The Pennsylvania State University

The Graduate School

College of Education

AN INTERGENERATIONAL STUDY OF
THE MATHEMATICS ATTITUDES
OF PRESERVICE WOMEN TEACHERS AND THEIR MOTHERS

A Dissertation in
Curriculum and Instruction

by

Kathleen A. Schanbacher

© 2009 Kathleen A. Schanbacher

Submitted in Partial Fulfillment
of the Requirements
for the Degree of

Doctor of Philosophy

May 2009
The dissertation of Kathleen A. Schanbacher was reviewed and approved* by the following:

Patrick Willard Shannon  
Professor of Education  
Dissertation Adviser  
Chair of Committee

John Daniel Marshall  
Professor of Education

Kimberly Anne Powell  
Assistant Professor of Education and Art Education

Brandon B. Hunt  
Associate Professor of Education

Glenn Blume  
Graduate Coordinator for Curriculum and Instruction

*Signatures are on file in the Graduate Office
An Intergenerational Study of the Mathematics Attitudes of Preservice Women Teachers and Their Mothers. Kathleen A. Schanbacher, 147 Wilbur Way, Cogan Station, PA 17728. Pennsylvania State University, University Park, PA. Thesis adviser: Patrick Shannon

Math...it’s all around us in everything we do. Numbers, shapes, sizes, prices. With no other subject, it seems, do we experiences the same degree of love or hate relationship. Women, in this study, vocalize their feelings about mathematics. What shapes their attitudes toward mathematics, and how might that affect practice in elementary classrooms? Four undergraduate female collegiate elementary education majors are interviewed individually on three separate occasions in a qualitative, narrative, human science inquiry. Formative pasts, present attitudes, and future beliefs about teaching and mathematics are explored. Mothers are interviewed once, for intergenerational attitudes and influences upon their respective daughters. Discussion yields seven themes: beliefs about innate mathematical ability, parenting and mathematics, friends and the social consequences for women in mathematics, teachers, the classroom mathematics environment, beliefs about career equity for women in mathematics, and perceptions of women seeking mathematical opportunities today. Three of four dislike mathematics, perform poorly, subscribe to traditional sex role stereotypes, and cite a variety of supporting evidence, corroborated largely by their mothers. All are interested in improving their mathematical teaching skills, but three of four also admit to using elementary education as a complement to raising a family. In light of participants’ skills and beliefs about mathematics, and their respective motivations for entering the teaching profession, teacher educators may wish to reconsider traditional teacher preparation, addressing inadequate mathematical skills and recruitment of dedicated candidates. These troubling results beg further investigation.
## Contents

Acknowledgments ........................................................................................................... v

Preface .............................................................................................................................. vi

Chapter 1: Introduction ..................................................................................................... 1

Chapter 2: Method .............................................................................................................. 7
   The participants ............................................................................................................. 12
   Timeline for participant involvement ................................................................. 13
   Interview protocol ...................................................................................................... 14
   Data collection and analysis ..................................................................................... 21
   Interpretations, conclusions, and insights .......................................................... 24

Chapter 3: Interview and analysis .................................................................................... 26
   Candy ............................................................................................................................ 28

Chapter 4: Kathy ............................................................................................................. 48

Chapter 5: Brenda .......................................................................................................... 68

Chapter 6: Alison ............................................................................................................ 91

Chapter 7: Discussion of Themes .................................................................................... 115
   Theme 1: Beliefs about ability: Does Math come from Mars? .............................. 116
   Theme 2: Parenting and Mathematics: Whose job is it? ....................................... 121
   Theme 3: Math Friends and other Social Consequences ...................................... 124
   Theme 4: Math: Mystery versus Mastery,
   Content Preparation for the Classroom .............................................................. 129
   Theme 5: Math Teachers as Role Models ............................................................. 136
   Theme 6: Beliefs about Equity-In two generations ............................................. 144
   Theme 7: Seizing the Possibilities ......................................................................... 155

Chapter 8: Conclusions .................................................................................................. 165
   Persistence of Math Beliefs and Resistance to Change ........................................ 168
   The Impact of Math Beliefs on Teaching .............................................................. 169
   Insights About Careers and Success for Women in Mathematics ....................... 172
   Making Choices-Competencies and Careers ....................................................... 176
   Responding to the Findings .................................................................................... 180

Appendix .......................................................................................................................... 189
   Item A ......................................................................................................................... 190
   Item B ......................................................................................................................... 191
   Item C ......................................................................................................................... 192

Bibliography ..................................................................................................................... 194
Acknowledgments

My dissertation journey started with my dad. I was in high school...

Dad would wake me, and then head downstairs to make breakfast. When I got there, he would be at the stove, ready to scoop the gluey mass of instant Ralston into two bowls. With a splash of milk and a scoop of sugar, I’d open my math book on the kitchen table and we’d begin. I never liked the cereal, but I loved working on the math. Dad could share insights into how an equation was solved, why it worked, or how it was used. He was a mechanical engineer and he used math to design and build.

Math, he said, was a tool belt. You had to learn about each tool. You had to practice on examples at school. Ultimately, you could create new ways to use those tools.

My teachers introduced the tools, but he gave me an insight into their real world uses. I stole that metaphor, and have used it in my classrooms ever since. I have tried to help my students build a mathematical foundation using those tools, whether they be elementary school students or elementary school teachers.

I also wish to thank my husband, for his encouragement during my doctoral study. So many hours I was away at classes and doing research, and when I was home, he delivered meals, coffee, and ice cream snacks while I struggled with my computer. Not once did he try to tempt me away. I am sure he wore out many pairs of sneakers taking our dog, Chance, on long walks so I could have solitude to work at home.

I want to thank my committee. Thank you Pat, for your time, direction, and humor; Dan, for the friendship and encouragement; Kim for your help with narrative inquiry and qualitative research; and Brandon, for your guidance and gentle reminder to step back and take the breath. That advice renewed my energy. Thank you all.
Preface

It is a new semester, but it happens every semester; the first evening meeting of our three hour Math Methods class for elementary teachers. A room of college sophomores and juniors waits nervously for class to begin. The majority are women. Some leaf tentatively through their textbooks, others are already sharing childhood nightmares about mathematics with their friends.

No one, it seems, is smiling...

Alicia and I revisit the memory together during one of our interviews.

Me: Like how many kids, in our first class, when I said, “Be honest, who hates math?”
A: Yeah, exactly, almost everybody raised their hand.
Me: Yeah, at least half. (Both laugh).
A: And I thought I was the only one who didn’t raise my hand.

(Interview 4/9/08)

For the past twenty-five years, I have been a teacher; a teacher of elementary school children, and a teacher of prospective elementary teachers. I teach them math...and I love it.

I have observed over the years, however, that many of my students do not share my enthusiasm. I have seen attitudes about mathematics strongly expressed by female elementary students, college students, and women with whom I interact. When do these attitudes develop? How do they impact the mathematical performances of these individuals? And maybe more importantly, how do these attitudes intermingle with and influence their interactions with others? I wonder if there are patterns or similarities in their experiences that will enhance my understanding of their attitudes. How do we as students, teachers, or mothers impact mathematical attitudes of other women?

That is how I arrived at this study. By collecting mathematical memories of
school, home, and community, I hope to explore mathematical attitudes.

Memories are slippery things, that modify and stretch thin over time. That is why I interview students and their mothers. It is my hope to find commonalities in their memories. In an attempt to understand their pasts, perhaps they and we can address the present and insightfully affect the future.

For the past thirty years, I have been a teacher; a teacher of elementary school children, and a teacher of prospective elementary teachers. I teach them math...and I love it...maybe, with what I can learn and share from this study, I and others like me, can help them love it, too.
Chapter 1: Introduction

In August 2007, the National Science Foundation (NSF) issued a press release outlining five myths about girls and their participation in science, technology, engineering and mathematics (STEM). Their findings were startling:

*Myth: From the time they start school most girls are less interested in STEM careers than boys are.*
Reality: Until 4th grade, girls and boys reported positive attitudes similarly, 66 and 68% respectively. However, as early as second grade, stereotypes existed that by middle school, high school, throughout college and beyond persisted with negative connotations for females.

*Myth: Classroom interventions that work to increase girls’ interest in STEM run the risk of turning boys off.*
Reality: Interventions that work to increase interest among girls likewise increased interest among the boys.

*Myth: Math and science teachers are no longer biased toward their male students.*
Reality: Teachers often interact more with boys than girls in science and math. Even the interactions have a different quality. A teacher will help a boy by explaining how to do it, while simply doing it for girls and allowing them to watch. The study noted that good math and science teachers recognized that when instruction was inquiry-based and hands-on problem-solving and cooperative, both boys and girls were more motivated to pursue STEM activities and careers.

*Myth: When girls aren’t interested, parents can’t do much to motivate them.*
Reality: Parental support has been shown to be crucial to a girl’s interest in STEM.

*Myth: At the college level, changing STEM curriculum runs the risk of watering down important “sink or swim” coursework.*
Reality: The mentality of “weeding out” weaker students disproportionately weeds out women, not necessarily because they are failing. The study showed women often perceive B as an inadequate grade and drop out, while men with a C persist with the class.

The NSF study provides yet another example of why it is so important to look behind the numbers in quantitative studies. For years, researchers have pointed to declining participation in mathematics-related studies and careers by women. The numbers are consistent in their decline.
It has been argued that there are significant differences in the biology of men and women. Researchers claim biological contributions give males advantages. For example, men are significantly more capable in spatial perception and spatial visualization (Voyer, Voyer & Bryden, 1995; Geary, 1996). Others find that men are more “thing” or task oriented, skills lending themselves to math and science, and women more “people” oriented, skills useful in the humanities (Weisberg, 1986).

Others claim that the differences spring from social forces. Research shows there is no biological predisposition for mathematics (Jacklin, 1989; Halpern, 1989). And although there is no difference in childhood mathematics performances (Hyde, Fennema & Lamon, 1990; Walkerdine, 1998), there is a sizeable difference in mathematics representation in adults based on SAT scores (Lubinski, Wai & Benbow, 2005; Brody & Benbow, 1990). Researchers looking behind the numbers ask what is happening that may be shaping women’s attitudes.

Rather than adding to the ever growing mountain of statistics, it might be more instructive to explore the sites of construction, where girls adopt attitudes and are shaped by their environments (Walkerdine, 1998; Shaw, 1995). Shaw and Walkerdine have performed extensive research on four sites in particular: the home environment, where parenting impacts girls’ developing attitudes; school teachers; school curriculum, where both influence females; and peer relationships.

While agreeing that gender differences exist prior to school, Shaw (1995) finds within a range of parenting styles and configurations. A child’s foundation can never be gender neutral. Into that foundation a child receives, fits, modifies and elaborates on successive experiences. Walkerdine (1998) points out studies also assume that mothers stereotype daughters into roles, not always passive and dependent, but constantly struggling to define and redefine their
emerging perceptions of their places in society. While others find father’s interests more influential on their daughter’s interest in math (Davis-Kean, 2007). The collected lived experiences of women may deepen our understanding of these complex relationships as they recount their own experiences and attempt to find personal perspectives on their pasts.

Perhaps the stories of women will tend toward their experiences in school. Here, too, research has pointed to stereotypes both of women in and outside the field of mathematics and the impact they have upon career choices (Johns, 2007; Kiefer & Sekaquaptewa, 2007). “Teaching encourages pigeon-holing, classification and false polarization” according to Shaw (1998, p. 23). Walkerdine (1998) discusses perceived stereotypes in curriculum “Math and science are masculine, language is feminine” (p. 97). Only personal remembrances and testimonials can reveal whether teachers and curriculum are viewed from these perspectives by individual subjects.

Finally, what weight will individuals place upon the influence of their peers regarding their participation in and attitude towards mathematics? Group dynamics subject individuals to pressures of compliance. Deviations are fraught with consequences. Walkerdine (1998) and Shaw (1995) agree largely on the above, but should our concern be for how women deal with the social culture available to them today rather than in pointing causal fingers of blame? Who I am “informs and shapes who I am as a scholar” (Ladson-Billings, 1997, p. 52). How then will who I am affect who I become, specifically, as a teacher?

The existing research in combination with my own thoughts and experiences, and the stories the participants share, will determine the topics of this study. The lived experiences of women, whether reflecting subtle influence or blatant indoctrination, free choice or limited
options, will be revealed in the stories they wish to share in the manner in which they remember them. Through narratives, we can “examine the lived experiences that lie behind the statistics” (Reay, 2003. p. 303). In discussing their lives, not only will they deepen their understandings and insights, but share a statement of worth. Their stories, reflective of our own or not, are the foundation for the development of a person whose past, present, and future intermeshes with others, whose lives in turn are impacted by that shared experience. In describing and analyzing those sites of interest, there is value. What underlies our performance and our attitudes deepens our understanding of ourselves, others, and the world in which we live.

For thirty years I have been an elementary school teacher of every subject. In my experience, no single subject brings about as strong an emotional response as does mathematics. Each year I witness that love-hate relationship, more predominantly on the part of girls than boys. And in parent conferences, nowhere do I hear more apologies about ineptitudes than on the part of mothers as they seek to make excuses for the struggles of their daughters. Not once, in my experience, has a father admitted personal weakness, nor has he sought to excuse math as a missing or defective gene in his son. For more than ten years I have heard the same attitudes about mathematics carried into adulthood, from the female prospective elementary teachers in my math methods classes, even while some consistently outperform their male counterparts.

Why math? What is it about the subject that threatens and intimidates students? Why do girls voice these opinions more often than boys? The intention of this study is to delve more deeply into the experiences and perceptions of women. How and when do they believe their attitudes developed?

I include their mothers because mothers can support the study in two ways. First, they can verify or elaborate upon the remembrances of their daughters. Second, they can
take a longer view of the evolution of women’s attitudes about mathematics. Annually, we collect volumes of quantitative data about mathematics. We administer state tests and nationally normed achievement tests beginning early in elementary school, and continue testing as we competitively rank students for college and beyond. Test scores may indicate the computational abilities of men and women in mathematics, but the beliefs and attitudes that underlie those scores may reveal more, particularly in terms of confidence. Do women perceive mathematics success in terms of test scores based on memorization of techniques or do they value the understanding of concepts? Only in discussion can this be revealed. In an effort to explore these foundational experiences, to begin, I direct the discussions to three sites: the family at home, school teachers and curriculum, and classmates and friends. Do the women I interview believe that their attitudes are somehow innate, imposed by family and/or society, or are they unique to each of them as individuals?

As long as women dominate the elementary classrooms as teachers, it is important to attend to their attitudes toward mathematics. The next generation of students depends not only on their teacher’s ability to pass on the traditional algorithms in mathematics textbooks, but also on their teacher’s ability to embrace alternative algorithms in problem solving. This requires flexibility in mathematical thinking and a confidence that is not measured in traditional testing. Beliefs and subsequent performance can either motivate or inhibit a teacher, and in the case of these women, influence the lives of young boys and girls in the classroom.

