theatre as a data collection activity was specifically created for this dissertation study.

In order to create a Reader's Theatre that operated as a place for valuable and meaningful mathematics stories to be heard, the participants were asked to first review their mathematics autobiographies and make notes of what they wanted to share with the group about what they wrote, how they still felt about what they wrote, what they had questions about, or found powerful, meaningful, joyful or sad (See Appendix G for participant directions and questions). The participants carefully reread their autobiographies and made comments as they were reading such as, "Wow, did I really feel that way" or "Yes I remember feeling that way so clearly." After fifteen minutes of quietly reviewing their math autobiographies, the participants left the table group area

and headed to the couches to be in a more relaxed atmosphere. As they sat down, they were asked to share passages they found meaningful from their stories and to respond to comments the other participants shared. One of the participants volunteered to begin with her narrative reflection. The three participants talked about how they felt about revisiting their mathematics autobiography. When everyone was done sharing, they commented on each other's sharing of their autobiographies. This sharing included themes they had in common with each other, questions they had about learning and teaching mathematics, with stories shared by one participant leading to more stories by the other participants. Participants were then asked to share their ideas regarding what creates feelings of anxiety in teaching elementary mathematics as well as what creates confidence in teaching mathematics. This data collection activity lasted for one hour and ten minutes and was audio recorded and videotaped. This Reader's Theatre activity served as a data collection event that generated meaningful and relevant narrative stories about mathematics anxiety from the three participants' mathematics autobiographies.

Conversations that matter.

The Conversations that Matter data collection activity provided the preservice teachers with a narrative tool in which to unpack their central hopes, fears, questions, and directions about learning and teaching mathematics. Created by Stoehr (in press), and specifically designed for this study, participants were each handed thirteen one foot long by one half foot wide sentence strips that had written prompts related to learning and teaching mathematics. Sample prompts included the following: In math I am good at...; for me teaching mathematics is...; one of the most important qualities that a mathematics teacher should possess is...; a time when I feel unsure about mathematics...; I think

anxiety and/or low confidence in mathematics is caused by.... (See Appendix H for a complete set of prompts).

The participants were asked to complete each sentence and were given twenty minutes to do so. After twenty minutes the participants shared their responses with each other. After all three participants shared their first prompt, they commented on the similarities they saw in each other's responses or how one person's responses prompted them to think of something else they found relevant to share. After all the sentence strips were read and shared, they were asked to individually review their sentence strips and select the top three they thought created confidence in their teaching of mathematics and the top three they thought added to their own feelings of anxiety and low confidence in mathematics. After seven minutes passed, they read their sentence strips aloud. Then they compared which prompts and responses they had in common. They also talked about the themes they shared with one another. This narrative tool functioned as a means that allowed the participants to go back and forth in a storied way to process and revise their own mathematics understandings and issues of mathematics anxiety. The conversations that matter narrative data collection activity was two hours and twenty minutes long and was audio recorded and videotaped.

Mathematics timeline.

The timeline was the final data collection activity completed by the participants and specifically designed for this dissertation. The goal of this novel narrative based activity derived from earlier research (Carter & Stoehr, in press) was to provide participants with the opportunity to reflect upon their experiences of learning to teach mathematics over the last eighteen months of their teacher preparation program.

Each participant was given a three and one half foot long by one and one half foot wide piece of chart paper with a photo of the participant. In the middle of the paper was a timeline. The paper was divided into three sections of boxes. There was one set of conversation bubble boxes above the timeline and one set below the timeline. The top set of boxes was used to record what each participant learned during each semester of her teacher preparation program. The bottom box was for recording the questions, concerns, and issues each participant had encountered during these specific moments in time as well as before mathematics methods began.

The participants were asked to use the conversation bubble boxes to place themselves on the timeline and to record their storied memories of questions, concerns, and celebratory thoughts in the conversation bubbles. In addition, they recorded the thoughts they had at each part of their journey at specific junctures. Then they made connections across the eighteen-month period by drawing lines across the different time periods. After they completed the timeline activity, several questions were asked to generate narrative conversations about their timeline. These questions included making connections between the participants' prior mathematical experiences and future role as a mathematics teacher; questions, stories, and concerns the participant had about mathematics and teaching mathematics (See Appendix I for a complete set of questions and directions for this activity). Each participant individually narrated her experiences, stories, questions, and thoughts about learning and teaching mathematics. This timeline activity provided me with the narrated stories of mathematics anxiety that occur across time and surround some women elementary preservice teachers' experiences in

mathematics. The timeline activity took each participant approximately one hour and twenty minutes to complete and was audio recorded and videotaped.

In an effort to summarize the various narrative methods used in this dissertation, I include the following table that outlines how each specific data collection instrument addresses my research questions.

Table 1: Data Collection Strategy

Data Collection Strategy								
	<i>Spring 2011</i>		<i>Fall 2011</i>	<i>Spring 2012</i>				
Research Question	Math Autobio- graphy	Methods Pre/Post Interviews	Focus Group Interview	Student Teaching Interview & End of Semester Interview	Student Teaching Pre/Post Lesson Interviews	Reader's Theatre	Conver- sations that Matter	Timeline Activity
What narratives shape women elementary preservice teachers' mathematical anxiety as they prepare to make the transition from student of teaching to practicing teacher?	X	X		X	X	X	X	X
What pivotal and salient experiences do women elementary preservice teachers say propel them forward or move them back relative to their anxiety in learning mathematics and teaching mathematics?	X	X	X	X	X	X	X	X

Narrative Analysis

Phase 1: demarcating narratives.

Audio and/or video recordings were used in each narrative generation in this dissertation, with the exception of the mathematics autobiography. After the narratives were collected, the audio and video from each narrative generation was transcribed. I began my analysis by thoroughly reading each participant's mathematics autobiography, as well as all thirty-eight complete transcripts gathered from across the three semesters of the participants' teacher preparation program.

After multiple readings of each participant's mathematics autobiography and transcripts, I began an iterative analysis (Bogdan & Biklen, 2006) by demarcating the narratives that pertained specifically to mathematics anxiety as well as issues of confidence in learning and teaching mathematics. I identified a narrative to be an individual's lived experiences and/or their interpretation of their experiences (Connelly & Clandinin, 1990). For each participant, I identified narratives within transcript and text passages that included key words specific to mathematics anxiety and issues of mathematics confidence. An example of these words included anxiety, confident, not confident, dumb, not a math person, math is not my thing, get through mathematics, wall against mathematics, negative thoughts about mathematics, not good at mathematics, smart kids, disregarded, low test scores, deficient, embarrassed, nervous, not taking anything in, never got mathematics, not a top mathematics student, get through mathematics, stressed me out, teacher moving on, confused, math is scary, worried, fumbled, not understanding, freeze up, does not make sense, struggled, messed up, frustrated, tense up, sore subject. If a transcript or text passage from participants'

autobiographies or interviews included one or more of the key words noted above, I identified the passage as a narrative related to mathematics anxiety. I repeated this demarcation procedure three separate times over a period of three weeks as a means to ensure reliability. I identified Estelle as having forty-two narratives whereas Phoebe had thirty-two. The total number of narratives for Roxanne was thirty.

Next, for each participant I divided the narratives that pertained to issues of mathematics anxiety and confidence into two categories, stories and reflections. I defined a story as a having a basic structure that included an event or a sequence of events with at least one character, a plot, a setting, a theme, and a pattern of action (Carter, 1993). I defined a reflection as thinking back on one's experiences as a means to understand what had occurred (Schon, 1992). At times, these reflections spontaneously arose from the participant's revisiting of the stories of mathematics anxiety that they told. At other times, the participants were specifically asked to reflect upon mathematics anxiety (i.e. the Reader's Theatre and Conversations That Matter Focus Group Interviews).

All three of the participant's mathematics autobiography included stories and/or reflections of mathematics anxiety. Each of the fifteen data collection instruments contained stories and reflections of mathematics anxiety for one or more of the participants. Estelle's data included a total of fourteen stories and twenty-eight reflections that were analyzed for this dissertation. Phoebe's narratives contained fifteen stories and seventeen reflections whereas Roxanne's data included fourteen stories and fifteen reflections. All participants had stories and/or reflections that were told more than once across the three semesters. However, each story or reflection was counted only once. The stories and reflections varied in length, with some being as short as a paragraph

in length while others were much longer.

The narratives that addressed each participant's mathematics anxiety during her K-12 student years of learning mathematics confidence were derived from the written mathematical autobiography and from interviews that were conducted during the math methods and student teaching semesters. The narratives that addressed mathematics anxiety during the methods/classroom internship semesters and while each participant was student teaching were from the multiple interviews conducted during the methods and student teaching semesters. From individual and focus group interviews, each participant told stories and reflected on how she envisioned her future role as a mathematics teacher.

Phase 2: analysis of narratives and case development.

Via a careful analysis of each of my three participant's narratives, I created a case study unique to each preservice teacher. I chose to present my findings through the case study approach, as case studies offer a method of exploration of a particular time period that focuses on specific situations where a series of detailed information is collected in a variety of ways (Sykes & Bird, 1992). This methodological device allowed me to present three women elementary preservice teachers' narratives of mathematics anxiety as substantive and distinct cases of mathematics anxiety.

I began the case development of each participant by utilizing an emergent coding scheme (Marshall & Rossman, 2006) to organize and sort each participant's stories and reflections. I first sorted the stories and reflections as being either positive or negative mathematics experiences. I then highlighted and labeled particular phrases or sentences that identified how a particular story or reflection seemed to create or reduce mathematics

anxiety, or seemed to reflect confidence or lack of confidence relative to mathematics anxiety. I separately recoded each participant's stories and reflections for consistency (or a lack thereof) after a passage of at least a week's time. This allowed me to evaluate the stability of emerging themes and/or consider alternative interpretations of the data. Next, I analyzed plot patterns in each participant's narratives related to mathematics anxiety. I defined a plot pattern as the main idea of the story or the reflection. Plot patterns were generated from the patterns of key phrases or sentences specific to mathematics anxiety and issues of mathematics confidence. In other words, the plot patterns reflected each participant's dealings or situations with mathematics anxiety. Some plot patterns encompassed numerous stories and reflections. Other plot patterns were derived from a single story or reflection. I then wrote analytic memos (Maxwell, 1996) to summarize key plot patterns across the stories and reflections that each participant told. I utilized the analytic memos to construct each woman's case while arranging their stories and reflections in chronological order.

In each case study I present my participants' interpretations of their experiences with mathematics anxiety at key moments or junctures, in her mathematical history. I first considered the narratives from each participant's experiences as a mathematics learner (Juncture 1). Next I addressed the narratives of her experiences as a preservice teacher learning to teach mathematics (Juncture 2). Then, I examined her narratives that surrounded her student teaching experience (Juncture 3). Finally, I draw attention to the particulars that put forward a data based composite or case of each participant. In each of these junctures, the participant's stories and reflections were drawn from multiple plot patterns. Throughout the different junctures, I have titled each plot pattern using a

composite of each participant's own words to encapsulate the essence of her narratives.

At the end of the three junctures, I draw attention to the particulars that put forward a data based composite or case of each participant.

Researcher Positionality

I had the unique opportunity and privilege to work with all three of my participants for two years. As a woman and a former elementary teacher, my participants seemed able to identify with me and value my teaching background. I was the instructor of my participants' required classroom management and processes course that they completed before they entered the final eighteen months of their teacher preparation program. Upon entering the first data collection point where all three of the participants were mathematics methods students, I had already established a strong rapport and trust with all three of them. Collecting data over a longitudinal period allowed more time for my participants to trust me and to feel more comfortable in sharing their narrative journey of what experiences shaped their mathematical anxiety. This journey was of utmost importance as they were preparing to make the transition from student to practicing teacher. Talking about their mathematics anxiety across methods, fieldwork placements, and student teaching offers more than a glimpse or a peek at the narratives that they have to tell. I believe the findings of my dissertation may offer mathematics educators with a better understanding of the issues of mathematics anxiety that plague some women elementary preservice teachers.

CHAPTER 4: FINDINGS: (CASE OF ESTELLE)

Introduction

I first met Estelle in the fall of 2010. She was one of thirty students in an upper division classroom processes and instruction course that I taught on campus. She was a conscientious and hardworking student who was prepared and ready for each class. In addition, she always chose to sit in the middle of the front row, surrounding herself with other serious students. She impressed me as being a caring student, informing me when she knew her classmates were going to be late for class because of parking issues or were missing class due to illnesses, sharing her class notes with a student in the class or when they missed a lecture. Throughout the semester she was positive and cheerful as she confidently engaged in classroom discussions and projects with her classmates.

I developed a deeper sense of Estelle during her math methods and student teaching semester, as I was the teaching and research assistant associated with Estelle's cohort. I discovered that Estelle came from a family background of teachers, as both her mother and aunt were educators. In fact, Estelle's mother taught at the same elementary school Estelle attended as a child. Estelle recalled spending time in her mother's classroom everyday and remembered thinking that she did not want to be a teacher. She said that she could see being a teacher was a challenging job that required more than just teaching. She reported her mother would spend time in the evenings and on weekends doing things like grading and planning lessons. Besides, Estelle said, teaching was her mother's thing, not hers so she pushed this possible profession out of her mind.

When Estelle was nearing the end of her high school years she recalled thinking seriously about what occupation she wanted to pursue. She reported that she became

excited about the possibility of becoming a teacher when she realized how much she loved being with children. However, one grave worry she admitted she had about becoming a teacher revolved around mathematics. She said that mathematics was the one subject she felt anxious about, as she viewed herself as someone who was not good at mathematics. In fact, Estelle recalled that her anxiety about mathematics made her seriously question if she should pursue a teaching career.

In this chapter, I will explore Estelle's experiences with mathematics anxiety at key moments, or junctures, in her mathematical history. I will first consider the narratives from Estelle's experiences as a mathematics learner (Juncture 1). Next I will address the narratives of her experiences as a preservice teacher learning to teach mathematics (Juncture 2). Then, I will examine her narratives that surround her student teaching experience (Juncture 3). Finally, I will draw attention to the particulars that put forward a data based composite or "Case of Estelle." In each of these junctures, her stories and reflections were drawn from multiple plot patterns. Some plot patterns encompassed numerous stories and reflections. Other plot patterns were derived from a single story or reflection.

Based on the data collection instruments (mathematics autobiography and interviews) I rearranged episodes from Estelle's life to create a chronologically ordered mathematical life story. A narrative thread that brings these episodes into relationship is Estelle's descriptions of a strategy for coping with mathematics anxiety, which she apparently used repeatedly across the junctures of her mathematical history and came to rely on for a sense of confidence both as a learner and as a teacher. This coping strategy was to conceal from both authorities and peers, and eventually students, that she did not

understand certain mathematical concepts or problem-solving strategies. As I will demonstrate below, Estelle primarily seemed to use this strategy for coping with mathematical anxiety, which she called "The Wall," even when the reassurance it brought her was only temporary and when it failed repeatedly. There are times however, when Estelle appeared to have the confidence to venture out from behind the wall as a means to access the mathematics that she did not understand as a student and a soon to be teacher. These experiences will be discussed as well.

Juncture 1 - Estelle's Student Mathematics Experiences

Five different plot patterns emerged from Estelle's experiential reflections and interview responses that revolved around her mathematical learning experiences as a student. They are: (1) Young Estelle Can Do Mathematics, (2) I Wished I Could Have Been One of the Smarties, (3) My Parents Threw Me a Safety Line, (4) Brick by Brick I Built The Mathematics Wall, and (5) Learning Mathematics Piece by Piece. Throughout the different junctures, I have titled each plot pattern using a composite of Estelle's own words to encapsulate the essence of her narratives.

Plot pattern 1: young Estelle can do mathematics.

Estelle described her early elementary school days in mathematics as being mostly positive and filled with a sense of being strong in this content area. She stated that she has always been a visual learner and has continued to utilize a strategy she remembered from a first grade counting mathematics lesson. She believed that this particular mathematics lesson not only captured her visual learning style but also moved her forward in feeling equipped and able to do mathematics. She recalled the following story:

My teacher had big letters printed out that were one through ten and were on the wall for us to see. On each number there were dots depending on how many the number required. For the number one, there was only one dot, for the number two there were only two dots, so it's a great way to count fast and do math problems by counting and picturing the invisible dots that we knew were there.

(Mathematics Autobiography, January 18, 2011)

Estelle's need to be taught by using visual representations appeared to have been met when her teacher presented a counting lesson that offered her the opportunity to see what she was counting. This positive mathematics learning experience seemed to have made such an impact on Estelle that she could recall it many years later.

Estelle spoke of having good elementary mathematics teachers whom presented mathematics in a positive light with the expectation that she could excel in this subject area. Estelle said she felt particularly successful in the content areas of multiplication and division. Although Estelle reported feeling fairly confident and capable in elementary mathematics, she stated she had to work "extremely hard" to not only get good grades in mathematics but to be able to understand the concepts that surround mathematics. Estelle reported that as a young child, she "rarely had negative thoughts towards mathematics." Unfortunately, as Estelle advanced through her elementary mathematics years, her sense of mathematics confidence diminished, perhaps prompting her to conceal what she did not know.

Plot pattern 2: I wished I could have been one of “the smarties.”

By the time Estelle reached fourth grade she described feeling inadequate because she had not been identified as one of the “smart kids” in mathematics. She recalled the following story:

Fourth grade math is when, right at the beginning of the year, we all took a math test. I don’t remember if it was just multiplication or what. The people who got one hundred percent on their math test were in the advanced group. Everyday we would see them leave the class and go to a different classroom. I just always remember that, thinking, “Why can’t I be in that group? Or “Is it because I didn’t finish my test in a certain amount of time?”

(Student Teaching Interview, March 26, 2012)

Estelle added:

I really feel like classmates can have a big affect on your perceptions of math and I really think experiences, you know, from my own personal experiences, being separated at a young age, even in fourth grade you know you’re advanced in math yet I’m stuck in the regular class. It always made me feel like I’m just regular but you guys are awesome cause you get to go in a different classroom. Man, I really wished I could be in there! Oh math, I don’t like you cause I’m not good at it. (Methods Post Interview, May 11, 2011)

Estelle’s two narratives spoke of the sense of defeat she felt in mathematics as well as being partitioned or separated from the students who were seen as the competent and smart kids. This separation or partition seemed to accentuate Estelle’s belief that she was inferior in mathematics and perhaps unable to be as successful as the “smart kids” in

mathematics. Moreover, as part of the “regular class,” Estelle could not hide from the fact that she had not been labeled as one of the smart kids.

As Estelle looked back at this experience, she imagined the excitement her classmates must have felt to be selected in the advanced mathematics groups. She revisited the stigma she felt for not being chosen and stated, “I don’t know, it’s always stuck in my head that wow, they’re really good at math. I must not be that good if I’m just in the regular classroom with everybody else.”

(Student Teaching Interview, March 26, 2012)

When Estelle had the opportunity to work with students whom she viewed as the smart kids in mathematics, she recalled:

I was a shy kid and I always felt that some children were overbearing in classes where it was always the teacher and them talking and no one else. And you never got a word in or you know, you say one thing and it’s just kind of disregarded.

Estelle recounted how from her perspective the “smart kids” were the ones the teacher was really talking to. She appeared to have interpreted this to mean that not only did her teachers “disregard” her questions and mathematical concerns but the smart kids did the same as well. Estelle seemed to feel not only partitioned or separated from the smart kids but from her teacher as well. Once again, it seemed as if she could not hide the fact that she was not considered to be one of the smart kids.

(Methods Post Interview, May 11, 2011)

Plot pattern 3: my parents threw me a safety line.

Estelle recounted how her parents (especially her mother who was an elementary school teacher) helped to support her mathematics understanding and build her confidence in this content area. She said:

My mother was an elementary school teacher for 25 years and has always done her best to give me the resources that would help me out the most for math. When school would get out for summer vacation, one of the first things my mom would do was get us math problem-solving books for us to work on. Each week we were given so many pages to do so math would stay fresh in our minds. Both of my parents were also really good about helping us out in math and they would take turns in helping us with homework and getting us to understand certain concepts. ... My parents always told me that by playing the piano it would improve my math skills so I became a big believer in that.

(Mathematics Autobiography, January 18, 2011)

The repeated workbook practice and the piano playing seemed to have been interpreted by Estelle as her parents' way of helping her to retain the mathematics she had hopefully learned during the regular school year. Estelle, who had identified herself as "not good in mathematics" seemed to cheerfully accept the extra support of the workbooks and the need to play the piano in order to capture the mathematics she was responsible for knowing. Therefore the help that Estelle received from her parents appeared to have functioned as a safeguard to help Estelle maintain the mathematics she would be required to know when the new school year started. Estelle's trustworthiness of her parents and her hardworking nature seemed to allow Estelle to accept the workbooks and the piano

playing as a tool to create mathematical success. Perhaps then when she returned for the new school year, she would not have to conceal what mathematics she did not know.

Plot pattern 4: brick by brick I built “the mathematics wall.”

Despite the summer workbook practice and Estelle’s piano playing as a means to enhance her mathematical skills, she remembered many instances of receiving poor grades in mathematics. She interpreted her low-test scores as proof that she was not a successful mathematics student. She shared the following memory:

During middle and high school, I know my attitude towards math was 100% affected by my low test scores. I began to build a wall towards math and it was, and it still is sometimes tough for me to open up and soak up information.

Sometimes teachers would want to talk to me in private about how I was doing in math and they usually were not positive talks. I began to get embarrassed and started to over think even the simplest math equations.

(Mathematics Autobiography, January 18, 2011)

Estelle recounted having erected a psychological “wall” to protect herself from others’ negative evaluations of her mathematical performances in school. Initially, “low test scores” represented unfavorable feedback. Then, the “not positive talks” with mathematics teachers about her work became experiences to avoid. As the negative feedback accumulated, Estelle reinforced her wall, which increasingly interfered with her capacities to “open up and soak up information” and to think through the “simplest math equations.” In other words, a negative cycle emerged in which the psychological wall, meant to shield Estelle from others’ criticism of her mathematical performances, blocked her mathematics learning. Unfortunately, while Estelle’s mathematics teachers, in

meeting privately with her to discuss her work, may have attempted to mitigate Estelle's "embarrassment," the very seclusion of these conversations may have strengthened Estelle's belief that she deserved to be sequestered from more successful mathematics students in her classes, and that she needed to conceal what she did not know about the mathematics content from others. In effect, Estelle's preferred strategy of separating herself from the mathematics as a means to cope with her anxiety appear to have made learning mathematics even more difficult.

Estelle recalled that by the time she reached high school she had seriously doubts about being able to learn mathematics. In an effort to cope with the anxiety associated with her not comprehending mathematics she said the following:

Math is everywhere and it's like you can't get away from it. ... A big factor of that is maybe a confidence issue. Maybe from like past experience. ... Sometimes I think maybe children can put up a wall against math, I don't know, that's what I did in high school when a teacher would start talking about math and I'd be like, I'm looking at the board, but I am not taking anything in.

(Methods Pre-Interview, February 2, 2011)

Estelle's narratives suggest that she may have enlisted the wall to ward off the anxiety she experienced in the moments the when mathematics lessons were being taught. By her own account, the wall blocked her momentarily from the anxiety associated with not understanding the content but the wall also appeared to distance her even more from learning the content. Moreover, the wall helped her to conceal the fact that she was not "taking anything in" even as she appeared to be looking at the board and listening to her teacher talk about mathematics.

There were times when Estelle remembered being in her mathematics class unable to comprehend the content being presented by her teacher. She explained how she tried to cope with this situation:

And I just know from my own personal experiences that especially in high school, when I couldn't grasp a concept, and a teacher would just move on and on, I was lost. And you kind of build up this wall like well I don't get it and so I don't know what else to do cause the teacher's already moving on.

(Methods Post Interview, May 11, 2011)

Estelle sought shelter from the wall as a way in which to handle the anxiety of being lost or cut off from the mathematics content. The wall appeared to have given her some relief from the anxiety of not knowing what to do when she was confronted with mathematics that she did not understand. In addition, the wall offered her temporary respite from teachers she believed left her behind. However, the wall could not provide a long-term solution for accessing the mathematical content knowledge that Estelle needed. Nevertheless, Estelle continued to utilize the wall to hide from the mathematical content she did not know.

Plot pattern 5: learning mathematics piece by piece.

Estelle remembered a mathematics lesson in which her algebra teacher helped her to see she could be successful in mathematics. This narrative story was powerful, occurring when Estelle was in high school and feeling particularly anxious about mathematics. She explained:

Just because I was never your top math student, I was always pretty average, like a B student. He just kind of understood me and broke things down to its simplest

form for me to understand. ... Things weren't so much on a timeline where this needs to happen and this needs to happen. It was just gradual learning with him. As a class, once we felt comfortable enough on one topic we were able to move onto the next. It just really helped me to build those basic algebra fundamentals. Knowing that I had a caring and understanding teacher made me feel more competent and it didn't really stress me out. A lot of kids get stressed out in math cause they know things get harder. (Student Teaching Interview, March 26, 2012)

In this story, the wall appeared to have broken down a bit, offering Estelle a way in which she could access and understand the mathematics. The break down in the wall seemed to provide Estelle with the opportunity to feel validated by her teacher as being a student who could learn mathematics. Estelle emphasized the importance of being given enough time to grasp mathematics concepts. This investment of time by her teacher appeared to signal to Estelle that he cared about her learning the mathematics as opposed to just moving on and leaving her behind. She seemed to gain this experience of confidence, as her psychological wall appeared to allow her to peer out from behind and make important mathematical connections. Moreover, Estelle seemed to be able to reveal what she did not know about the mathematics been taught as opposed to concealing what she did not know.

Juncture 2 – Math Methods and Classroom Internship

Five separate plot patterns emerged from Estelle's experiential reflections and interview responses that surrounded Estelle's experiences of learning to teach mathematics. They are: (1) I Made A Vow of Never Leaving a Student Behind, (2) I Want To Teach Like Ms. C! (3) I Am Not Sure I Am "Good Enough" at Mathematics to

Teach Like Ms. C, (4) I Worry About My Students Not Liking Mathematics, and (5) I Have Nagging Notions of Necessary Mathematics Knowledge.

Plot pattern 1: I made a vow of never leaving a student behind.

During the spring semester of her third year in the teacher preparation program, Estelle was enrolled in the required math methods class. At the beginning of the semester, Estelle shared her vision of her future mathematics class. She vowed that her mathematics class would be one in which she would:

break down methods and lessons for them because that's something I felt that like I didn't get in elementary school. And I want it to be a very talkative class in a way that we can communicate back and forth about math. Where it's not just the teacher talking and the children doing like I don't get this in my head, where they feel comfortable and ask questions that they're feeling. ... I just want to be that awesome math teacher that children remember.

(Methods Pre-Interview, February 2, 2011)

She reported that her own student mathematics experiences of the “teacher already moving on” led her to carefully consider how she would teach mathematics to her future students. Instead Estelle envisioned being able to offer her students enough time to understand the mathematics she would be teaching them as well as feel confident to ask questions that would promote their understanding. Having faced multiple experiences with mathematics anxiety and issues of confidence as a student, Estelle seemed to want to create a mathematics classroom for her students that would spare them from this fate. Moreover if Estelle could create the type of classroom that she envisioned for her

students, then perhaps she could be viewed as an awesome teacher, a label she never earned as a student.