The following chapters gather the experiences of four female preservice teachers. All four are students at a small liberal arts college. All four are elementary education majors seeking employment in the next two years. They come from backgrounds of varying financial status,
although all would be considered among the middle class with either one or both parents employed or recently retired. One is married and seeking a second undergraduate degree, one is recently engaged, and the remaining two are single. All have completed their methods block and are embarking on either externships or student teaching experiences in the next year.

Their stories are the foundation for the discussion that follows. Each is unique, but themes emerge among them that serve as discussion points. Conversations take place on three different occasions and focus on three time periods of their lives: the past, present, and future. In each case, they touch upon family, school and friends wherever relevant. From those discussion points, areas of interest and concern arise and are pursued by the interviewees or by myself as interviewer. Some serve as issues for reflection, while others provide issues upon which teachers and other teacher trainers like myself might act.
Chapter 2: Method

John Dewey believed experience, education, and life were intertwined (1938). The past, a lifetime of memories, was fit and molded to make sense of experience and used to reaffirm the present. He believed memories were used to self-educate, form attitudes, and inform the future as part of the decision-making process. These stories, these experiences, were where social science inquiry began, Dewey said, and these same stories lived and told could educate others (Clandinin & Connelly, 1994). I am drawn to this form of research because, “The heart of interviewing research is an interest in other individuals’ stories because they are of worth” (Seidman, 2006, p. 9). Theorizing experience, the possibilities of human science and the importance of narratives led me to organize my study as three conversations with four women and then an additional conversation with their mothers in order to explore the possibilities of gender and mathematics across generations.

Van Manen (1990) uses the term human science research. It is the science of studying people and their uniqueness, while at the same time seeking to find out what is shared that might be thoughtfully described. It is not research for the sake of research, but rather, research based on prior interest. “It offers us the possibility of plausible insights that bring us more in direct contact with the world” (Van Manen, 1990, p. 9). Van Manen (1990) distinguishes human science research from other forms of scientific research on this point. It cannot be conducted by disinterested or neutral parties.

“Any view is a view from some perspective, and therefore is shaped by the location (social and theoretical) and ‘lens’ of the observer” (Maxwell, 2005, p. 39). Like our participants, we work outward from our own biographies, from our own perspectives, into the
worlds of our participants (Lather, 1993; Denzin, 1997; Peshkin, 2001). Decisions of importance
are based on our beliefs of what is important, and in the case of research, what our opportunities
for learning are. Van Manen (1990, p. 5) terms it a caring act, “the intentional act of attaching
ourselves to the world, to become more fully part of it.”

“For narrative human science inquirers, it is crucial to be able to articulate a relationship
between one’s personal interests and sense of significance and larger societal concerns expressed
in the works and lives of others” (Clandinin & Connelly, 2000, p.122). The starting point of this
study is my interest in the attitudes of women toward mathematics, which in many but not all
cases, seems predominantly negative. Using a systematic practice of questioning, reflecting,
revisiting, and refocusing, it is a series of attempts to articulate meaning derived from
conversations. It acknowledges my own personal interest in the subject as a woman, a teacher of
mathematics, and teacher educator, while at the same time recognizing the impact those interests
may have on the human interactions taking place during the research.

Experience, it would seem, is personal and social. It has an inward importance and an
outward projection. It is not possible to enter others’ experiences perfectly, but rather, to
comprehend them by understanding their actions. It is like walking in the woods seeing a man
chopping wood (Seidman, borrows the metaphor from Schutz, 1967). The observer can have an
“observational understanding” of the woodchopper, but what he understands may not be
consistent with how the woodchopper views his behavior. Therefore, in the case of women,
mathematics, and their already established quantitative performance scores, we need to add
meaning through conversation. Unlike natural science, Van Manen (1990) points out, it is a
human science, the subject matter of which is the lived human world; experiences consciously
and meaningfully lived. “It is an attempt to accomplish the impossible: to construct a full interpretive description of some aspect of the life world, and yet to remain aware that lived life is always more complex than any explication of meaning can reveal” (Van Manen, 1990, p. 18). It involves “the human world of thoughts, consciousness, values, feelings, emotions, actions and purposes which find their objectifications in languages, beliefs, arts and institutions” (Van Manen, 1990, p. 3).

Experience is set in time and place, where the memory is triggered by new experiences and new environments. Experience is a complicated cloth, in which the shuttle travels not only from past to present to future adding length to the warp, but horizontally, adding the colors of inward personal emotions and outward projections of their impact. The shuttle travels diagonally across the fabric as well, as the stories and experiences shared by others tangle or support the beliefs embedded in the weave. It intermeshes with not only personal stories but those shared by others. In time, those stories may blend from separate facts to creative fictions. According to Van Manen (1990), human science research is retrospective, a reflection on lived experience. It is giving structure and meaning to what has been lived through.

Human research requires careful listening and recording of the stories to see, or not see, themes between and among these women as they relate mathematics to their childhoods, families, friends, fellow students, or teachers. It involves their interactions now, with their families, friends, teachers and the children in classrooms where they practice their teaching. It is a study over time, to explore the possibilities women saw for themselves, those they see as possibilities for women now, and to discover whether they feel society has evolved in ways that help or hinder women in STEM subjects in the future. It demands close reading, reflection on
themes, and careful analysis, to as accurately as possible report deeper understandings about the lived experiences of the subjects.

Narrative human science inquiry is an effort to, as faithfully as possible, honor the stories and shared beliefs of individuals. Conversations with all eight participants are recorded, transcribed and detailed. Effort is made to interpret and come to a self-reflective and critical analysis of the threads of the participants gathered together. It is an effort to find similar patterns that may exist, as well as additional themes that may have been overlaid, intentionally or unintentionally, by family, school, or community. These themes may be inter-generational or even societal. Van Manen (1990) describes this point of view as an exploration of human experience for which there cannot be only one interpretation. “No single interpretation of human experience can ever exhaust the possibility of yet another complementary, or even potentially richer or deeper description” (p. 31). The goal, then, is to record and consider the complexity of factors that participants bring to their positions as teacher candidates and mothers of these teacher candidates.

Clandinin and Connelly (2000) challenge the human science researcher to experience the experience and ask questions in every direction. This research is a journey to identify and analyze the sites of construction of women’s mathematical attitudes. It is an effort to explore, in-depth, the lived experiences of four women, to deepen our understanding of attitudes that are too often oversimplified to numbers or letters on test scores and report cards. Human scientific study does however, require its own objectivity. Objectivity means remaining true to the object (Van Manen, 1990). In contrast to scientific objectivity, which requires detached observation, controlled experimentation, and mathematical or quantitative measurement, human science takes
into account a person’s consciousness and purposeful actions (Van Manen, 1990). I have made every attempt to relate conversations as accurately as possible. Discussions have been tape recorded, fully transcribed, and edited for this paper, with the intent of excluding extraneous or side-tracked topics irrelevant or distracting from the focus and organization of information true to the subject of the research.

But human scientific research also requires subjectivity. Van Manen (1990) defines subjectivity as the attempt to show or disclose the object in its full richness and in its greatest depth. Here I have attempted to include the feeling and emotion expressed by the participants in order to establish the uniqueness of their testimony while attempting to minimize my own impact on the conversation, always aware that my own point of view might influence what my participants share. All four teacher candidates were students who had completed my math methods class a year ago, so even their academic standing could not be impacted by participation in the study, I was ever aware that being interviewed by a woman strong in mathematics was still potentially intimidating. To one of the four subjects, Candy, in spite of my efforts to put her at ease, this remained the case.

My venture into human science inquiry is written in the form of a narrative. It is a pilgrimage with four collegiate women, delving into their pasts, presents, and looking forward to their futures as they reflect upon their mathematical experiences and how those experiences have already and might further translate into their future plans. It is an effort to untangle the threads of the experiences they share with me individually over the course of three conversations. These experiences are separated by themes that have contributed to the formation of the personal attitudes and beliefs upon which they, as individuals, build character,
personality, and act upon decisions.

The beginning themes are derived from related mathematics research by Walkerdine (1990b, 1998) and Shaw (1995). It seems reasonable to look at mathematics in the past by prompting family memories, childhood school memories, and friendships. Follow-up interviews with each participant’s mother is particularly helpful in verifying and expanding upon rememberances. The additional phone conversation with their mothers also allows me to explore the possibilities of gender and mathematics across generations. Second and third conversations center around experiences with mathematics in college classes, and observations and internships in local classrooms. Future plans, although focused initially on the classroom, are drawn in a variety of directions by the interviewees themselves.

The structure of my interview process is based on Seidman’s in-depth interviewing. In separate conversations open-ended questions are used to explore a participant’s experiences and attitudes. The goal is to have the participant fit that experience into the framework of the topic of study. Following Seidman’s (2006) model, the participants attempt to place the context of mathematics into their lives and the lives of those around them in an effort to identify the factors contributing to the formation of the attitudes and beliefs upon which they base their actions and behaviors.

The Participants

The participants were chosen on the basis of particular criterion. Maxwell (2005) terms it purposeful sampling. “This is a strategy in which particular settings, persons, or activities are selected deliberately in order to provide information that can’t be gotten as well from other choices” (p. 88). The first purpose is to limit the study to individuals of similar collegiate experience in an elementary education program. The second, is to gain heterogeneity in the
sample to represent the range of attitudes toward mathematics within that program. The third goal is to use the differentiation between individuals for purposes of comparison.

The research was conducted with an inter-generational group of eight women. The group consisted of four university women, sophomores and juniors, from a small university of about 2000 students. The other four participants were mothers of the university women. To select the four university students, a preliminary survey was administered to all forty students in the Math Methods classes for prospective elementary education teachers, asking their willingness to participate in several interviews during the following spring semester. This was given at the conclusion of the fall semester. From these, four women were selected based on their availability, and the availability of their mothers to likewise participate in an interview.

Those meeting the requirements were then sorted by a question on the survey asking whether they liked or disliked mathematics. Students were chosen at random from both groups for a broader representation of prospective teachers. The focus group was perspective elementary teachers because of their potential to transmit their own attitudes to future students. The interest in their mothers was also to explore whether they, too may have been products of mathematical bias (home and school being two sites targeted by Walkerdine and Shaw in their research, 1998, 1995, respectively).

Timeline for Participant Involvement in the Study

1. The preliminary survey was distributed after the conclusion of the fall semester of the Math Methods courses at the university. See Appendix A

2. Contacts were made by email to reconfirm interest in participation and interviews were tentatively planned between February and May of 2008.
3. Once receiving I.R.B. (Penn State’s Institutional Review Board) approval to commence with the research study, students were contacted, permissions signed, appointments made and interviews were set up. See Appendix B and C.

4. A time and location was chosen to conduct the interviews during April and May of 2008. Students were interviewed in person. We met as soon as I could arrive on campus after leaving my regular classroom in the public school ten miles away. That placed our appointments close to 4 pm. Rather than meeting in a campus classroom, one student suggests I conduct the interviews at a quiet coffee house very close to campus where tape recording of the conversation could occur with minimal distractions. There we could sit comfortably at a small table and have coffee and a home baked cookie. These snacks gave us a few minutes to unwind and establish rapport. Seidman (2006) recommends a series of three interviews with each participant. In order to accomplish in-depth, phenomenological interviewing he recommends spacing the interviews from 3 days to a week apart. “This allows the participant to mull over the preceding interview but not enough time to lose the connection between the two” (p. 21). Each interview lasted approximately 90 minutes.

5. Mothers were interviewed by telephone, in conversations lasting from 60 to 90 minutes, at the conclusion of their respective daughter’s three interviews.

Interview Protocol

My first challenge was to develop the broad topics I wished to explore with my participants. As an elementary teacher, I realized that mathematics attitudes might originate at home since so many of my own students boasted a dislike of math by the time they were eight
years old. Therefore, my first general topic was to be an exploration of mathematics at home. I had also, in over thirty years of teaching, encountered a number of elementary school teachers who themselves admitted disliking mathematics. School became a second general topic. My own family experiences included a socially powerful sister who passionately hated math and surrounded herself with friends who felt likewise. So I included peers as my third general topic. Having read Walkerdine (1998, 1990b) and Shaw (1995) previously, I retained the curriculum topic for discussion as well, although I suspected the attention given to ethnic, gender and racial proportionality in texts would yield less interesting discussion now than in the past.

Finally, because I was a product of high school and college in the 1960s and 70s, during much of the women’s liberation movement, I wondered what my participants might think of mathematics opportunities for themselves and other university women in 2008.

My dilemma was how to engage my participants in conversation without giving it the feel of a structured interview. I wanted the individuals to narrate their experiences in a manner that would flow naturally as spontaneous recollections, allowing time for reflection and elaboration rather than structuring direct questions, unless I required clarification. I had already informed the participants I would tape record the conversations, and had purchased the tiniest recorder I could find, so they would not feel intimidated or distracted. My solution was to carry a small binder with a 5 by 7 inch tablet inside. In pencil, I jotted key words to remind myself of areas I wished to explore. I never took notes other than to jot a word to ask a follow up question once they had completed their stories. I tried very hard not to interrupt until they seemed finished with a thought. That, I admit, was very difficult for me.

The first interview was a focused life history. By reconstructing early experiences
with family, in school, and with friends, interviewees could share the ways mathematics influenced their lives. They could tell as much as possible about themselves up to the present time. First we talked about their immediate family. The participants shared where they lived, the occupations of their parents, and stories about their relationships with brothers and sisters. We talked about the math they saw at home and the kinds of play in which they engaged. I thought it remarkable when one participant admitted she struggled with math at play. This allowed our conversation to flow into other math at home, homework for example. Who helped? I gained some interesting perspectives about the family dynamics. Family dynamics around math played out much differently than other social arenas. Seidman (2006) had suggested avoiding “why” questions, and instead asking “how,” so participants could reconstruct and narrate the context of their own lives. I made every effort not to ask participants “why” to avoid speculative answers, although many felt they needed to justify their answers, which gave me insight into topics to explore with their mothers in later interviews.

When I transitioned the conversation from homework to school, it was originally my intention to share math texts and report cards, workbooks and worksheets in order to help participants remember their mathematical experiences. However, after looking at the report cards I had available, I felt sharing items involving grades would inhibit conversation or confine it to a quantitative focus, rather than encouraging broader discussion. Almost every participant shared grades spontaneously, interestingly, the weaker students more than the academically competent one. Likewise, mathematics text books and curriculum, it became evident, were among the least memorable of math artifacts. Not one could remark on math class other than to recall it was lock stepped and based on reading the book and performing calculations. Of other subjects, they could recall activities and share them with enthusiasm. So I abandoned all artifacts from the
initial conversations. Discussion in the second interview would focus more naturally on the current use of math manipulatives they were seeing and experiencing in the classroom.

Over a cup of coffee and cookie at the quiet coffee shop on the edge of campus, the initial conversations evolved into a more relaxed talk, with me asking about favorite teachers and friends with a watchful eye on opportunities to redirect the conversation specifically to math.

The first interviews also ran the longest. After ninety minutes, the college participants were reluctant to stop, so I made excuses that I had to be going. I did not want to overstay, and lose the enthusiasm we shared. We scheduled our next meeting and each said she was looking forward to our next talk. I was pleased with the outcomes. I had been very nervous about going into the interview with so little structure, but I had gathered a tremendous amount of information on my tapes.

After each interview I had 2 or 3 days to type the transcript. I struggled with the typing, trying to note as many pauses, gestures, and facial expressions as I thought relevant. Candy, in particular, often revealed more in her facial expression than in her very guarded answers. I also did an initial coding using the recommendations I found in Charmaz (1983) when I completed the type written copy. It seemed logical to me to identify each interview with its number, the first being 1, and the first initial of the participant’s pseudonym: C, K, B, and A. Being a visual learner myself, I then chose to use thick pastel magic markers. I highlighted the margins to indicate relevant conversation in broad areas I had initially chosen to explore: mint green for family, orange for schoolwork, yellow for teachers, pink for friends. Then I realized I had topics for which I had no color or compartment in which to categorize them. At
this point, I simply marked them with a red x, deciding it best to continue the interviews and see if they recurred and led me to subdivide broad topics or add new ones later on.

To prepare for the next interview, I reread the transcript of our previous conversation and noted my word cues as before. The second interview delved further into experience. The purpose of the second interview was to probe again, into their pasts and reconstruct details upon which their opinions of mathematics were built. In part, it was an effort to develop validity, by member checking, which I found in Candy’s case mattered very much. After considering her stories from the previous meeting, she did revise or edit at least one. Again, this led me to note that for clarification, I would again employ member checking with the recollections from her mother’s interview. The second interview was also intended to compare their experiences with the present, where the collegiate participants were currently seeing mathematics in the classroom. How were they like or different from their own previous experiences? Here it was possible to concentrate on sites of new meaning and how they were being incorporated into existing attitudinal frameworks. We spoke about college courses and their relevance to classroom observations and teaching practices in the field. We spoke of the use of texts and hands-on manipulatives they had seen in their methods class compared to the manipulatives they witnessed in classrooms. They related stories of how they themselves had learned and how they might better have learned using materials available today. Each participant steered the conversation away from curriculum and toward the teacher. Each noted personality, teacher-student relationships, and teaching style and recollected more about their own teachers. Alison went so far as to admit she wanted to model herself after her own second grade teacher. At the conclusion of the conversation, which this time seemed to end of its own accord after 60 to 75 minutes, depending on the amount of experience each had had visiting classrooms, we arranged our next meeting at the coffee shop.
Again, I returned home, typed and color-coded each conversation. My dining room now had 8 bulldog clipped stacks, ordered by conversation and participant. More red x’s appeared throughout the color-coding I had used before.

Beginning again with member checking, interview three was for reflection on the meaning of the stories shared. How had these stories about mathematics impacted the lives of the interviewees? What sense could be made of these experiences now? How would these stories about math and the way that individual understood them impact the decisions they made in the future? The participants shared speculatively how they saw themselves as teachers. They spoke about the teaching style they would employ, the manipulatives they considered vital to learning, and they even spoke about how they might help struggling students like themselves. More than one became emotional, Brenda, for example, was adamant about individualizing and nurturing students in school because she felt she had not received adequate help. We also spoke about opportunity. My most startling and unexpected twist took place at this point. The participants, each spoke about their desire to have families and careers. I had not considered this as motivation for entering the teaching profession and they took this opportunity to redirect the conversations.

We were no longer talking about math, but about economic concerns, timing a career and having children, and family responsibilities. Less a matter of upward mobility, they spoke of teaching as a good match with a family lifestyle. My interest in their ambitions and the opportunities available was skewed by their own personal agendas. Now I knew my study would involve subcategories within the areas I anticipated, but also categories I had not even considered.
At the conclusion of our talk, I gave each a thank you bag with coffee and treats since their finals were a week away. We all felt reluctant for the meetings to end. It had been stimulating conversation that they admitted bringing into other classes as questions and concerns about teaching. They had also initiated many outside conversations with their families and friends about the topics we had discussed. Again, I typed each transcript and color-coded it, adding the 4 stacks to the existing 8.

Each conversation provided a foundation for the next. The sequential nature of the interview structure provided a logic and controlled the direction of questioning. “The combination of exploring the past to clarify the events that led the participants to where they are now, and describing the concrete details of their present experience, establishes conditions for reflecting upon what they are now doing in their lives” (Seidman, 2006, p. 19). And given what they had reconstructed, it allowed them to consider where they were going in the future.

According to Seidman, internal validity was based on the consistency over a period of time, in other words, believability that the interviewees were giving serious thought to the questions, and making every attempt to say what was true for them at the time they were saying it. It was also important that when rereading the transcript, I, as the interviewer had not made leading comments, interruptions or redirections that tampered with the reflections on their understandings (Seidman, 2006). In the case of Candy, the interviews, I fear, may have violated these guidelines because she was so reluctant to speak unless I shared my own stories or over-elaborated upon the topic of discussion.

To further validate the stories, another set of interviews was added. The mother of each participant was contacted one time. Using additional recollections, I thought it possible to member check, compare or contrast, the mother’s memories with those shared by her daughter. It
might also be possible to explore attitudes and beliefs not only as individuals, but as part of a larger social structure, the family. At the given time and on the evening her mother had specified to her daughter to share with me at our third meeting, I contacted each mother after having reviewed all three conversations with her daughter. I did write some specific questions for each mother. I reminded her that the conversation was being recorded while I spoke with her on speaker phone. Many of the questions focused on the family and the math needs of her daughter. Others addressed the mother’s math background and her attitude toward math. We also spoke about her observations regarding math opportunities available to women today as compared with her own experience. The conversations were informative and cordial except for one topic regarding Kathy’s change in major at the university. These conversations, too, were categorized and color-coded.

I chose Seidman’s (2006) in-depth interviewing model of narrative inquiry as the vehicle to best organize, collect, and share the data of this human scientific study. It provided a sound structure and yet gave leeway for individuality. My subjects had experiences, personal stories, vital to the understanding of their mathematical attitudes, that required commentary and speculation, as well as literary review. This format allowed for all three.

Data Collection and Analysis

In lived experience, data is the term used for information gathered or collected. It is not to be confused with a quantifiable entity, the hard evidence available to other sciences (Van Manen, 1990). Although my personal experiences are the starting point for my research, they have been kept to a minimum by including them in the dedication and preface of the paper. This research is not intended to become autobiographical or a set of personal
mementos, although in the case of one participant, I reluctantly found myself sharing more than I wished or intended to encourage her participation in conversation. In the case of the other three participants, conversation flowed naturally, sometimes in unintended directions, some of which become additional topics based on the strength of participant concern, or were deleted because they shifted from the topic of the study.

Each interview was tape recorded on site and transcribed within twenty-four hours to include significant memos about body language and pauses, intonation and volume, to better interpret and understand the “subject’s reality” (Silverman, 1993; Lemke, 1995). Conversations were then coded. Initial coding looked for leads, ideas and issues in the data from as many vantage points as possible (Charmaz, 1983). The conversation was edited to eliminate side conversations, opening formalities, intrusions by servers at the café, etc. Then I began with general categories: family, school teachers and curriculum, peers, and the opportunities these women felt were available to them. Each general topic was color-coded. I thought of these figuratively as cabinets, each emblazoned with the number of the interview and the participant’s initial for her pseudonym. After initial coding it became evident I would need to subdivide the these general categories into more specifically defined compartments, or drawers, in that particular cabinet.

The second coding (Charmaz, 1983) clarified categories, or topics for interpretation. By second coding, I do not literally mean a single second coding. I refer to further refining the compartmentalization of the topics for discussion. This was a tremendous undertaking. After I had resorted all conversations by color, I took a general topic, like school, for example, and further differentiate the coding within that topic to address teaching techniques,
school supplies, positive teacher personality traits, and negative ones. These I maintained in the original color, but added A, B, C, D, etc., to designate my new subcategories, or cabinet drawers. Family was divided into compartments A through F. I coded them A. mom, B. dad, C. siblings, D. math at home, E. homework help at home, and F. family relations at school. By reorganizing that particular notion from the school category and sitting it alongside its counterpart, I could see from what type of person the participant felt most comfortable receiving remedial help. The stories about the role of women in today’s family and workplace were the most difficult to separate because the personal investments each participant brought to the study were so varied.

Some were based on personal experiences, others on hearsay, some on the experiences of friends, parents, or grandparents, and others on speculative generalizations. I coded and recoded many times. Ultimately I settled on splitting the role of women into their personal ambitions as teachers, their notions of their responsibilities as mothers, a comparison of their expectations with the roles their mothers played, their views on the opportunities available to women particularly in STEM subjects today, and the notion of equality between men and women in our society, A through E.

This entire undertaking became the section called Interviews. Here the essence of the conversations was shared for readers to gain a meaningful association with the participants and the interview process without having to experience the volume of material collected. Had certain family members played dominant roles in forming attitudes toward mathematics? Had particular teachers served as role models or discouraged these individuals from pursuing math? Had particular friends or classmates contributed to their attitudes? Did other themes not
previously considered come to fore? Each topic elaborated on a particular aspect of the
development and practice of mathematical attitudes of the participants in the study.

Interpretations, Conclusions and Insights

The paper was divided into chapters based first on individual interviews, to gather a
collective feel for each participant. To assimilate her personality within the confines of the
conversation, was first to better know her. Then, having formed a sense of the individual, the
themes in Chapter 7, allowed me to compare and contrast their reactions and responses
when lifted from the context. These snapshots contributed to what I determined as the
most relevant parts of the conversations regarding women, education, and careers, with particular
interest in mathematics.

The final section, was reserved for possible explanations. After scanning
across themes, exploring the similarities and distinguishing the differences an analysis was built.
Geertz (1973) describes it as guessing at meanings, assessing the guesses, and drawing
explanatory conclusions from the better guesses.

Ultimately, this human science study embraced a philosophy of action because it was
both personal and situated. The young women expressed concerns rooted in their experience that
were important to my life as a teacher. It was here I re-entered the narrative. I felt responsible
and wanted to better understand their individual attitudes so that I might make better decisions
not only in their best interest as future teachers of mathematics, but more informed decisions
regarding mathematics students in my own elementary level classrooms. Although each situation
was unique, there is still much to be learned from the relationship between research, lived
experience and subsequent actions. Knowledge pursued and meanings thoughtfully
gained lead to pedagogic competence. It is my hope, as a result of the research, that I will become a more reflective practitioner and a more deliberative decision maker, as Van Manen suggests (1990).
Chapter 3: Interviews

The Interview section is divided by participant. A description of the subject’s background serves as an introduction, followed by three separate interviews. Using common discussion topics, the interviews are organized consistently. Mothers’ testimonies are interspersed for detail, affirmation of the memories, and personal commentary to enhance the dimensions of where and how they perceived their daughter’s attitudes may have formed. Later, in the Conclusion section, subjects are compared across these and other more deeply embedded themes as they became apparent.

The first interview drew upon personal memories as mathematics students. We explored the subject itself: how it was approached in school, materials, teaching techniques, and desired outcomes. We discussed teachers and the qualities that made them outstanding. We looked at the family dynamics of education and the roles assigned to different individuals, particularly in regards to homework. Finally, we talked about peers. Were friends and relationships affected by math abilities, groupings, and aspirations? Although some general topics had been pre-selected, they became themes for the conclusion of the paper only if two or more the interviewees pursued discussion with stories, showed emotion, or became animated, over the topic.

Beginning with the elementary education major’s sophomore year, prospective teachers have the opportunity to visit several classrooms, to observe, and to teach lessons. Students in their junior and senior years spend additional time in the cooperating classrooms at a variety of grade levels. During the second interview each subject was asked to respond to the same topics: math as a subject, the materials, teachers, homework, and peer relationships from the point of
view of a teacher in training, ever mindful of her own experience as a student. How would past experience play out in personal intentions?

The focus of interview three was reflection. How did each participant view women in mathematics today? Had she observed differences between her mother’s generation and her own? How would she merge her perceived position with mathematics, her ambitions as a teacher, and her understanding of societal expectations in regard to women and STEM subjects?

I included my interview with Candy first, not because it occurred first, chronologically, but because I wished to acknowledge the particular circumstances under which her interviews were conducted. Candy was the first candidate to contact me, interested in participating in the research, and yet, she was the most reluctant to speak. I had the feeling she was always guarding her words, considering whether to share, worried about saying something that I would find disagreeable. She was reserved and shy, and did not move far from this posture even in the final interview.
Candy

Subject’s Background Information

Candy is a large Caucasian girl with thick sandy hair that cascades over her face. She sits, looking down, with her hands folded, almost clenched, in her lap. She is nervous, soft spoken, and painfully shy. It is nearly twenty minutes before she looks up and I can see the hazel color of her eyes. Her answers are often preceded with long pauses, and interspersed with giggles. Sometimes she smiles during her responses, as though remembering, but then pauses as though planning or guarding the ways she will share them. I find myself offering her much more explanation and many personal examples in order to elicit responses, and fear that I might be leading her responses by saying too much. She is, by far, the most difficult of the four students to interview.

Candy describes herself as the “middle child,” with two older sisters and a brother five years younger. Her mother became a “stay at home” after her oldest sister was born, and her dad remains employed as an electrical engineer. Their family lives in a suburb of a large northeastern city in the United States.

Having attended the same elementary school as her sisters, Candy says, “A lot of my teachers would say, ‘Oh, you’re Wendy’s sister.’ I don’t know if that was a good thing or a bad thing,” (interview 3/18/08). Then the old elementary school was demolished. “So they built a new elementary school about five minutes from my house. And I was their first 5th grade graduating class. (Laughing) It was a really big deal,” (interview 3/18/08).

Following elementary school, Candy remembers attending a middle school where students were grouped into three sections, and then a large high school of about 2,000 students.
Currently attending a small private university, of also about 2,000 students, Candy is a sophomore, majoring in elementary education. She resides with eight other women, none of whom are involved in teacher preparation.

Interview 1: Personal Remembrances of Math in Their Pasts

Topic of Math: The Subject

1. Candy (interview 3/18/08)

    Candy described what appeared to be a traditional sort of classroom. Every student had the same textbook, workbook, and/or worksheets. Students covered the lesson in the text with the teacher, and received accompanying assignments provided by the series’ publisher.

    Me: Did you do the textbook and worksheet kind of thing?
    C: I remember a few workbooks.
    Me: Did the teacher teach you as a whole group? Did everybody do the same thing at the same time?
    C: Um...

    I tried to prod her memory without telling her what I was already expecting to hear.

    Me: Like a lot of teachers have reading groups, but they don’t always work that way in math.
    C: In math we were all doing everything at the same time.
    Me: I guess differentiation wasn’t really heard of back then.
    C: I remember much more about middle school. Um...

    I learned quickly that Candy was a sensitive girl who was very careful not to offend, even though I had assured her that no one we spoke about would ever be able to identify her in my final paper. She squirmed and guarded her language as she continued.

    C: A lot of the students had this idea that there were different levels of math. Like there was a smart class and there was a class that was really far behind, at risk, and there was anything to that. If it was true or if...
    Me: That’s very possible. Where did you think you were?
There was a long pause. She didn’t want to use a label probably because her education courses railed against labeling or pigeon-holing children. I remembered I had done so in my own classes.