Estelle also explained that she planned to create a classroom environment that would be built on trust. She stated that her classroom would be a place where her students could share their mathematical thoughts and ideas and come to her with any questions they might have without feeling scared or ashamed. She reported that she wanted to create confident mathematics students who viewed making mistakes as part of the learning process. Estelle imagined a classroom in which she would be decentralized as the sole authority in mathematics. She envisioned a classroom in which she would not be expected to know everything about mathematics and could let her guard down. In other words, Estelle vowed to create a classroom culture in which she and her students would be able to “break down” the psych-social walls that both protected and prevented them from participating in mathematics. In addition, by creating a classroom environment that did not require Estelle to be the sole mathematics knowledge provider, she could potentially conceal the areas of mathematics that created anxiety for her.

As Estelle neared the end of her math methods semester she acknowledged that she learned many important things about teaching mathematics. However she shared that of utmost importance was her responsibility to ensure that her students understood the concepts she would be teaching them. Her confidence seemed to surge as she shared the following observation at the end of her math methods course:

I'm really excited about teaching math and I think this semester really helped me build my own confidence with math... It was really about understanding how to teach these concepts to children. And I think that I can, all of my good and bad

experiences in math, I really think I can bring a positive attitude to my students and knowing. ... you may go through a hard time sometimes in math but you will get through it and I just, I want to see my students get that “Ah hah I get it moment.” (Methods Post Interview, May 11, 2011)

Estelle had a great desire to provide an environment conducive to learning the mathematics she believed was important for her future students to know and understand. In imagining her ideal mathematics classroom, Estelle positioned herself as one of her students—equal to them in social status but also in responsibilities. In this vision, Estelle excused herself from being the sole authority on mathematics. However, while she vowed to “bring a positive attitude” and encourage her mathematics students to “communicate,” it is unclear which “concepts” Estelle hoped her students would learn, other than to “get through it.” Indeed, it seemed that within Estelle’s ideal mathematics classroom, both she and her students would engage mathematics only insofar as to *survive* it. At this point in her teacher preparation program, Estelle did not specify how she and her students would *thrive* as mathematics learners. In this way, Estelle projected her own past as a mathematics student onto her future mathematics class and onto the mathematics teacher-learner she would be.

Plot pattern 2: I want to teach like Ms. C!

After completing math methods, Estelle entered her senior year of her teacher preparation program. She spent the first semester interning in a third grade classroom with Ms. C., an expert teacher as defined by her school district as well as an experienced teacher in the mentoring of preservice elementary teachers. Estelle’s main responsibilities during the semester was to observe Ms. C’s teaching, assist Ms. C with small group

lessons, and offer additional support to individual students across the different curriculum areas such as mathematics, language arts, and science as assigned by Ms. C.

Estelle described how her goals as a future teacher were positively impacted when she observed how Ms. C. engaged students together on the classroom carpet during mathematics lessons. Estelle stated:

They all sit on the floor with the teacher while she explains what they'll be doing for the day in math. And they have like a one on one discussion, you know, the kids give their feedback, what they think, and ask their questions. The teacher will respond and it's a very open and kind of welcoming community. Like right before they go off and do their activity and I don't know, it just prepares them, they're less stressed and kind of excited to go do their activity.

(Focus Group Interview, November 30, 2011)

Estelle witnessed learning episodes that she believed enabled students to approach mathematics more prepared, less stressed, and more excited about the content area. Through Ms. C's positive modeling of preparing the students for their daily mathematics lessons, Estelle saw her own vision of what a mathematics classroom could look like being enacted. She seemed to become excited and hopeful that she could carry out her own vow of having a "talkative class" where she would be able to "communicate back and forth about math" with her future students. Estelle shared how she believed that this type of communication, missing from her own elementary mathematics experiences, was essential for learning mathematics. Moreover, Estelle may have believed that the communication back and forth between herself and her students might offer her the

opportunity to conceal what she did not know about mathematics, provided that her students could make sense of the mathematics on their own.

Plot pattern 3: I'm not sure I am "good enough" at mathematics to teach like Ms. C.

However, Estelle's optimism was not without worry. Estelle talked about an ongoing concern she encountered during her semester long internship in Ms. C's classroom. She explained that while she was responsible for checking the students' completed work, often times she did not understand the strategies they used to solve the problems. She described the following situation that occurred during a three-digit subtraction lesson:

When I go around and help the students during math, they'll go, "Estelle, can you check my work?" and I instantly go back to my traditional method where when we're doing three digit numbers, I carry the one, when we subtract, I borrow, and the kids go, "Estelle what are you doing?" They have not been taught that and I feel like I have to hide that from them so they don't get confused. And I really need to work on the methods they're doing so when I check their work, I can be using their method. And it's not that I can't, it's just my mind automatically goes to traditional. ... They're curious, you know, why is she not letting us see what she's doing? I just don't want them to get mixed up.

(Focus Group Interview, November 30, 2011)

Estelle acknowledged the importance of needing to know and understand the strategies that her students were using to solve mathematics problems. However, when she was not familiar with them, her narrative signaled that she experienced mathematics

anxiety, as in the moments when she needed to understand her students' strategies, she could not figure out what to do. Her strategy was to try and hide what she was doing from the students. Although Estelle acknowledged the need to learn the methods the students were using, she did not seem to have a plan to of how to do so. Perhaps Estelle felt less anxious relying on what she knew rather than trying to learn something new or risky.

Plot pattern 4: I worry about my students not liking mathematics.

While spending time in Ms. C's classroom, Estelle expressed concern about the repeated conversations she overheard the students having about "hating math." She drew the conclusion that the students' dislike of mathematics might be due to feeling anxious and not confident in mathematics. The conversations she heard her students' having about their negative views of mathematics appeared to remind her of her own mathematics anxiety and issues of confidence as well as returned her to her vow as she stated, "I want math to be stress free for kids because just the word math puts stress on kids as it is. I want students to ask questions and not be worried or embarrassed to ask math questions." Estelle seemed to transfer her student experiences with mathematics stress, worry, and embarrassment to the reasons behind her students' dislike of the subject. In other words, she seemed to assume the students said they "hated" mathematics for the same reasons she as a student often did not like mathematics. Perhaps Estelle thought her students were concealing the mathematics anxiety she believed they may have had by claiming to "hate math."

Plot pattern 5: I have nagging notions of necessary mathematics knowledge.

Upon completing her math methods course and her internship semester in Ms. C's classroom, Estelle talked about some concerns about teaching mathematics that were on

her mind. She shared that with her student teaching semester looming ahead, she worried about how she would teach mathematics content areas that she did not feel confident in such as decimals and fractions. Estelle said:

I am going to have to almost reteach myself those things again. I want to become a confident math teacher and confident in those lessons so my children, so yeah, this teacher knows what she's talking about, we can do this."

(Methods Pre-Interview, February 2, 2011)

In addition, Estelle felt anxious as she thought about the following scenario:

When I think about teaching older grades, I get a little nervous sometimes, thinking about, gosh, you know, when they ask me questions, how, what if I can't answer them? What if I don't know these, the answers right on the spot? ... How am I going to handle that? I don't want my future students to get stuck or not know what they need to know. (Math Methods Post Interview, May 11, 2011)

Estelle acknowledged that teaching children to understand mathematics is "one of the top things a math teacher should be doing." Yet before embarking upon her student teaching semester she asked herself:

How am I going to be a good math teacher?" [*Chuckling*] "What if I can't reach and teach all of my students?" I kept thinking, "I have to understand what I'm teaching for myself before I can teach it to anybody else." I kept thinking, "This is scary." Math is the one subject that gives me anxiety. At the end I just told myself, I wanted to be the math teacher that I always wanted, which was having a teacher who was supportive, encouraging, and understands where my students are coming from, so they can be successful in math. (Timeline Activity, May 2, 2012)

Despite her vow of wanting to be the mathematics teacher that she wished she had, Estelle worried about how she would be able to do so. Her semester spent under Ms. C's tutelage provided her with an excellent example of what good mathematics teaching looked like as well as how challenging mathematics teaching could be. As Estelle gained a broader understanding of what it meant to teach mathematics, she questioned herself as to how she would be able to attend to all of the different facets that teaching mathematics successfully required. As she entered her student teaching semester she kept in her mind her goal of being "a confident math teacher" despite feeling that "math is the one subject that gives me anxiety." In other words, as Estelle thought deeply about teaching mathematics she could not conceal her own mathematics anxiety.

Juncture 3 - Estelle's Student Teaching Experiences

Six separate plot patterns from Juncture three revolve around Estelle's student teaching experiences. They are: (1) Will I Flourish or Crumble in Ms. C's Classroom, (2) Working to Minimize Mathematical Mistakes, (3) I Seem to Know This Student, (4) Dilemmas and Distress in Teaching Fractions, (5) Can I Create Mathematical Understanding for My Students, and (6) The Ah-Ha and Jumbled Moments of Teaching Mathematics.

Plot pattern 1: will I flourish or crumble in Ms. C's classroom?

Estelle reported that she entered her student teaching semester feeling somewhat anxious, having been reassigned to Ms. C's third grade class. Although Estelle respected Ms. C and knew that she would benefit greatly from Ms. C's expertise, she reported that Ms. C could be overly critical and harsh at times. Although Estelle was a hardworking

and caring person, these qualities did not save her from being embarrassed by Ms. C in front of the students.

Estelle remembered on several occasions during the previous semester feeling publicly exposed and shamed for mistakes she made while working with students. She revealed that she felt nervous when Ms. C was critiquing her, pointing out the things she was doing wrong as well as the things Ms. C thought she should have been doing. However, Estelle reported that being mentored by Ms. C, especially in the area of mathematics, would be invaluable as she was learning to teach and accepted the placement.

Estelle made the decision that she would “just really try to soak up everything I could” by learning the strategies Ms. C used in teaching mathematics to the students while managing the class at the same time. In fact, Estelle said that she asked Ms. C at the beginning of her student teaching semester if she could start teaching mathematics earlier than planned. Estelle believed by gaining as much experience as she could teaching mathematics, especially under the watchful eye of Ms. C, then the more comfortable she might become with mathematics. She stated that her hope was that her experience in teaching mathematics in Ms. C’s classroom would lead her to feeling more mathematically confident. Perhaps then Estelle could let down her wall and not have to conceal the mathematics she did not know that appeared to cause her mathematics anxiety.

Plot pattern 2: working to minimize mathematical mistakes.

Estelle recalled that at the start of her student teaching semester she felt particularly nervous about teaching mathematics. She shared that her breakfast time was

spent thinking about the mathematics lesson she was going to teach for the day. She realized that the mathematics she was teaching was new not only to the students she was teaching but also new to herself.

One of the first mathematics lessons Estelle taught during her student teaching semester was a story problem lesson. Estelle explained that one of the main goals of the lesson was for her students to be able to decipher when to use the operation of multiplication or division in story problems and then to successfully solve the problem. Estelle reported that she was excited about teaching the lesson because she loved multiplication and division. However, she admitted she felt nervous about modeling the lesson for class. When asked what made her nervous she said:

“I guess just cause my kids are, are pretty smart and they’ll catch on, you know, if there’s a mistake made. ... I guess it just makes me feel like, I don’t know, I know what I’m trying to teach. Sometimes it’s just hard for me I guess to get it fully across to them. (Pre-Observation Interview, February 6, 2012)

Estelle further explained that she felt unsure of herself when she tried to use the mathematical terms associated with multiplication and division. She shared:

I guess it’s just you know, trying to explain to the children what number is the, you know, the number of groups, which number goes for each group, kind of like teaching the dividend, the divisor, and the quotient. You know in a word problem scene – this would be your dividend and this would be your divisor kind of thing. And I know they’ll, they’ll understand it, I guess it’s just this is such a brand new concept to them that I’m just a little nervous cause I don’t want to mess it up for them. (Pre-Observation Interview, February 6, 2012)

In addition, Estelle said that her students would be completing a chart where they would be expected to identify each part of the story problem that would be posed to them such as the number of groups and the number in each group. Estelle admitted that this chart made her nervous because:

It's just because you know, there's a certain number that goes in each one of these and I don't want to get confused and mess that up for the students because when I looked at it for the first time, I really had to sit down and do these problems. And figure out where each number goes – determine what number is the product, how many groups are in this equation, that kind of thing. I guess it's just this chart that they'll have to fill out later during the activity because I, I can see some students getting confused on that. ... If they get confused, I, I think sometimes it makes me feel like okay, I'm not doing a good job because they're not understanding it it's my fault. (Pre-Observation Interview, February 6, 2012)

After teaching the lesson Estelle shared the confidence she experienced while teaching the lesson. She reported:

I felt really confident about the story problems that I did with them because I had written them down the night before and I had gone over them and you know, thought of some different strategies that the children might use so I would be familiar with their answers and response. I honestly think, you know my main concern with this lesson was with that chart. Um, the multiplication and division chart and I didn't want to put the wrong numbers in the wrong place of the chart. Because it all has to kind of go together, you know, the way you write it, the groupings, there all a certain....um spot for each number and I was worried that I

was going to put them in the wrong spots. So I know I've been talking about that a lot, but I guess that was just really my, my main concern.

(Post Observation Interview, February 7, 2012)

Estelle appeared to feel more confident by believing she could plan or map out all answers her students might say or do as they work on the mathematics she presented to them. However Estelle explained that she also felt worried when she presented the lesson to her students. She recalled:

I guess going into this lesson I didn't really pin point where they might get confused. I guess I was just kinda more worried ab- of the parts where I always get confused and I didn't want to confuse the students. But I don't think I really was surprised, cause I just feel like that every time I teach a lesson there's just something new that comes up that, which I wasn't expecting.

(Post Observation Interview, February 7, 2012)

The story problem multiplication and division lesson was one of the first lessons Estelle was responsible for undertaking during her student teaching semester. She was pleased to be assigned a lesson in a content area in which she loved, which may have initially boasted her confidence as planned for the lesson. However, as she prepared the lesson, she began to worry if she would be able to “model” the lesson correctly to the class. This worry appeared to create anxiety for her, as she wanted to be seen as a teacher that knew what she is doing. In addition, she had a great desire to be viewed by her students as “smart in mathematics,” a description she longed for when she was a child learning mathematics.

By “working through the story problems” and anticipating how her students might solve them the next day, Estelle appeared to feel more confident about the lesson she was preparing to teach, especially because she could do the mathematics. However, Estelle exposed her worry when she discovered that she did not fully understand the mathematical terms or the application of a chart that the students were expected to complete. Her strategy of working hard to be prepared for her lesson failed her when she tried to plan what she didn’t know versus learning what she didn’t know. Moreover, while she was trying to teach the lesson and conceal her own confusions, her worries grew as she was confronted by her students’ confusions that she did not anticipate.

Plot pattern 3: I seem to know this student.

While teaching the multiplication and division story problem lesson Estelle shared her experience with one of the girls in the class. She recalled:

There's one girl who, who wanted to give her answer but then realize that she's a little bit confused. ... But then she still came back later and you know explained it and gave her answer. ... You know I feel like I can totally relate to this little girl. And you think you know something so well and you're so excited to say it and then bam! Once you realized you've seen it you go "Oh, I don't, I don't think I'm on the right track" and she was on the right track and I knew exactly where she was going. So I think, I think if I remember right I said, "You are on the right track and "You're really close" so I didn't want her to give up and not give an answer. And I knew where she was going so I think letting her know that. You know, she kept apologizing, "I'm sorry! I'm just really confused." I was letting her know that "no it's ok, you're doing perfectly great".

(Post Observation Interview, February 7, 2012)

Estelle shared how she identified with this student. She said:

She asks questions but sometimes she's really hesitant. I was like that when I was in school because the people I was around with never asked questions. To me, if you ask questions that just means that I don't know anything. I felt embarrassed. I never asked questions and it kinda just hurt me in the end that I didn't ask questions. (Student Teaching Interview, March 26, 2012)

Estelle wanted her student to see that she was "on the right track" of being able to solve the problem so that she could experience a sense of success and not give up. Perhaps she did not want her student to feel embarrassed like she did as a child learning mathematics. Estelle was holding true to the vow of supporting her students by encouraging this girl to ask questions and hearing what she had to say in a way in which she wished her teachers would have done for her.

Plot pattern 4: dilemmas and distress in teaching fractions.

When Estelle was almost halfway through her student teaching semester, she taught a mathematics lesson where the goal was for the students to create a set of fractions strips they would use to facilitate their learning throughout the unit. Each student was given five different colored sheets of paper so that each fraction type would be represented by a different color. Estelle shared how she felt about teaching the lesson. She said:

I'm looking forward to it. I've been kind of planning it and going over it almost everyday for the past week just cause it makes me feel better and I feel more confident about it knowing exactly what I'll be saying and doing. I've taken some

time to do it myself, the fraction sets, so I'm ready. ... So I'm just that type of person where I feel better when I review things and know exactly what my students are going to do. ... I feel like it might be a little crazy cause there's a lot of activity and movement going on with this lesson but I'm looking forward to it. (Pre-Observation Interview, February 20, 2012)

However, when Estelle thought more deeply about the lesson, she expressed the importance of being able to properly and clearly explain to her students the definition of a numerator and denominator, which tugged at her confidence. She admitted:

I don't know, for some reason when I try to explain the denominator and numerator to students I get a little fumbled. I guess I just don't really know how to, to say it or to explain it. So that would probably be, that would be the part where I feel nervous about is explaining, you know, the differences between the numerator and denominator. (Pre-Observation Interview, February 20, 2012)

While talking to Estelle when the lesson was over, she shared that when she taught the lesson her students explained to the class the definition of a numerator and denominator. She reported the great sense of relief that she felt. She said:

I anticipated, you know, some students getting confused on certain....certain parts that I think, I was mostly concerned with the numerator and denominators, but at, at the beginning of the class I had asked students if they knew which number was the numerator and which number was the denominator and I had students who raised their hand to tell me what a denominator was and what it stood for and what a numerator was and what it stood for. So that was just great that I didn't, I didn't have to explain it to them. They explained it to the entire class. They knew

exactly what it was so....um....I was just confused, I wasn't confused, I was afraid that the students would be confused on that topic of the lesson.

(Post Observation Interview, February 21, 2012)

Estelle felt prepared for her lesson in which her students would create their own fractions strips. She had the supplies that the students would need ready and anticipated that the lesson would create a lot of activity and motion from the students. She rehearsed what she would say to her class and even made a set of the fraction strips herself in an effort to ensure that what she was asking the students to do could in fact be carried out successfully. However, Estelle's anxiety seeped through as she spoke of how she would get "fumbled" when she tried to figure out how to define the two terms (denominator, numerator) that were critical to the students' understanding of the lesson. She didn't believe that she would be able to "say it or to explain it."

Estelle was able to teach from behind the wall as her students shielded her from her confusion of how to explain the two mathematical terms. Their explanations led to the class' understanding of the two words without a contribution from Estelle. By teaching from behind the wall, Estelle was able to conceal her inability of how to explain the two mathematical terms. Her students were able to define the terms for her, protecting her from her own anxiety. Moreover, by teaching from behind the wall, Estelle may have been able to escape her feelings of failure while simultaneously preserving her own sense of worth. Covington (1984) has argued that these failure avoiding strategies often provide a temporary sense of relief but across time may impede an individual's willingness to persevere with tasks that they perceive as difficult or challenging.

In the fractions lesson, Estelle also talked about how her students created their own fraction pieces. After completing the task, Estelle asked her class to place their fractions in order of size from smallest to greatest. She was under the impression her students understood the concept but felt stumped when she realized that they cut them up in different ways. Estelle stated:

There were so many ways the students were creating their equal pieces, like for the $\frac{1}{8}$, some students would cut them into rectangles, and some were in squares, and some were in triangles. And I was, you know, I kept thinking to myself, how am I going to explain this to my students that these are all equal pieces, yet they're just cut differently. So that was something that I, I worried about while I was explaining that. ... I did feel very anxious about the student who I didn't check his $\frac{1}{8}$ fraction pieces. And when he brought them to me to show the entire class of how they fit into one whole, they, they were not equal. So at that point in time in front of the class, I didn't really know where to go from there and I didn't want to point this out and embarrass the student. So....at that point I just felt like in a bind. I didn't know what to do. (Post Observation Interview, February 21, 2012)

Estelle's recount of this part of the fraction lesson suggested that she knew the fraction pieces most of her students had created were equal but represented in different shapes. However she struggled with the necessary language needed to explain the different shapes. Her struggle created worry, which seemed to be accentuated when she realized the student who shared his fraction pieces in front of the whole class did in fact not have equal sized pieces. Estelle was a caring person and did not want to embarrass the student in front of his classmates, like she had experienced so many times in her own student

experiences. Being in front of the class Estelle “just felt like in a bind” and “didn’t know what to do” as all the eyes of her students appeared to be waiting for her to respond. Her mathematics anxiety seeped out as she was unable to seek relief from her strategy of concealing what she did not know.

Estelle also shared that she worried about the delivery of the fractions lesson, finding it to be her biggest challenge. She reported:

“Not that I don't feel prepared, you know, I have these ideas and the things I want to say. I just think it's the way, you know, all the students, different ideas, and trying to accommodate and answer them and I tend to get a little mixed up in my own mind of what I want to say and what I'm trying to say. ... I think the students grasped what I wanted them to. So I'm happy in that sense, but thinking about organizing and how I could have made the lesson go a little smoother, I think there's better ways I could have gone about it to do that.

(Post Observation Interview, February 21, 2012)

Estelle prepared for teaching her fractions lesson, “having gone over it almost everyday for the past week” in an effort to feel more confident about the lesson. Yet she admitted feeling worried when she tried to execute the lesson in a manner that followed her vow by creating a “very talkative class” where there was communication going back and forth between herself and her students about mathematics. Estelle tried to absorb the different student ideas and respond to all her students, having been just an average student who had often felt like her own teachers did not value what she had to say. However while she tried to process all the mathematical dialogue that was coming her way, she got “mixed up” and was unable to hide her anxiety about how to handle all her students’ different

ideas. Estelle believed that perhaps she could have made the lesson go smoother but at the time she was not able identify any definitive ways of doing so.

Plot pattern 5: can I create mathematical understanding for my students?

When Estelle was nearing the end of her student teaching responsibilities in mathematics, she taught a lesson on equivalent fractions and decimals. She described the main goal of the lesson for students to be able to correctly identify equivalent fraction and decimals as well as write them out. As she prepared the lesson for her class she said:

I feel pretty good. We've been doing a lot with fractions lately and it seems like it's coming pretty easily to the students and when they understand it, it puts me at ease cause I feel like "Yes! They're getting it and my objectives are being met!"

So I, I feel pretty good about tomorrow. It will definitely be different because they have to find equivalent fractions and decimals but I think the students will do fine with it...the students know what equivalent fractions are. We've gone over it a lot and we've done a lot of examples so I think, I mean we touched on it last Friday making an equivalent fraction and decimal. So now, I guess my strength is of this lesson that, I think the students will be able to understand it pretty well.

(Pre-Observation Interview, March 11, 2012)

In addition, Estelle reported she felt confident having her students utilize multiple resources while teaching the fractions and decimal lesson. Referring back to her own experiences as a visual learner she said:

You know I am a big visual learner and so when I'm teaching with visuals I just, I feel like I know what I'm doing, I know what I'm presenting and, you know, I feel my confidence go up and I think the kids can see that. Um, so that's probably something I've been working on a lot in my full time takeover. Just using multiple resources in, in a lesson so I'm not limited teaching the students.

(Pre-Observation Interview, March 11, 2012)

Being able to teach with visuals seemed to allow Estelle to feel like she was meeting the various needs of her students by using multiple resources in the classroom. She did not have this opportunity as a student and offering multiple ways for students to learn mathematics honored her vow to teach all students. In addition, by using visuals in her teachings, Estelle believed “her confidence goes up” and “the kids can see that.” One of Estelle’s goals as a teacher was that she been seen by her students as a mathematics teacher that knew what she was doing.

After teaching the fraction and decimal lesson Estelle talked about how calm her students were and how they were able to “move through” the lesson fairly quickly, resulting in her not needing to spend a lot of time on the content area. Estelle revealed that this helped to boost her confidence in talking about fractions. In addition, she stated that her students were sharing their examples and deciding if the fractions and decimals were equal amongst themselves. However, she added that in general, she still felt challenged delivering mathematics lessons to her students. Estelle reported:

I've really been trying to work on my pace and I've notice that when, you know, I'm kind of going through things at a good pace I feel more confident because I'm not dwelling on things and I think that when I'm dwelling on a content, a subject,

you know, I tend to just phase out. So I've really been working on my pace and I think that's been helping me deliver the lesson.

(Post Observation Interview, March 12, 2012)

When Estelle's students were able to quickly grasp the fraction and decimal content and "move through" it, Estelle was once again shielded from having to access the content in a deeper fashion, and the need to utilize her strategy to hide the content that she did not know. In addition, when her students were able to work together to determine if they had correctly identified equivalent fractions and decimals, Estelle was spared from experiencing the anxiety she encountered at times when explanations of the content were needed.

Estelle admitted that overall, she still felt nervous about teaching mathematics. When asked what specifically made her feel anxious about teaching mathematics she said:

I think just again delivering it and saying the right things to my students. I, lately I've been having just a few, like a handful of students who say "I don't get it" so I go into a deeper break down of instructions for them and they eventually get it. But I guess when students, when I hear students automatically say, "I don't get it" it makes me nervous because I feel like I'm not doing a good job teaching. That they're obviously not understanding what I'm saying. That's just probably the biggest thing I'm worried about is not getting the point across to the students.

(Pre-Observation Interview, March 11, 2012)

Estelle's vow to teach in a manner that left nobody behind was put to the test when her students voiced their lack of mathematical understanding. Challenges associated with

creating understanding for all her students made Estelle feel nervous about whether she was doing a good job teaching.

Plot pattern 6: the ah-ha and jumbled moments of teaching mathematics.

As Estelle approached the end of her student teaching semester she shared the following thoughts:

My math experience in student teaching has been a really positive one. I find myself learning something new every day during math. Whether it's how to end math discussions or using different strategies of students showing their work. Not only have I seen the "ah-ha" moments and the children learning but I myself have been having those exact same moments with them. The learning is going both ways. ... Now I feel a lot more confident. ... I learned the many different ways that math can be taught through manipulatives, strategies, communities, and online resources. (Student Teaching Interview, March 26, 2012)

Estelle talked about the importance of being prepared for each and every one of her mathematics lessons over the course of her student teaching semester. She stated:

I spent a lot of time preparing for my math lessons. Just because it did give me anxiety, and through my preparation, and just making sure I had everything I need, that made me feel a lot better going in every day teaching my lessons. I made dialogue for every day, and I went over everything I was going to say, and all the problems we were going to do, I would also look at the math that I was giving my students, you know the worksheets. I would do all of those myself too before I taught them, so it was a lot of work, but it really helped me.

(Timeline Activity, May 2, 2012)

Despite the amount of time and effort Estelle spent preparing for her daily mathematics lessons Estelle shared that while teaching mathematics she struggled with being able to explain mathematics to her students. She said, “I feel anxious about my students not understanding my lessons.” Estelle reported:

I tend to have a hard time using math, I guess math vocabulary or saying the, the right words and just getting jumbled up in my thoughts and that all goes into delivering the lesson. I mean my lessons have been going well. And all of my objectives and lesson focuses are being met. I think I'm just very hard on myself and um, I'll try anything to not get criticized for it, for my math lessons, but I know it just comes with it. (Pre-Observation Interview, March 11, 2012)

Estelle’s reflection on her student teaching semester spoke of various types of learning experiences she encountered as she was learning to teach mathematics. She managed to teach from behind the wall by eliciting her hardworking and caring personality. In addition, her strategy to conceal or hide what she did not know enabled her to “get through” teaching mathematics as her means to cope with mathematics anxiety. She appeared to attend to all of the details for each mathematics lesson she was teaching. She worked hard in an effort to deliver mathematics lessons that would adhere to her vow of not leaving anyone behind while also offering her students the opportunity to communicate back and forth about mathematics. Moreover Estelle aimed to create a classroom where the teacher was not the only person talking. Therefore her efforts to utilize manipulatives, strategies, communities, and online resources helped to support her vow of having her students learn mathematics much differently than she had. As Estelle

had the opportunities to teach in this manner she experienced her own “ah- ha” moments which she believed led her to feel more confident about her mathematics teaching.

However, Estelle struggled with being able to “talk” mathematically in a manner in which required her to be able to not only use but understand the mathematical vocabulary she was teaching. She got “jumbled up” as she tried to deliver mathematics lessons. Her strategy of enlisting “the wall” as a means to conceal or hide what she did not know about mathematics did not protect her from what she did not truly understand. In other words, when it came down to Estelle really knowing the mathematics content in which she was teaching, she was confronted head on with mathematics anxiety.

Summary

Estelle began her mathematics journey as a young child feeling mathematically confident and competent. According to Estelle, her early years elementary teachers held high expectations for her to achieve in mathematics, which she embraced. Moreover Estelle believed they were able to teach her in a manner that complemented her visual learning style. Estelle viewed herself as someone who did well in mathematics but admitted that she had to work hard to not only achieve good grades but to understand the mathematical content expected of her.

As Estelle progressed through her elementary years of schooling, her hard working nature did not earn her a place in the top tier of her mathematics classrooms. Estelle began to feel partitioned or separated from the smart students, equating her status as a “regular” student to mean she was less valued than her peers in the higher-level mathematics group. This public comparison, in which she could not hide or conceal her status of being classified as a “regular student” led Estelle to believe that she was not

good in mathematics. She perceived that her teachers were less interested in her mathematical thinking and less attentive to her mathematical questions and concerns. Estelle's confidence waned, leaving behind a trail of mathematics anxiety for her to attend to.

However, Estelle's parents whom she trusted implicitly, were committed to helping Estelle achieve mathematical success. She willingly accepted their help as well as the tools they provided her with to not only review but strengthen her mathematical understanding. Her parents' investment in her mathematics education coupled with her hardworking nature may have helped to alleviate her mathematics anxiety, perhaps even temporarily replacing her anxiety with a sense of mathematics confidence.

However, according to Estelle, when she entered middle and high school, her mathematics test scores confirmed to her that she had low mathematics ability. She began to believe even more firmly that not only was she not good at mathematics, she did not understand this content area as well. She spoke clearly of the psychological wall she built as a means to protect herself from the mathematics anxiety she was experiencing, as an attempt to conceal or hide what she did not know and understand. Moreover, when Estelle was confronted with teachers who taught mathematics concepts at a pace faster than Estelle could grasp, she would hide behind her wall in an effort to ward off the anxiety she encountered as she was separated from the content.

On occasion, Estelle was presented with teachers that enabled her to break down her wall to access the mathematical content in a manner in which she could grasp. Having a caring and understanding teacher who was willing to provide Estelle with the time and explanations she required to learn mathematics seemed to create in Estelle the confidence

she needed in order to feel successful. This type of learning environment appeared to calm her mathematics anxiety.

When Estelle thought seriously about becoming an elementary teacher, she was concerned that her mathematics anxiety might be a stumbling block to her chosen profession. As she entered the teacher education program she vowed that she would provide her future students with a positive mathematics experience that would promote their understanding as well as instill in them a sense of confidence. Moreover as a caring person, she wanted to ensure that none of her students got left behind, an experience that she encountered many times in her own learning of mathematics. In addition, Estelle wanted to be seen by her students as a capable and competent mathematics teacher, a label that was not associated with herself as a student.

When Estelle began to study how to teach mathematics, she discovered that teaching mathematics seemed to be as challenging as her student experiences of learning mathematics. Her experiences of learning to teach mathematics, especially as it related to understanding her students' thinking, often mirrored her experiences of the feelings she had of "being lost" in this content area as a child. The wall that Estelle built as a student learning mathematics continued to be utilized as she was learning to teach in an effort to ward off the mathematics anxiety she encountered. While preparing for her mathematics lessons, Estelle tried to conceal what she did not know about the mathematics content by trying to anticipate every possible strategy a student might utilize. However, while Estelle was teaching her carefully prepared lessons, her students would often arrive at an answer using a strategy that she had not planned for. As Estelle was trying to figure out her

students' mathematical thinking, her mathematics anxiety would ignite and she would become confused.

In other instances, Estelle would teach from behind the wall as a means to hide what she did not know about the different mathematical content areas. She accomplished this by having her students explain particular mathematics terms that caused her confusion or by sharing their explanations about strategies they utilized that she did not understand. Estelle seemed to almost be like holding her breath in anticipation while she waited and hoped that her students could offer the explanations that she herself could not provide.

The strategy that Estelle utilized as a student learning mathematics was to conceal or hide what she did not know about the mathematics content she was supposed to be learning. While this strategy may have offered Estelle temporary relief from feeling incompetent in mathematics and anxious about this content area, this strategy failed repeatedly. However, Estelle continued to employ this strategy as a preservice teacher, even though it did not work. She did not appear to seriously consider that maybe what she needed to do was to learn the mathematics content. Perhaps then she might of felt more confident and less anxious about mathematics. I wonder what the future holds for women like Estelle who move into their own classrooms and discover that the strategy of trying to conceal or hide what they do not know about mathematics doesn't address their mathematics anxiety and issues of confidence? These ideas will be addressed in the Implications section of this study.

CHAPTER 5: FINDINGS (CASE OF PHOEBE)

Introduction

My first introduction to Phoebe occurred in the fall of 2010. Phoebe was my student in a required classroom processes and instruction course taught on campus. Phoebe impressed me as having a friendly and spunky personality. She possessed a creative flair and always seemed confident and competent in class discussions as well as in the coursework assignments she produced. Later I discovered that Phoebe's confidence seemed to be linked to her having been identified as a gifted student early in her education. This classification seemed to have afforded her high status in her various school environments.

During the mathematics methods course, I learned that Phoebe's mother was an elementary teacher and that her father had a strong background in mathematics with a PhD in Physics. As Phoebe talked about her father, it appeared evident that she respected his mathematical expertise. In fact, her narratives suggested that Phoebe was in awe of her father's mathematical abilities. Phoebe did not make any reference as to how she perceived her mother's mathematical skills and ability and made no mention of her mother helping her with mathematics despite the fact that her mother was a teacher. Later, Phoebe revealed to me that she had defined assumptions about the mathematical capacities of men and women, which she related to giftedness. I will discuss these assumptions later in this chapter."

It came as a great surprise to me that Phoebe, whom I had seen as a confident, competent, and successful student in the classroom processes and instruction course, did not view herself as such a student in mathematics. In fact, in her matter of fact style, she

let it be known that mathematics was “not her friend.” Moreover, Phoebe stated that she decided to become an elementary school teacher because she thought she would not have to know or do a lot of mathematics in this profession. This was as Phoebe explained, “a selling point” for an elementary education degree.

In this chapter, I explore Phoebe's experiences with mathematics anxiety at key moments, or junctures, in her mathematical history. I first consider the narratives from Phoebe's experiences as a mathematics learner (Juncture 1). Next I address the narratives of her experiences as a preservice teacher learning to teach mathematics (Juncture 2). Then, I examine narratives that surround her student teaching experience (Juncture 3). Finally, I summarize key ideas in the “Case of Phoebe.” In each of these junctures, her stories and reflections reflected multiple plot patterns. Some plot patterns were comprised of numerous stories and reflections. Other plot patterns were derived from a single story or reflection.

Based on the data collection instruments (mathematics autobiography and interviews) I rearranged episodes from Phoebe's life to create a chronologically ordered mathematical life story. A narrative thread that brings these stories and reflections into relationship is Phoebe's strategy for coping with mathematics anxiety, which she came to rely on for a sense of confidence both as a learner and as a teacher. This coping strategy was to inform others that mathematics was not a content area in which she had great ability. Her hope appeared to be that by being open and honest about her relationship with mathematics, others would excuse her from knowing the content or at least not expect her to excel in this content area. As I will demonstrate below, Phoebe persisted in using this strategy for coping with mathematical anxiety even when the reassurance it

brought her was only temporary, and when the strategy failed repeatedly. There were times however, when Phoebe stepped outside of her role as a non-mathematics person and allowed herself the opportunity to learn the mathematics that she did not understand as a student and a soon to be teacher, which I will discuss below.

Juncture 1 - Phoebe's Student Mathematics Experiences

Four different plot patterns emerged from Phoebe's reflections on her mathematical learning experiences as a student. They are: (1) How Can I Be Gifted When I Don't "Get Math?" (2) Whom Can I Depend On To Teach Me Mathematics? (3) Shining the Light on Mathematics Understanding, and (4) Juggling Mathematics Insecurity Amidst New Mathematics Skills. Throughout the different junctures, I have titled each plot pattern using a composite of Phoebe's own words to encapsulate the essence of her narratives.

Plot pattern 1: how can I be gifted when I don't "get math?"

Phoebe reported having few memories of her days as an elementary mathematics student but clearly recalled never liking the subject. In fact, the first words she wrote in her mathematics autobiography were, "I have never been a math person." Phoebe remembered how hard she struggled as a young child to learn basic addition and subtraction facts and said, "Even today I freeze up when asked a simple math problem." Phoebe remembered her teachers showing her just one way to "do" mathematics without an understanding of what she was doing. She described these early mathematics experiences in her life as being quite traumatic, causing her to "generally hate the subject." Phoebe believed she never really "got" mathematics and was always

uncomfortable with mathematics. She openly admitted that her attitude towards mathematics had mainly been negative.

Phoebe frequently talked about being labeled as a gifted and talented elementary student. Yet Phoebe said she wondered how that could have been true when mathematics was always so challenging for her but not for the other kids who were labeled as gifted and talented. She stated:

That's why it was so hard for me because all of my friends were of that same status I guess you could say. It was hard because I would think about them and they were better at math than I was. That was hard.

(Student Teaching Interview, March 22, 2012)

It appeared as if Phoebe could not quite understand why she was seen as being one of the more intelligent students when she believed her mathematics ability did not support this recognition. Claiming that she “was not a math person” may have helped Phoebe to temporarily alleviate the mathematics anxiety she encountered.

Phoebe remembered the struggle she encountered while learning Roman Numerals in her second grade gifted mathematics class. She stated:

I recall not understanding how to count or read Roman Numerals and feeling as though the rest of my classmates understood it so easily. It was such a terrible feeling that it took me until I was in my Math 302A class sophomore year of college that I was actually able to read and understand Roman Numerals.

(Mathematics Autobiography, January 18, 2011)

Despite the fact that Phoebe was in a class created specifically for her and the other gifted and talented students in second grade, she still saw herself as someone who was

not good in mathematics. In fact when she compared herself to the other gifted students, it seemed to her that her peers did not encounter the mathematics struggles that she had. Phoebe's constant comparisons to the other gifted students in her class seemed to fuel her mathematics anxiety.

By the time Phoebe reached high school she said she continued to wonder why she could not "get" mathematics like so many of her classmates. She reported:

In high school when I would get like a D on the test or something and the kids would just, no problem, get As and Bs and it just made sense. I just remember thinking, I just remember not understanding how it made sense to them and not to me. (Student Teaching Interview, March 22, 2012)

Phoebe seemed to persist in believing that her classmates had the ability to understand mathematics more than she did. In fact, the tangible evidence of the grades her classmates received when she compared them to her own seemed to confirm to Phoebe that she was not as good in mathematics as her peers. These experiences may have served to heighten her anxiety and lack of confidence in mathematics.

Phoebe's cumulative set of anxiety-laden experiences appeared to shape significant decisions in her mathematics story. She stated that as soon as she had met her high school mathematics requirement, she chose not to take any more mathematics classes. Phoebe seemed to think that not taking any more mathematics classes was her best option, given the struggles she had encountered thus far. She did not appear to consider that perhaps an additional high school mathematics course could yield a successful outcome for her.

Plot pattern 2: whom can I depend on to teach me mathematics?

Phoebe did not recall feeling supported by her high school mathematics teachers. In fact, she stated that many of her high school mathematics teachers actually “hindered” her learning. She remembered feeling so frustrated in mathematics because as she said:

My parents would not let me get away with the excuse, “Well my teacher’s not teaching me.” They said, No, you still have to learn. You still have to do enough that you can get a good grade in the class.” I remember having to sit with my dad and learn math with my dad, which you don’t wanna do at home. My dad is a patient man but you just don’t wanna do math homework at home when you should be learning it at school. (Student Teaching Interview, March 22, 2012)

Phoebe’s story revealed the pressure she felt to learn mathematics, regardless of her perceived lack of teacher support. Moreover, the pressure that Phoebe described to also meet her parents’ expectations to earn good grades in her mathematics class hinted at other potential sources of anxiety. Meeting these familial expectations may have heightened or elevated Phoebe’s mathematics anxiety, complicating her chances to go forward in learning mathematics.

When reflecting back upon her high school mathematics days, Phoebe summarized two of her mathematics teachers as follows:

I had the most ineffective teachers and was convinced that I just could not do it. My geometry teacher was an awkward caffeine addict who would repeatedly bang his head against the wall during class time and make strange gestures while attempting to teach. I will say that I learned next to nothing in that class. My

algebra II/trigonometry teacher cared more about basketball and his girlfriend (a co-worker of his) than his actual job at hand.

(Mathematics Autobiography, January 18, 2011)

Phoebe's final high school mathematics class was one in which she described as receiving no learning or support from her teacher. She explained:

I remember he would, we would go to class and he would say, "Okay, read the book and then do the homework." Then he'd say, "We'll talk about it tomorrow." That did not work for me. I just couldn't do it because I struggled with math as a kid. I never really got it. If tomorrow did come it was more of like a ten-minute, "Okay what were your questions?" Then he'd kinda go over quickly how to do it and that would be it. It was mostly a lot of not-teaching happening.

(Student Teaching Interview, March 22, 2012)

Phoebe's stories of her high school mathematics teachers suggested she did not receive the mathematical guidance she believed she needed in order to access the content. She did not seem to consider that learning mathematics at school despite being assigned to "ineffective teachers" was a possibility. Without her teachers' guidance, Phoebe felt like she "just could not do it," strengthening her belief that math was not her thing. In short, Phoebe's experiences in high school mathematics appeared to chip away at her confidence.

Although Phoebe had mixed feelings about the required mathematics study sessions with her father, she strongly believed he was the primary person who supported her mathematics learning. She described her father as being a "math genius" with a PhD in Physics. Phoebe stated:

Fortunately, I had my father to help me throughout my middle and high school years. He sat with me for endless hours, helping me with my homework and studying for tests. At the time, I really hated having to do that but today I am very grateful for his extreme patience and willingness to help me out. My dad was the thing that made my life so much easier when it came to math. While my early experiences in math ruined my enthusiasm for it, my dad helped me make it through. (Mathematics Autobiography, January 18, 2011)

Phoebe's words expressed great gratitude to her father for helping her survive her middle and high school mathematics classes. When she could no longer keep mathematics at arm's length by declaring her distaste for mathematics Phoebe stated that her father was key in helping her to move forward. Believing that she was not a math person, Phoebe was grateful to her father for helping her "make it through" middle and high school mathematics.

Phoebe also talked about a high school friend who supported her with high school mathematics courses. Indeed Phoebe claimed that this friend helped her to "survive" one year of high school mathematics. She recalled:

One of my good friends in my sophomore year of high school was in my math class. She got it more than I did and she always did better than me on the tests and stuff. I remember she would try to explain, I mean, she was that kind of person. She would try to help me learn it and explain it to me. She just, yeah, she just understood it and could do it and knew what, yeah, wouldn't make the same mistakes I would, I guess. (Student Teaching Interview, March 22, 2012)

By the time Phoebe reached high school she had experienced many episodes of feeling unsuccessful in mathematics. Therefore she was grateful to have a friend who, like her dad, would take the time and had the ability to explain the mathematics to her. Phoebe viewed this friend as being more capable than herself, given the fact that her friend “got” mathematics, something she herself seemed to believe was out of her reach. Once again, Phoebe viewed herself as someone who was just “not smart when it came to mathematics.”

Plot pattern 3: shining the light on mathematics understanding.

As part of her requirements to enter the College of Education, Phoebe needed to successfully complete the two mathematics content courses for elementary teachers. She stated that this was when mathematics began to “click” and make sense to her. She attributed her new understanding to her mathematics professor whom she said changed how she saw herself as a mathematics learner. She recalled:

I had the worst education when it came to math that I had almost given up on math entirely by the time I got to the university. ... Thankfully my attitude was changed when I had to take the Math 302 course. Thanks to my wonderful teacher, my confidence in my math skills was restored to a certain degree. She was so patient and went through the lessons very thoroughly. Somehow, she shed new light on a subject that I could never quite understand. Things that I had struggled with as a kid were explained to me in a different way that they were suddenly very clear to me. Finally, I became the student who had the answer before the rest of my classmates, and hardly ever struggled to understand a concept. (Mathematics Autobiography, January 18, 2011)

One way in which Phoebe attributed being “smart” in mathematics was to be the student who had the answer first. She associated this ability to be quick with a right answer to be synonymous with being smart in mathematics. As a young child, this quickness did not characterize mathematical answering occasions for her. She often referenced how in a class of gifted peers, she was slow to provide correct mathematical answers to posed problems. Phoebe routinely recalled feeling nervous when she could not grasp the mathematical content quickly, believing she was not capable of understanding mathematics concept. Based on the difference between these “then” and “now” stories, one would expect Phoebe to have had a positive turning point experience with thinking she could do mathematics, as she succeeded and met her own criteria of associating being smart with the student who has the answer first. Unfortunately the glimpse that Phoebe experienced with success in mathematics did not prove to be sustainable or convince her that she could be a “math person.”

Plot pattern 4: juggling mathematics insecurity amidst new mathematics skills.

While Phoebe declared that her university experience in mathematics boosted her confidence, she added that mathematics remained her least favorite subject. She stated that she believed nothing could “erase the old insecure feelings of being a weak math student.” However, Phoebe reported that she would be able to teach mathematics to her future students, as she said her skills and knowledge of mathematics were much stronger than they were as a K-12 mathematics student. However, even with this refreshing but clearly limited newfound confidence, she added that she would not feel confident teaching mathematics beyond pre-algebra.

Even with conflicting evidence that she could be a skilled mathematician, Phoebe held strong to her belief that mathematics was not her thing, ranking it as “her least favorite subject.” It may be that this was a self-protective technique, which helped her ward off the anxiety and alleviate deeply held feelings of humiliation and shame about her mathematics ability. However, her university mathematics experience seemed to give Phoebe confidence enough to believe she could teach up to the pre-algebra level.

Juncture 2 – Math Methods and Classroom Internships

Five separate plot patterns emerged from Phoebe’s reflections on learning to teach mathematics. They are: (1) Can I Be A Teacher Who Creates Successful Mathematics Students? (2) Ms. D Believes In Me - Why Can’t I? (3) Reaching For The Teaching Crutch, 4) Will I Really Be Able To Teach Mathematics? and (5) Mathematics Lessons That Leave Students Behind.

Plot pattern 1: can I be a teacher who creates successful mathematics students?

During the spring semester of her third year in the teacher preparation program, Phoebe took a course in elementary mathematics teaching methods. At the beginning of the semester Phoebe talked about her commitment to offer her future students a mathematics experience different than her own. She explained:

I do not want my future students to feel as discouraged as I did. I want them to feel like they are smart kids and can become successful math students. I think my experience can help me in many ways because I will be able to empathize with the children who struggle. As I continue on in my education, I know that I will

become equipped with strategies that will help me to teach a difficult subject.

(Mathematics Autobiography, January 18, 2011)

Phoebe's comments suggested she was optimistic that somehow she would be able to learn how to teach mathematics as she continued on in her elementary teacher preparation program. Given her own background of mathematics anxiety and feelings of mathematics weakness Phoebe was of the mindset that her experiences would help to guide her teaching of struggling students.

Plot pattern 2: Ms. D believes in me - why can't I?

A major component of Phoebe's math methods course was a teaching internship in a local elementary school. Phoebe was assigned to Ms. D's bilingual first/second grade classroom. Ms. D was considered to be an expert teacher as defined by her school district. Ms. D was supportive of Phoebe as she was learning to teach mathematics by providing her with opportunities to observe the teaching of mathematics as well as eliciting Phoebe's ideas as Ms. D planned mathematics lessons for the students. In addition, Ms. D gave Phoebe multiple mathematics teaching experiences with individual and small groups of students. After observing Phoebe's mathematics teaching twice a week for six weeks, Ms. D commented to Phoebe that she impressed her as being a capable preservice teacher whom she saw as confident and competent in the classroom. For example, as evidence of Phoebe's competence, Ms. D had recalled that Phoebe was organized and had great rapport with the students. Phoebe reported that she respected Ms. D and learned a lot about teaching by being in her classroom, describing Ms. D as always knowing how to make mathematics relevant and comprehensible to the students.

During the last few weeks of her mathematics methods course, Phoebe was required to teach a whole group mathematics lesson in her internship classroom. The mathematics unit the class was working on was geometry. Although Ms. D did not expect perfection from a novice teacher, she felt confident that Phoebe would be able to successfully teach the geometry lesson. In fact, Ms. D did not advise Phoebe on the design of the lesson, and was probably unaware of Phoebe's fear of geometry. Phoebe had reported that during high school she had learned "next to nothing in that class" and that the topic of geometry "makes me really uncomfortable."

Phoebe drew her lesson from *Investigations*, the mathematics textbook used in Ms. D's classroom. The purpose of Phoebe's lesson was to teach the different characteristics of three-dimensional shapes (e.g. triangle, cube, triangular prism, rectangular prism). The lesson, as Phoebe described it, was to introduce the faces of the three-dimensional shapes, followed by a discussion of the edges and vertices of the shapes. Finally, the students were expected to describe the different characteristics of the shapes using mathematical vocabulary.

After she taught the lesson, Phoebe expressed disappointment with herself for having struggled to present a lesson in which the students could mathematically describe the characteristics of the objects. She said:

We did 3D geometry and I didn't really, I wasn't sure what words to use. I introduced faces of the 3D blocks and stuff like that. ... So things got a little bit confusing I guess. ... I had trouble with that. ... I was stuck like on, okay, this is a cube, this is a triangular prism, this is a rectangular prism and they don't know that yet. And I could have handled it a lot better. I should've just talked to my

cooperating teacher and said, “What should you know, what should I use?” but I feel like I messed up on that. (Methods Post Interview, May 11, 2011)

At the beginning of the lesson, Phoebe attempted to show students that each face of a three-dimensional shape (e.g., a pyramid) is a two-dimensional shape (e.g., a triangle). However, at the beginning of her demonstration, Phoebe did not ask the students to recall the names of familiar two-dimensional shapes before introducing the names of new three-dimensional shapes. While enacting her demonstration, Phoebe realized that the students, especially the English Language Learners, did not understand the vocabulary that she was utilizing. Moreover, Phoebe recognized that she herself did not understand the concept of dimension. Phoebe wished that she had asked for Ms. D’s assistance in planning the lesson. In striking contrast to Ms. D’s assessment of her abilities, Phoebe doubted her capacity to design and teach a geometry lesson, wishing that she had transferred the conceptual work to Ms. D: “What should they know? What should I use?”

As Phoebe thought more deeply, she also reflected on her goals for the lesson.

She said:

What I wanted to give them was to make those connections between 2d shapes and 3d shapes and I think that was really difficult for them to do because it was on paper and they saw five 2d shapes but then it was a 3d shape. ... I think they had a hard time understanding that and so I think I could’ve executed the lesson a lot better. But I think I had good intentions. ... I just don’t think it went well. ... I just, I’m really hard on myself I think and I think I just felt frustrated cause I wanted them to understand it. I wish I could have expressed it better.

(Methods Post Interview, May 11, 2011)

Having to teach a geometry lesson seemed to heighten Phoebe's anxious feelings towards mathematics, as high school geometry was a content area where she believed she learned "next to nothing." Therefore as Phoebe thought about the lesson in more detail, her focus was focused on her teaching mistakes. She talked about how her students had difficulty understanding the vocabulary words associated with the lesson as well as the concept of dimension and attributed their difficulty to her teaching. Wishing the lesson went differently, Phoebe viewed her lack of clarity in how she presented the geometry lesson as the main cause of the students' misunderstandings. Perhaps Phoebe expected that since mathematics was not "her thing," especially geometry, that she alone was to blame for what she perceived was wrong with the lesson.

Phoebe also explained that Ms. D had reviewed Phoebe's geometry lesson with the class on the following day. Ms. D later told Phoebe that students had understood and retained key ideas from Phoebe's lesson, including the mathematical vocabulary and the concept of two-dimensional and three-dimensional shapes. In fact, Ms. D had regarded Phoebe's first whole-class mathematics lesson as a success. However, despite this positive feedback, which also included Ms. D explaining that students often need more than one lesson on a mathematical topic, Phoebe insisted that her lesson was a failure. Moreover Phoebe wondered how Ms. D had concluded that she needed only a little improvement in her presentation of geometry concepts to early elementary students, especially English Language Learners who were taught the lesson in English. Phoebe insisted that she was not "a math person," and asserted that she would always struggle with geometry. Were it not for her sense of obligation to fulfill her duties as an elementary teacher, she would avoid teaching mathematics, especially geometry.

Strikingly, in this interview and in those to come, Phoebe did not mention ever having attempted to put Ms. D's recommendations into practice while planning and teaching whole-class mathematics lessons. Nor did Phoebe ever report having attempted to learn more from Ms. D, the *Investigations* teacher's guide, or some other resource, including her university instructors, about the geometric concept of dimension or about how to teach this concept to young children. Instead Phoebe appeared to focus on what she believed she failed in doing.

Plot pattern 3: reaching for the teaching crutch.

As Phoebe's math methods semester continued on, Phoebe shared how challenging she found it to write a required mathematics lesson plan. She admitted that the mathematics lesson plans were the hardest of the content lesson plans for her to write. She attributed her difficulty in preparing the mathematics lessons plans to the fact that she considered herself to be more of a language person with a love of social studies who "shied" away from mathematics.

Phoebe also talked about how using the curriculum could take control of what she needed to be teaching. She thought that by adhering directly to the curriculum she might be able to overcome some of the anxiety she experienced when she thought about teaching mathematics in the future. She said:

It's easier to sit back because you really don't have anyone really like other than the test I guess breathing down your back. You could just be like okay, this is the curriculum, I'm just going to teach this because this is what it tells me to do and I really don't want to get into that because I really want to make math more

relevant to the kids but being nervous you're just like okay, I don't want this to be my crutch, I guess. (Methods Post Interview, May 11, 2011)

If Phoebe decided that teaching mathematics became too stressful for her, she devised a plan that would “tell her what to do.” She viewed letting the curriculum take over the teaching as a means to deal with her nervousness about teaching mathematics. However, Phoebe also wanted to be able to teach in a manner that would make mathematics more relevant to her students. Phoebe appeared to be experiencing a tension between creating curriculum relevance versus utilizing the prescribed curriculum. If Phoebe discovered that trying to create a curriculum more relevant to her students was too stressful, she suggested that she could fall back on teaching the prescribed curriculum. Moreover with Phoebe's belief that she was not a math person, the utilization of the prescribed mathematics curriculum might help to alleviate her mathematics anxiety.