C: Um...I think I was in the average...um... I don’t want to generalize that way but...
Me: That’s ok, that’s what I’m interested in...the way you perceived what was going on. You wouldn’t have known...they wouldn’t have told you.
C: Yeah, right...

Again, she paused, uncomfortable to go on. So I went into one of my own examples, aware that I might be saying too much, but needing her to clarify for me.

Me: But the kids usually figure it out. Like ours had letters. For some reason the groups had letters and for some reason the bottom group was the D group. And the kids said, “Well that’s the dummy group.”
C: Our teachers told us it was like that because of our schedules, or something like that. But a lot of it is I remember being in the lower group. The bottom group I remember the families being a little rough. The advanced or higher classes were the kids who knew they were smart. I just remember being average and getting through it.

Since she was interested in becoming an elementary teacher, I wondered how she had learned the 390 basic facts, some of the biggest stumbling blocks through grade 4. Many teachers did and still do use timed tests of up to 5 minutes to check for memorization of addition, subtraction, multiplication, and division facts.

Me: Did you like memorizing math facts and taking timed tests?
C: NO!!!! For the timed tests I always freaked out!

Then she quickly looked around, embarrassed, and laughed. This was undeniably the most spontaneous, loud, and most emotionally charged answer during any of her three interviews.

Me: Too much pressure?
C: Yeah, but I remember one boy in my class who was the smartest kid in our grade and he always seemed to blow through everything. And I’d be sitting there, like, ok, and I’d be looking around to see who else wasn’t done.
...But there would always be other kids still working when I finished. So I really didn’t feel that I was all that different....

She went on to qualify her answer, and in doing so, verified my suspicions. Candy memorized
her math, by poems, by steps, but not by logic. And that shaky foundation could not withstand
the test of upper level mathematics.

As a matter of fact, in conversation with her mother on 4/11/08, the same topic arose. Candy’s mom had mentioned how much the teaching of mathematics had changed. She remembered memorizing multiplication tables, using flash cards, and making multiplication charts. When she supplied her daughter with one, the teacher had forbidden Candy to use it. Her mother went on to describe the rhymes her daughter had learned to remember math facts. “I just always remember, maybe I was learning it from a memorization standpoint, but to me, once you memorize it, it’s always there. So many times the kids had no idea what the simple facts of math were.” Candy’s mom stated she had learned in a more straightforward way and actually understood the concepts, where the math facts came from, better than Candy did. “They [her children] don’t know what I do,” she continued. “Like heaven forbid if you’re in the store and the computer goes. They can’t subtract or put two amounts together without a calculator.”

C: I did well if there was stuff with rules, some rhyme or some phrase to remember it, rather than strictly memorizing it all the time.
Me: So the memorizing part wasn’t your favorite thing. Was the problem solving, or practical part of math easier for you?
C: I don’t remember liking word problems. If it was something I could handle. If it was something I could see it to work it out... That was a lot easier.

We switched to upper level school math memories, where the term “average” resurfaced again.
This time, however, taking on the qualities of resignation and acceptance.

Me: And in the middle school they started grouping?
C: Yeah, I remember there were three different levels and I think I was in the average class. So that was ok.
Me: Is that where your friends were?
C: Yeah.... and [in high school] I remember going in you went into geometry if you were in the average level then algebra.......... and there were kids who were retaking geometry..... or..... and I think that’s when I started to figure out who was doing ok.
Clearly, Candy never developed a confidence level in mathematics. Her independent skills, she had already recognized, restricted her to a lower elementary level of mathematics for her career.

Me: So when you went to college...
C: I took stat.
Me: How did that go? Did it make sense? Did you understand standard deviation and all that?
C: It makes some sense. There are so many patterns that you can do on Excel where you don’t have to sit there and do every one.
Me: So you are getting away from the memorization and getting towards practical application.
C: I think there’s a little clearer because you’re applying it to something real life.

Candy neither indicated an area of mathematics where she excelled, nor a topic of mathematics she enjoyed for its face value. She memorized rhymes and trick phrases, but lacked the comprehension to apply the mathematics. However, when provided with concrete manipulatives, she realized patterns and concepts made more sense.

Topic of Materials:
1. Candy (interview 3/18/08, restated in interview 3/31/08)

Candy was very clear that she had used manipulatives in mathematics on rare occasions. She remembered a store in her kindergarten classroom where she used play money. But with a broad smile and a giggle, she remembered playing store at home. “A lot of times I practiced on my own. I went downstairs to my school.” She also mentioned base 10 blocks and shapes in geometry.

C: With math I remember using cut out money. I remember the cubes, the base 10 blocks, I really don’t remember too many others, but a lot of it was right out of the book. I remember building things in elementary school when we actually cut out the cubes and put them together, but I don’t remember that happening too much after elementary
school.

Topic of Teachers:

1. Candy (interview 3/18/08)

Me: So you decided you were going to be a teacher very early?
C: Yeah…and I would pretend I was teaching there [downstairs]. It would help me to talk out loud even though I was talking to myself. I was talking out loud and teaching myself as I was going through it.

On 3/31/08 she added:

C: I think second or third grade. I like that age, I would even do first. I like the lower elementary. I really think that the first few grades, they really start understanding math and reading, and I want to be sure they have an appreciation and really start to get into math and start to love to read. That’s the way early on and I just want to establish that in them.

Her mother concurred in our conversation on 4/11/08.

Mom: Well it’s certainly been her dream, oh my gosh for as long as I can remember. She’s always talked about it, played school for hours. I think that it well definitely be a good thing for her. She tends to, no matter where we are, gravitate to children. She plays with them. She’s drawn to the little ones. She loves babysitting. She’s never turned down a babysitting job unless there was a total conflict. I can remember my older daughter doing it once or twice, but that was definitely not her thing. When somebody’d call she’d say, “But my sister will do it for ya.” (Laughs)

It was interesting to me that Candy had decided to become a teacher early in elementary school yet she could not name a single one of her elementary teachers. There was nothing that stood out to her from her own elementary career. She was not negative, she simply had no memories of them. In middle school the first memory was far from fond. In high school, she remembered one female math teacher, and otherwise all male math and science teachers.

C: Basically, in middle school my math teacher was Miss Hauck. She was no treat. She was known as a really bitter lady.

Candy hesitated, like she was feeling bad about what she had said.
C: I really had no problem with her and she really seemed to like me in class so...kids teased me...”The teacher likes Candy”.... teacher’s pet kind of thing. She had had my cousin so there was a little bit of a connection... but she was definitely tough, but we got along pretty well.
Me: When you needed help could you go to her?
C: I remember going to her a few times. Um......I would go to school early and talk to her about homework.

But her tone was wavering and her eyes kept looking away, as though to indicate that the experience had not been too successful. She brightened with her next teacher memory. It was her math teacher from 8th grade. The memory of the person was fond, but the subject, again, less so.

C: In 8th grade I remember we had a lot of fun. It was Mr. Malore. He called his classroom Maloreland. He had a huge sign. His classroom was really loud and he got really excited about math. It was fun going into class but if I wasn’t understanding it, I just tried to get through it....
I remember I was tutored by my teacher... for whatever reason. I don’t remember what we were working on, but I was not getting it. So I would stay after school or go in early.
Me: Did you find he helped you understand it?
C: I understood it enough to get through it, but if I had to sit down and explain it....I’m not sure I would be able to do that.

Candy’s memories of mathematics teachers were based more on their personalities than their ability to teach mathematics. And clearly these teachers, at least from her childhood perceptions, did not take enough of a personal interest in her success.

C: Yeah.... Precalculus was awful. I don’t remember anything. The teacher was terrible and he was a male. He studied something completely not...he didn’t study to be a math teacher...he didn’t study to be a teacher and just decided he wanted to get into teaching. He was very hard to approach...um... that whole year was a waste.
Me: That’s weird. So the guy wasn’t really a teacher.
C: Yeah. His main goal when he was in school was not to be a teacher.
Me: He told you all that?
C: I think...my sister had had him and he told her class.
Me: So he was still there...
C: Yeah, and then I got signed up for his class and she said, “Oh, good luck!” (laughing)
Me: Did your sister ever help you with math?
C: She had help from my dad, too. For a while, any homework whether it was math or spelling or vocab or anything...he wanted to check it out. So we had to get it out, have it done by dinner. So a lot of her experience was similar to mine.
Me: Do you think she was about the same quality of student?
C: Yeah, I think we were about the same

Getting help was something Candy did remember vividly. Her family and the individuals who helped tutor her she remembered with fondness and appreciation. She made it very clear that without their help she would not have gotten through much of her mathematics. In no other subject did she request or require such support.

Topic of Homework:

1. Candy (interview 3/11/08)

From the start of her schooling, Candy remembered fondly the involvement of her family. Beginning in elementary school a pattern was set. Both she and her sister had help from their dad. Candy’s mother had clear recollection of exactly the same scenario, adding her own experience with math homework as a child. It sounded remarkably like history repeating itself. In their family dynamic, males took the leadership role in mathematics. It was, according to Candy’s mom, “their thing.” Mothers neither sought nor desired it. And in much the same way as her mother and grandmother, Candy had adopted a similar attitude.

Mom’s story:

Mom: Well...I’m not a big fan of math. Mainly because when I had to do algebra and problem solving kinds of stuff I really hated it. And I can remember my dad, who really loved math and was a builder by his trade, and did math to figure all kinds of things with buildings, he would sit so patiently with me trying to get through the problem solving kinds of things, and the geometry and the algebra.......... And now that I think back on it, with my kids, that’s how my husband tried to help them. My dad was very good at simplifying it and putting it in my kinds of terms. And helping me understand it better. Yeah, he was definitely the more helpful parent as far as my two parents go.
Me: Now Candy, did she get more help from dad than from you?
Mom: Absolutely, yes. Very early on in early elementary, I could probably handle that kind of stuff. Once they started getting up into middle school, he definitely took over. And being an engineer that’s definitely his thing. (Laughs) He works with figures all the time,
ya know, (Interview 4/11/08).

Candy’s story:

C: My mom could help me with some basic things, but my dad would always look over my homework and once I got older a lot of the math went straight to him.
Me: So dad was the kind of homework go to guy. Mom helped in the younger grades but then she felt more like she was ready to hand it over. Right?
C: Right.
Me: When your dad helped with homework was it very painful? Seriously, did he explain it or did he say this is how it’s done.
C: He definitely worked through things. He gave examples and made me do it, watched me do it, helped me through whatever I wasn’t understanding. There was (nervous giggle) a lot of (giggle again) tense homework sessions.

She didn’t continue, so I told about my dad, a mechanical engineer and how he tried to help my math-challenged sister. Her tears...his frustration. As she listened, she smiled and nodded in agreement, then continued.

C: Right. I think my sister would have a few things to tell you. One night my dad broke a pencil....(laughing between pauses) because he was so frustrated...and ya know....he just got to the point where he was ....just....done. She still brings that up....the night he broke the pencil. Um....but my dad, being an engineer, he knows his math...He would look in my book, and we would read it, and then he would do it one way and the book was maybe a different way. Some of them [teachers] seemed like it was ok, and others seemed like they taught you and they didn’t understand it or they weren’t comfortable with how you did it. (The story came up again during the interview on 3/31/08).

There was a difference in how dad had learned math or how he would have best solved the problem. He understood what the book or teacher had said, but he sometimes had a better or a different approach that worked for Candy as well.

Even when mom or dad didn’t help with math, they supported Candy with rides to school to meet teachers before or after school. She returned again to the 8th grade teacher where she received what she called “official tutoring.”

Me: Did your parents set that up?
C: The teacher offered to tutor me.
Me: When was that? After school or before?
C: Yeah...my mom or dad would drop me off before school until home room started. 
He’d go over the homework, make sure I understood what was going on in class. He’d 
review what he had taught the day before. 
Me: Then you felt more confident to participate in class?
C: Yeah...right.

I wasn’t sure from her smile and tone if she agreed with me or she was being a bit sarcastic.

Math still didn’t come easy. It was all a matter of survival for Candy. 

Senior year, Candy’s problems with mathematics were compounded with medical issues.

She had mononucleosis.

C: Actually, my senior year of high school when I had him I had mono so I missed a lot of work, and obviously everything that was going on in class. And I had work that was brought to me at home but....oh God....it was awful. Being sick, and I had so many questions and so I was continually lost and there was absolutely no way I could get caught up and he wasn’t very helpful.
Me: So he wasn’t willing to spend any extra time with you?
C: No, no
Me: Did he want you to drop the class or something?
C: No, I don’t think it was he didn’t want me there....he wasn’t...he didn’t...he was very, he would have an opening drill in class, then he would get the paper, and we would do some book work, and he would do his own thing. I think his teaching style and personality didn’t... work well.
Me: Do you think he was comfortable with the math? Do you think he understood it? Or he just couldn’t explain it?
C: I don’t know
Me: Your dad must have been really involved when you had mono.
C: Yeah, every subject, math reading. My mom and my dad and my sister tried to keep me on track.
Me: Did you get help from your friends?
C: No, there wasn’t time to do homework at school.

Our discussion of friends and the role they played in mathematics was an interesting one.

Candy’s friends were all in her classes, with similar abilities and grades. She admitted having only one friend who was a math class or two ahead of her.
Topic of Math Peers:

1. Candy (interview 3/11/08)

   Me: So nobody ended up a math teacher.
   C: (She laughed, shaking her head side to side as though the suggestion was absurd)
   Nooooooooooo...I don’t think so. Business maybe. We were all pretty similar. One of my girlfriends was a math class or two ahead of us and she was teased a little bit, but most of us were pretty similar in a lot of classes. I know a lot of kids from my high school are in college now, I know some went into the service, and are not in college. When I’m thinking back about high school and my real close friends here, I’m the only one who wanted to be a teacher.

Since she indicated a slight prejudice against her friend who was good at math, I decided to pursue her feelings about other students with mathematics ability.

   C: I thought of them as nerdy. Obviously they were getting it. They were doing something right but that whole factor of so many kids in class weren’t as fast or understanding it as quickly well I guess they were jealous. But I think a lot of them were just the nerdy kids. They sat with their calculator all day.

Candy clearly had a distaste for successful mathematics students. Whether a stereotype of appearance, jealousy, role modeling at home, or simple safety among peers of similar values and abilities, Candy had decided math was not for her.

   Me: So it sounds like maybe there was a stereotype thing in your head too, that that’s not for me because they’re nerdy.
   C: Maybe...maybe. My sister, a lot of her friends, a lot of the people she was friends with were in the AP classes, those real high classes, like ridiculous high scores on the SATs. Two or three of her friends are into biology and are chemists and things like that. So they are obviously different than the friends I had.
   Me: And she got along with them ok? How did she fit in with them? Academically she wouldn’t have been in their classes. Was she in sports or something with them?
   C: I think it was just socially they were friends at school and social places just separated. I remember she took a trip to Canada. And my dad went to pick them up. They had all just taken SATs and they were talking about their scores and how well they did and they asked my dad how he did on his SATs. And he said, “I don’t even remember. It just wasn’t important.” But these kids were very proud of how they were doing in school. So I guess there was a little bit of...I mean, she did well, but um, she was average compared to some of her friends’ scores. So I guess that’s a little bit of a difference between my sister and I. That some of her friends were a few math levels above her.
It appears Candy’s confidence level in mathematics, the examples set at home, and her need for acceptance by her peers as she worked her way through school impacted her career decisions. She chose to focus on kindergarten through second grade, the lower elementary levels, based on her love of small children and her limited ability in mathematics.