Plot pattern 4: will I really be able to teach mathematics?

Upon finishing math methods, Phoebe wanted to believe that she would be able to teach mathematics. However, she discussed some concerns that troubled her. She stated:

Math, I've always shied away from it so I think that's a part of it. ... I am worried that I am not going to be able to do it. I'm not going to get the information or knowledge I need to bring it to my students. ... I am worried that I am not going to know enough. I won't have a deep enough knowledge to help my students learn. ... I'm nervous about math teaching you know what I mean, and it's not that I can't do it, but it just, it makes me nervous. ... Yeah, because you just get through methods and then you're like okay, I'm a real teacher.

(Methods Post Interview, May 11, 2011)

Phoebe tried to envision herself as the one responsible for teaching her future students mathematics. When she thought about teaching mathematics, the doubts about her own fragile relationship with mathematics made her wonder if she would be able to do so. Her worry intensified as she grappled with needing to know both the content and the pedagogy of teaching mathematics. This seemed to be especially challenging for Phoebe, who did not consider herself to be a math person.

Plot pattern 5: mathematics lessons that leave students behind.

After completing her mathematics teaching methods course and internship in Ms. D's first/second grade classroom, Phoebe spent her final internship semester in Ms. F's fifth grade classroom. Phoebe observed how Ms. F seemed to move on to the next lesson despite knowing that many students in the class had not yet learned the content at hand. In particular, Phoebe recalled the following multiplication lesson:

A lot of my students didn't even know like two times three. Like they literally could not do their multiplication facts and so it wasn't helpful to them to do these models because they didn't understand it. I worked with a lot of students one on one because they needed the help and it was really frustrating to me because I would go back and try to put it in a different way that I've learned to, like that I had learned. You know, try to show them about place value or show them about how like when you're multiplying 28 times 3, when you do 2 times 3, you're not multiplying 2 times 3, you're multiplying 20 times 3, but they didn't get it, so I was frustrated this whole time. ... My teacher would just get mad at them and get frustrated and wouldn't want to do anything to help them. She'd just continue

right down the path and like wouldn't slow down when the kids needed it. I was like, oh my gosh! (Focus Group Interview, December 1, 2011)

Phoebe shared how her experiences in this classroom caused her to reflect more carefully on her future mathematics teaching goals. She reported:

A lot of the questions that came to my mind this semester was the thing that I kept asking myself was when you notice that your students are struggling with math, when you notice that they're not getting it. ... when do you stop and go back, and when do you move on? Because the mentor teacher that I had just moved on. She didn't do anything about it. She just kept plugging away. I just thought that was so detrimental to their learning because they just...they just didn't get it. I didn't really understand why she wasn't stopping and taking the time to go back on, back over these things. (Focus Group Interview, December 1, 2011)

Phoebe believed that Ms. F was teaching in a manner that was detrimental to the students in the class when she "just moved on" to the next lesson too quickly. Phoebe seemed to worry that the students might give up on being successful in mathematics, a feeling she experienced when she could not figure out mathematics fast enough. Moreover, because students were struggling with multiplication facts, a skill they were expected to have mastered before fifth grade, Phoebe may have sensed that like her, they would begin to believe that "mathematics was not their thing." Wanting to intervene, Phoebe grappled with how to teach students whom like herself just didn't "get" mathematics.

Juncture 3 - Phoebe's Student Teaching Experiences

Five separate plot patterns from Juncture three revolve around Phoebe's experiences of learning to teach mathematics, including the challenges and confidence she confronted.

They are: (1) Mathematical Sense Making From My Head to My Students' Heads (2) I Can Construct a Creative Math Lesson But Can I Teach The Content?, (3) Waiting For The Light Bulb To Go Off in My Head, (4) Wired Boys and Mixed Up Girls, and (5) Will I Ever Get a Break From Teaching Mathematics?

Plot pattern 1: mathematical sense making from my head to my students' heads.

Phoebe recalled how delighted she was when she was assigned to complete her student teaching and final semester in her teacher preparation program in Ms. D's classroom. Phoebe joined Ms. D at her new school, where she was teaching in a dual language second/third grade combination classroom.

Phoebe assumed the responsibility of teaching mathematics six weeks into her student teaching semester. Prior to this, Phoebe reported that she assisted Ms. D with planning the daily *Investigations* mathematics lesson and working with small groups of students. In addition, Phoebe stated that she asked Ms. D as many questions as she could such as how to make mathematics more fun, relevant, and interesting. Most importantly, Phoebe stated that Ms. D taught her how to use the curriculum as a guide in order to create mathematics lessons tailored to the needs of her students.

One of the first mathematics lessons that Phoebe was responsible for executing on her own was a lesson to teach students to reason and explain how increasing or decreasing numbers in a subtraction problem changes the difference. Using the promethean board, Phoebe drew her students' attention to a word problem about stickers. She explained to the class that one of the goals of the lesson was to build strategies to solve word problems and proceeded to pose the sample problem to them. Phoebe asked

the class to solve and explain which person would have more stickers left over – a person who had ninety stickers and gave away thirty-five would or a person who had ninety stickers and gave away forty.

Phoebe shared some of her worries about teaching this lesson, which for third graders she regarded as complex. She stated:

I was really concerned about teaching this lesson. Pretty much everything. I was worried about the content. I was worried that they wouldn't be able to grasp what it was. ... And I was worried, really worried about student engagement. I was really concerned....I was going to be faced with the same, you know, 30% of kids, you know, listening to my lesson and I just, yeah I was really concerned....I really feel like I'm doing them a disservice if they're not paying attention and so I was concerned about my teaching. (Post Observation Interview, February 15, 2012)

Phoebe's story of this lesson continued as she revealed what she saw as her greatest challenge in teaching the lesson. She said:

Ok, I felt, I feel challenged in when I'm trying to explain something. ... it makes sense in my head and I know it makes sense the more it's in the lesson. ... I know it makes sense in some of their heads as well. ... I'm trying to articulate the concept in a way that's clear and not muddled and not confusing and being able to do that in several different ways so that it can make sense to everybody. That's my biggest challenge. (Post Observation Interview, February 15, 2012)

Phoebe then shared a specific part of the lesson where her confidence waned. She reported:

I was standing over there and so I remember, I think it was when they had the bowls and they were using the sticks to show how one versus the other has more. I don't remember what I was saying, but I remember, I don't remember at all what I was saying at that point but I remember thinking, thinking ok say this clearly. I remember feeling like I was struggling to find the words. I was grasping at what I was trying to say to make it clear. Unfortunately I don't remember anymore, what it was that I was saying, but I do remember feeling like, okay, come on! It's making sense in your head, why can't I articulate what it is that I'm trying to say? (Post Observation Interview, February 15, 2012)

Phoebe admitted that it seemed like her students understood the content of the lesson. Ms. D confirmed that Phoebe's lesson was successful, not only in reaching the majority of the class but also in helping students to communicate their reasoning. Yet when Phoebe reviewed the lesson, she seemed convinced that the lesson was more of a failure than a success. She appeared to battle the mathematics anxiety that permeated her teaching of the lesson, as she fought to find the right words to help students understand. Once again, Phoebe discounted the feedback she received from Ms. D, a widely regarded expert teacher, and instead dwelt on how she "struggled to find the words." Phoebe focused on how she was "grasping" to present a lesson in a subject that she believed she would always find challenging. This challenge was perhaps supported by her own belief that she was not a math person. Therefore mathematics might be a content area that she would always feel uncertain about.

Plot pattern 2: I can construct a creative mathematics lesson but can I teach the content?

Phoebe stated that Ms. D gave her the opportunity to construct a problem based mathematics lesson that incorporated specific multiplication, division and fraction teaching goals. Phoebe said that being a creative person, she was excited about the lesson. She created a lesson that required the students to plan a class party consisting of food and entertainment. Phoebe believed this would provide the class with opportunities to practice multiplication, as they identified items they might need that are packaged in groups. As Phoebe thought more deeply about the lesson she explained:

So we're going to start the morning by talking about, if we plan a party, what, what comes in groups? What, what kinds of things do we need in a party? And I'm hoping they'll say things like cupcakes or brownies or something like that or candies or juice boxes because all those things come in groups and so we'll talk about, okay, well if you want to bring juice boxes and the class will have juice boxes, how many juice boxes will you have to bring? And then we'll talk about, we'll talk about having, you know, there's ten juice boxes in a box, how many boxes do we need for a classroom and turning it into multiplication problems and being able to see multiplication in groupings.

(Pre-Observation Interview, March 26, 2012)

Phoebe believed her students would be motivated to engage in the lesson when they discovered the party they planned would be an actual party they would have at the end of the unit. Phoebe reported:

I felt pretty confident about the multiplication discussion. I felt like it would be really easy to relate to the real world. What do you see in the store? What do you see at home? And what would you like to have here that comes in groups? I felt pretty good about that. ... I was challenged during the multiplication part of it, just for the engagement, the engagement issue. It was kind of challenging to keep it from like exploding out of my reach.

(Post Observation Interview, March 27, 2012)

While Phoebe felt confident about teaching this mathematics lesson, her attention was diverted to ensuring her students were engaged in an appropriate manner. She discovered that maintaining classroom management while engaging her students in a high interest mathematics lesson was challenging. Perhaps her confidence might be tested in yet a different direction as she strived to keep her classroom “from exploding out of my reach.”

Phoebe admitted she felt nervous when the focus of the lesson shifted to a review on ordering fractions from least to greatest with unlike denominators. She stated:

Explaining the opposite relationships, I think it was a really hard thing to understand and while we were doing that she [Ms. D] was like make sure to relate it to a pan of brownies. Do you want to share with twelve people or do you want to share with one other person?. ... With the fractions I expected that a lot of them would be confused with the opposite, that inverse relationship between the size and the denominator. I just didn't expect it would be so many.

(Post Observation Interview, March 27, 2012)

Phoebe struggled to explain the portion of the lesson that focused on fractions, a concept that she found difficult to understand. She was surprised to discover that not just a few but many of her students did not understand her explanation of the inverse relationship of fractions. Her surprise seemed to signal that this made Phoebe feel nervous.

Ms. D tried to redirect Phoebe to offer another explanation to the students by suggesting she relate the fractions concept she was trying to teach to a pan of brownies. When Phoebe hesitated to take Ms. D's suggestion, Ms. D took temporary command of the teaching of the lesson. She had the class imagine a pan of brownies cut into two pieces versus a pan of brownies cut in to twelve pieces. Ms. D suggested that Phoebe continue teaching the lesson. When Phoebe did not seem to know what to do, Ms. D proceeded to explain to the students using the brownie example that a brownie cut in two pieces would be bigger than a brownie cut in twelve pieces. Then Ms. D pointed out that with fractions, the smaller the denominator, the bigger the piece. Phoebe, who struggled to model the inverse concept for the students, seemed to be reminded once again of her ongoing battle to understand mathematics.

Plot pattern 3: waiting for the light bulb to go off in my head.

Phoebe reported that she felt the most stressed and worried about teaching mathematics when she was nervous about the content. She admitted that when she was nervous about the content, she felt anxious. She told the following story about how worried she was when once again, she was confronted with teaching a geometry lesson. She recalled:

With this geometry lesson I just would go home at night thinking, "I don't know what to do tomorrow!" I think I just feel so responsible for their learning that I

think if I don't know what to do, how are they gonna learn? And how are they gonna be successful? With AIMS¹ coming up that kind of makes me nervous, too because I don't want to, as a preservice and as a student teacher, I don't want them to lose out because I'm spending my time learning. I want them to be learning, too, even though I am as well. Yeah, that's been stressing me out a little bit lately. (Student Teaching Interview, March 22, 2012)

Phoebe expressed how unequipped she felt to be teaching yet another geometry lesson. She worried about how her own content weakness in geometry would affect her students. She displayed a deep concern for her students' learning and yet wondered how she could learn and teach the geometry lesson at the same time. Phoebe's sense of uncertainty that surrounded the teaching of her geometry lesson seemed to have generated feelings of mathematics anxiety that she could not escape.

Phoebe explained that Ms. D was a great support to her when she worried about teaching mathematics. Phoebe said:

I talk to my mentor teacher a lot. She's a really good support system; she's very supportive. We have a lot of conversations about mathematics and I feel comfortable going to her and saying, "Okay, what do you think about this? Or how do you think I should handle this situation? Or I don't know what to do, I don't know what's coming up next. Do you have any suggestions?" (Student Teaching Interview, March 22, 2012)

Phoebe felt fortunate to have a mentor teacher like Ms. X that she could seek advice from regarding how to approach the teaching of mathematics.

¹ Standardized test administered by the State of Arizona.

When Phoebe specifically sought Ms. D's guidance on the geometry lesson, Ms. D advised her to:

Fall back on the *Investigations* curriculum and don't worry about making it my own until I figured out what to do. I didn't get to that point. That kind of worried me a little. I didn't get to that point with this unit where I was like, that light bulb never went off in my head. I said, "Okay, I'm gonna get through this unit. I'll do the very best that I can teaching based off the curriculum that's given to me.

(Student Teaching Interview, March 22, 2012)

When Phoebe sought Ms. D's advice on how she should approach the geometry lesson she was preparing to teach, Ms. D told her to rely on the curriculum until such time that Phoebe could figure out how to teach the lesson. While completing her math methods semester, Phoebe had contemplated that if she encountered a content area that she felt nervous about then she could let the curriculum take control of what she needed to be teaching. Phoebe decided to take the advice of Ms. D who she greatly admired and respected for her teaching expertise and "fall back," relying on the curriculum to get her "through this unit." Phoebe's anxiety was not thwarted however because she worried that while following the curriculum, she never reached the point of being able to make the lesson her own. Moreover, by just getting "through this unit," Phoebe seemed to be reminded again that mathematics was a content area that she often did not know "what to do."

Plot pattern 4: wired boys and mixed up girls.

As Phoebe neared the end of her student teaching semester, she shared her thoughts on teaching the boys and girls in her class. She explained:

We grew up thinking that women are not as good, or good at math than men. I experienced that, I suppose, when I was, not that I didn't believe it, but I just wasn't as good at math. You think, well, girls are not gonna be as strong in math. Especially, I guess, we have, I have a class full of boys. ... It's easy to forget about the girls. I try hard not to. (End of Semester Interview, April 23, 2012)

Phoebe further explained that she found the boys in her class to be more of a management challenge than the girls. She believed that the boys demanded more positive reinforcement than the girls to stay focused and engaged while she was teaching her mathematics lessons. She discovered that the girls in her class were more apt to sit quietly, following along with the lesson, doing what she asked them to do. Phoebe said, "It's easy just to think, "Oh. They're just sitting there. They're fine. I forgot to assess for their understanding."

Phoebe appeared to genuinely believe that boys were stronger in mathematics than girls. She used her own experience of a girl struggling to learn mathematics to serve as a working example of the differences between the genders. She even stated her belief that as a teacher, her focus during mathematics had to be on the boys, citing that otherwise they could create classroom management problems. Phoebe seemed to think that as a teacher, paying little to no attention to the girls during mathematics was an acceptable option for her.

Phoebe elaborated more upon her thoughts of why girls weren't as good as boys in mathematics and said:

I'm wondering if maybe it's because math is more, I mean, math is complex. ...

You have a set of rules and those are the rules. There's no really, exceptions to the

rules. Boys are a lot more wired to think that way. Whereas, girls are a lot more complex. ... have you ever heard the demonstration that girls' brains are like spaghetti and everything's woven and intertwined and everything's mixed up? Boys' brains are like waffles. They have one compartment. ... They [boys] can only be in one compartment at a time. ... Girls are more going off on all sorts of different tangents. (End of Semester Interview, April 23, 2012)

Phoebe seemed to think that boys had the brain that made them more likely to be successful in mathematics than the brain that girls possessed. In addition, if Phoebe believed that she had a "mixed up spaghetti brain," that sent her off on tangents, then perhaps this helped her to understand why she felt so unsuccessful in mathematics.

Plot pattern 5: will I ever get a break from teaching mathematics?

As Phoebe finished student teaching and prepared to embark upon her new profession as an elementary teacher, she reflected upon her experiences as a student of mathematics and a preservice teacher. She said:

Math is not my favorite subject. I just don't particularly care for math. I mean I like it more than I used to but I don't particularly care for math. I prefer the language arts. Sometimes it's just like I'm tired of talking about math. I wanna move onto something else. I think it's because it's difficult sometimes...I think as much as I feel like math is going well in my class, sometimes I'm like can we just not do math for a week? It would be so nice. It's a stressful subject to teach and I just want to be effective and I want the students to learn what they need to learn. ... I want my students to not have the experiences that I had where I felt just completely unsuccessful. ... I just want them to feel successful and I think that's a

struggle because I feel so much responsibility for their learning that it makes it really hard. (Conversations That Matter, March 31, 2012)

Phoebe was very open and honest about her negative feelings towards mathematics. She found mathematics to be a subject that was stressful for her as a student and as a practicing teacher. Although she did not particularly like mathematics and did not experience much success as a mathematics student, Phoebe felt great responsibility to provide her students with a positive and successful mathematics journey. The anxiety that Phoebe encountered while teaching mathematics made her dream of having occasional breaks from teaching mathematics altogether.

Phoebe thought deeply about her turbulent relationship with teaching mathematics. She reported:

Some of the thoughts that I had was that teaching math is really hard but it was also rewarding. I think of all the subjects that I teach, math is the one I hate the most and love the most at the same time. Because sometimes I really hate planning for it, and sometimes I really just hate, I don't know it just makes me, it's frustrating. It's a frustrating subject to teach sometimes. It's also the most rewarding to teach when they finally get what you're trying to say to them. When they finally get it, and when you see them making those gains, then it really becomes worth it. All that hatred that you have for it and planning becomes worth it. ... When it comes to math in general, I don't know I guess I, it's just always gonna be one of those subjects that makes me tense up a little bit.

(Conversations That Matter, March 31, 2012)

Phoebe viewed her relationship with learning to teach mathematics as either positive or negative. When she experienced success in teaching mathematics she felt rewarded by her students' understanding. Conversely, when she felt what she was teaching was difficult, she hated mathematics and was frustrated when she tried to teach it. Phoebe appeared to be vacillating between feeling like "math was not her thing" and a subject that she had a long history of "hating" with feelings of great accomplishment, making the effort she put into her teaching "worth it."

Summary

Phoebe had never envisioned herself as a mathematics person. When asked about her early mathematics experiences, Phoebe had no recollection of positive memories. In fact, Phoebe primarily recalled negative thoughts and feelings about this content area. She was eager to share that mathematics was "just not her thing."

The struggles that Phoebe encountered in mathematics created confusion for her as she tried to make sense of her academic abilities and talents. As a young child, Phoebe was placed in her school's gifted education program. Phoebe felt like this label was befitting for most academic content areas such as language arts and social studies. She enjoyed being viewed by her classmates as one of the smart kids. However, Phoebe's struggles with mathematics seemed to create great anxiety for her and challenge her status as a gifted student. Phoebe felt the pressure to uphold the status of a gifted student who in her mind was a student who could figure out mathematics problems correctly and efficiently. This was something Phoebe stated she could not do. In order to cope with the mathematics anxiety she encountered and protect her gifted status, Phoebe seemed to compartmentalize and denote what content areas she was gifted in. By adopting the

stance that she was not a “math person,” her hope seemed to be that as a non-math person there would be no need to raise the question about her gifted status. In other words, by stating she was not a “math person,” she may have hoped to be seen as neither good nor not good in this content area. Moreover as a non-math person, perhaps the anxiety she encountered as she tried to successfully engage in mathematics could be eased when she remembered “math was not her thing”.

As Phoebe progressed through middle and high school, she held on to her conviction that she was not a mathematics person. She continued to dislike mathematics as she struggled to understand the content. She felt let down and disappointed by the manner in which her high school teachers conducted and taught her classes, not considering that perhaps she could take charge of her own mathematics learning. Knowing that she needed to take a required number of mathematics classes in order to graduate from high school and enter college, Phoebe could not choose to opt out of mathematics even though she considered herself to be a non-math person. Instead, she depended on her “genius father” and her “more capable friend” to get her “through” high school mathematics. Needing to seek out the more mathematically confident people in her life to help her through her rocky mathematics moments was one of many sources of confirmation to Phoebe that she was not a mathematics person. However, the mathematics assistance that Phoebe received from her father and friend was not a long-term solution. In fact, this assistance may have complicated Phoebe’s chances to go forward in learning mathematics as she resolved to “get through” this content area, instead of trying to learn the content.

Upon entering college, Phoebe discovered that her elementary teacher preparation program required her to take mathematics courses. Through the careful guidance and patience of her college instructor, Phoebe found herself capable of understanding and excelling in mathematics. She discovered that learning mathematics did not have to be painful for her. She felt a temporary boost in her confidence as well as confirmation that perhaps she was indeed a capable mathematics student who was now able to successfully figure out problems faster than her classmates. However, Phoebe still held on to her belief that mathematics was not a source of pride in her academic identity, continuing to rate mathematics as her least favorite subject.

When Phoebe began to study how to teach mathematics, she committed herself to learning how she could become a teacher who could create successful mathematics students, despite the fact that she viewed herself as a non-math person. She was motivated to be a successful teacher because she did not want her future students to experience the discouragement she encountered in learning mathematics. She believed that she would be able to empathize with her students that struggled in mathematics. Moreover Phoebe was hopeful that her teacher education program would provide her with the teaching tools she would need in order to be able to teach mathematics, a subject she not only viewed as difficult but not her thing.

However when Phoebe interned in an elementary classroom she experienced how challenging teaching mathematics could be. Many of the students in the class were struggling with mathematics content they should have learned in their earlier years. She could see that they were unable to grasp the new content being taught. She began to have serious thoughts about how she would be able to juggle the mathematics learning needs

of her future students, especially as she witnessed the classroom teacher moving on to the next lesson, leaving the struggling students behind.

As Phoebe moved into her student teaching semester, she was responsible for teaching mathematics for five weeks. This gave her many opportunities to teach whole group mathematics lessons. Feeling the support of Ms. D, her mentor teacher, Phoebe often sought general teaching advice from Ms. D. At times, she felt confident and proud of the mathematics lessons she was teaching, especially lessons that centered on multiplication and division. At other times, Phoebe experienced great fear about the content (such as geometry) that she was expected to teach.

Identifying herself as a non-mathematics person seemed to fuel her anxiety as opposed to protecting her from the mathematics anxiety she encountered. By labeling herself as a non-mathematics person, Phoebe worried about how her students would be able to successfully learn the content areas that she did not understand nor know how to teach. Phoebe spoke of the anxiety she experienced when she questioned if she would ever feel like her mathematics lessons would go well. Moreover she wondered if she would always feel nervous about teaching mathematics.

Phoebe had a great desire to teach in a manner that created successful mathematics students. However, she grew up believing that girls were not as strong in mathematics as boys were. The fact that she was a girl who “just wasn’t good at math” supported this idea. In addition, she focused more on the boys while teaching mathematics, as they seemed to demand more of her attention than the girls. She believed that if she did not consistently engage the boys, they would create a classroom management issue. Moreover, Phoebe thought that boys’ brains were more capable of

learning mathematics than the girls. Perhaps Phoebe inferred from her particular situation, that for girls in general, math might not be their thing.

Phoebe completed the elementary teacher preparation program clinging firmly to her image as a gifted student who was simply not strong in mathematics. Her feelings towards mathematics continued to be mostly negative ranging from tolerating mathematics to hating mathematics, despite the success she experienced learning to teach mathematics. She remained steadfast in believing mathematics was a subject that would always be stressful for her, even dreaming of weeks in her future career void of teaching this content area.

In summary, the cumulative data analysis across the junctures suggest that Phoebe developed a kind of self-protective narrative that permitted her to view herself as a gifted student but not “a math person.” Phoebe’s narrative may have worked to protect her identity and status as a gifted student while excusing her from knowing the content or exceling in mathematics. While this running narrative may have offered Phoebe temporary relief from feeling incompetent in mathematics and anxious about this content area, it proved to be faulty, as she was still expected to learn mathematics as a student and learn to teach mathematics as a future elementary teacher.

CHAPTER 6: FINDINGS (CASE OF ROXANNE)

Introduction

I had the privilege of becoming acquainted with Roxanne in the fall of 2010, as she was my student in a required classroom processes and instruction course. The class was small, having been assigned at a time that was not convenient for many students. The small class size afforded me more opportunities to get to know Roxanne who always chose to sit in the front row. Being an outgoing person, Roxanne enjoyed participating in classroom discussions and working with the other students on the various assignments.

I discovered early on in the semester that along with being a full-time student Roxanne had a full-time job. Roxanne stated that although her parents did not have college degrees, their goal for her was to receive a college education. She shared with me that her father passed away while she was in high school, leaving her responsible for helping to support her unemployed mother. Roxanne worked at a tire store with a schedule that allowed her to attend school full-time and work on her class assignments when she was not busy at work. Roxanne said that she would have preferred a job that would have given her experience working with children but she was able to work more hours and at a higher hourly rate at the tire store.

When Roxanne made the decision to pursue a career as an elementary teacher, she stated that she felt anxious about teaching mathematics. Roxanne reported that she viewed mathematics as “a sore subject,” that she never really understood. She said her lack of understanding led to her to believe she was not a confident mathematics person. Roxanne said she was nervous about how little mathematics she had taken in high school and college. Therefore she was concerned about how she was going to learn the

mathematics she would need in order to teach this content area. Roxanne stated that her hope was to be assigned to a strong mentor teacher who would show her how to teach mathematics.

In this chapter, I will explore Roxanne's experiences with mathematics anxiety at key moments, or junctures, in her mathematical history. I will first consider the narratives from Roxanne's experiences as a mathematics learner (Juncture 1). Next I will address the narratives of her experiences as a preservice teacher learning to teach mathematics (Juncture 2). Then, I will examine her narratives that surround her student teaching experience (Juncture 3). Finally, I will draw attention to the particulars that put forward a data based composite or "Case of Roxanne." In each of these junctures, her stories and reflections were drawn from multiple plot patterns. Some plot patterns encompassed numerous stories and reflections. Other plot patterns were derived from a single story or reflection.

Based on the data collection instruments (mathematics autobiography and interviews) I rearranged the narratives from Roxanne's life to create a chronologically ordered mathematical life story. A narrative thread that brings these episodes into relationship is Roxanne's descriptions of a strategy for coping with mathematics anxiety: create practical ways for her to "get through" mathematics. Roxanne used this strategy repeatedly across the junctures of her mathematical history and seemed to rely on it for a sense of confidence both as a learner and as a teacher, even when the reassurance was only temporary and failed repeatedly. There are times however, when Roxanne appeared to have the confidence to consider doing more than just "getting through mathematics" as

a means to access the mathematics that she did not understand as a student and a soon to be teacher. These experiences will be discussed as well.

Juncture 1 – Roxanne’s Student Mathematics Experiences

Three different plot patterns emerged from Roxanne’s experiential reflections and interview responses that revolved around her mathematical learning experiences as a student. They are: (1) The Mathematics Roller Coaster Ride, (2) I Have Been Deemed Math Deficit, and (3) I Caught A Glimpse of a Shining Light in Mathematics.

Throughout the different junctures, I have titled each plot pattern using a composite of Roxanne’s own words to encapsulate the essence of her narratives.

Plot pattern 1: my mathematics roller coaster ride.

Roxanne reported that as a student she did not enjoy mathematics because she could not relate to the mathematics instruction she received. In fact, Roxanne stated, “Really I can count on my hand good experiences in math for me that were memorable.” During her elementary school days, she remembered her teacher modeling problem solving strategies that she was required to use when completing her mathematics assignments. Roxanne revealed that most of her mathematics learning time seemed to be spent doing seatwork, and that she felt nervous to ask her teachers for help when she did not understand a concept.

Roxanne wished that she could have had the opportunity to collaborate with other students in her school mathematics classes, because it would have supported her mathematical understanding. Instead, she claimed that her mathematics classrooms usually consisted of everyone being seated in individual desks in alphabetically arranged rows void of opportunities for students to share their thinking.

Roxanne recalled she felt the mathematics she was expected to learn as a student seemed to have little connection to real life and that concepts were presented without explanations. She wished that her teachers could have made mathematics more fun to learn as well as more relevant to her. She stated as the years of learning mathematics pressed on, her confidence dropped, leaving her feeling “dumb” without much hope of ever really knowing what she was doing.

Roxanne stated that her parents supplemented and supported her learning of mathematics as a means to fuel her mathematics confidence. She said she was provided with flash cards to practice her mathematics facts, which she found challenging to grasp. In addition, her parents purchased computer mathematics games to aid in her understanding of the subject. She also remembered her parents helping her with her mathematics homework. However, Roxanne explained that as she grew older and the mathematics became more challenging, her parents did not understand the mathematics she was responsible for learning. Instead, Roxanne said, they would urge her to seek help from her teachers. Roxanne reported that she was hesitant to seek out extra help from her teachers, as she worried about being viewed as “not smart.”

When Roxanne was in sixth grade, her family moved to a different state. She remembered being placed in a class where she felt inspired by her new teacher’s positive insight. Moreover Roxanne discovered that she had already been introduced to the mathematics being taught in her new school. Therefore her confidence soared, especially as she was placed in the gifted and talented program in mathematics.

However, when Roxanne entered high school, her attitude towards mathematics once again spiraled downwards. Having been tracked as a gifted and talented middle

school mathematics student, she was placed in honors level mathematics classes. She found her classes to be taught primarily by teachers whom she reported utilized a lecture-based format, requiring her to memorize mathematical rules and formulas that she did not completely understand. She remembered knowing how to take notes and follow the mathematics procedure that had been modeled by her teachers but “to use it and apply the material was just gone.” I didn’t know how to do it.”

Roxanne explained that she never knew how she was really doing in high school mathematics so she consistently second-guessed herself, withholding judgment until her work was graded and returned to her. She stated:

I didn’t have a full understanding when I was younger. ... When I was in school, it was, here are the problems, do the work, and then turn it in. I never understood if I did it right until I got my paper back.

(Mathematics Autobiography, January 18, 2011)

When Roxanne received a high grade on an assignment or a test, she seemed to interpret this as having understood the material whereas a low grade meant she failed to grasp the mathematical concept. Unfortunately, Roxanne said that her days of learning mathematics tended to be “one bad experience” with more instances of low grades than high marks. When Roxanne reflected upon her student days of learning mathematics she stated, “I didn’t have the confidence and I wasn’t doing well.”

Roxanne stated that she did not feel supported by her high school mathematics teachers. She described her Algebra 1 experience as follows:

Going into that class, it was an honors class so in my mind I was really good at math. Sometimes I feel like she [the teacher] was holding high expectations for us

but it was almost that she just expected us to, (*snapping fingers*) tell us and know, and so when I didn't get something I felt stupid and I felt as if I wasn't smart anymore because I wasn't getting it and she wasn't really making me feel like, "Oh it's okay. We can go back and we're gonna show you this way." It was always her way, on the board, notes, we would write the notes and then do like thirty problems in class and so it was never like group work. It was never her communicating with us. It was literally direct instruction, notes on the board, do your work, do thirty problems for homework and have a nice day. To me, I didn't take anything away from that class because I felt dumb. ... Because I didn't have like really good foundations from Algebra 1, I was really lost in Algebra 2.

(Student Teaching Interview, March 20, 2012)

Roxanne's student experiences in mathematics appear to have left her feeling unsure as to what her capabilities were. As a young child, she described not being able to "relate" to how mathematics was being taught to her, perhaps leading her to believe she was not good in this subject area. Then as a middle school student when she moved to a new state and school, she was suddenly seen not only as a capable mathematics student but also as a gifted and talented mathematics student. Roxanne talked about how "her confidence soared" until she entered high school where once again she was met with teaching styles that left her feeling uncertain and even mathematically "dumb." Given her inconsistent mathematical performances, Roxanne appeared to finish her high school days confused about whether she was mathematically "gifted" or "dumb." Adding to this confusion may have been her desire or need to learn mathematics through opportunities to collaborate

with other students that were not provided for her during her K-12 days. She seemed to believe that collaborative learning in mathematics was critical to her understanding.

Plot pattern 2: I have been deemed math deficit.

Roxanne revealed that she graduated from high school a semester early, having never taken calculus. She reported that this left her with a mathematics deficit on her transcript, so she enrolled in a refresher mathematics class at the local junior college. Roxanne was required to complete this class with a passing grade so that she could enroll in the college algebra course at her university - a mandated course for the elementary teacher education program. Roxanne told the following story about this mathematical experience:

After making it through this [the refresher class] class, I became even more negatively affected. The teacher would only show up 75 percent of the time and blame traffic for her lack of attendance. When it came to the final, I didn't believe in myself for two reasons. The first one was the fact of learning the material on my own through a text. I am more visual and need to see things done so learning out of a text by myself doesn't benefit me as much. The second reason was that the answers were a bunch of C's in a row and then A, B, or D. The pattern continued and I was thrown off because I thought more than five C's in a row was incorrect. I was wrong with this theory, but I originally changed some of my answers, which resulted in a worse grade on the final. This was the worse grade I have ever received in my entire academic history. I received a D as my final grade. (Mathematics Autobiography, January 18, 2011)

Two months before her college graduation, Roxanne spoke once again of her mathematical experience at the junior college. She sadly recalled:

When I got to [the junior college], it was supposed to be like similar to like a lower community college or high school higher end class, and I was lost. I got a D and it just devastated me because I was just not understanding. It was stuff that I had never seen before and I was supposed to have seen it in high school, so I just kind of felt lost that, okay now I'm really not as good a math student as I thought I was and how can I be doing this if I was in honors in high school? So I just became kind of negative towards the whole math aspect and I didn't go further. I never took anymore math classes. I just did the bare minimum to get into the College of Ed, which I kind of regret because I never did trig, I never did calculus, I never kind of challenged myself because I didn't feel like I would have the support that was needed.

(Student Teaching Interview, March 20, 2012)

Upon exiting high school, Roxanne already had self-doubts about her mathematical abilities. She was questioning if she was “gifted,” the label she received in middle school or “dumb” the way she reported she often felt in her high school mathematics classes. When she was required to take a refresher mathematics class at the local junior college and discovered that once again, she was going to be confronted with a lecture-based class, her confidence waivered as she lost “my belief in myself” to be successful. In addition, she doubted her confidence in knowing the content she was tested on and paid more attention to the pattern of the letters on the answer sheet, changing them to what she thought was a more believable pattern.

Roxanne then questioned if she ever really learned mathematics in high school, let alone honors level mathematics. The refresher class that she was required to take at the junior college was meant to serve as a review for the honors mathematics that she had learned in high school and prepare her for the university level courses. The letter grade of a D seemed to be proof for Roxanne that she was not good in mathematics. Roxanne's expression of sadness over not challenging herself to take more than the minimal required mathematics courses for the elementary teacher education program suggests that perhaps she lacked the confidence to believe she could experience mathematics success in more difficult content courses. The refresher course she took at the junior college seemed to solidify this belief.

Plot pattern 3: I caught a glimpse of a shining light in mathematics.

Roxanne remembered approaching her college algebra class with a heavy heart, having just barely passed the refresher mathematics course. Once again Roxanne said that she found herself sitting through a lecture-based course that held little relevance to how she would ever understand or apply what she was learning in her life. Then when she was admitted to the College of Education, she took the two required mathematics content courses for elementary teachers. It was at this point in time that “a glimpse of light was shone.” Roxanne recalled:

I admit that I was frustrated in the Math 302 classes but in a good way. These classes challenged me in a way that I never explored before. The classes were student lead in groups as the teacher floated around with guidance. We fed off each other and learned from one another, whether it be a mistake or discovery. I particularly enjoyed Math 302B because this teacher really focused his curriculum

on everyday things we would experience in life such as elections and poverty. We did stuff about polls and we did stuff about gardening and things like that and how to tie in math, which is really cool to see. Because I always thought about pen and paper, notes and then class is over. ... We used real life situations for geometry and it helped hit home for us to where I really understood on a more in-depth level. We were also required to write reflections on math teaching methods and it enhanced us to think about what we would do as teachers in a situation like those provided. (Mathematics Autobiography, January 18, 2011)

Finally it seemed as if Roxanne was learning mathematics in a manner in which she viewed as crucial. She was provided with opportunities to engage with other students where mistakes were seen as part of the learning process, not as a definition of who was smart or not smart in mathematics. She was exposed to learning multiple strategies to solve mathematics problems; something she longed for in her own K-12 experiences. In addition, Roxanne spoke of how she could seek “guidance” from her instructors as opposed to the direct instruction teachings that comprised the majority of her experiences. Moreover, Roxanne viewed the mathematics she was learning in the required mathematics content courses for elementary teachers as relevant and practical to real life. Her story suggests that as a college student she was thriving in this type of learning environment, one she had dreamed of for herself as a child.

Juncture 2 – Math Methods and Classroom Internships

Five separate plot patterns emerged from Roxanne’s reflections and interview responses related to learning to teach mathematics. They are: (1) Can You Show Me How to Teach Mathematics? (2) Is There No Need to Learn Mathematics Everyday? (3) My

Big Chaotic Teaching Mess, (4) Magnificent Mathematics Mentoring for Me, and (5) Ms. S Thinks I Can Teach Mathematics and So Do I!

Plot pattern 1: can you show me how to teach mathematics?

During the spring semester of her third year in the teacher preparation program, Roxanne was enrolled in the required elementary mathematics teaching methods class. A major component of the course was a teaching internship in a local elementary school. Roxanne revealed that at the beginning of the semester she was anxious about how she was going to learn to teach mathematics, stating that one of her major concerns was how to “become the teacher who has everybody feel like they can do it.” As she pondered this concern, Roxanne said that she was excited to learn procedures to help her meet this goal. Unfortunately, her experience in her math methods internship did not help her to achieve this goal. As a matter of fact, Roxanne stated things “kind of went downhill.”

Roxanne found herself assigned to a second grade teacher, Ms. A, who had recently moved from a Montessori school to the public school where Roxanne was assigned to do her internship. Roxanne explained that she often felt confused by how Ms. A was incorporating *Investigations*, the required curriculum for the school, into her mathematics lessons. Roxanne shared that Ms. A had expressed to her that her teaching style did not fit the *Investigations* model of exploration and problem solving. Therefore there were not opportunities for her to observe Ms. A teaching mathematics because she was “basically just sitting them down and having them do their work.”

Roxanne’s description of Ms. A suggested that Ms. A did not do enough to support her students’ mathematics learning. This seemed to remind Roxanne of her own student experiences in that she spent much of her classroom mathematics learning time

working independently. Roxanne, however, appeared to be most interested in learning to teach mathematics in a manner in which she was interacting more with students and helping to facilitate their learning. Instead, Roxanne believed that Ms. A took a more passive role in her students' learning.

Roxanne added that she didn't see a connection between what she was learning in math methods and what Ms. A was doing in her classroom. She stated:

She didn't do the things the way we were doing in methods. She had like her own plan. Her own way that she learned how to teach and Montessori is very individual based. I almost feel like self paced. Like I just didn't see a correlation to what we were doing and what she was doing, so I was confused on what to do at that point. That's why I was kind of like, "Am I dumb?" because I didn't know some of the things that she was trying to teach and some of the stuff we were doing in class like concepts with problem solving and probability. I was just like, "Whoa, I don't know what's going on," and so I felt kind of dumb.

(Timeline Activity, April 25, 2012)

Roxanne was expecting to see the mathematics being taught in Ms. A's classroom to resemble Dr. T's (Roxanne's math methods professor) teachings of her math methods course. Instead of seeing students working together in groups to solve engaging mathematical tasks, Ms. A utilized her Montessori background and had the students working individually at their own pace, leaving Roxanne feeling "confused" and "dumb." In addition, as Roxanne was trying to make sense of what it meant to teach mathematics, she discovered she did not know some of the mathematics content she encountered in Ms.

A's classroom and in Dr. T's math methods course. She questioned her mathematical confidence, just as she did during her K-12 years sharing that she "felt kind of dumb."

Plot pattern 2: is there no need to learn mathematics everyday?

Roxanne also revealed her confusion when she discovered that in Ms. A's classroom, students were not required to engage in mathematics everyday. Roxanne explained:

So they (the students) have a goal for the week to complete this certain word plan type of thing but if they don't want to do the math work that day, they don't have to. But they better have it done by Friday, I guess, in a sense which I'm confused about is because they keep saying it's student based, it's student based and whatever the student wants to do. But I don't understand how they're accommodating for the standards of what the kids have to know.

(Methods Post Interview, May 5, 2011)

Roxanne continued to try and make sense of what it meant to teach mathematics as she interned in Ms. A's classroom. Ms. A's style of teaching did not seem to align with Roxanne's desire for a plan that would help her feel less anxious about teaching mathematics. Moreover Roxanne's perception of a lack of order in Ms. A's classroom seemed to have Roxanne questioning whether students had sufficient opportunities to learn the mathematics they were required to know.

Plot pattern 3: my big chaotic teaching mess.

Roxanne shared that during her semester with Ms. A, she was given the opportunity to teach mini-mathematics lessons to the students. Roxanne worried about how she would be able to engage the class as a whole knowing that the students were

accustomed to working independently and on their own. After teaching one such lesson she pondered:

How do you use different engagement strategies when the kids are only exposed to one? Since she (Ms. A) was Montessori based, she did things a certain way and so when the kids got a bit of freedom to do an activity, I lost control of the class. It turned into a big chaotic mess. (Timeline Activity, April 25, 2012)

Roxanne's experience in Ms. A's classroom seemed to suggest that she did not believe she received a practical vision of what it meant to teach mathematics from a Montessori based teacher. When Roxanne lost control of the class, she had no modeled procedure to follow. Roxanne had admitted earlier in the semester that while she felt anxious about teaching mathematics, she looked forward to learning procedures that would facilitate her teaching ability. When this did not occur in Ms. A's class, Roxanne seemed to believe her mini-lesson failed as "it turned into a big chaotic mess."

As Roxanne finished her mathematics methods course and the accompanying classroom internship she shared the nervousness she experienced as she thought about moving forward into her second internship. She expressed the following concerns:

How do you teach something if you don't know it? There were projects and little problem solving things that we did in [methods] class with Dr. T, and if I didn't know it I felt dumb, so I kept saying, "Well how can I be a teacher if I don't even know how to do this stuff myself," so I just kind of lost a little bit of confidence there. (Timeline Activity, April 25, 2012)

Roxanne admitted that she felt anxiety about teaching mathematics and attributed it to not "really" have taken mathematics classes in college, only the necessary courses needed to

enter into the Elementary Education program. Roxanne appeared to continue to see herself as deficient in mathematics, a label attached to her when she graduated from high school. However, Roxanne also shared a sense of hope, “I didn’t feel confident in math, but now that I’ve gotten through math methods and then I’ve gone through the classroom part of teaching it, I feel a little bit better about it.” Roxanne managed to make it “through” math methods with the accompanying internship, deficit and all. Now Roxanne could concentrate on being an elementary teacher and focus on the other responsibilities involved in being a teacher that did not appear to create the anxiety of knowing and teaching mathematics.

Plot pattern 4: magnificent mathematics mentoring for me.

During the first semester of her senior year, Roxanne had more methods courses to complete. In addition, she was required to complete a second internship in a different grade level. She reported her worry about being placed in an upper elementary grade for her final internship semester and/or her student teaching assignment. Roxanne stated that her program coordinator informed her that she wanted to her to have the experience of being in an older grade so she could have a broader perspective of teaching. Having had an internship with younger students she said:

I haven’t taught in an older grade yet. So I am a little curious on what it’s going to be like. I know that the math is obviously going to be a little bit more difficult and I don’t necessarily know if I, I am sure I know how to do it, but I don’t know if I’m gonna be ready to teach it from different perspectives that the kids might need....it’s going to start my little bit of scared feeling again, to come up.

(Methods Post Interview, May 5, 2011)

As Roxanne was preparing herself for the possibility of teaching in fourth or fifth grade, she appeared to believe she could teach the required mathematics content. However, when Roxanne thought more deeply about this possibility, her “scared feeling,” returned. She questioned if she would be able to teach mathematics in a manner that would address all of her future students’ needs. Meeting this goal was important to Roxanne, as she had expressed concern at the beginning of her first internship experience as to how she could “become the teacher who has everybody feel like they can do it?” Now, Roxanne seemed to be wrestling with the anxiety of how she would attain that goal.

Roxanne was placed in a fourth grade class with Ms. S, a highly respected teacher who was classified as an expert teacher by the school district. Although Roxanne was not required to teach mathematics during this semester, she had the opportunity to observe the *Investigations* mathematics lessons that Ms. S taught and assist Ms. S during mathematics as needed. Roxanne described Ms. S as skillful at creating “a really well built community,” wherein she elicited her students’ thinking and had students engaged mathematically and with one another. These qualities mirrored what Roxanne had voiced on numerous occasions as being important teacher qualities.

Roxanne believed that the structure set forth by Ms. S was invaluable to the students’ learning of mathematics. She recalled:

She [Ms. S] always had mathematical arguments. If one student said an answer and another student thought it was another answer she would have them come to the front of the room, and one kid would defend his answer and then the other kids would say his answer. Then another student who was still sitting down would have to choose who made a better argument. . . . It was really cool to see them

explain their thinking thoroughly to make other kids just understand why they were picking a certain answer. ... She also did re-voicing so the kids would say something. It was a good engagement strategy to make sure everybody was paying attention because if somebody was explaining math or how they got the problem, she would call on somebody else to have them retell it and explain what the student just said. ... If kids were done early she would have them do it a different way, "Show me another way to do it. Draw a picture. Use words."

(Timeline Activity, April 25, 2012)

In Ms. S's classroom Roxanne observed how Ms. S engaged students with one another and with their own learning, goals that Roxanne felt were critical to student learning. Moreover she wished that as a child learning mathematics she could have been exposed to these types of learning experiences.

Roxanne said that being a part of Ms. S's classroom was instrumental in her learning how to teach mathematics to elementary students. She stated:

When I got into this great community based classroom for fall 2011, I kind of got a little bit of my confidence back. I was still anxious, and not sure of myself at the time, but I learned how to do this math, you know the teacher I was working with didn't make me feel stupid and was there to support me. I could ask her questions.

She was there for me. (Timeline Activity, April 25, 2012)

Ms. S's mentoring provided Roxanne with the opportunity to experience mathematics being taught where students were engaged in a meaningful manner and where a learning community was built that created mathematics understanding for students. Moreover, Roxanne was provided with the chance to learn the mathematics she would be expected

to teach in her own classroom without feeling “stupid.” The support that Ms. S provided for Roxanne helped her to feel more “confident” about her role as a future mathematics teacher. This seemed to be especially important to Roxanne, as she was particularly worried about teaching mathematics in an upper elementary grade.

Plot pattern 5: Ms. S thinks I can teach mathematics and so do I!

Roxanne recalled the following teaching story about being in Ms. S’s class. She said:

One day the kids weren’t getting something. Ms. S didn’t know what else to do with them. Like she couldn’t figure it out. She was like, “Do you want to try?” I was anxious, but I felt like I can do this because she’s asking me to go try something else. That was a big turning point right there is that I just got up in front of the class randomly and did something, and it was for math!

(Timeline Activity, April 25, 2012)

Roxanne stated how this event positively affected her confidence in teaching mathematics. She said:

At first I was like, “Oh my gosh,” but then I was like, “No it’s fine because she’s not getting through to them so if I don’t get through it I won’t feel as much failure,” but I would still feel like, “Okay I can try to do this.” With her community, like the kids weren’t going to make fun of me if I didn’t know something or I made a mistake. (Timeline Activity, April 25, 2012)

Thinking about this experience and its impact on her future teaching Roxanne added:

I want my classroom to become that, too. Like just because somebody

makes a mistake doesn't mean you're dumb or you're stupid or you can't do it.

That's where that whole community ties in and management.

(Timeline Activity, April 25, 2012)

Roxanne wasn't feeling judged by Ms. S a when she did not know exactly how to teach a math lesson. In addition, seeing the strategies she had been taught in math methods being enacted in Ms. S's classroom seemed to afford Roxanne the opportunity to approach teaching mathematics more confidently. Roxanne valued the manner in which Ms. S had a plan or procedure that engaged students in their learning of mathematics. Moreover, in Ms. S's classroom, making mistakes was seen as part of learning mathematics.

Juncture 3 - Roxanne's Student Teaching Experiences

Five separate plot patterns from Juncture Three revolve around Roxanne's student teaching experiences. They are: (1) Navigating My Way Through Student Teaching With the Wonderful Ms. J, (2) I Tried Every Which Way to Make Mathematical Sense, (3) Should I Take a Step Back or Do My Own Thing? (4) Tackling Technology: Please Work For Me, and (5) I Just Don't Want to Feel Dumb.

Plot pattern 1: navigating my way through student teaching with the wonderful Ms. J.

Roxanne spent her final semester in her elementary education program student teaching in Ms. J.'s second grade classroom. She recalled how Ms. J consistently treated her in a kind, professional and supportive manner. Roxanne said that she and Ms. J became good friends and would talk outside of school by telephone or text. Although many of their conversations were about school related issues, Roxanne reported that they also talked about other things in their lives such as Ms. J's family or Roxanne's move out

of state after she finished her studies. Without Ms. J as a mentor teacher, Roxanne believed she would have had a much more difficult time navigating her way through her student teaching experience.

Roxanne talked about the importance of being able to seek Ms. J's support when she experienced anxiety or nervousness while teaching mathematics. She also found that she could accept Ms. J's feedback without feeling criticized or shamed. She talked about how Ms. J. "really built my confidence." She said:

I have a really good relationship with my mentor teacher, so I just go to her and am like what does this mean and how do I do this? I feel like as long as there's a safe person to go to, I don't want to feel dumb but I also want to make sure that I understand so that when I get up there I'm not confusing the kids. ... I felt like her criticism was structured enough. I accepted it because I knew she wasn't trying to belittle me, or make me feel dumb. She was actually just saying, "It's not a bad thing, but this is what you can do to do better". ... She wrote me little post-its and stuff on my lesson plans and in the book, so that I would remember to do it. ... I never felt like, "Oh I'm such a horrible person," and she's like attacking me. You know? It was just that relationship that we had.

(Timeline Activity, April 25, 2012)

Roxanne's positive and trusting relationship with Ms. J suggested that she could seek help when she needed support in teaching mathematics. Roxanne seemed to have built a level of trust level with Ms. J that allowed her to be vulnerable and admit that she needed help and wanted Ms. J's input. In addition, Roxanne was able to accept the feedback she received Ms. J because of the trust they shared. The personal relationship she established

with Ms. J appeared to have been an important element in Roxanne being able to share her thoughts and worries about teaching mathematics.

Plot pattern 2: I tried every which way to make mathematical sense.

Roxanne described her experience of teaching a geometry lesson early on in her student teaching semester. She said that the trust she created with Ms. J afforded her the confidence to ask Ms. J for help when she did not know what to do. She recounted the following scenario:

When I had started taking over math, because the curriculum is a spiral, there was some geometry that I had to still go over with the kids. It was this thing where they needed to, it was a line segment that was bent in different ways. It was something to do with dividing in half. Every which way I tried to divide in half, it didn't make sense to me. How are the kids gonna see that when you divide it in half it's gonna be symmetrical because I couldn't even see it. She showed me and I was like well now that I see it, how am I gonna explain it? It was just one of those things where I felt okay going to her but if I had to ask somebody else I might have felt stupid. (Conversations that Matter, March 31, 2012)

Roxanne appeared to feel secure and confident in asking Ms. J for her help when she couldn't "make sense" of the geometrical concept herself or how to teach the concept to her students. Based on her relationship with Ms. J, Roxanne believed that she would not be judged as being "dumb." In addition, Roxanne seemed to expect that Ms. J would treat her kindly and help her "navigate" her way through the geometry lesson.

Plot pattern 3: should I take a step back or do my own thing?

Roxanne stated the importance of being able to understand the curriculum she was required to use while teaching mathematics. Roxanne said that the *Everyday Mathematics* curriculum she was required to use during student teaching was quite different from the *Investigations* curriculum that she had become familiar with. Roxanne stated that she felt more comfortable with the problem-based curriculum employed in *Investigations* versus the spiral approached teaching method of *Everyday Mathematics*. She said, “It was like a culture shock to me having to leave *Investigations*.” In addition, she reported that the *Everyday Mathematics* program made her feel quite nervous, especially given the fact that she had full responsibility for teaching mathematics. She stated:

Then when I got into doing the whole group math lessons, it was *Everyday Math* for the curriculum, which scared me because it wasn't something I had worked with before and it switches. Like it's a spiral system so they like do addition today but then tomorrow we're doing regrouping, subtraction. So the kids, I noticed, were getting really confused with everything to where I had to back up a total of I think three weeks while I was teaching math and had to do a whole review like where I had to make up my own lessons, my own power point games because they were getting confused with addition and subtraction, double digit, when to regroup, do we regroup with adding? They were starting to carry and regroup when it was adding and we were like, “What are you doing? We don't do that right now,” and so that was a whole week.

(Student Teaching Interview, March 20, 2012)

Roxanne admitted she was “scared” when she discovered she would be teaching her mathematics lessons from the *Everyday Mathematics* curriculum. Her unfamiliarity with *Everyday Mathematics* as well as the spiraling nature of this curriculum appeared to create anxiety for her, especially when she compared it to the problem-based *Investigations* curriculum that she had grown more familiar and confident in utilizing. Moreover, Roxanne believed the continuously changing mathematics topics created confusion for her students, which seemed to produce anxiety for her as she juggled to meet their mathematical needs.

Roxanne recalled the uneasiness she continued to experience throughout the semester as she planned her mathematics lessons around the *Everyday Mathematics* curriculum. She said:

Being new into teaching. I don't have the resources that my mentor teacher necessarily did. She just pulls out a drawer and there's all this stuff in it. When you're going off just a curriculum guide, I just think it's super hard to teach fractions. They wanted to do graphing; they wanted to do addition, story problems. It was just all jumbled up. To me, the kids were not understanding because they're switching channels everyday.