Interview 2: Evaluating the Modern Classroom and Testing the Water

Topic of Math: The Subject

1. Candy (Interview 3/31/08)

C: I was in a third grade classroom. That was this past winter. Third grade was a long time ago and it was interesting watching how the kids were responding, what they were grasping and the teacher had a lot of different approaches for spelling and for math. Every math lesson was... I thought it was interesting, every day she would just start out, it was across the board different activities. Kids had to think about money, time... even if they were doing a lesson about something different, they were still working with different aspects.

Me: Spiral review?

C: Yeah, right. They would do time or money with decimals and review so they didn’t forget everything that they were learning then. So that was something I really liked a lot.

Even though the teacher still used a traditional mathematics series in the classroom, Candy saw the spiral review as an initiative worth practicing in her own classroom. Another difference from her own experience was grouping for math. Although the classroom would not have been considered differentiated on many levels for the needs of all students, the room accommodated a group of students who were more needy of time and individual attention.

C: She had a group that were... um... taken out because they weren’t as advanced.

Me: A pull out.

C: Right... but I think it was 5 to 7 students and they would work with an aide. You know, she [the classroom teacher] did have them for the other subjects. Even if it was just reading directions, those kids would be that much more behind. For math they were pulled out, but the rest of the class was all on the same page.

She went on to note that although she had not seen learning centers in the classroom, she would
use them herself to further individualize. There, children could do reinforcement as well as challenging activities that were self-correcting or partnered, totally independent of teacher involvement.

C: I think if some kids are understanding, there are so many things you could do with them [learning centers]. The kids could go to them and move on while I help everybody else who really needed it.

Candy hadn’t mentioned seeing students work with memorization of math facts, so I asked her about how she would handle multiplication facts in a third grade. Apparently, Candy had come to realize the way she memorized math facts was inadequate. Her focus had shifted to memory with meaning.

Me: Do you feel memorization is important?
C: I think it’s important as long as they’re understanding the rules they’re memorizing, not just memorizing. Does that make sense? ‘Cause I feel like a lot of times they know how to do something but they don’t know when to apply it when something else comes along. It seems like they could save time, like if they memorize some things, but if they don’t know what to do, memorizing doesn’t help either.

Clearly, she had been doing a lot of thinking about mathematics. In order to be useful, she wanted to insure her students not only had the tools, but knew how to use them. She went on to describe some of the manipulative tools she had seen and used.

Topic of Materials:

1. Candy (interview 3/31/08)

In the third grade classroom, Candy had worked with the children on geometry. They did a lot with angles, triangles, and polygons. They used straws and twister ties to demonstrate right angles and equilateral triangles, for example. She described the math journals where students wrote their understandings and drew rotations.
C: Some kids would be looking around to see what everybody else was doing, but they did that every day and by the end of the week, everybody really understood what they were supposed to be doing. That really seemed to work, and definitely the hands on was beneficial for a lot of the kids.

At a math fair event for first and second grades, Candy did an activity with a balance scale.

Me: So how do you think that worked
C: I remember you saying after a couple of kids came through, you’ll be more comfortable. That definitely proved true. I remember some kids, I had little cars and little Cookie Monster, and I would try to use Cookie Monster and try to reach out and say, “How many cookies do you think he ate and what does he weigh now?” I tried to make it fun. I remember one boy wanted to just play with it.
Me: He was probably somebody who’d never used a scale and needed time to explore.
C: Some of them knew. Some of them had an idea what it was, but they’d never used one before.
Me: And when you came to the fourth grade, tell me about the project you did.
C: We worked with different leaves. We did a circle graph and had that categorized. And again, it got easier by the third group.
Me: I think the whole thing of classifying is interesting too, because kids look at something and think of how they would classify it, not that they could classify the same leaves in three different ways at the different stations.
C: Right.
Me: So you are obviously getting comfortable with manipulatives. You came up with your own, and sometimes they are cheaper and more effective.
C: I also likes the lesson because we tied a few different subjects. I think that’s important. It was a lesson in math, but we tied in science, and that really worked.

Candy was making some significant observations about the ways education is changing in the elementary classroom. Students were not only being met more at their ability level, but concrete manipulatives aided in visualizing operations and making connections to real world applications.

Me: So do you think you will use a lot of manipulatives in your own classroom?
C: I think so. Um....I said for me, I’m a real hands on person, so I don’t see myself teaching another way when I know it was better for me.

Topic of Teachers:

1. Candy (interview 3/31/08)
Candy was particularly impressed with the teacher she observed in the third grade. She noted that the woman had every student involved. She had them describe, write, share, partner, and physically become involved with their learning. “She would have them stand on the floor and move in a 90 degree angle clockwise.” It worked, and the kids were demonstrating their understandings in ways other than paper and pencil tests. She wasn’t doing the math for them, she was working through it with them.

Topic of Homework:
1. Candy (interview 3/31/08)

Candy had not had the opportunity to work with the classroom teacher on homework. I wondered how she would deal with parents who taught their children alternative algorithms, or did not support the education system for their children.

*Me:* How will you work with parents in your classroom? How will you get them on your side?
*C:* Well, I’d hope that every parent I’d run into would be respectful and appreciative that I’m trying to help their son or daughter….but I know there will be some…..
*Me:* How will you handle kids who come in without their homework?
*C:* I think...I mean....I don’t know if it would work, but if it was a small group they could come in a few minutes early or miss recess a few minutes to get help. I don’t want them to miss all their free play.
*Me:* Then homework becomes a punishment.

She seemed at a loss, so I described a lunch bunch plan I used. She seemed impressed with the idea of eating lunch with the kids while doing the math, then still giving them their recess. But I reminded her, recess might be the only planning time she had, and she would be giving that up. Still, she seemed devoted to making every effort to get children and parents on her side. Her closing comment was...

*C:* I think it will definitely be a lot of work.
Topic of Math Peers:

1. Candy (interview 3/11/08)

   Interestingly, in every classroom experience thus far, Candy saw mathematics as a collaborative effort. Whether between the teacher and class in geometry, individuals or pairs at her weighing station at the math fair, or small groups of five or six students at her graphing activity in fourth grade. Each and every activity relied on cooperation, explanation, and providing concrete experience with a mathematical concept. Speaking, writing, and drawing conclusions from numbers were key elements in promoting not only relationships with math, but relationships with peers.

Interview 3: Where in the World are Women in Mathematics?

Topic of Career Opportunities

1. Candy (interview 4/1/08)

   Our final interview began with a discussion of math ability and whether it was a matter of nature or nurture. Candy was unsure about what makes us different in our math abilities.

   *Me: Some people say things about a math gene. Do you think there is anything to that?*  
   *C: I don’t know......................I think there is.*  
   *Me: Do you think boys and girls learn differently?*  
   *C: You were hinting at, and I was saying that some teachers treat boys and girls differently, if you’re disregarded and you’re not taught in a way that makes you want to be doing math, or liking math, or understanding math....*  
   *Me: Then it’s not so much that you’re inheriting math, but that you’re picking up subtle hints all the time?*  
   *C: Yeah, I think so.*

I pressed her further to tell me about the differences she saw in boys and girls in school, and how those differences led to career choices.
Me: But at this point, if you’re seeing a difference in the ways boys and girls are performing, are there attitudes, is the confidence the same? Do you think that will affect career choices?
C: I think so.....I think there’s something to say about the different genders as teachers. A lot of the younger grades are women, and a lot of the middle, a lot of the high school are male teachers.
Me: Do you think it’s a status thing? Like a pecking order and the men didn’t want to be at the bottom?
C: Yeah, I think there’s a lot to that.
Me: So do you think even though we are making an effort, and we are aware girls have underperformed in the past, and they are changing in elementary school now, do you think that socially outside of school, people are still in that mind set that math and science are still for boys more than girls?
C: I think so....I think it’s still out there.....a lot of times when I think of business, I think of business MAN.

Candy was cognizant of her own experiences that boys had been the academic leaders in her classes. She was also aware that her teachers had overwhelmingly been women at the lower levels and men as she entered math and science courses in the middle and high school. Even in her own family, her father had been the successful mathematician while she, her sister, and her mother had struggled with math. Whether an issue of genetics or social acceptance and stereotypical perpetuation, Candy was keenly aware of male dominance in mathematics.

Topic of Equality

1. Candy (interview 4/1/08)

Pursuing the idea further, I questioned her about why she thought women in society allowed this to perpetuate.

C: I think women have the house, they are definitely the nurturers, and you choose a profession that fits that, and that’s why women are the elementary teachers. They want to work with the children. Yeah, I think that has a lot to do with it.
Me: So even if it’s not a genetic thing....I don’t know if that nurturing part of it is hormonal or what....even if that wasn’t part of it, a career choice might be how you see yourself juggling things. Do you see boys having the same sort of conflicts the girls do? Like wanting to get married, have kids, so the teaching thing fits.... do you think boys give that a thought?
C: (laughs) I don’t think so. There are all those roles at home. Even that is dependent on the woman doing that.
Me: So you think society isn’t walking the walk we are talking?
C: Yeah.

Candy brought up her father’s company and the woman engineer he employed while she was in college. She noted that the woman was doing mainly clerical and receptionist jobs. She wasn’t allowed to get into the heart of the engineering work.

C: And there’s a woman working there now, and again she’s doing a lot of the secretarial work, things around the office, but she’s not taking advantage of her degree. And the rest of the office is men.

Interestingly, when mom discussed the opportunities for women today, she too, brought up the women engineers in her husband’s office. She said that for her generation, opportunities were mainly secretarial or receptionist, but for girls today, opportunities are endless. When I mentioned my conversation with Candy, that she felt there were more opportunities but they are not necessarily equal opportunities, she agreed. She too, felt that girls still had a harder time breaking into traditionally male dominated fields than boys do. She also said that the role modeling for girls, taking care of children, the mother cooking and cleaning, had not yet been adequately shared with men.

Me: So you are seeing that as the proper thing to do? When you think back to your grandmother, did she work?
C: I’ll speak about my mom’s mom because I know...I am real close with her. She didn’t go to college, my mom didn’t go to college ever...and my grandmom worked for a few years but...I think some time when my mom was little, she stopped working. And then my mom worked until she started having kids. She thought they needed the attention at home. I think whatever you grow up with, whatever you’re used to, you go with it. If your mom’s doin’ it and it works for her, then you’ll probably do it too.

The Topic of Measuring Success

1. Candy (interview 4/1/08)
Mom also agreed in her interview of 4/11/08 that many women were careful not to take on too much. If you wanted a family, you knew you probably couldn’t juggle it all.

C: I’ve always wanted to be a teacher. I’ve also always wanted a lot of kids. And I do want to get married. (Laughs) And I’m a lot closer to becoming a teacher than I am to having kids, of getting married. (Laughs) But I hope that happens.

Candy went on to say that she felt that women of her generation were compromising how successful they would be in a career because they didn’t want to take on too much. She felt that was something that was driving her career choice. She agreed that even though Title IX had initiated legislation for equal opportunities in the world of work, the family life part hadn’t changed so much that women could take advantage of equal opportunity. Mom agreed.

In closing my conversation with mom, I shared that Candy had said her mom was exceptional at what she did. She raised a family, had a job. Candy saw that as successful. That worked as a good path to follow. She didn’t feel the need to force a career. She wanted both worlds. The difference was that college was expected of her generation, and families were getting started later than in generations before.

Mom: Yeah, that was very different for me. I didn’t have any interest in going to college. I wanted business, and in senior high school I told my mom what I wanted. So I took business, worked three years and had my first daughter, and never worked after that. I was a stay at home mother after that.
Me: Now all the pressure’s on the girls to get 30 credits or a maste’rs degree in the first 5 years after they graduate.
Mom: I told her, finish school.

And so she will. Candy’s closing thoughts were, in spite of her career and family goals:

C: I think the teaching thing’s gonna happen before the boyfriend and family part, but I’m still hoping it will balance out in the end.

Candy likes children. That is why she wants to be a teacher. She admits this and her mother confirms it. Her father is her math role model, and the family member who helps her
most with mathematics. Although she has taken extensive math in high school, she is still uncomfortable with the subject. She believes she can teach math using manipulatives not yet available when she was in school. However, she stereotypes good math students negatively and nor does aspire to its ranks. She feels mathematics is more accessible to women in college now, but ultimately, she believes society does not provide women with equal opportunity. For herself, she feels teaching is a good match because she intends to someday marry and have a family.
Chapter 4: Kathy

Subject’s Background Information

Kathy is petite Caucasian, with straight dark hair to her shoulders, and eyes so strikingly dark brown the pupils are indistinguishable. Calling her enthusiastic would be an understatement. When she enters the room, you almost feel the energy level rise. She wiggles and fidgets as she speaks, literally pouncing on each question. Her speech is exceptionally fast, and she uses broken phrases, jumping from thought to thought. Sometimes, in reading the transcription of our interviews I wondered what she was really trying to say. At our first interview she was proudly sporting a large engagement ring. She was a junior and her boyfriend, a recent graduate of the same university, was now a first year law student in the Midwest. She bubbled with plans for their future as we chatted before the recorder was officially turned on.

Kathy grew up in a rural community not far from the mid-Atlantic coast. She comes from an intact family. She has a fraternal twin sister, and two younger brothers. One is a senior in high school and the other is a freshman. Dad is a dentist and mom was a stay at home mom for a long time. Within the past six months she went back to work part time as a physical therapy assistant.

Unaware of much math going on in her own home, she mentioned that her father used math and chemistry in his business. She had worked in his office as a secretarial assistant, numbering teeth on charts. She smiled, “obviously math.” She added, “And I guess like for the insurance companies so that they would pay how much they would pay and that kind of stuff,” (interview 3/17/08).

“Actually, my mom, I don’t know how much she has done math, I guess she can tell you as much as I will. (Apologetically) I’m not, you know, the math student per se but I couldn’t really tell ya,” (3/17/08).
Kathy seems to feel she must apologize for not being good at math. She does this continually during the interviews. I try to smile and brush these comments aside. I don’t want her to focus what she thinks I want to hear. I want her to answer the questions as honestly as she can.

**Interview 1: Personal Remembrances of Math in Their Pasts**

**Topic of Math: The Subject**

2. Kathy (interview 3/17/08)

- *Me:* So you didn’t really see a lot of math at home.  
  *K:* No, not too much, no.  
- *Me:* Other than like grocery shopping and stuff like that.  
  *K:* Yeah, yeah, the typical lifestyle type of things.

In school, however, she remembered workbooks and textbooks.