(End of Semester Interview, April 25, 2012)

Roxanne spoke of the challenge she encountered as she worked to create successful mathematics lessons for her students within a spiral based curriculum. However, the continuous change in mathematics topics appeared to confuse not only Roxanne's students but Roxanne as she explained “it was just all jumbled up.” Roxanne's mention of Ms. J's drawer seemed to suggest that if she had “the stuff” that Ms. J had in her

drawer then she might be more prepared to teach the curriculum. Then perhaps Roxanne would feel less uneasy or anxious about working with a curriculum that required her to teach multiple mathematical concepts simultaneously.

Roxanne remembered that throughout her student teaching semester, she had many conversations with Ms. J about her anxiety with the spiraling methodology embedded in the *Everyday Mathematics* curriculum. She asked Ms. J if she needed to follow the curriculum exactly as presented in the teacher's guide or if she could "move in a different way." Ms. J advised Roxanne that she could "just take a step back" when needed and teach the mathematics concepts in more depth than the *Everyday Mathematics* curriculum outlined.

As Roxanne continued to try and make sense of Ms. J's advise to her regarding *Everyday Mathematics* she said:

I learned that it's okay to abandon the curriculum. ... I learned that you can back up and reteach something. It doesn't mean you're a bad teacher, that the kids just need a little bit more practice with it or a little bit more in-depth discussion about why things happen a certain way. ... Once you shut your door in your classroom, you can do what you need to do kind of thing. *Everyday Math* is that spiraling effect and it just, to, me doesn't work well. (Timeline Activity, April 25, 2012)

Throughout Roxanne's student teaching semester, she continued to experience anxiety as she struggled to make sense of the spiraling *Everyday Mathematics* curriculum. Roxanne appeared to feel greatly relieved when Ms. J informed her to "take a step back" when she needed to teach a mathematics concept more in depth than what was outlined in the curriculum. Roxanne appeared to interpret this to mean she could "abandon the

curriculum.” Perhaps then when Roxanne closed her classroom door, she could teach in a manner that would alleviate her mathematics anxiety.

As Roxanne neared the end of student teaching and thought about stepping into her own classroom, she shared that one of her biggest worries about teaching mathematics was what curriculum she would be expected to teach. She reported she felt scared knowing that different school districts utilized different types of curriculum. She worried about the possibility of having to teach *Everyday Mathematics* again.

Plot pattern 4: tackling technology: please work for me.

As Roxanne was nearing the end of her student teaching semester, she recalled that Ms. J had her incorporate the use of the smart board into her mathematics lessons. Roxanne expressed that she felt nervous about embedding this form of technology into her lesson for fear of the smart board not operating correctly. Roxanne remembered an equivalent fraction lesson she planned that revolved around the usage of the smart board. She reported she was excited about her lesson, as she believed her students would find the lesson very engaging. She reported:

We get to a problem and I made this really cool plan on the smart board and the technology fails. Because it’s been a really big lesson to have a paper copy backup for the ELMO or something. Because you plan this really great interactive thing and then you kind of lose the whole idea of your lesson and the message that you’re trying to send the kids. Because everyone’s trying to fix the smart board, you know? I feel unsure about math when they’re trying to get all of us to start teaching through this technology and everybody should be using technology. It’s like okay but did I just lose the whole class because it didn’t work? ... Most of the

time I use the board for math and so it's always like please just do it for me.

(Conversations that Matter, March 31, 2012)

Roxanne appeared to be anxious about using the smart board in her mathematics teaching, as embedding this technological tool seemed to be yet one more variable she needed to attend to while teaching mathematics. When the smart board failed with no paper copy of the lesson for her to lean on, she loses “the whole idea of the lesson and the message that she was trying to send the kids.” Roxanne may have believed that the use of the smart board was not a practical tool that she could count on when teaching her mathematics lesson. Instead, this technological tool she appeared to cause her great anxiety as she bargained with the smart board to “just do it for me.”

Plot pattern 5: I just don't want to feel dumb.

As Roxanne completed her elementary teacher education program she spoke of the importance of having “a safe person” to go to for help when she felt unsure about mathematics. She stated:

I just feel like as long as there's a safe person to go to, I don't want to feel dumb but I also want to make sure that I understand so that way when I get up there, I'm not confusing the kids. ... When I feel unsure about a math concept, I just feel unsure completely. ... Nobody wants to feel like they're dumb or can't do it. ... Maybe somebody in the past has already instilled that well you can't do it. Whether it's family or teachers or just friends that are—they're sitting next to the smart kid who's already getting it. I think it's just all about being wrong.

(Conversations That Matter, March 31, 2012)

Roxanne questioned if she was “dumb” in mathematics when she was a student learning mathematics, in her math methods course and her accompanying internships and when she was a student teacher. Roxanne seemed to believe that this description was assigned to her from early on. She hoped that she would always have a “safe person” by her side to guide her learning and teaching of mathematics. Without such a person, Roxanne felt more susceptible to feeling anxious about her mathematical ability.

Summary

Roxanne did not view herself as a strong mathematics person. In fact, Roxanne believed that mathematics was a subject that she never really understood. She perceived her student encounters of learning mathematics as a series of bad experiences. Moreover, she stated that learning mathematics was not a fun nor relevant experience for her but a subject that she needed to “get through.”

Roxanne had difficulty remembering specific mathematics experiences as a young child. However she clearly recalled the problems she encountered learning mathematics. Being a visual person, she spoke of how she struggled to learn mathematics by the direct teaching model her teachers utilized and instead tried to figure out mathematics on her own. She wondered if opportunities to collaborate with her classmates would have supported her understanding in this content area. From her early mathematics days, she questioned if she was mathematically “dumb” and worried if she would ever really know how to “do” mathematics.

When Roxanne’s family moved to a new state, Roxanne was suddenly labeled as a sixth grade gifted mathematics student, having already covered the content that her new school was teaching. Her narrative suggested that she seemed almost incredulous that this

description could possibly be used to describe her mathematical abilities. However, this new label transformed mathematics into a more rewarding subject for Roxanne that got her “through” her middle school days.

Unfortunately, when Roxanne entered high school, her narratives revealed that once again, she felt discouraged in mathematics. She struggled to relate to mathematics, as the class formats consisted of primarily lectures and memorization. She consistently second-guessed herself as to how she was doing in mathematics, relying on her graded work to determine her mathematics progress. In addition, she graduated from high school early, leaving her with a mathematics deficit upon her entrance to college. Once again, she felt mathematically “dumb.”

Graduating from high school with a mathematics deficit placed Roxanne in a position that required her to take a refresher mathematics course at the local junior college. When she barely received a passing grade in this course, she felt even more anxious about mathematics and her ability to be successful in this content area. At this point, she recalled making the decision not to take more than the required mathematics courses needed for the elementary teacher program. Later on Roxanne spoke of how she regretted this decision. However, the anxiety that Roxanne experienced when confronted with doing mathematics reinforced her strategy to just get “through” the minimum mathematics courses that were required.

Roxanne’s nervousness regarding her limited mathematics background caused her to wonder how she would be able to teach this content area to her future students. Her hope was that she would be able to learn from a strong mentor teacher how to teach mathematics and create practical means to maneuver her way through this portion of her

teacher education program. Her narratives spoke of how important it was for her to be shown how to teach mathematics as well as have a supportive curriculum.

Upon entering her math methods course and the accompanying classroom internship, Roxanne's sense of mathematics anxiety separated her from her goal of wanting to "become the teacher who has everyone feel like they can do it." She found herself confronted with mathematics content that she did not understand as well as a mentor teacher who did not "show" her how to teach mathematics. Her worry of feeling "dumb" resurfaced as she tried to make sense of teaching mathematics. She contemplated how she would be able to teach elementary mathematics without having the necessary knowledge.

Roxanne's last year in her teacher preparation program was spent under the guidance of two mentor teachers who "showed" her how to teach mathematics. This practical induction into teaching mathematics was what Roxanne seemed to have longed for so that she could feel less anxious/more confident about teaching mathematics. Ms. S's ability to create a mathematics-learning environment where students engaged with each other and shared their mathematical thinking was one that Roxanne regarded as crucial. Moreover, the guidance that Roxanne received from Ms. S's enactment of the *Investigations* curriculum appeared to provide her with the opportunity to view this curriculum as viable tool to assist her in teaching mathematics. Although Roxanne voiced that she remained quite anxious about teaching mathematics, she was relieved that Ms. S supported her learning and did not make her feel "stupid," a feeling that she often struggled with as she regarded her own mathematical abilities.

Roxanne spent her final semester student teaching in Ms. J's second grade classroom. Despite the anxiety she experienced around teaching mathematics, Roxanne described how she was able to seek Ms. J's support in helping her feel more confident about this content area. Roxanne found that because her relationship with Ms. J was built on trust, she could accept criticism about her mathematics teaching from Ms. J. Moreover, Roxanne believed that Ms. J was not judging her or viewing her as mathematically dumb but showing her how to teach mathematics in a better way.

Throughout her student teaching semester Roxanne struggled teaching mathematics while utilizing the *Everyday Mathematics* curriculum. She found the spiraling nature to be confusing. As she neared the end of her teacher preparation program and readied herself to seek an elementary teaching position, she worried about being assigned a mathematics curriculum that challenged her confidence. Her hope was to secure a teaching position within a school district that employed a curriculum like *Investigations*.

Roxanne hoped that when she became a teacher and had a classroom of her own that she would be able to find a "safe person" to continue to show her how to teach mathematics. Perhaps this type of support might calm Roxanne's feelings of mathematics anxiety that seemed to fuel a sense of being "unsure" about understanding and teaching mathematics.

CHAPTER 7: CROSS CASE SUMMARY AND DISCUSSION

This chapter describes the patterns found across the three cases. These patterns lift off individual cases as well as compare and contrast the narratives of the three women, as they relate to significant outcomes of their cases. I have identified key ideas within the patterns that occurred across the cases and titled them according to their content. While synthesizing the cases, I also look back to past research in the areas of mathematics anxiety and mathematics teacher education.

Mathematics Anxiety is Persistent and Varied

As I have demonstrated in Chapters 4, 5, and 6, the three women preservice elementary teachers who participated in my study reported experiencing mathematics anxiety while learning mathematics as K-12 students, while learning to teach mathematics as college students enrolled in a teacher preparation program, while imagining themselves as future mathematics teachers, and while engaging in their early attempts to teach mathematics during their student-teaching internships. Thus, my research suggests that experiences of mathematics anxiety may not be limited to formal testing situations as indicated by prior research (Bursal & Paznokas, 2006; Luo, Wang, & Luo, 2009; Mc-Glynn-Stewart, 2010) but, instead, may arise in response to a range of experiences with mathematics, both enacted and imagined, across a lifetime. While I do not argue that all individuals who experience mathematics anxiety will find that it pervades their mathematical histories, my participants' narratives suggest that a generalized experience of mathematics anxiety can occur.

The three women's narratives spoke of experiences with mathematics anxiety that occurred throughout their K-12 years of learning mathematics and during their time in

their teacher preparation program. Estelle often felt “jumbled up” as she sought to learn and teach mathematics. She dreaded the criticism that would follow from her K-12 teachers as well as her mentor teacher, as she attempted to make sense of mathematics. Phoebe struggled to understand mathematics, wishing at times that she could just forget mathematics and avoid this content area all together. Roxanne’s contradictory experiences of being labeled first as a “gifted” mathematics student, then as a “deficit” mathematics student left her clinging to the hope that learning concrete methods for completing required college-level mathematics coursework and for teaching mathematics to elementary students might “get her through” this subject area. Based on these findings, my study indicates that mathematics anxiety may be an issue or concern for women elementary preservice teachers that may recur for decades. Previous research has demonstrated that negative experiences with learning mathematics may affect how future teachers think and feel about this content area (Ball, 1988; Brady & Bowd, 2005; McGlynn-Stewart, 2010). My work extends this research by examining how the legacy of anxiety-producing experiences with mathematics education may continue overtime and be cumulative in nature.

Additionally, most researchers interested in mathematics anxiety have focused on the arousal in response to assessment situations (Bursal & Paznokas, 2006; Luo et al., 2009; McGlynn-Stewart, 2010). For example, Bursal and Paznokas (2006) define mathematics anxiety as “a state of discomfort that occurs in response to situations involving mathematical tasks that are perceived as threatening to self-esteem” (p.173). My dissertation extends this work by expanding the boundaries of “assessment” and “mathematical tasks” to encompass the diverse range of activities which preservice

teachers understand to be mathematical: for example, defining mathematical vocabulary for students (Estelle), translating roman numerals (Phoebe), and using an interactive whiteboard to deliver a mathematics lesson (Roxanne).

As an example of the range of activities that prompted mathematical anxiety for my participants, the three preservice teachers reported having felt their earliest experiences with mathematics anxiety in relation to what they perceived as “ability” grouping (see Chapters 4, 5, and 6). When Estelle was separated or partitioned from the advanced students in her childhood elementary mathematics class, she felt anxiety and in response created her own “Wall” to conceal what she did not know about this content area. In response to being classified as a universally “gifted” student throughout her K-12 years, Phoebe invented another all-encompassing identity, “not a math person,” to protect her from the anxiety she felt when she did not understand mathematics concepts or compute mathematics problems as quickly as her gifted peer group could. Phoebe hoped her non-math person status could co-exist with her gifted status. Roxanne was labeled as both a “gifted” and a “deficient” mathematics student, apparently without careful assessments of her mathematical abilities. Feeling confused and anxious about what group she belonged in, Roxanne came to regard mathematics education as something to endure, to bear for a limited time like an ill-fitting label. Thus my research indicates that the strategies for coping with mathematics anxiety that individuals seemingly create on their own may, in fact, be tightly related to their experiences with ability grouping and may even have been suggested to them by those situations. Previous research confirms how harmful and misguided ability grouping in mathematics can be, especially when the sorting of the groups is done at a young age when vast developmental differences are

likely (Boaler, 2008). My study adds to the conversation on ability grouping by showing not only that experiences of mathematics anxiety may arise from ability grouping but also that ability grouping itself may shape the coping strategies that individuals invent in response to those experiences.

Unique Fears and Coping Strategies

Additionally, in previous chapters, I have shown that the three women experienced mathematics anxiety as specific and distinct fears. Estelle described the dreaded consequence of failing to exhibit mathematical competency as the loss of *social belonging*, or opportunities to participate; Phoebe, as the loss of *personal identity*, or recognition for being a gifted individual; and Roxanne, as the loss of *resiliency* or the capacity to endure difficult experiences. Moreover, as I have elaborated in my three case studies, each woman developed a related coping strategy, which she used repeatedly across her mathematical experiences, even when the strategy failed to protect her from stress, embarrassment, and demoralization. Estelle concealed from others behind "the Wall" what she understood to be her lack of mathematical knowledge and skills; Phoebe insisted that she was "not a math person," and Roxanne focused on concrete methods for "getting through" mathematical experiences. Previous studies of mathematics anxiety have attended primarily to the physiological and psychological feelings of mathematics anxiety. For example, Luo et al., (2009) investigated affective responses to mathematics tests like panic, helplessness, confusion, depression, nervousness, fear, and dissociation. My dissertation adds to this work by considering how individuals make sense of their feelings of mathematics anxiety and attempt to diminish its effects on their lives. Thus, my dissertation challenges "one size fits all" orientations towards mathematics anxiety.

Moreover, as I have elaborated in my three case studies, each woman developed a related coping strategy, which she used repeatedly across her mathematical experiences, even though the strategy at times failed to protect her from stress, embarrassment, and demoralization. Estelle concealed her perceived lack of mathematical knowledge and skills behind “the Wall;” Phoebe insisted that she was “not a math person,” and Roxanne focused on concrete methods for “getting through” mathematical experiences. My participants’ narratives suggest that individuals may associate specific fears with mathematics anxiety and may develop particular strategies for coping with those fears. Based on these findings, I argue that researchers should consider patterns in individuals’ interpretations of, and responses to, experiences of mathematics anxiety: that is, their specific fears and coping strategies. This is important because the identification of specific fears and strategies relative to mathematics anxiety is an initial step in being able to address them.

Coping Strategies for Mathematics Anxiety that Offer Relief But May Limit Learning

These three case studies also demonstrated that when the women confronted situations in which they felt expected to know mathematical content that they did not understand, they used their specific strategies for coping with mathematics anxiety rather than seriously attempting to learn that content. For example, during her math methods semester, Estelle realized that there were several key mathematics topics that she did not fully understand. In an effort to conceal what she did not know about the topics, Estelle focused on projecting the qualities of a supportive, encouraging, and empathetic mathematics teacher who would model a positive attitude about this content area. In other

words, she hid behind her smile. Upon completing the math methods semester, Phoebe was concerned that she did not have enough knowledge or understanding to be able to teach elementary mathematics. Thus, she seemed to disregard the possibility that she could be an effective mathematics teacher. Although Phoebe was troubled by this fact, she turned her attentions to the other responsibilities associated with being an elementary teacher, even misleading herself for a time that elementary teachers were not required to teach mathematics, or were not professional “math people.” Roxanne encountered significant defeat in her learning experiences both in the college level refresher mathematics course as well as the college algebra course. Following these experiences, her focus shifted to “getting through” the minimum number of mathematics courses required for her teacher preparation program. Then during her math methods semester, Roxanne discovered that she did not understand some of the content being taught in the course and in her mentor teacher’s classroom. Instead of bringing her misunderstandings to the attention of her course instructor or her mentor teacher, she interpreted her struggle as proof that she was “dumb.”

Taking these cases together, my research demonstrates that preservice teachers’ use of certain strategies for coping with mathematics anxiety may ultimately impede mathematics learning. Previous studies of mathematics anxiety have addressed how affective responses, in the immediate term, may hinder mathematical performances (Bursal & Paznokas 2006; Luo et al., 2009). My dissertation adds to this research by arguing that coping strategies such as concealment behind a “wall”, claims of being a “non-math person, and “getting through,” developed in response to fears of mathematical

participation and evaluation of mathematical performances may hamper mathematics learning.

In previous chapters I have also demonstrated that while each woman's specific strategy repeatedly broke down, there were instances when the strategy provided some relief (albeit temporary relief) from mathematics anxiety. For example, while student teaching a fractions lesson, Estelle struggled to explain the difference between a denominator and a numerator to her class. When several students were able to explain the two mathematical terms to the class without Estelle's input, she was able to conceal her inability to do so in that teaching moment, though her relief was only momentary. After teaching a geometry lesson during which Phoebe scrambled to meet the language demands of the English Language Learners in the class as well as teach the three-dimensional characteristics of shapes, Phoebe arrived at the conclusion that mathematics might always be a subject that would cause her difficulty and stress. In order to help her cope with such experiences of mathematics anxiety, Phoebe reminded herself that she was not a "math person" but a language arts person. When Roxanne taught a mathematics lesson in Ms. A's Montessori-based classroom she was unable to maintain classroom management. Describing this experience as "a big chaotic mess," Roxanne sought comfort in knowing that Ms. A had not shown her concrete procedures to "get through" presenting mathematics lessons in that classroom culture. Although the three women could not rely on their coping strategies to protect them from mathematics anxiety at all times (e.g. Estelle did not always have students who could provide mathematical explanations on her behalf, Phoebe's image of herself as a non-math person did not exempt her from teaching mathematics lessons, and Roxanne, after leaving Ms. A's

classroom, encountered other mentor teachers who did not always provide step-by-step explanations of mathematics teaching methods) their coping strategies nevertheless temporarily protected them from completely avoiding mathematics or not participating in mathematics at all. Thus, my research provided evidence that strategies for coping with mathematics anxiety may be reused by individuals because at times, these strategies may work to temper the anxiety. My study also suggests that in reusing strategies for coping with mathematics anxiety, individuals may develop familiarity with them and derive comfort from these strategies, even when they don't always work. Moreover, strategies for coping with mathematics anxiety may allow individuals to continue to move forward in their work as preservice teachers.

Previous research conducted on mathematics anxiety has provided evidence that many preservice teachers experience mathematics anxiety, especially when faced with the expectation of teaching mathematics (Brady & Bowd, 2005; Bursal & Paznokas, 2006; Harper & Daane, 1998; Hembree, 1990; Sloan, Daane, & Giesen, 2002). However, these studies have presented experiences of mathematics anxiety as momentary states rather than as recurring experiences. Moreover, prior research has not considered the coping strategies that individuals develop in response to experiences of mathematics anxiety or examined how these strategies may be used repeatedly over time. My study adds to this literature by considering individuals' long histories not only with mathematics anxiety but also with particular strategies for coping with mathematics anxiety.

The Influences of Coping Strategies on Preservice Teachers' Views About Mathematics Learning and Teaching

In Chapters 4, 5, and 6, I also demonstrated how the preservice teachers' strategies for coping with mathematics anxiety were related to their ideas of mathematics. All three of the women viewed mathematics as a content area to learn as students and to know as preservice teachers but one that held little appeal for them. Estelle saw mathematics as something that she could not escape, as mathematics was everywhere. Her "Wall" could only temporarily protect her from having to understand, practice, and teach mathematics. Phoebe found mathematics to be a subject area that she strongly disliked because she was not able to "pick up on math problems" as quickly as her other gifted classmates. She believed she was just not a "math person," and often reached for the comfort of her non-math status to dismiss others' high expectations of her in this content area. Roxanne's viewed mathematics as "a sore subject." Having spent most of her K-12 and college years trying to pass mathematics classes despite not understanding the content, Roxanne had few ideas about mathematics other than mathematics was a subject to be endured. In other words, all three women spoke of mathematics as a requirement in their academic and professional lives but not as a rich discipline. Based on these findings, I argue that although preservice teachers who have mathematics anxiety may learn and gain an understanding of this content area, their strategies for coping with mathematics anxiety may limit their opportunities to expand their mathematics understanding. Previous research reveals the critical importance of teachers having a strong foundational understanding of the intellectual, demanding, and challenging aspects of mathematics (Ma, 1999). My study illustrates how strategies that preservice teachers

invent and utilize to cope with mathematics anxiety may impair a deep or rich understanding of mathematics that is of critical importance when teaching elementary mathematics.

In previous chapters, I have additionally demonstrated that the strategy that each of the preservice elementary teachers used to cope with mathematics anxiety influenced how she viewed mathematics learning. Estelle believed that mathematics could be best acquired when learned at a pace that left no students behind. In contrast to her own experiences with learning mathematics, Estelle imagined that her future students would not need to hide behind a wall to conceal that they needed more time to learn mathematics. Confiding that she could not “erase the old insecure feelings of being a weak math student,” Phoebe hoped that her future students would not feel so discouraged by mathematics learning that they would give up on the subject and identify themselves as a “non-math person.” Roxanne thought that students need to *do* mathematics to *learn* mathematics, and emphasized the importance of student collaborations and discussions of their mathematical thinking. She believed that hands-on activities would give students the sense that they could literally “do it” and that they were not “dumb,” a feeling that she had wrestled with throughout her mathematical history. Perhaps then Roxanne imagined her students’ experiences with mathematics could be more than just “getting through” this content area. In this way, my study suggests the possibility that preservice teachers may not only assume that their future students will experience mathematics anxiety as they did but may also model their visions of successful mathematics learning on the strategies that they developed to cope with mathematics anxiety. Previous research demonstrates that preservice teachers experiences with mathematics anxiety and fears

around mathematics impact their views on how to teach mathematics (Brady & Bowd, 2005; McGlynn-Stewart, 2010; Swars et al., 2006). My dissertation adds to this discussion by considering if the strategies that preservice teachers utilize to ward off mathematics anxiety play a role in determining how they imagine students best learn mathematics.

My three cases also addressed how the preservice teachers' coping strategies were related to their views of mathematics teaching. Estelle hoped that her mathematics teaching would not require her students to hide their confusion or to feel scared or ashamed to ask questions. Phoebe aspired to teach mathematics in ways that would create confident learners who did not feel the need to disassociate themselves from mathematics. Roxanne wanted her students to become physically involved in mathematics tasks rather than to numb themselves to mathematics lessons in order to "get through" them. Based on these findings, I argue that the coping strategies that preservice teachers use to ward off their own experiences with mathematics anxiety may shape how they imagine effective mathematics teaching. Previous research indicates that many beliefs teachers have about teaching are derived from personal experiences as students (Carter, 1993, 2003, 2007, 2012; Lortie, 1975). For example, preservice teachers who, as K-12 students, underwent their "apprenticeship of observation" (Lortie, 1975, p. 61) in mathematics classes in which they experienced mathematics anxiety may enter teacher preparation programs assuming that mathematics and mathematics teachers are threatening. My dissertation confirms this work. However, my research also adds to the discussion by showing how preservice teachers may carry with them more than vague or fragmented memories of the teaching they observed during their K-12 years. Instead,

future mathematics teachers may have well-developed habits of using particular strategies as guides for how they think, feel, and make decisions about mathematics education. In addition, preservice teachers who experience mathematics anxiety may have difficulty conceptualizing, anticipating, tracking, and responding to ongoing changes in their students' understanding.

Moreover, as I have demonstrated in previous chapters, the three preservice teachers' experiences with mathematics anxiety shaped their views of the ideal mathematics teacher. For Estelle, the ideal mathematics teacher was one who would never embarrass students in front of the class, who would be truly interested in all students' mathematical thinking (not just the smart students), and who would hold high expectations for all students. In other words, the best mathematics teacher, in Estelle's view, would not let students' hide behind a "Wall" of feigned understanding; nor would she make them wish they could. For Phoebe, the ideal mathematics teacher was one who would explain mathematics concepts and problem-solving methods in multiple ways and who would thus create a learning environment in which no student would struggle with mathematics because the teacher would emphasize that there were multiple ways to be a "math person." For Roxanne, the ideal mathematics teacher was one who would provide opportunities for students to actively engage in mathematics, regardless of their mathematics ability so they would not have to focus on just "getting through" this content area. Thus, my research indicates that future teachers' experiences learning mathematics and learning to teach mathematics may influence how they imagine the qualities of the ideal mathematics teacher. In fact, they may imagine this person as one who would have made it unnecessary for them to use their strategies for coping with mathematics anxiety

when they were students. Previous research on mathematics teacher education has promoted a vision of the ideal mathematics teacher as one who is knowledgeable and skilled both in mathematics and in mathematics teaching, including assessment of students' mathematical thinking (Ball & Forzani, 2010; Hill, Ball, & Schilling, 2008). Indeed, Ball (1988) has argued that to achieve this goal, mathematics teacher educators need to engage preservice teachers in "unlearning" their presuppositions about mathematics teaching (their "apprenticeship of observation") so as to become more receptive to coursework on mathematics content and mathematics-teaching methods. My dissertation complicates this discussion by showing how preservice teachers' strategies for coping with mathematics can influence their views of mathematics, mathematics learning, and mathematics teaching. Moreover, these strategies can even inform visions of the ideal mathematics teacher which may conflict with those of mathematics teacher educators. Strikingly, none of the women in my study explicitly acknowledged links between her views on mathematics education and her experiences with mathematics anxiety (and with attempting to cope with them). This complexity suggests that the project of "unlearning" is perhaps not as straightforward as Ball would suggest.

The Influences of Coping Strategies on Student Teaching Experiences

The three preservice teachers' narratives also revealed how their coping strategies for mathematics anxiety shaped their student teaching experiences in this content area. Having already spent an internship semester in Ms. C's classroom, Estelle knew that Ms. C could be harsh and critical at times. This thought alone created mathematics anxiety for Estelle. However, Estelle believed that being under Ms. C's tutelage for student teaching would be good for her, as Ms. C was a confident and competent mathematics teacher.

Estelle discovered early on that smiling at Ms. C (a strategy she had used during her K-12 days) did not save her when Ms. C questioned her about uncertainties in the mathematics lessons that Estelle was teaching. Compensating for Ms. C's rigor, Estelle tried to conceal what she did not know about the mathematics lessons she was responsible for teaching by trying to predict all the possible ways students would answer her questions. She hope that the wall would protect her from mathematics anxiety while she taught in front of Ms. C.

Phoebe spent her student teaching semester with Ms. D, her mentor teacher from her previous math methods semester. Although Phoebe felt she could seek advice about teaching mathematics from Ms. D, she did not share with Ms. D her fears about teaching this subject area. Instead, the questions that Phoebe posed to Ms. D revolved around student engagement and classroom management. When Phoebe experienced episodes of anxiety while teaching mathematics, she was quick to let Ms. D take control of teaching the lesson or to let the curriculum instruct her on what to do. Phoebe seemed to think that it was logical for a "non-math" person like herself to relinquish responsibility for mathematics teaching. Roxanne focused on having her mentor teacher show her how to do "things that work" while teaching mathematics. Through Ms. J's mentoring, Roxanne discovered that having a drawer full of "tried-and-true stuff" might be a valuable resource that she herself could use while teaching mathematics. In addition, Roxanne learned that the interactive whiteboard that Ms. J utilized while teaching mathematics could be a valuable tool that Roxanne might also employ to involve students in mathematics lessons, if she could learn how to use the board. In other words, Roxanne concentrated on learning to teach mathematics in a manner that would "get her through" this content area. Based on these findings, I argue that the particular strategies that preservice teachers

develop for coping with mathematics anxiety can filter what they attend to or learn about teaching mathematics during their student-teaching experiences. Previous research indicates that preservice teachers' feelings of mathematics anxiety can limit what they notice and come to understand while learning to teach mathematics (McGlynn-Stewart, 2010; Sloan, 2010). My dissertation confirms these findings by suggesting that the specific coping strategies that preservice teachers invent to alleviate mathematics anxiety can create patterns of interpretation and response that impede how they learn to teach mathematics.

Visions of Successful Mathematics Teaching Despite Mathematics Anxiety

These three case studies also reveal that despite repeated experiences of mathematics anxiety as K-12 students and as preservice teachers the three women clung to the hope that when they stepped into their own classrooms, they would be able to successfully teach elementary mathematics. Estelle believed that by establishing a classroom where the mathematics discussions would be shared between herself and her students, mathematics could be learned. In this way, she imagined herself having the “ah ha” moments of mathematics understanding alongside her students. Phoebe thought that her own challenging mathematics background could be used to meet the needs of her students who struggled in this content area. Moreover, she trusted that by the time she finished her teacher preparation program, she would have a solid mathematics teaching foundation to draw from. Roxanne hoped that she would be provided with a curriculum that would guide her teaching of mathematics, while providing her with the flexibility to teach what she found important and omit what did not appeal to her. She also hoped she would find a “safe person” (someone that would not make her feel dumb) in whom to

find support as she took on the responsibilities of a first-year teacher. Thus, my research indicates that although women elementary preservice teachers experienced mathematics anxiety across the various junctures of learning mathematics and learning to teach mathematics, their strategies to cope with mathematics anxiety served as a means for them to continue to pursue their goal of becoming a competent and successful elementary teacher. All three of the women spoke of the confidence and strengths they possessed in the other content areas they would be expected to teach as elementary teachers (such as language arts and social studies) as well as their strong desire to work with children. Previous research has shown that women elementary preservice teachers who battle mathematics anxiety both while learning mathematics and while learning to teach mathematics nevertheless often believe they will be able to teach mathematics (Swars, Daane, Giesen, 2006). My research suggests a possible, if partial, explanation for this surprising trend by demonstrating the power of women preservice elementary teachers' strategies for coping with mathematics anxiety in helping them to pursue careers as teachers, despite long-term experiences with mathematics anxiety.

Summary

Overall, the three women's narratives provide evidence that they tended to project their own mathematical experiences onto other students, both those they taught in their mentor teachers' classrooms and those they imagined teaching in the future. However, none of the preservice teachers seemed consciously to acknowledge this relationship between their strategies for coping with mathematics anxiety and their views on mathematics, mathematics learning, and mathematics teaching. Moreover, while Estelle, Phoebe, and Roxanne each pointed to specific mathematical content with which they

struggled both as learners and as teachers (e.g., fractions and geometry), none of the women described, in specific terms, how they approached and solved mathematical problems, or how they designed and implemented mathematical tasks for students. Instead, their narratives mentioned general teaching methods, like engaging students in whole-class discussion or manipulative-based activities, which could be used to teach other content areas. In fact, the three preservice teachers did not mention attending to students' discipline-specific thinking when they spoke of teaching mathematics. Thus, my research suggests that preservice teachers' experiences with mathematics anxiety may limit their learning of mathematical content knowledge and pedagogical content knowledge. Previous research on teacher "noticing" has demonstrated that mathematics classrooms are complex environments, in which teachers may face multiple distractions. For this reason, teachers' capacity to focus on and make sense of important evidence of students' mathematical learning is crucial (Sherin, Jacobs, Philipp, 2011). My dissertation builds on this research by proposing that preservice elementary teachers' noticing and sense-making practices may be linked to their previous experiences with mathematics anxiety. Moreover, my study reveals how the strategies for coping with such experiences that future teachers invent may do more than help to diminish their feelings of mathematics anxiety but may also fundamentally shape how they understand mathematics and the work of mathematics teaching.

CHAPTER 8: CONCLUSIONS AND IMPLICATIONS

This chapter provides a final conclusion to this dissertation study. This conclusion briefly summarizes the study's findings by research question. Then a summary of the implications for practice and research follows. The limitations of this study are also provided.

Summary of Findings for Research Question One

The first research question of my study is as follows:

What narratives shape women elementary preservice teachers' mathematics anxiety as they prepare to make the transition from student of teaching to practicing teacher?

This question investigated the narratives that shaped women elementary preservice teachers' mathematics anxiety as they prepared to make the transition from student of teaching to practicing teacher. Through the utilization of a narrative lens, I examined my participants' experiences with mathematics anxiety as K-12 students learning mathematics and as preservice teachers learning to teach mathematics. Taken together, the cases of the three participants in my study suggest that their mathematics anxiety was both pronounced and pervasive. In short, my findings have revealed that for some women elementary preservice teachers, mathematics anxiety may be an issue or concern that remains consistent and recurs for decades. In fact, the multiple stories that the three preservice teachers had to tell indicated that their experiences in learning mathematics led them to develop a specific coping strategy to deal with mathematics anxiety. They continued to utilize their strategy repeatedly across their experiences as a student learning mathematics and learning to teach mathematics, even when the strategy sometimes failed to protect them from stress, embarrassment, and demoralization. Moreover, these coping

strategies appeared to become so powerful that when the women confronted situations in which they felt expected to know mathematical content that they did not understand, they used their specific strategies for coping with mathematics anxiety rather than seriously attempting to learn that content. In this manner, these coping strategies often appeared to have injurious effects on their mathematics learning.

The women's mathematical anxiety was also influenced by their understanding of who could do well in mathematics. This understanding was generated from both inside and outside the walls of academia that intervene and declare who can do well in mathematics. Sadly, these narratives remain full of stereotypical views that still promote a gender division in mathematics. Unfortunately, as Fennema & Peterson (1985) discovered, gender related issues in mathematics are "some of the most pervasive and persistent educational inequities that exist" (p.17).

Summary of Findings for Research Question Two

The second research question of my study was as follows:

What pivotal and salient experiences do women elementary preservice teachers say propel them forward or move them back relative to their anxiety in learning mathematics and teaching mathematics?

This question focused on the experiences that the participants had to tell about mathematics anxiety that either propelled them forward or moved them back in learning mathematics and learning mathematics. My research indicates that although the three women experienced mathematics anxiety throughout their student learning days and during their teacher preparation program, overall they believed that they would be able to reach their goal of becoming a competent and successful elementary teacher. They spoke

of experiences they thought contributed to them being able to meet this goal such as positive mathematics learning experiences as students and as preservice teachers and the tutelage of nurturing and supportive mentor teachers. In addition, they drew comfort in experiencing confidence both as students and as preservice teachers in other content areas they would be expected to teach. However, they simultaneously shared stories of worry and fear about teaching mathematics. These narratives included issues of worries of not having enough content knowledge to teach mathematics, harsh and/or critical mentor teachers, see-saw experiences of ah-ha moments in teaching mathematics as well as jumbled teaching experiences, and the pressure and expectations to create mathematically competent students. This suggests that women elementary preservice teachers with mathematics anxiety have multiple experiences that propel them forward and move them back while learning mathematics and learning to teach mathematics. These experiences are not one-directional but instead are multi-directional in nature.

Implications for Teacher Education Research

My findings revealed that experiences of mathematics anxiety might go beyond formal testing situations. Mathematics anxiety may emerge as a response to mathematics experiences, both enacted and imagined, that occur across a lifetime. While I did not claim that all individuals who experience mathematics anxiety will find that mathematics anxiety pervades their mathematical histories, I did suggest that a generalized experience of mathematics anxiety can occur. Future research might interview and/or survey a larger sample of this population, regarding the frequency and duration of their experiences with mathematics anxiety. Further study is important because the findings related to the

frequency and duration of mathematics anxiety of a much larger sample of participants might elicit a greater understanding of mathematics anxiety.

My three participants' narratives about mathematics anxiety also suggest the need for future scholarly inquiry to include preservice teachers' individual interpretations of, and responses to, experiences of mathematics anxiety: that is, their specific fears and coping strategies. There may be more to know about the individual patterns and fears that some preservice teachers encounter in learning mathematics and learning to teach mathematics. Continued research in this area of inquiry may reveal additional patterns and interpretations that women elementary preservice teachers utilize to cope with experiences of mathematics anxiety. This is important to know in order to gain a more complete picture of the various patterns and interpretations of mathematics anxiety.

Additionally, I have asserted that the use of certain strategies for coping with mathematics anxiety may impede mathematics learning. Moreover, my study does not address whether there are specific mathematical topics that trigger an anxious response to learning mathematics more than others. New inquiries investigating episodes of mathematics anxiety might reveal if there are patterns related to particular concepts that impede mathematical learning more than others. Moreover, studying the settings in which mathematics anxiety occurs (i.e. formal classroom settings versus less formal spaces) may be a promising line of inquiry. Such knowledge of the specific and differing types of topics along with the context in which the anxiety occurs is important to examine so that they may be more directly addressed. This broader research agenda may help teacher educators pave the way to meet the dual goals of increasing preservice teachers'

mathematical knowledge and confidence across the varied and more challenging topics they will ultimately teach.

Moreover, I have argued that preservice teachers' experiences with mathematics anxiety and their strategies for coping with them may impair their ability to develop complex understandings of mathematics and personal interests in the subject matter. However, my study did not delve into variables that could have a positive impact on women elementary preservice teachers' understanding and participation in this content area. Future research could focus on uncovering factors that help preservice teachers not only to learn to understand mathematics as they confront their mathematics anxiety but also to find reasons to enjoy participating in this content area.

I have also argued that although women elementary preservice teachers experienced mathematics anxiety across the various junctures of learning mathematics and learning to teach mathematics, their strategies for coping with mathematics anxiety was a sort of double-edged sword that seemed to enable them to continue to pursue their goal of becoming an elementary teacher but yet appeared to prevent them from engaging in important learning activities. This is significant for teacher educators, as they seek to create teacher preparation programs that equip preservice teachers with the skills, abilities, and knowledge they need to know in order to take on the responsibilities of an elementary teacher. Work remains to be done through the use of narrative inquiry to gain a deeper insight into the strategies that preservice teachers employ for coping with mathematics anxiety. Perhaps then the strategies for coping with mathematics anxiety can be replaced by strategies that create more confidence in teaching mathematics.

Based on my findings, I have proposed that strategies for coping with mathematics anxiety may be reused by individuals, even though those strategies often do not prevent experiences of mathematics anxiety. Moreover, I have proposed that in reusing strategies for coping with mathematics anxiety, preservice teachers may develop familiarity with them and derive comfort from these strategies, even when they don't work. Although my study offers insight into how persistent yet faulty coping strategies may inform preservice teachers' professional decision-making, I have provided only some evidence regarding how these coping strategies were developed and why they continued to be used. Future studies in this area could further investigate these issues, and explore and compare strategies for coping with mathematics anxiety used by preservice teachers from a range of social groups, including men. This is important to understand because different groups of people may rely on different types of coping strategies for dealing with mathematics anxiety.

Additionally, I have made the claim that mathematics anxiety may be an issue or concern for women elementary preservice teachers that may recur for decades. In fact, it may be that some individuals may never stop experiencing mathematics anxiety. Future research might address how mathematics educators can work with preservice teachers' histories of experiences with mathematics anxiety, keeping in mind that their efforts might primarily serve to raise awareness and provide options rather than to prevent mathematics anxiety. Future research may provide mathematics teacher educators with a more in-depth view of how pervasive mathematics anxiety is for some women elementary preservice teachers. Moreover, investigating mathematics anxiety through the use of a beliefs, resiliency, identity, or micro-identities framework may lead to a

better understanding or different perspective of the experiences that some women encounter as students and preservice elementary teachers.

In response to the three preservice teachers' narratives of their mathematical experiences, I have contended that the strategies for coping with mathematics anxiety that individuals seemingly create on their own may, in fact, be related to their experiences with perceived "ability grouping" and may even have been suggested to them by those situations. However, my study does not address other possible sources for such coping strategies, including, for example, techniques directly taught by textbooks, teachers, paraprofessionals, peers, and/or students' home culture. More focused inquiries on preservice teachers' strategies for coping with mathematics anxiety might pursue this line of questioning. Knowing more about the sources of individual's coping strategies is important to understand so that they can be properly addressed.

Similarly, I have asserted that preservice teachers' strategies for coping with mathematics anxiety may not only affect how they learn mathematics but how they eventually learn to teach mathematics. What this study does not offer is insight into if and how preservice teachers enact their coping strategies for mathematics anxiety during their first few years of teaching. This would be important to understand so that possible strategies for this issue could be addressed. In addition, this study does not provide evidence regarding the frequency of strategy use or whether the strategies were modified in response to particular situations. Instead, my dissertation is a valuable first stage in such a research trajectory.

Additionally, I have claimed that the particular strategies that preservice teachers develop for coping with mathematics anxiety can filter what they attend to or learn about

teaching mathematics during their student-teaching experiences. In other words, my study shows how coping strategies can influence how preservice teachers interpret and respond to what they notice in classrooms. This is important to consider, as for example, there is a great need for teachers to attend to the mathematical needs of diverse students (Turner, Drake, McDuffie, Aguirre, Bartell, & Foote, 2012). Future studies could further investigate this process, perhaps by using teacher-mounted video cameras and by inviting preservice teachers post-lesson to comment on their videotaped “noticings” (Sherin, Jacobs, Phillip, 2011). However, my dissertation demonstrates that in-depth interviews on preservice teachers’ mathematical histories are also rich data sources for such inquiry. Mathematics teacher educators would likely benefit from continued research on how patterns in preservice teachers’ interpretations of, and response to, their interactions with students relate to their own mathematical experiences.

I have also proposed that preservice teachers may not only assume that their future students will experience mathematics anxiety as they did, but may also model their visions of successful mathematics learning on the strategies that they developed to cope with mathematics anxiety. Given that the purpose of my study was to describe the mathematical experiences of women preservice elementary teachers, I did not explore the interventions made by course instructors and mentor teachers affiliated with their teacher preparation program, other than to record what Estelle, Phoebe, and Roxanne reported. Knowing more about how course instructors and mentor teachers respond to preservice teachers mathematics anxiety could inform the field of teacher educators of possible strategies that help to alleviate mathematics anxiety.

Additionally, future research might examine preservice teachers' responses to the use of elements of my methodology (e.g., focus groups, the timeline activity) at various stages of a teacher preparation program. A perennial concern of mathematics teacher educators is how preservice teachers come to develop and enact certain philosophies of mathematics teaching. My dissertation suggests that opportunities remain to elicit and use preservice teachers' narratives of their mathematical experiences as touchstone texts in their teacher preparation program. This may help to serve a means to gain a better understanding of how individuals develop and enact coping strategies for dealing with mathematics anxiety.

In previous chapters, I have demonstrated that preservice teachers' strategies for coping with mathematics anxiety may strongly shape how they imagine effective mathematics teaching and the ideal mathematics teacher. While my study provides only an initial view of how women elementary preservice teachers who have experienced mathematics anxiety make sense of the work of mathematics teaching, continued inquiries might examine what happens when mathematics teacher educators invite preservice teachers to identify those qualities that they associate with a "good mathematics teacher" and to explore the history of, and possible models for, those ideas. Mathematics teacher educators often work with and against perspectives on mathematics, mathematics learning, and mathematics teaching that preservice teachers raise in their coursework and field experiences. My dissertation suggests that preservice teachers' narratives of their mathematical histories might serve as a useful anchor for those conversations. This could provide mathematics education researchers with a deeper

understanding of this issue as well as provide preservice teachers with a means to help address their mathematics anxiety.

Implications for Teacher Education Practice

The findings from my dissertation provide some suggestions for mathematics teacher educators. Of great importance is the need for teacher educators to create time and space in busy teacher preparation programs to address the issue of mathematics anxiety that some women preservice teachers experience. For example, in mathematics methods courses, teacher educators often have preservice teachers write a mathematics autobiography about their K-12 learning years in this content area. Methods course instructors could use this narrative assignment as a starting point to address the different themes that pertain to preservice teachers experiences with mathematics anxiety.

Mathematics teacher educators might also want to consider using the data collection instrument introduced in this study called *Conversations that Matter* to examine issues of mathematics anxiety in preservice teachers. This narrative tool offers preservice teachers the opportunity to explore mathematics anxiety as they unpack their central hopes, fears, questions, and directions about learning and teaching mathematics. Mathematics teacher educators could then address the particular concerns and worries of their preservice teachers.. Creating time in mathematics methods courses to address the specific issues that some women elementary preservice teachers experience is essential. In this way, preservice teachers may be more fully able to embrace the content of the mathematics methods course.

The National Council on Teacher Quality (2008) has made the recommendation that preservice teachers should be required to take more mathematics content courses.

Arguably, additional coursework might lead to successful performance and increased confidence in teaching mathematics. However, teacher educators might want first to consider addressing the anxiety that some women elementary preservice teachers associate with mathematics. By acknowledging preservice teachers' anxiety during their professional sequence, teacher educators may increase the likelihood that these novice teachers may more fully embrace learning and/or consolidating the content during their teacher preparation programs.

Mathematics teacher educators may want to consider offering preservice teachers who experience mathematics anxiety coping strategies that do not impede mathematics learning and teaching but help preservice teachers to gain access to these experiences. In this way, perhaps mathematics teacher educators can directly address the issue of mathematics anxiety before sending preservice teachers into the classrooms where they will be expected to teach mathematics.

In closing, this study explored the narrative themes related to women's mathematics anxiety. The powerful stories of mathematics anxiety that three women had to tell calls into question the idea that gender inequity in mathematics no longer exists. Fennema (2000) stated that the study of gender and mathematics is one that is complex and warrants ongoing research. In this dissertation, I have brought to the forefront the narratives that shaped three women elementary preservice teachers' mathematics anxiety as they prepared to make the transition from preservice teacher to practicing teacher. In addition, my study revealed what kinds of experiences propelled these women forward in learning and teaching mathematics as well as unveiled the types of experiences that moved them back. Narratives are important for mathematics teacher educators to

consider, as in Nel Noddings (1991) “stories have the power to direct and change our lives” p.157).

APPENDIX A: MATH AUTOBIOGRAPHY

TEACH MATH Data Collection Source From Math Methods Assignment

I. Math Autobiography – Individual Assignment

You will write a ‘math life story’ to reflect on your own experiences with mathematics as a student, and in life, and to think about how those experiences impacted your attitude towards mathematics as well as your understanding of mathematics. You will also reflect on how your own experiences may impact you work as a teacher.

Begin by reflecting on the following questions. For each question, think about specific experiences and events that you remember, instead of just generalities. Make sure to address the required questions. Other than that, you are free to address the questions that are most interesting / relevant for you. All thorough, thoughtful, and insightful assignments will receive full credit. Target length: 3 pages, double-spaced.

Math Autobiography Reflection Questions (REQUIRED):

1. What do you remember most about learning math in elementary and middle school?
2. How do you feel about math? How have your feelings changed over time?
3. How do you think your school math experiences impacted your attitude towards math?
4. How do you think your school math experiences impacted your understanding of mathematics? What experiences made it easier/harder for you to learn math?
5. What did your teachers do or not do to connect mathematics to your home / cultural / community experiences? How do you think this impacted your experience?
6. How was your math learning supported at home and in your community? Did your parents or other family members engage in activities involving math? Did you do any activities that involved or applied math outside of school (e.g., sports, hobbies, games)?
7. If you received mathematics instruction in a language other than your home language, what was your experience like? What did teachers do or not do to support your learning?
8. In what ways were you alike or different from the other students in your math classes? Consider math backgrounds, ethnicity, race, gender, linguistic, and/or socio-economic backgrounds. Please be specific in your own identification(s) and those of others.
9. How do you think your experiences, feelings and beliefs might impact the kind of mathematics teacher that you will be, or the kind of teacher that you want to be?

APPENDIX B: PRE/POST MATH METHODS INTERVIEWS

TEACH MATH Data Collection Source

Pre-Service Teacher Interview - Pre- and Post (Audio Recorded)

Spring, 2011 (Math Methods)

Part I: Introductory Questions (BRIEF)

1. Describe the mathematics class you envision teaching. What does it look like and sound like; what kinds of activities are the children engaged in?
2. What are you most excited about in learning to teach mathematics?
3. What are some questions or concerns you have about learning to teach mathematics?
4. PRE-INTERVIEW ONLY: Tell me about your prior experiences working with children in schools or other learning settings.
FOLLOW-UP: What experiences do you have working with children that are different from you in some way (different language background, different SES, different race, ethnicity, etc.)?
5. POST-INTERVIEW ONLY: How has your vision of your mathematics teaching changed over the course of this semester?

Part II: Children's Multiple Mathematical Knowledge Bases and Identities

6. What does it mean to teach mathematics for understanding?
7. Why is mathematics important for students to learn?
8. What is hard about learning mathematics? Why do some students have difficulties learning mathematics?
Possible probes: Consider specific topics/domains in math (e.g. multiplication, fractions, algebra) and/or specific demographic groups.
9. Why are some students able to do well in mathematics?
10. What roles will children's families and their communities play in your mathematics planning and instruction? If possible, describe specific examples of these roles.
11. What roles will children's language play in your mathematics planning and instruction? If possible, describe specific examples of these roles.
Possible probes: Consider role of home language if other than English.
12. What roles will children's mathematical thinking (e.g., the ways that children reason about different mathematical concepts, strategies they use to solve problems, the ways that they make sense of mathematical ideas) play in your mathematics planning and instruction? If possible, describe specific examples of these roles.
13. What roles do (or can) children's out-of-school knowledge and experiences play (for

example children's culture, family activities, home language, and community experiences) in children's learning of school mathematics? Again, if possible, describe specific examples of these roles.

14. Some teachers are trying to make stronger connections in math lessons between children's mathematical thinking and children's lives/experiences. What challenges might you face as you try to make those connections in your math instruction?
15. What kinds of support would help you address those challenges?
16. When you think about adapting curriculum materials (e.g., a textbook lesson) to meet the needs of your students, what kinds of things do/might you consider?

Part III: POST-INTERVIEW ONLY: Reflections on Course Activities

19. One of the goals of this course has been for you to learn about how to make stronger connections in math lessons between children's math thinking and children's lives/experiences (for example children's culture, family activities, home language, community experiences). In this part of the interview, I'd like you to describe how well each of the following course activities helped you to meet this goal. For each activity, give specific examples of what the activity helped you to learn. [ASK ONLY THOSE ITEMS THAT WERE ACTUALLY INCLUDED IN THE COURSE, INCLUDE A ONE SENTENCE DESCRIPTION OF EACH ACTIVITY THAT REFLECTS HOW THE ACTIVITY WAS IMPLEMENTED AT THAT SITE. PURPOSE OF THE DESCRIPTION IS TO REMIND PSTs OF THE ACTIVITY.]

- Analysis of classroom video (Video lens activity)
- Observations and analysis of classroom teaching
- Analysis of own teaching (e.g., analysis of lesson plan after teaching or analysis of video recorded teaching)
- Getting to Know A Student Interview
- Problem-solving interview(s)
- Shadowing a student
- Community mathematics exploration
- Curriculum spaces analysis

20. What connections did you notice, if any, between what you learned in your math methods course and the mathematics instruction in your mentor/cooperating teacher's classroom?

21. What differences did you notice, if any, between what you learned in your math methods course and the mathematics instruction in your mentor/cooperating teacher's classroom?

APPENDIX C: FOCUS GROUP INTERVIEW

TEACH MATH Data Collection Source

Focus Group Interview (Audio Recorded)

THINKING BACK (30 MINUTES):

1. **Talk about your experiences with math teaching in APPS this semester.**
 - a. Probe for examples of lessons taught, lessons observed, interactions with children around mathematics.
 - b. How has your mentor teacher (this semester) supported you in learning to teach mathematics?
 - c. How did your experiences with math teaching this semester connect to ideas or topics we explored in math methods?

2. **Think about both your methods courses from this semester, and your experiences in APPS.**
 - d. Is there anything from this semester that has helped you to think about how to connect to a child's home and community knowledge and/or their mathematical thinking in your math teaching?
 - i. For example, in science methods you explored children's funds of knowledge. How do you think those ideas apply to math teaching, if at all?
 - e. Were there things that you did this semester to find out more about a child's home and community knowledge, for example their language, culture, home experiences, etc...?
 - f. How did you use knowledge, if at all, in your planning and instruction?

3. THINKING FORWARD (30 MINUTES):

1. Describe the mathematics class you envision teaching during student teaching. What does your class look like and sound like; what kinds of activities are the children engaged in?
2. In what ways have your methods classes prepared you for teaching mathematics during student teaching?
Probe for specific examples
3. What concerns do you have about teaching mathematics during your student teaching experience?

4. DURING STUDENT TEACHING:

- a. What roles will **children's families and their communities** play in your mathematics planning instruction? If possible, describe specific **examples** of these roles, and probe the **purpose** of making these connections.
- b. What roles will children's **languages** play in your mathematics planning and instruction? If possible, describe specific **examples** of these roles, and probe the **purpose** of making these connections.

c. What roles will children's **culture** play in your mathematics planning and instruction? If possible, describe specific **examples** of these roles, and probe the **purpose** of making these connections.

d. What roles will children's **mathematical thinking** (e.g., the ways that children reason about different mathematical concepts, strategies they use to solve problems, the ways that they make sense of mathematical ideas) play in your mathematics planning and instruction? If possible, describe specific **examples** of these roles, and probe the **purpose** of making these connections.

**APPENDIX D: STUDENT TEACHING PRE/POST-OBSERVATION
INTERVIEW**

TEACH MATH Data Source

**Student Teaching Pre-Observation Interview Questions (Audio Recorded)
Spring 2012**

Tell me about the lesson I am about to observe.

How do you feel about teaching this lesson I am going to observe?

What are your mathematical goals for the lesson?

What other goals do you have for the lesson?