- *K:* K to 2 there was a workbook and some manipulatives. Like I remember base 10 blocks. I remember using them. You know like the rods were tens and ones like place value and stuff. But then in third through pretty much high school was text book style. I mean there were some worksheets we did, there were textbook pages. Some would take it to the board.  
- *Me:* Are there any particular teachers you are thinking of now?  
  *K:* I started not liking math in 6th grade.  
  *Me:* What happened to you?  
  *K:* We played Around the World with math facts and I became a lot slower than some people and (nervous laugh) and some people didn’t want me on their team (nervous laugh and long pause).

Clearly this was a hurtful memory. Kathy’s face was serious and her mood unhappy as she revisited the past. She was unusually quiet for several moments.

- *Me:* So you really didn’t like competition.  
  *K:* (still very serious) No.  
- *Me:* So did you like the memorization or word problem part of math?  
  *K:* (brightening again) Definitely the memorization, and in third grade we would have the math sheets where you would have the math facts and you would have to fill in the missing number, and I would LOVE doing them. LOVE THEM!
Me: So you loved multiplication, then word problems and critical thinking?
K: I didn’t like them at all. I could do the ones where so and so came in first and so and so came in second, I could do those but they never really kept my interest.
Me: What kind of grades did you get in school?
K: Um...they weren’t letter grades. They were like satisfactory. I got like S1 or S2. But when it did become letter grades it was like a B or C. I tried to capitalize on some of the things I did understand. And then I slid on my knees for some of the things. I was glad we only had to take three required years so I thought I could get out of it not taking math my senior year.

Later in our conversation I returned to what she had identified as a turning point in math for her.

I was curious what else had happened in 6th grade that she could so readily identify it.

K: I just realized I wasn’t good at it. I had a difficult time understanding concepts and there were other students there....(long pause, I was expecting her to describe perhaps the better students, but she changed tack and spoke in her own defense)....I could grasp the concepts but I needed more time with it.

Kathy also identified another aspect of her defeatist attitude in 6th grade. She’d been grouped, and although she rationalized her placement, her twin had been assigned to the top group.

Although she denied feeling competitive with her sister, there was an edge to her voice indicating otherwise.

K: I was placed not in the highest, but the academic, not remedial, but if I’d been in a group between academic and remedial I think that would have benefitted me a lot because I would have had more time with the concepts. I mean, I think, I just saw myself not having a mind for math and I saw my grades slowly dropping, and that didn’t help my self-esteem with it.
Me: Having your sister do so well...
K: Oh, yeah, that too.... there’s always that competition.

Topic of Materials:

2. Kathy (interview 3/17/08)

Kathy recalled using base ten blocks in early elementary school, for ones and tens places, but no manipulatives beyond first and second grade. On 3/20/08, at our second interview she
elaborated further. She never remembered using play money at any time in school. Just the workbooks, worksheets, and textbooks.

Topic of Teachers:

2. Kathy (interview 3/17/08)

Kathy had no recollection of her elementary teachers teaching math lessons other than the occasion of having used base 10 blocks. She spoke in detail about the textbook style of teaching she encountered in middle school and how it turned her off to math. Rightly so, it was far removed from the philosophy of teaching advocated in her elementary teacher preparation program.

* K: That’s when I started to realize, in seventh grade, if you don’t get it, we’re moving on. And I mean, I was told that in the classroom, they would say that. If you don’t get it you have to come in for help because we’re moving on.

Me: Did that happen to a lot of people?

K: Um.....I know quite a few kids in the class who were on the edge. Some people would go in but some people didn’t. But it seems as though they were teaching with what completely conflicts with what I’m learning now. You know. You have to pick up from where a student can start and go from there to prepare them for the tests.

Without ever alluding to the teacher as a personality, she dwelled on the teaching style.

* K: I remember, I think it was seventh or sixth grade, the teacher taught from an overhead. It was all on transparencies. You tried to do certain things, but I feel like actually trying to involve the kids in doing it would help them. Like doing things on the board. Having them come up and do the problems could’ve had a greater effect on me understanding the problems.

I wondered if she was missing the nurturing aspect of teaching. Were her teachers now predominantly male for mathematics?

* Me: Did you have a lot of men teachers?

K: Yeah, I think my first male teacher was seventh....and then I had him again for 8th grade, then I had a freshman male teacher and a sophomore male teacher. So I had like four years of a male teacher from seventh until sophomore year of high school. Some
things I understood in sophomore year and some things I didn’t. But the personalities of the freshman and sophomore teacher were completely different. The freshman teacher was more outgoing, verbal, more extraverted, more energetic in the classroom. Where the sophomore teacher was very quiet. This is how you do this and that was it.

Me: Which teacher did you connect better with?

K: COMPLETELY the freshman teacher.

Kathy admitted she also needed the personal interest. This teacher had also coached freshman basketball. She had been on the team and he had sideline conversations with her. He cared about her not only in the classroom, but outside the classroom as well. When I asked her if she thought math teachers were different from other subject teachers, she hesitated, taking time to mentally compare her English teachers with her math teachers, specifically.

K: No, it think it was just a random draw of all kinds of people. I just think of teachers and their attitudes toward the subject. Ya know, it seemed like maybe, the way they said, “This is important, and you have to learn this, and it’s important in everyday life.” And there were those teachers who would do that too, but they would just list off random things and you needed to know it, but they’re not really showing students why. There were other teachers who just showed up for their job and did their job and went home. Even though they were very intelligent in their subject, and they knew the math, it just didn’t seem they put 110% into their job. I don’t know….it’s hard to show people you love everything you do all day.

Kathy realized that teachers come in varying shapes, sizes, and personalities, and in varying degrees of dedication. She was accepting of that, and a bit regretful that anyone had to have those teachers. I asked if she thought perhaps the quality of teachers differed in their assignments from top groups to the bottom. Did the better teachers seem to get the top groups?

K: Maybe some of the teachers were more effective in their instruction. And she [twin sister] was in the higher math class and I was in the academic one.

Kathy considered the possibility and didn’t rule it out. Perhaps the math advantaged [like her twin sister] were afforded advantages in the classroom.
Topic of Homework:

2. Kathy (interview 3/17/08)

Having twin daughters of differing abilities had to have posed some problems. And while Kathy tried to minimize them, I was curious to know more about her perceptions of the family dynamics.

Me: So you don’t really think there’s anything to that math gene thing? Like some people get it and other people don’t get it?
K: I don’t know.....yeah. I think she (sister Lauren) just has a different way of thinking about things. I think I make things harder than they have to be sometimes. And she just goes with what’s given to her.
Me: Now you’re really outgoing. You’re very verbal. Is she the same way? Or...
K: No, she’s not outgoing. She used to be worse. She’s gotten a lot better. She plays basketball. She’s really good at basketball. So she’s had to be interviewed a lot, so she’s had to become better. So I think she’s a lot better now. She’s not afraid to pick up the phone and order a pizza.
Me: Sounds like she’s a totally different personality.
K: Yeah.
Me: Are you identical?
K: No. Some people think we’re not twins. They think we’re lying. Some people think we look so alike. We don’t but...like some of her friends at school will say (to me) “That’s so Lauren.” And her friends will say the same to her. We both think, and we’d both agree we have different personalities.

As a matter of fact, when it came to math, mom was more than happy to rationalize Kathy’s shortcomings as genetic.

Mom: Yeah, and I think poor Katie has my brain as far as that. She’s no good at math either. That was just not her thing and I know she would just have a hard time understanding, and her sister loved math. Her sister’s more like my husband.

Later in the conversation on 3/23/08, she revisited the topic again.

Mom: Yeah, I say to her all the time, “You got my genes...poor kid.” She struggles a lot. And I don’t know, I think part of Kathy panics, then she works herself into a tizzy and it doesn’t matter if you explain it until the cows come home, she wasn’t gonna get it because she was already in that mental frame. And I think as she matured she’s gotten better with things like that.
Me: Seems like she was a little bit shy.
Mom: And too, I think in her situation, her twin sister was so much better in math. Math
came easier to her sister.... than to her.... I think that was another thing. There was a lot of rivalry.

Mom shared the story about separating the girls in school, although she did not agree with it at first. Kathy never mentioned missing her sister in school, just the aspect of math grouping.

Mom: They were separated in kindergarten and I wasn’t happy about it. But I thought they needed each other for company, but they were right across the hall, and the teachers were very good about letting them go to the doorway and wave to each other. From then on they were always separated. I think in high school they might have had a class together, but never math.

At that point I raised the question about homework. I wondered who helped Kathy. Had the girls ever done homework together? I asked Kathy and mom about it.

Me: And your parents were pretty fair about not comparing you with your sister?
K: No they were happy as long as I did my homework and tried as hard as I could. If that wasn’t good enough and I wasn’t passing then they say I had to go get extra help and they’d say, “You have to spend more time with that.” And my sister was never like that... And I was like, (whining) “Why…”
Me: Did your sister ever help you?
K: Yes, she’s majoring in it. So...(apologetically) it was tough. I was horrible in it. More in high school and when I took a summer course after my freshman year in college. She helped me then.

Mom agreed:

Mom: Her sister took a lot of honors math because that’s what she was good at. And Kathy just took college prep. And so they were definitely split by their ability. They’re just very different. They’re just totally different. They’re kind of like night and day.
Me: Although Kathy did say there were times when her sister helped her with math. She was appreciative of that even though they might have had a lot of rivalry going on.
Mom. They did. Now that they’ve gone to different colleges I think they’ve gotten closer.

I asked Kathy if she had received any math homework help from anyone else.

K: Yeah, towards the end of high school, but in the beginning it was my dad. (More specifically on 3/20/08 she said dad began helping with math during middle school when she started dealing with algebra. “It was just more abstract.”)
My mom not so much. I guess some things, she could understand it, and if she could understand it... it was harder for her to help. But my dad helped more than my mom.
Other than that, my grades, I started to have difficulty too and my dad had a patient who was a math teacher who ended up tutoring me for geometry and algebra II. I would
understand it, you know, when I took more time with it.
Me: Was the tutor a woman?
K: Yeah.

Mom concurred in her conversation with me on 3/23/08.

Me: But she said dad was very patient. She also got help from teachers. She either went in early or got help right after school or before class.
Mom: Her teachers were good to her. One of my husband’s patients is a math teacher, and I remember Kathy didn’t like her because she thought she was sarcastic, and she probably was a little bit, but she knows her stuff and um...I think when she got past, “I’m just dumb,” and realized this lady is here to help me, and got to know her personality, she did a lot better with her. And then she took a math course over the summer.
Me: Yes, she said that.
Mom: “And if I get into trouble my sister can help me [Kathy said]. Since she was going for math, but then you have the sister thing, and this is my summer too, and I don’t want to be sittin’ here doin’ math and I said we should have asked the math tutor to help, and she did come toward the end to get her through the tests and exam. I said, ‘Just think, you don’t have to take any more math after that. You won’t have any other math classes, just get your math done and you don’t have to worry about it. Then you can do whatever you want to.’”

But Kathy wasn’t finished. She had to take Methods of Math Instruction, where she had to learn and understand the math she would be teaching in elementary school. I continued the conversation with mom as follows.

Me: You know, because she struggled, she really has that empathy and she’s already thinking of ways she’s going to make things better for her own class. And she said, “Those manipulatives, those things we used in class. I’d really like to get those. I think I would have understood fractions better.” She’s already planning for the things she had trouble with.
Mom: That’s great. We had the textbooks and the workbooks.

Her tone was one of relief and pride. It was very apparent she had struggled with her daughter through school, feeling helpless to offer academic aid, but always there to give her emotional support. It was as though she could finally see the end of a long bumpy road, and my words had reassured her that it was going to work out for Kathy.
Topic of Math Peers:

2. Kathy (interview 3/17/08)

Me: Now let’s talk about your friends at school. Was your sister like your best friend? Or how did that work? I have twins in my family and they were totally separate. Different friends. Like different peer groups. You said you didn’t have a really big school.
K: Our high school was bigger because it was a regional high school. Our school district wasn’t so small, but they weren’t huge school districts either. So as far as my friends, my sister and I hung out with some of the same individuals, some of them were stronger in math and some of them weren’t. It was like some of the people in the group could help other people in the group. Like Lauren and her friends were really good at math and mine weren’t as interested in math.
Me: That’s how my sister and I were. My friends were good at school and her friends weren’t so good at school. Ok then, so you had a mixture of friends and they helped you, or you helped each other. It wasn’t like if you weren’t good at math it wasn’t cool.
K: Yeah, we liked them because they helped us.
Me: So they weren’t like nerds out there.
K: Oh, we would joke about that...but then seriously, “We really do need your help.”

It was interesting that even though Kathy and her friends were well aware of math stereotypes, they were willing to joke about them with her sister and her friends and use those acquaintanceships to their advantage. “We liked them,” Kathy said, “because they helped us.”

Being good at math was not seen as a key to popularity, and, it appears, Kathy and her friends were not working to become part of that realm. They were working just hard enough to survive their math classes and fulfill the high school requirement of three years of mathematics.

On 3/20/08 I asked Kathy if she had ever helped anyone with math. She immediately smiled and said she had in elementary school, when she had learned her multiplication tables. She took pride in the fact she was able to recognize that when you reversed the factors the answer was the same.

K: Even if I didn’t get the concept, kids came to me because I could do it quick.
Me: It’s interesting that some girls say the breaking point for them was when they had mastered the math facts and got to problem solving and analysis.
K: Yeah, oh yeah!
Me: That’s when they lost interest.
K: Uh, huh! Yeah!

Kathy knew and understood her learning style. Memorizing math had served her well to a point, but without understanding, her foundation in math could not support the later learning required of her.

Interview 2: Evaluating the Modern Classroom and Testing the Water

Topic of Math: The Subject

2. Kathy (interview 3/20/08)

We began today with a discussion about how the teaching of math is changing. We spoke about alternative algorithms and multiple correct answers. Kathy became nervous when I described an open-ended question similar to one you might find on the Pennsylvania State Assessment Test in 4th grade.

Me: It wasn’t so straight forward. You know I had a group of kids doing a PSSA open ended prompt yesterday. They’ll give them a menu or something like that and you have to...Well, the problem went, you had $13 and you had to plan a party. They had to spend $4 on a video and then they had to buy 2 healthy snacks. Then it says, show the math and spend the money. They you spend the $4 on the video and the 2 healthy snacks and you could go on with that. The girls had the worst time with that because “Well, what if it doesn’t come out even?” They wanted it to be a perfect zero answer at the end. “Well, go on if you want.” They had the worst time with that. The boys were buying junk food and the girls were very worried about getting the right answer. Some were really distressed about that.

K: Well, it’s totally about that. I don’t think my teachers told me there’s not a right answer. It’s about how you explain yourself. I didn’t really get that. But I think if I did I would have been frustrated. Like, what do you mean? Of course there’s a right answer, like it’s math (sing song voice). I mean, that’s your expectation ever since 1 plus 1.

Me: And we’re dropping it down lower now, but especially since 6th grade we see more of that. There’s more that one way to get there.

K: Right

Me: And that freaks people out...