Can you talk about things in this lesson that you feel the most confident about teaching/least confident about teaching?

How does this lesson fit into other lessons you are teaching this week?

Is the lesson part of a unit? If so, where does it come in the unit?

Is this lesson related to previous lessons you have taught? If so, how?

What kinds of things did you consider as you planned the lesson?

Probe for specific examples.

Probe for how they used curriculum resources, if relevant, and how they adapted curriculum resources, if relevant.

How has your mentor teacher helped to prepare you for this lesson?

Probe for how conversations with mentor teacher about the lesson, and examples of the kind of input or suggestions the mentor offered.

Probe for anything else they considered, such as students' prior math knowledge and experiences, students' out of school and family/community experiences, language proficiency, student participation patterns, etc.

Talk about strategies that you think students might use during the lesson, or concepts they might draw upon, and/or potential confusions that might arise.

How do you feel about the strategies that you think students might use during the lesson, concepts that might draw upon, and/or potential confusions that might arise?

Is there anything else you'd like me to know about the lesson I am about to observe?

What do you think were the strengths of the lesson? Probe for specific examples.

What did you feel the most confident about in teaching this math lesson? Least confident about?

Is there anything that surprised you during the lesson? If so, describe this in more detail.

How do you think the lesson went?

What did you learn about children's mathematical thinking during the lesson?

Probe: To what extent did children's strategies /thinking/ confusions align with what you anticipated that students would do?

Probe for specific examples.

Probe: What evidence of learning did you notice?

What part or parts of the lesson challenged you the most in your ability to teach this lesson? Was there anything in the lesson that made you feel anxious?

What did you learn about children's home and community-based knowledge and experiences during the lesson? How might this inform future math lessons that you teach?

Is there anything that you wished would have gone differently during the lesson? If so, describe this in more detail.

If you taught the lesson again, what changes would you make?

** Ask this question at the end of the third teaching observation:

Now that you have had the opportunity to teach a number of math lessons during your full math takeover, what do you feel most confident in teaching mathematics? Least confident?

APPENDIX E: INDIVIDUAL INTERVIEW

Dissertation Data Source

Individual Interview (Audio Recorded) Spring 2012 (Student Teaching)

1. Tell me about your student teaching experience in mathematics. What have you found to be the most rewarding? The most challenging?
2. What has surprised you about teaching mathematics?
3. Tell me about a math teacher you remember during your K-12 years.
(Other optional probing questions: Why do you think you remember that teacher? What made you choose this teacher to talk about, etc).
4. When you think about this teacher, how does this help to inform you of how you think about teaching math?
5. Thinking back again to your own K-12 mathematics experiences, can you think of a student or students in your class that were good at mathematics?
6. Thinking back again to your own K-12 mathematics experiences, can you think of a student or students in your class that struggled with mathematics?
7. Can you tell me about a student with whom you worked that seemed confident of their mathematic abilities?
8. Can you tell me about a student with whom you worked that seemed anxious or not confident in mathematics?
9. When you think about these students, how does this help to inform you of how you think about teaching mathematics?
10. What questions do you have about teaching mathematics?
11. What worries you about teaching mathematics?

APPENDIX F: END OF STUDENT TEACHING INTERVIEW

TEACH MATH Data Source

Spring 2012 Interview of Preservice Teacher Participants

(Audio Recorded)

(at the end of Student Teaching)

1. Describe how you see your mathematics class. What does your class look like and sound like; what kinds of activities are the children engaged in?
2. In teaching mathematics what are three aspects that are really important to you?
3. How do you believe your views on teaching mathematics have changed over the semester?
4. What have you found to be the most rewarding parts of teaching mathematics?
Need examples of specific lessons.
5. What have you found to be the most challenging parts of teaching mathematics?
6. What would you say are your strengths in teaching mathematics to diverse groups of students? Specific examples.
7. What are areas that you'd like to continue to work on relative to teaching mathematics to diverse groups of students?
8. What has supported you as you are learning to teach mathematics to diverse groups of students? Not meaning to focus so much on the mentor (Is it the curriculum, interactions with others at the school, etc).
9. How does your own background –your language, your culture, class, gender, race impact your mathematics teaching?
10. What roles have children's families and communities played in your planning and teaching of mathematics this semester? Take for example, as you are planning lessons, how did you consider your students' families, communities.

Probe for specific examples.
11. How might children's families and communities affect your mathematics teaching in the future?

12. Did you see your mentor teacher teaching mathematics in ways that drew upon children's home or community experiences? Any thoughts on how they maybe tried to do that?

Probe for specific examples.

Probe: How did your mentor teacher help *you* to learn to do these things, if at all?

Probe: How did your supervisor help *you* to learn to do these things, if at all?

13. What role has children's mathematical thinking (e.g., the ways that children reason about different mathematical concepts, strategies they use to solve problems, the ways that they make sense of mathematical ideas) played in your mathematics planning and instruction?

Probe: If possible, describe specific examples.

14. Did you see your mentor teacher teaching mathematics in ways that connected to children's mathematical thinking?

Probe for specific examples.

Probe: How did your mentor teacher help *you* to learn to do these things, if at all?

Probe: How did your supervisor help you to learn to do these things, if at all?

15. Can you talk about a lesson or activity that you or your mentor teacher taught in which you or your mentor teacher connected children's mathematical thinking with children's home or community experiences.

15. Did you see your mentor teacher teaching mathematics in ways that were different from the kinds of mathematics teaching you learned about in your mathematics methods course?

Probe for specific examples.

16. How well do you think that your methods classes prepared you for student teaching? For teaching mathematics?

Probe for specific examples

17. How can Teacher Education programs more fully support PSTs' learning of teaching mathematics during the methods course and during the student teaching experience?

18. What are your plans for next year? If not teaching, talk more about that.

19. What is the best way to contact you over the summer? Get more than one number, i.e. email address, parents phone number.

20. How does your own background inform your mathematics teaching?

APPENDIX G: READER'S THEATRE

Dissertation Data Collection Source

Reader's Theatre (Audio Recorded and Videotaped Focus Group Activity) Spring 2012 (Student Teaching)

Participants will be given a copy of their mathematics autobiography that they previously wrote for math methods and will be asked to thoroughly read it to themselves. As they read they will be asked to pick a couple of thoughts/ideas/points they had written about to share with the group that they have questions about, find powerful, meaningful, joyful or sad, etc. After each participant has read and chosen what they want to share with the group, the participants will take turns sharing what their individual points are and why they chose them. The other three participants will be free to comment, ask questions, etc. about the portion of the reading that was shared.

Then participants will be asked to think about the following questions and to share their thoughts if they would like to:

What do you think creates feelings of anxiety and low confidence in teaching elementary mathematics?

What do you think creates confidence in teaching mathematics?

APPENDIX H: CONVERSATIONS THAT MATTER

Dissertation Data Collection Source

Conversations that Matter Activity (Audio Recorded and Videotaped Focus Group Activity) Spring 2012 (Student Teaching)

In this activity, the participants will be given broad prompts that relate to knowing mathematics and teaching mathematics. They will individually respond to the prompt by writing what comes to their mind on a sentence strip. After recording their thoughts or ideas they will turn them face down until they have responded to all the prompts. The prompts will include statements such as:

In math I am good at.....

One of my best mathematics experience as a student was.....

One of my most challenging experiences as a mathematics student was.....

For me, teaching is.....

For me, teaching mathematics is.....

One of the most important qualities that a teacher should possess is.....

One of the most important qualities that a mathematics teacher should possess is.....

When I am planning my weekly mathematics lessons and I come to a content area that I love I

When I am planning my weekly mathematics lessons and I come to a content area that I am unsure about I.....

If my students do not understand a mathematical concept that I am teaching.....

As I get ready to teach in my own classroom, a question I have about teaching is.....

As I get ready to teach in my own classroom, a question I have about mathematics is.....

A time when I feel unsure about teaching is.....

A time when I feel unsure about teaching mathematics is when.....

A time when I feel unsure about mathematics is

I think anxiety and/or low confidence in mathematics is caused by.....

APPENDIX I: MATHEMATICS TIMELINE

Dissertation Data Collection Source Mathematics Timeline

(Audio Recorded and Videotaped Individual Activity) Spring 2012 (Student Teaching)

Thinking back to Math Methods and your field placement during Math Methods in the spring 2011 semester, your field placement in the fall semester of 2011, and your student teaching assignment in the spring 2012 semester, what has your mathematics journey been like? What have you learned during each of these time periods as a student learning to teach mathematics? What questions did you have at each juncture? What questions do you have about mathematics and the teaching of mathematics as you make the transition from student of teaching to practicing teacher?

Use this timeline to record your journey over this 18 month time period. The top box is for recording what you learned from each of these academic experiences during these specific time periods. These experiences tend to be the ones that are more easily measured. The bottom box is for recording the questions, concerns, issues you may have encountered during these specific moments in time as well as before Math Methods began.

Using these conversation bubbles, place yourself on the timeline and try accurately to write out your questions, concerns, celebratory thoughts in the conversation bubbles. Try to write your thoughts at each part of your journey at specific junctures: What was I thinking about? What was I concerned about? What was I excited about? What did I feel anxious about? What did I feel strong about?

Questions for me to ask after participant has filled out the timeline:

As you look at all these bubbles what kinds of connections can you make?

What has arisen out of all these bubbles that you notice about math and your teaching of math?

What questions/concerns do you have about math and teaching math?

How does where you've been and where you are going define you as a mathematics teacher?

Allow as much time as participant needs to respond to these questions.

REFERENCES

- Atkinson, R. (2007). The life story interview as a bridge in narrative inquiry. In D. J. Clandinin (ed.), *Handbook of Narrative Inquiry* (1st ed., pp. 224–246). Thousand Oaks, CA: Sage.
- Baddeley, J. & Singer, J. Charting the life story's path: Narrative identity across the life span. In D. J. Clandinin (ed.), *Handbook of Narrative Inquiry* (1st ed., pp. 177–202). Thousand Oaks, CA: Sage.
- Ball, D. & Forzani, F. (2010). What does it take to make a teacher? *Phi Delta Kappan*, 92(2), 8–12.
- Ball, D. & Cohen, D. K. (1999). Developing practice: Developing practioners: Towards a practices-based theory of professional development. In L. Darling-Hammond & G. Sykes (Eds.), *Teaching as the learning profession: Handbook of policy and practice* (pp. 3–32). San Francisci, CA: Jossey-Bass.
- Ball, D. (1988). Unlearning to teach mathematics. *For the Learning of Mathematics*, 8(1), 40–48.
- Beilock, S., Gunderson, E., Ramirez, G., & Levine, S. (2010). Female teachers' math anxiety affects girls' math achievement. *Proceedings of the National Academy of Sciences of the United States of America*, 107(5), 1860–1863.
- Bell, M. (2004). *Everyday mathematics: Second grade*. University of Chicago, School Mathematics Project: Columbus, OH: SRA.
- Belenky, M., Clinchy, B., Goldberger, N., & Tarule, J. (1986). *Women's way of knowing*. New York, NY: Basic Books, Inc.
- Biklen, S. K. (1983). *Teaching as a occupation for women: A case study of an elementary school*. Syracuse, NY: Education Designs Group.
- Boaler, A. (2008). *What's math got to do with it?* New York, NY: Penguin Group.
- Bogdan, R., & Biklen, S. K. (1992). *Qualitative research for education: An introduction to theory and methods*. Boston, MA: Allyn and Bacon.
- Brady, P. & Bowd, A. (2005). Mathematics anxiety, prior experience and confidence to teach mathematics among pre-service education students. *Teachers and Teaching: Theory and Practice*, 11(1), 37–46.
- Brophy, J. & Good, T. (1970). Teachers' communication of differential expectations for children's classroom performance: Some behavioral data. *Journal of Educational Psychology*, 61(5), 365–374.
- Bruner, J. (1990). *Acts of Meaning*. Cambridge, MA: Harvard University Press.
- Bursal, M., & Paznokas, L. (2006). Mathematics anxiety and preservice elementary teachers' confidence to teach mathematics and science. *School Science and Mathematics*, 106(4), 173–180.
- Cadinu, M., Maass, A., Rosabianca, A., & Kiesner, J. (2005). Why do women underperform under stereotype threat? Evidence for the role of negative thinking. *Psychological Science*, 16, 572–578.
- Carter, K. (in progress). Narrating stories through reader's theater.
- Carter, K. & Stoehr, K. (2012). Developing stories from the field: The impact of audience and advice on preservice teachers' narrative understandings of teaching. Paper presented at the annual meeting of the American Educational Research Association, Vancouver, Canada.

- Carter, K. (2007). Carter, K., Doyle, W., & Romano, Molly. (2007). Themes in preservice teachers' narratives of personal well-remembered events. *Proceedings of the Hawaii International Conference on Education*, Honolulu, HI.
- Carter, K. (2003). Narratives and learning to teach: Implications for teacher-education curriculum. *Journal of Curriculum Studies*, 35, 129–137.
- Carter, K. (1994). Preservice teachers' well-remembered events and the acquisition of event structured knowledge. *Journal of Curriculum Studies*, 26(3), 235–252.
- Carter, K. (1993). The place of story in the study of teaching and teacher education. *Educational Researcher*, 22(1), 5–12.
- Casey, K. (1993). *I answer with my life: Life histories of women teachers working for social change*. New York, NY: Routledge.
- Charalambous, C., Hill, H., & Ball, D. (2011). Prospective teachers' learning to provide instructional explanations: how does it look and what might it take? *Journal of Mathematics Teacher Education*, 14(6), 441–463.
- Clandinin, D. J., Davies, A., Hogan, P. & Kennard, B. (1993). *Learning to teach, teaching to learn: Stories of collaboration in teacher education*. New York, NY: Teachers College Press.
- Clandinin, D. J. (1989). Developing rhythm in teaching: The narrative study of a beginning teacher's personal practical knowledge of classrooms. *Curriculum Inquiry*, 19(2), 121–141.
- Clandinin, D. J., & Connelly, F. M. (1990). Narrative, experience, and the study of curriculum. *Cambridge Journal of Education*, 20(3), 241–253.
- Connelly, F. M. & Clandinin, D. J. (1990). Stories of experience and narrative inquiry. *Educational Researcher*, 19(5), 2–14.
- Connelly, F. Michael & Clandinin, D. J. (1988). *Teachers as curriculum planners*. New York: NY: Teachers College Press.
- Corbett, C., Hill, C., & St. Rose, A. (2008). *Where the girls are: The facts about gender equity in education*. AAUW Education Foundation. Washington, DC.
- Covington, M. (1984). The self-worth theory of achievement motivation: Findings and implications. *The Elementary School Journal*, 85(1), 4–20.
- Doyle, W., & Carter, K. (2003). Narrative and learning to teach: Implications for teacher-education curriculum. *Journal of Curriculum Studies*, 35(2), 129–137.
- Drake, C. (2006). Turning points: Using teachers' mathematics life stories to understand the implementation of mathematics education reform. *Journal of mathematics teacher education*, 9, 579–608.
- Drake, C., & Sherin, M. (2006). Practicing change: Curriculum adaptation and teacher narrative in the context of mathematics education reform. *Curriculum Inquiry*, 36(2), 153–187.
- Drake, C., Spillane, J., & Hufferd-Ackles, K. (2001). Storied identities: teacher learning and subject-matter context. *Journal of Curriculum Studies*, 33(1), 1–23.
- Feiman-Nemser, S. (2001). From preparation to practice: Designing a continuum to strengthen and sustain teaching. *Teachers College Record*, 103(6), 1013–1055.
- Feiman-Nemser, S., & Remillard, J. (1996). Perspectives on learning to teach. In F. Murray (ed.), *The Teacher Educator's Handbook: Building a Knowledge Base for the Preparation of Teachers* (1st ed., pp. 63–91). San Francisco, CA: Jossey-Bass.

- Fennema, E. (2000). Gender and mathematics: What is known and what do I wish was known? Paper presented at the Fifth Annual Forum of the National Institute for Science Education, Detroit, MI.
- Fennema, E., Carpenter, T., Jacobs, V., Franke, M., & Levi, L. (1998). New perspectives on gender differences in mathematics: A reprise. *Educational Researcher*, 27(19), 19–21.
- Fennema, E. & Leder, G. (1990). Justice in mathematics education: Reaching beyond equity. *Journal for Research in Mathematics Education*, 22(2), 157–161.
- Fennema, E., Peterson, P., Carpenter, T., & Lubinski, C. (1990). Teachers' attributes and beliefs about girls, boys, and mathematics. *Educational Studies in Mathematics*, 21(1), 55 – 69.
- Fennema, E., & Peterson, P. (1985). Autonomous learning behavior: A possible explanation of gender-related differences in mathematics. In L. C. Wilkinson & C. B. Marrett (Eds.), *Gender influences in classroom interaction* (pp.17–35). New York: Academic Press.
- Fennema, E. (1974). Sex differences in mathematics-learning: Why? *The Elementary School Journal*, 75(3), 183–190.
- Frenzel, A. C., Pekrun, R., & Goetz, T. (2007). Girls and mathematics: A “hopeless” issue? A control-value approach to gender differences in emotions towards mathematics. *European Journal of Psychology of Education*, 22(4), 497–514.
- Garrahy, D. (2001). Three third-grade teachers' gender-related beliefs and behavior. *The Elementary School Journal*, 102(1), 81–94.
- Gavin, M. & Reis, S. (2003). Helping teachers to encourage talented girls in mathematics. *Gifted Child Today*, 26, 32 – 45.
- Gilligan, C. (1982). *In a different voice*. Cambridge, MA: Harvard University Press.
- Glasser, H., Smith, J. (2008). On the vague meaning of “gender” in education research: The problem, its sources, and recommendations for practice. *Educational Researcher*, 37(6), 343–350.
- Goodell, J., & Parker, L. (2001). Creating a connected, equitable mathematics classroom: Facilitating gender equity. In B. Atweh & H. Forgaz (Eds.), *Sociocultural research on mathematics education: an international perspective*. (pp. 411–432). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Goodson, I., & Sikes, P. (2001). *Life history research in educational settings: Learning from lives*. Philadelphia, PA: Open University Press.
- Gresham, G. (2007). A study of mathematics anxiety in pre-service teachers. *Early Childhood Education Journal*, 35(2), 181–188.
- Griffin, G. (1988). The future of teachers and teaching: Imperatives and possibilities. *Peabody Journal of Education*, 65(3), 74–87.
- Gudmundsdottir, S. (1991). Story-maker, story-teller: Narrative structures in curriculum. *Journal of Curriculum Studies*, 23(3), 207–218.
- Hammerness, K., Darling-Hammond, L., & Bransford, J. (with Berliner, D., Cochran-Smith, M., McDonald, M., & Zeichner, K.). (2005). How teachers learn and develop. In L. Darling-Hammond & J. Bransford (Eds.), *Preparing teachers for a changing world: What teachers should learn and be able to do* (pp. 358–389). San Francisco, CA: Jossey-Bass.

- Hanson, K. (1992). Teaching mathematics effectively and equitably to females. Newton, MA: WEEA Publishing Center/Center for Equity and Cultural Diversity.
- Harper, N. W., & Daane, C. J. (1998). Causes and reductions of math anxiety in preservice elementary teachers. *Action in Teacher Education*, 19(4), 29–38.
- Hembree, (1990). Nature, Effects and Relief of Mathematics Anxiety. *Journal for Research in Mathematics Education*, 21(1), 33–46.
- Hill, H., Ball, D., Schilling, S. (2008). Unpacking pedagogical content knowledge: Conceptualizing and measuring teachers' topic specific knowledge of students. *Journal for Research in Mathematics Education*, 39(4), 372–400.
- Hollingsworth, S., & Dybdahl, M. (2007). Talking to learn: The critical role of conversation in narrative inquiry. In D. J. Clandinin (ed.), *Handbook of Narrative Inquiry* (1st ed., pp. 146–176). Thousand Oaks, CA: Sage.
- Hollingsworth, S. (1992). Learning to teach through collaborative conversations. *American Educational Research Journal*, 29(2), 373–404.
- Huebner, T. (2009). Encouraging girls to pursue math and science. *Educational Leadership*, 67(1), 90–91.
- Hyde, J. & Jaffee, S. (1998). Perspectives from social and feminist psychology. *Educational Researcher*, 27(14), 14–16.
- Johns, M., Schmander, T., & Martens, A. (2005). Knowing is half the battle: Teaching stereotype threat as a means to improving women's math performance. *Psychological Science*, 16, 175–179.
- Investigations in number data and space*. (2004). TERC.
- Jurich, D. (2005). The narrative nexus of teachers' lives and practices. Paper presented at the annual meeting of the American Educational Research Association, Montreal, Canada.
- Knowles, J. & Cole, A. (1996). Developing practice through field experiences. In F. Murray (ed.), *The Teacher Educator's Handbook: Building a Knowledge Base for the Preparation of Teachers* (1st ed., pp. 648–688). San Francisco, CA: Jossey-Bass.
- Laird, S. (1988). Reforming 'women's true profession': A case of 'feminist pedagogy' in teacher education. *Harvard Education Review*, 58(4), 449–463.
- LoPresto, K., & Drake, C. (2004). What's your mathematics story? *Teaching Children Mathematics*, 11(5), 266–271.
- Liu, (2008). Impact of online discussion on elementary teacher candidates' anxiety towards teaching mathematics. *Education*, 128(4), 274–279.
- Lortie, D. (1975). *Schoolteacher: A sociological study*. Chicago, IL: University of Chicago Press.
- Luo, X., Wang, F., Luo, Z. (2009). *Journal of Mathematics Education*, 2, 12–19.
- Ma, L. (1999). *Knowing and teaching elementary mathematics: Teachers' understanding of fundamental mathematics in China and the U.S.* Hillsdale, NJ: Laurence Erlbaum.
- Marshall, C. & Rossman, G. (2006). *Designing qualitative research*. Thousand Oaks, CA: Sage.
- Marx, D. & Roman, J. (2002). Female role models: Protecting women's math test performance. *Personality and Social Psychology Bulletin*, 28(9), 1183–1193.

- Maxwell, J. A. (1996). *Qualitative research design: An interactive approach* (2nd ed.). Thousand Oaks, CA: Sage.
- McGraw, R., Lubienski, S., & Strutchens, M. (2006). A closer look at gender in NAEP mathematics achievement and affect data: Intersections with achievement, race/ethnicity, and socioeconomic status. *Journal for Research in Mathematics Education*, 37(2), 129–150.
- McGlynn-Stewart, M. (2010). Listening to students, listening to myself: Addressing pre-service teachers' fears of mathematics and teaching mathematics. *Studying Teacher Education*, 6(2), 175–186.
- Meehan, D. (2007). *Learning like a girl*. Cambridge, MA: Perseus Group.
- National Assessment of Educational Progress. (2011). The Nation's Report Card in Mathematics. U.S. Department of Education.
- National Center for Educational Statistics. (2010). Characteristics of full-time teachers. Retrieved from <http://nces.ed.gov/pubs2010>.
- National Council on Teacher Quality. (2008). No common denominator: The preparation of elementary teachers in mathematics by America's schools. *NCTQ Full Report*.
- Nicol, C. & Crespo, S. (2006). Learning to teach with mathematics textbooks: How preservice teachers interpret and use curriculum materials. *Educational Studies in Mathematics*, 62, 331–355.
- Noddings, N. (1991). Stories in dialogue: Caring and interpersonal reasoning. In C. Witherell & N. Noddings (Eds.), *Stories lives tell: Narrative and dialogue in education* (pp. 157–170). New York, NY: Teachers College Press.
- Oswald, D. (2008). Gender stereotypes and women's reports of liking and ability in traditionally masculine and feminine occupations. *Psychology of Women Quarterly*, 32, 196–203.
- Penner, A.M. & Paret, M. (2008). Gender differences in mathematics achievement: Exploring the early grades and the extremes. *Science Digest*, 37, 239–253.
- Peterson P. & Fennema, E. (1985). Effective teaching, student engagement in classroom activities, and sex-related differences in learning mathematics. *American Educational Research Journal*, 22(3), 309–335.
- Sadker, D. (1999). Gender equity: Still knocking at the door. *Educational Leadership*, 56(7), 22–26.
- Sadker, D. & Sadker, M. (1994). *Failing at fairness*. New York, NY: Touchstone.
- Sadker, D., Sadker, M., & Zittleman, K. (2009). *Still failing at fairness*. New York, NY: Scribner.
- Schon,
- Seidman, I. *Interviewing as Qualitative Research: A guide for researchers in education and the social sciences*. (2006). New York, NY: Teachers College Press.
- Sloan, T. (2010). A quantitative and qualitative study of math anxiety among preservice teachers. *The Educational Forum*, 74(3), 242–256.
- Sherin, M., Jacobs, V., Philipp, R. (2011). *Mathematics teacher noticing: Seeing through teachers eyes*. New York, NY: Routledge.
- Sloan, T., Daane, C. J., & Giesen, J. (2002). Mathematics anxiety and learning styles: What is the relationship in elementary preservice teachers? *School Science and Mathematics*, 102,(2), 84–87.

- Spitzer, S., Phelps, C., Beyers, J., Johnson, D., & Sieminski, E. (2011). Developing prospective elementary teachers' abilities to identify evidence of student mathematical achievement. *Journal of Mathematics Teacher Education, 14*(1), 67–87.
- Steele, C., Spencer, S., & Aronson, J. (2002). Contending with group image: The psychology of stereotype and social identity threat. *Advances in Experimental Social Psychology, 34*, 379–440.
- Stoehr, K. & Carter, C. (2011). Stories and statistics: A mixed picture of gender equity in mathematics. Paper presented at the annual meeting of the American Educational Research Association, New Orleans, LA.
- Stoehr, K. (2012). Conversations that matter: A narrative approach in qualitative research.
- Strauss, A., & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques*. Newbury Park, CA: Sage.
- Stuart, C. & Thurlow, D. (2000). Making it their own: Preservice teachers' experiences, beliefs, and classroom practices. *Journal of Teacher Education, 51*(2), 113–121.
- Swars, S. L., Daane, C. J., & Giesen, J. (2006). Mathematics Anxiety and Mathematics Teacher Efficacy: What is the Relationship in Elementary Preservice Teachers? *School Science and Mathematics, 106*(7), 306-315.
- Sykes, G., & Bird, T. (1992). Teacher education and the case study. *Review of Research in Education, 18*, 457–521.
- Tobias, S. (1993). *Overcoming math anxiety*. New York, NY: W.W. Norton & Co., Inc.
- Turner, E., Drake, C., McDuffie, A., Aguirre, J., Bartell, T., & Foote, M. (2012). Promoting equity in mathematics teacher preparation: A framework for advancing teacher learning of children's multiple mathematics knowledge bases. *Journal of Mathematics Teacher Education, 15*(1), 67–82.
- Vinson, B. M. (2001). A comparison of preservice teachers' mathematics anxiety before and after a methods class emphasizing manipulatives. *Early Childhood Education Journal, 29*, 89–94.
- Wood, M., Jilk, L., & Paine, L. (2012). Moving beyond sinking or swimming: Reconceptualizing the needs of beginning mathematics teachers. *Teachers College Record, 114*(8), 1–44.
- Zumwalt, K. & Craig, E. (2008). Who is teaching? In M. Cochran-Smith, S. Feiman-Nemser, D. J. McIntyre, & K. Demers (eds.), *Handbook of Research on Teacher Education* (3rd ed., pp. 404–423). New York, NY: Routledge.