K: Yeah

It was evident from her body language, the way she stiffened in her seat and her eyes darted
around the room, that she was feeling nervous about handling this kind of question in her own classroom. She had said 6th grade was where math fell apart for her, but now she was facing the same kind of problem solving at a lower grade level. I was curious how she would approach this type of mathematics. I found out she was determined to try, in spite of a serious lack of confidence.

*Me:* And you said you would want to teach 4th or 5th grade, but you definitely didn’t want to go more above 6th grade. Is there something, well, a lot of stuff is dropping lower, what you thought of 6th grade for you is dropping down now. Like did you have algebra in 6th grade?

*K:* What I’m feeling now, I think I can understand it now. I mean, I hope I can understand it. Just bringing myself back now, and thinking in a mathematical way is completely, like, torturing your mind. And being able to do it myself, and I think sometimes I still find it difficult. And then to teach it to another child, I guess the challenge with it is that it’s not what I thought. It would be hard for them as well. I knew it was hard for this reason and they think it’s hard for this reason? Then I wouldn’t... I think it would be frustrating and it would especially be a challenge for me.

We talked about an observation she had done in a first grade classroom. The teacher had used traditional worksheets with pictures for counting across the top, creating the basic fact families using addition and subtraction. I used this as an opportunity to explore the notion that mathematics is now being approached through patterns, and to revisit the activities I had done with them in the Methods class.

*K:* They would have worksheets that would have five of them on top. But the rest of the worksheet would be just 2 plus 3, simple math facts. I think that it got easy for them, but I think pretty much it was like that. I also remember in class there was a lot of pattern work. With the color blocks and the cubes you put together?

*Me:* Now why do you think they did that? What was the foundation with those things? Why would they want to do patterns?

*K:* I think they wanted to work on sequencing with them. I’m not sure. Like first, second, third, just understanding the meaning behind them and then having them in a certain order helps them organize thoughts in their heads.

*Me:* Not just that, but everything in math is a pattern, place value...so once kids start looking for patterns they start looking for patterns everywhere. There’s a lot of that research that hadn’t been done, and now we’re understanding yeah, you have to lay the
groundwork. So I’m curious if you’re seeing those kinds of things happening in the classroom.

K: We did a lot of patterns with base ten blocks, and colored noodles, and those kinds of things. So they wouldn’t just think of blocks. They could use markers, crayons, anything to define order.

She was beginning to see how foundation work was necessary to building understanding. Not games and math toys for the sake of making math fun, but concrete objects to demonstrate concepts that children could touch and feel to make connections.

K: My math fair project was patterns, too! And for the lesson we did in the [4th grade] classroom, my part was more with weight. I had them invent something on their own. Which was all strategies. Like you said, there was no real answer to how to build the boat. The one kid made one that was flat and I didn’t know if that was gonna work and it held the most weight. I think what appealed to the kids more was the unknown in a way...the excitement of whoa, look at so and so’s work.

It was interesting to me that as she described the girls’ approach once again, working for that one right answer, she was, in essence describing herself and her approach to mathematics in elementary school. Follow the steps, memorize the facts, fill out the worksheet, get the right answers. She was not a problem solver. I was intrigued that she had chosen this project for her lesson in 4th grade, and was not recognizing what was perhaps a gendered approach to mathematics that would have to be dealt with in her own classroom.

Me: How would you compare the boys and girls in the class that day? Were the boys more risk takers? More aggressive? I got to stand back and watch who’s copying who. Were you able to notice that or was it such a...

K: I think it was the boys. Maybe there was a boy and a girl that partnered up and they would work together. But if the girls, it was two girls partnered, they wanted to watch and see what everyone else was doing. Maybe like we said before, they wanted a right answer. The guys were like, forget the answer, I’m makin’ my boat how I want it and forget the answer.

Me: Some started over. I remember that.

K: I don’t think they even thought of it as math. They just had fun. It was more the challenge, or an activity they thought was good. So...the girls knew they had to come up with something...try to hold this much weight...maybe they thought there was some kind of trick behind it. So I think the guys had a little more of a relaxed fun time of it. The girls were more antsy, they wanted a worksheet about it, am I doing this right?
Me: If you remember the base ten blocks were used for a lot of things. How are you gonna deal with memorization of facts, though? How are you gonna teach those? I know you didn’t like the way you had to learn them. The way you were tested on them with the time tests and all. Do you think it’s necessary to learn those facts?
K: Um…I definitely think they’re necessary. Like sight words. There are math facts you will use in your everyday life. I mean, it’s just easier to learn the math facts because you use them so often. I do think it’s necessary to memorize them earlier because they’re gonna be using them all the time.

Kathy had come to the conclusion that math was no longer what she had experienced as a student. It had become a series of patterns and relationships, with memorization of facts one of the many tools she would have to give her students to prepare them for the real world of problem solving.

Topic of Materials:

2. Kathy (interview 3/20/08)

During one of her observations in a special education classroom, Kathy was impressed with technology available to the students.

Me: Do you think it’s an advantage to use a lot of manipulatives. I mean, you, yourself, didn’t experience a lot of them, so do you think now, they way they teach is better?
K: I think it is. I think you have to use them the right way though. Because if they see it, that can help them too. But if they’re auditory you can confuse the students a little bit more. They may learn from just saying it. But one thing I think is extremely beneficial is the smart boards they put in because they can have children come up and they are using the technology and getting what the possibilities are. They can physically just touch the board, move it over, those things really help people. The class I was in with special needs children, kids were doing math problems without any problem with it. So if they could do it I think other kids wouldn’t have any problem with it.

But more important, perhaps was her realization that she, as a teacher, would need time to develop a comfort level with mathematics and the materials available for the classroom.
Topic of Teachers:

2. Kathy (interview 3/20/08)

One of the problems of teaching methods at the university is that the materials we use in class may not be familiar to the supervising teachers in the elementary classrooms. It is a careful balance to be achieved between exposing our students to new ideas, and sharing that information with the public schools, without sounding arrogant. We cannot be too critical of the people who will be training our prospective teachers during their student teaching. We are always learning ways, testing new ideas, to help our students succeed.

Me: Anything that you’ve taken to heart and thought, “I don’t want to be like that,” or “I like that, I want to be like that.”
K: I think maybe I want to be... mainly I want to become more comfortable with math and mathematical things. As much as I can, a positive attitude towards it and if people see that, then they won’t think you’re having such a difficult time with it, and then you know, everyone...you don’t have this negative thing that’s already associated with math. So that’s one thing I really really should address initially and immediately. Classes look on everything you’re going to be teaching and they think that, they get the message, that it’s important and it’s necessary.
Me: Every subject is your favorite subject.
K: Exactly. Because it’s important, and you can say maybe, “I had trouble with this, I wasn’t perfect and they’ll see...”
Me: Yeah, you can make mistakes on the board and they’ll catch them.
K: Yeah, and I think that’s good because they realize my teacher’s not perfect either. I think that’s an important balance.
Me: Another thing is you’ll be able to say, “I never had these tools when I was in school. You’re so lucky. We’ve got pattern blocks, look at this!”
K: Yeah, I see that.

Just as important as a teacher connecting with her students, is a teacher connecting with her parents. I asked if she had thought about how she would get parents on her side.

K: I think it’s very important to be open and honest with them when their kids are having difficulty. I think it’s important that they (laughs) help them. Um, but I think most importantly, the most important thing is one on one. To pay a lot of attention to the teaching. I mean if a child is having difficulty, find that and identify that early and you need to have different work stations in your classroom, to work on things and maybe reinforce them within the child. So they can have activities or a worksheet that they can
do to reinforce the idea with their parent. I mean, I think it’s important to send home some work, but other than that it seems dry. If it’s interesting to the child perhaps it’s something they’re good at, something they can grasp. It could be an activity or something at home they could do. Something that could make them interested. That could help, and then as far as, I mean, the parents coming in and trying to help their child, if you don’t have support can be really frustrating, but you do your best in trying to help their child. If you do this with their child, you build more knowledge of whatever mathematical concept they have.

I always close my beginning of the year parent letter, “Together we can make this your child’s best year ever.” I think Kathy is on the same page.

Topic of Homework:

2. Kathy (interview 3/20/08)

We only touched on the topic of homework, and she stated that she thought it was necessary. However, we did not discuss how to get it completed, and what to do if it wasn’t. She did not observe any classroom teacher deal with that topic, other than our discussion of lunch bunch.

Me: I do have a thing I call a lunch bunch. The kids and I do math while they eat lunch. I don’t use any other time than that. I mean, food gets on stuff but...when you send something home for a family fun night, and some of them come back with nothing, you know? I say, “If you didn’t have a chance to do this, I’m having a lunch bunch.” A lot of the kids who did it at home want to come in too, but I say, “Only the kids who didn’t get a chance. That keeps it positive.

K: Yeah, right.

Me: And they don’t miss their recess. Because if I kept them in from recess, now that’s a punishment.

K: Yeah, lunch bunch is a privilege.

Me: So that’s something to keep in mind. You can still pull the kids in even if you can’t pull the parents in.

Topic of Math Peers:

2. Kathy (interview 3/20/08)
In every experience, Kathy saw students working together. In small groups they worked with manipulatives like noodles and markers. They planned with partners in the boat building project in 4th grade. They shared strategies among groups, as they solved problems. Unlike her own experience where assignments were individual and class work was teacher led, she was attracted to students sharing strategies and working cooperatively. She even noted that workstations, or learning centers, would have a place in her classroom, where again, students would work with partners to reinforce and extend their learning.

Interview 3: Where in the World are Women in Mathematics?

Topic of Career Opportunities

2. Kathy (interview 3/21/08)

It was interesting, in her first interview on 3/17/08, Kathy spoke about receiving help in math from her sister and her sister’s friends at school. As part of that conversation I had asked if any of those friends besides Lauren had pursued math careers. None had.

Me: Did any of them besides your sister become math majors?
K: Um...I don’t think any of them did. I know one of them started school. She was really smart, then she quit being a math major and went to beauty school. She told me that a lot of people think beauty school is easy, but mixing chemicals and all that stuff. Another one went to Lebanon Valley to be a special education teacher. She’s taking a lot of the same courses I am, but another one might be journalism, but it’s not really like they started out looking for a career in math.

When I asked Kathy’s Mom on 3/23/08 if she felt career choices had changed over the years involving women and mathematics, she said,
I don’t think girls were interested in that when I was in school. I graduated in ’78. I’ve been out for a while. I think guys were pushed more into math. They were pushed into engineering, things that went with math.

Me: So with Kathy’s generation you see it more as an open opportunity with math? For girls? So you think things are changing?
Mom: I think so.

Topic of Equality

2. Kathy (interview 3/21/08)

During our first meeting, (3/17/08), Kathy and I had spoken about gender, genetics and math ability. Clearly, she had had experiences that spoke to neither gender dominating the other, although there was indication from both Kathy and Mom that they thought there was genetics involved in inheriting mathematical ability.

Me: Oh, there are mixed messages about men and women in math roles in your experience. Your dad, your mom, your sister, your tutor.
So what do you think about stereotyping? Maybe when you were young with your dad helping you more than your mom...but as time went on you saw more women being successful.
K: Yeah, I don’t think there was either female or male. Some people were just better at math. I struggled and Lauren was good at it.
Me: You were lucky to have such a strong support system...with your dad, and a tutor.
K: Yeah, I knew the person teaching me would be my tutor and my dad would understand the math concepts and then my sister....it wasn’t like either gender had you know a stronger...

But when we spoke during our final interview, she seemed very sure that there were circumstances beyond personal preference operating against women in the realm of career choice.

K: I definitely think there are career advantages and disadvantages by gender. Like a lot of careers are dependent on career interruption and the desire to have a family. Boys don’t necessarily have to do that as much, unless they are the one who is going to stay at home. But I don’t think for the most part the majority of males would do that. So just knowing that you would want to have a family and a career could alter what you want to do. For me, I know I want to have a family and it would be beneficial for me to want to be there and to have a tight family, and for my career to be a teacher. So...
for teachers, I would hope that they are looking for the person who could best do the job.

Me: So you’re saying stereotyping is still there.
K: I don’t think it’s as obvious anymore, because that holds a negative effect, if people think you’re like that, that would be something you don’t want to be known for, but...

Me: So where does that come from? The disconnect between men and women being equal.

Kathy felt that career stereotypes and family responsibilities were deep seated in our culture and weighed far more on women than on men. Using herself as an example, she had altered her career plans to accommodate a future family.

K: A lot of it is built into society. Men would make the money while women did the chores at home and the men had the advantage to go out and gain knowledge. So women were always doing something at home, feeding the family, and the men had the opportunity to go out and receive that knowledge...

Me: So that stereotype goes way back
K: Yeah, and I think we’re still slowly starting to break that in a way. It would be a huge movement to change that.

Me: It would be a huge step in childcare (both laugh).
K: My mom, when she got home, had to start dinner. Her brother didn’t, like he’d come home and ya know, he wouldn’t be starting dinner. So men wouldn’t do those sorts of things and carry out what my mom was expected to do. It’s just nice to come home to someone whether it’s your dad or your mom.

Me: But it’s kind of more expected of mom than of dad...
K: Yeah.

Me: So you don’t think that men and women are treated today, yet, on equal terms with equal expectations and responsibilities. So would that be part of the reason you chose teaching, the hours, summers off.

K: Oh, I think it was, because otherwise I’d have entered broadcasting.

Me: Do you think family is part of a man’s decision making?
K: (Laughs) No. I mean it’s not that I’m not doing what I want, but, I really just know...

Me: So you want to have both careers, home and family, where they’re kind of one track minds...the career.
K: Yeah

She was adamant that she was doing what she wanted in order to have both a career and family, but in light of her troubles with math, I wondered if the career fit her needs but not necessarily her skills. After all, she had been convinced she wanted to go into journalism up through her senior year in high school. Had her recent engagement and plans for a family put her in search of
a job that traditionally fit nicely with raising children? Summers off. Same school day.

Mom voiced some confusion about the career change, as well. Apparently Kathy had not shared her vision of job and family with her.

Me: Kathy said that she was thinking about journalism for a while.
Mom: Well, journalism, and broadcasting, and the radio and all that. Then I don’t know where the change came from to be a teacher.

The Topic of Measuring Success
2. Kathy (interview 3/21/08)

Kathy said, “For the most part, a lot of it is you are a male or female and this is what you’re gonna do. You believe it and it’s a self-fulfilling prophesy. You grow up believing it, so...

In high school I really did like the media aspect, but there were other things that just weigh out, and you want to do both and you have to find that balance.” For Kathy, it seems more like a compromise. It isn’t what she necessarily wanted, but it works for her future plans. She alluded to the fact that men do not have to justify their career decisions the way she had to.

On the other hand, she still advocated the right for women to hold any job for which they were best qualified. She wanted to talk the talk but was unwilling, herself, to walk the walk.

K: I think it should be more of whoever wants it should get it. Whoever wants it most, whoever will work hard enough...I mean if working hard enough, and going for what you want like president of a bank may have gains in all those aspects, but not in the aspect of having children. It’s all what you perceive as a life benefit, a cost analysis.
Me: Do you think there are more things at stake for a woman?
K: Yeah. Just because I think most women are more emotional. We have more stresses we have to juggle. I think a lot of things are expected of women. I think it’s expected of us to have children. You know, maybe not as much as it used to be. But it’s still an expectation that if people marry they’re gonna have a family, and if you don’t they’re kind of wondering why.
So, you know, it’s just like that, either way, like if you have children you can’t focus as much on your job. And if you are, it’s like why aren’t you having children? There’s always something.
Finally, I asked her if she thought women shy away from some career choices because they are aware of the demands placed on them from the job and the home. She said without hesitation, “Yeah.” I felt certain she was referring to herself.

Kathy is admittedly not as strong in mathematics as her sister. She, like Candy, stereotypes mathematicians, but she includes her sister in that group. Math ability is not recognized by Kathy as sex-linked, but is, perhaps inherited. Kathy has only recently decided to become a teacher because she is under the impression that a teaching career meshes well with very recent plans she has for marriage and children. Her mother seems to feel that this decision has been strongly influenced by her fiancé, since until college, Kathy had been interested in journalism. As far as STEM careers, Kathy believes women are at a disadvantage in acquiring them. She believes women entering these careers must make compromises and sacrifices not required of men. She says women are under more pressure at home and on the job, and likens the career and family choices to a cost analysis. Knowing that women carry the majority of the responsibility for childrearing, she is willing to sacrifice career goals for what she perceives as a less demanding way to earn wages.
Chapter 5: Brenda

Subject’s Background Information

Brenda is a Caucasian in her late twenties. Tall and lean with straight sandy-blonde hair. It is immediately obvious she is very fit. She stands straight and emits an air of confidence. It is clear from our discussions that Brenda is observant of details both in academics and in the lives of her family and friends. She is caring and thoughtful, engages easily in conversation, and is often opinionated out of concern for the situations of others, rather than being critical of them.

Our conversations often run overtime because she asks many follow-up questions of me.

I find myself on guard, wanting her to clarify herself but not wanting to share too much of my own experience so as to influence her viewpoints. In our second interview, she literally turns part of the discussion around and becomes the interviewer, herself. Her experience in the second day’s topics is so limited, I cut the interview short, rather than let my opinions dominate the session.

She shares that she was on the track and cross country teams, and was a state champion in high school and went to Nationals in college. On 4/10/08 she described how her dad supported her athletics and how much that meant to her.

B: Once I got into college, my dad, all through college, every weekend, my dad would be there everywhere I went. I went to Drake in Iowa, and my dad flew there. And my dad hates to fly. He went to Oregon, California, everywhere I went. They would both try to be there if they could, but it was always my dad. I want to be there for my kids. That meant the world to me that they would support me. My husband and I argue about that now. That with his job and his career, I know it’s always what he wanted to do from the day I met him, but, “Don’t you want to coach? Don’t you want to do more with your kids?” But he said, “I could never be a teacher.” So I said, “Once you get the title you want and you’re on first shift, then you’ll have more freedom.” And he said, “I do, and I want weekends off so I can do things.” I think now that I’ve started my career I’ve seen I’m gonna have to make a choice, do my teaching now, and when my kids get older take on more responsibility. But I don’t want to give up weekends with my kids. Because being a
mother is way more important than being a teacher. Your family should always be more important. But I feel I’m always going to struggle with that. I feel it now at my age and I don’t even have children.

Throughout every interview, Brenda returns often to the conflict that weighs on her mind. She is preoccupied with making a plan for juggling a family and a career. It is the driving force behind her decision-making, and often turns our conversations from the topic at hand to advice-seeking sessions.

Born and raised in the suburb of a New England city, she is the second oldest of four children: a sister two years older, a brother two years younger, and another sister 4 years younger than herself.

Her older sister majored in biology. Brenda called her a “wiz.” Mom corroborated on 4/20/08, adding that by comparison with her sister, Brenda struggled in school.

Mom: Things didn’t come as easy for her.
Me: That’s what she said. She said she didn’t understand why she didn’t get what they got.
Mom: You know, too, she’s got a July birthday. She was younger. Her older sister was an October birthday and she was in gifted classes in elementary school. But I would not send her early, so she was by far the oldest in her class.
Me: That makes such a difference.
Mom: So she excelled through school. She was second, and a late July birthday, so it was probably harder for her, and harder for us because we couldn’t understand why she wasn’t picking it up and her sister didn’t have a problem. Then her brother came along, and he didn’t have a problem. And he was younger too. He had an August birthday.

In an attempt to justify Brenda’s struggles, her voice was sympathetic as she spoke, but I detected she was a bit defensive toward me, perhaps for wanting to discuss Brenda’s shortcomings, so I moved quickly off that topic and onto her son, who was apparently very successful. He graduated from college in engineering. While Brenda spoke with pride about her siblings’ intelligence and their accomplishments, her self esteem seemed to waver. Brenda said, “I don’t know what happened to me. God. We talk about it to this day. He was wonderful at
math,” (interview 4/3/08). Mom swelled with pride as she spoke about Brenda’s brother, too.

Mom: And his strength was always math. Sometimes he would amaze us. We did some complicated problems, and I would always do them in my head. But he would always beat me. And that bothered me. (Laughs)

Finally, Brenda’s youngest sister, apparently also had no difficulties in school. Brenda’s mom described her in the same interview, “And then the youngest one is a January birthday, and she did extremely well through school with a double major. And that had to be hard for her sister [Brenda] because she [her sister] graduated early and graduated college early.” Brenda again, was quick to praise her sister, and put herself down in the same sentence. “My younger sister...she was on top of her class.........(long pause. She spoke softly, regretfully, but with a smile as she shook her head side to side)...I don’t know what happened to me,” (interview 4/3/08). Her parents are retired now, but mom was an elementary school secretary, and dad was a marketing teacher in the high school for thirty-five years.

Brenda completed her first 4 year degree in psychology. Then she returned home for a year and got married. For reasons she never explained, Brenda did not go to graduate school and finish a master’s degree in school psychology, as had been her original plan. She and her husband bought a house. Four years later, in June, Travis was transferred to the area. Brenda began working in a nursery school. After 3 years she decided to return to college and complete a second degree, this time in elementary education. This put her on a different track and time frame from the traditional undergraduates, although she was taking all the undergraduate education courses. She worked during the day and took classes at night. She was not required to do the observations other students had to do, but rather, to use her experience in the nursery school. The only time she had been in a real elementary classroom was to teach a lesson to my 4th graders.
At our last interview she shared that Travis had been transferred again. They would be
moving to the mid-west in the fall. She spoke at length about whether motherhood or finishing
her program in another state should be her priority since many credits would not transfer.

Interview 1: Personal Remembrances of Math in Their Pasts

Topic of Math: The Subject

3. Brenda (interview 4/3/08)

B: I don’t know what the right word would be, but everybody looks at math as being the
most difficult subject, I don’t know why it is.

Everyone did the same thing at the same time, Brenda remembered. She memorized it as
best she could, and admits never understanding the concepts. She referred specifically to addition
and subtraction algorithms that relied heavily on understanding place value in order to regroup.
She admitted not having the foundation in mathematics and having the same discussion with her
husband, who apparently understood his mathematics and helped her with her work in her college
Math Methods class.

Me: So how did you do in math? Any memories about that?
B: You know, I talked to my husband about that. I can remember almost every subject in
school, and math was the subject I never enjoyed. I wasn’t good at it. But I think I could
have been if I’d had somebody who worked with me. I don’t know how I was let, slip
through the cracks all those years, from Kindergarten through 6th grade. I got decent
grades in math. I had to have gotten Bs or Cs, but I don’t honestly know how I managed.
Me: Obviously there was grouping in reading. (She had described being identified for
Title I reading and being pulled out for extra help). Did they group in math?
B: I think it was everybody on the same page with the same worksheet, and if you had
problems you put up your hand and the teacher came over and helped you with it. I don’t
remember any group work though.

In middle school there were 4 groups referred to as pods. Brenda didn’t know how they were
grouped, by ability or at random, but she did not recall struggling as badly as she had in elementary school.

Me: So you think you memorized your way through?
B: Ohhhhhh I definitely did. (The way she said that made me picture a child whose hand had been caught in the cookie jar).
Me: So by memorizing you were able to get the grades, but you never understood.
B: And that’s what my husband said, “I understand it,” and he tried to explain to me how to find the surface area of a cylinder. He said, “This is what you are finding. You just memorized the formulas and plugged in the numbers.”

Brenda seemed to share everything from our class with her husband, Travis. He was apparently not only her confidante, but very supportive of her efforts. Later on, in our final interview, she shared that she was less comfortable with her classmates, because she felt she had a maturity level and an appreciation for what she was learning in college that they lacked.

B: I haven’t taken a government class since high school. And one girl turned around recently and said, “God, this is so boring for me, I just had all this stuff last year.” Because she was a freshman. I haven’t had anything like this in so long, I appreciate it more. I’m learning so much and I’m watching CNN 24-7 now. Same thing with your course. You go back and you’re learning things that you didn’t grasp or fully appreciate.
Me: I think a lot of the kids in class were taking the class because they had to, they weren’t really thinking about, “Am I gonna be able to stand up in front of a classroom of kids and explain this. They all thought they could do it, but doing it and teaching it are two different things.
B: Oh yeah.
Me: And you’re not at the same maturity level a lot of them are.
B: And they don’t understand that you’re actually gonna use it. Through elementary, middle school, high school, college, a lot of people are just getting that grade. They’re not realizing that what they’re taking, you’re actually gonna use. But now, going back, studying education, I know that every single thing I have learned starting last summer to this point, is gonna determine how good a teacher I am, every bit of it. So I know that, but when you’re going through college, you’re young and you don’t know that.

“You can’t teach something unless you understand it,” she ended. Pretty astute. Regardless of age and experience, some teachers never grasp that concept.
Topic of Materials:

3. Brenda (interview 4/3/08)

B: Me and my older sister would do that and we would play school all the time, or play house. We had a notebook and we played store. Now adding, I would remember my sister saying, “You’re gonna work behind the desk,” and adding and subtracting money, I would have trouble with that. And I’d say, “You’re gonna have to help me with that. But I can remember having difficulty even playing things like that.

Me: So in your background [at school] you don’t remember manipulatives at all? Play money or anything like that?

B: I do remember play money. That I do remember, you know, counting change, things like that. But I can remember mostly, “Take out your book, tonight’s assignment is chapter ten exercises one through ten.” And that’s what I would go home and work on with my parents. And that’s when all the frustrations would start.

Not unlike the other students I interviewed, she had limited experiences with math manipulatives other than play money.

B: But base ten blocks, no. But play money I do remember, and I have that. The other things you bring in, no. We didn’t have any of that stuff, no hands on stuff, not at all. I remember borrowing and carrying. I didn’t understand any of that stuff until I took your class. That’s terrible that I’m almost 27 and I’m just now learning what it actually means. The idea that you took a hundred from....I don’t know if it evolved over time, or we’re learning better ways to explain it, or...I don’t know. Because I was in a very good school district as a kid.

She returned again to her frustration with her own schooling, “Can you tell the kids that are struggling? I don’t understand that.....why was I......”

She was putting me at a disadvantage, one of many times, where I could not defend the past practices of other teachers.

Me: Maybe you needed those concrete things to relate to.

B: Like I told my husband, I must need visual things, because like in your class I learned a lot using visual things. And maybe I didn’t have them as a kid, and now I need them to comprehend so many things I should have learned so long ago.

All I could do was to encourage her to take the best of what she had seen and experienced and put
it into her own repertoire.

Topic of Teachers:

3. Brenda (interview 4/3/08)

Even though she had no memory of mathematics in elementary school, she had fond memories of her second grade teacher. She was fun and helpful. She didn’t lecture and she, “actually enjoyed kids.” Brenda soured her face when she added, “Whereas my first grade teacher didn’t really like kids. It was her job. And I understand that but it made a difference to have a teacher who made it fun for us.” I had a harder time understanding and accepting that, but I let it pass.

B: My favorite years of math were high school. Every semester I took math. I can remember having an equal number in high school. In college, one female and all the rest were males. Elementary mostly females. But the ones in high school. I liked the one male and one female, but they taught totally different.
Me: How did they teach?

Interestingly, it was the reasons for their interest in her more than their teaching styles that impressed Brenda. She, like the other interviewees focused in their need to be cared about, that personal interest part of teaching versus technique.

B: Maybe the teachers were more willing to help because I was a really good athlete in high school. And they looked at me, like I was one of the top in cross country and track. I was very good and when I wouldn’t grasp something, maybe I had more confidence because I was an athlete in high school, but I would raise my hand and say I didn’t understand something. Teachers would stay after and help me.
Me: The males and females were willing to help you?
B: No...the males more. Well one of them was the track coach. He knew I had to get that grade or I was gone. So he helped me a lot more. And he could put in the time because his schedule was the same as mine. So he could give me that half hour so we could sit down and work on this. And I took it very serious. I wanted to get the grades. I was an overachiever in high school. Some of the female teachers.........would be willing to help me.......but not so much. The other male was a biology teacher. He was a marathon
runner. He didn’t coach, but he knew where I was coming from. He understood it took so much time. They asked how your practice was and after school they would help you. Teachers who would show an interest in my athletics made me want to try even harder in their class. Showing an interest in me made me want to try harder, so that had a lot to do with it.

For Brenda, the personality of the teacher inspired the interest in the subject. Unlike the emphasis we place on subject matter in teacher preparation, and the energy we put into grades and qualifying teacher examinations, the student responded to that external motivation.

Topic of Homework:

3. Brenda (interview 4/3/08)

Although the topic of homework help was a focus at the first interview as she spoke about her past, Brenda revisited the family dynamics and brought up homework help at every interview. At our first meeting she shared that homework was a difficult memory for her.

B: I remember coming home from school, either elementary or junior high, and I don’t know if my mom will remember and tell you this. I remember sitting at the kitchen table with her. Now she’s just had 8 hours of work and she’s coming home to 4 kids, but we’d sit at the kitchen table, and she’d have to leave the table so frustrated with me that I couldn’t comprehend it. I’d just give up. I’d think if I can’t logically reason what she’s trying to teach me about math, and she’s getting up and leaving because she’s frustrated, I figured nobody could help me. Or nobody wanted to take the time to sit down what I was and wasn’t understanding. Then my dad would come in, and other times my brother would help me. He was two years younger, but he was a wiz in math. He could help me on concepts he hadn’t even learned yet because he already understood those basic fundamentals of math and apply it to what I was doing. And I had a horrible time with story problems. I didn’t have the patience to read it.

Brenda knew she was different from her siblings in school aptitude, and she did seek help, but she grew unhappy, voicing her remembrances of desperation and helplessness when she said, “I figured nobody could help me.”
Me: and you had trouble with reading....(Brenda had earlier described that she was pulled out for Title I reading throughout elementary school).
B: And my brother would try to help me, and my older sister would try to help me, but if my mother tried she got frustrated with me. Now my mother didn’t go to college, after high school she was done, so I don’t know if maybe she didn’t really understand or maybe she didn’t know how to teach it to me, but my dad seemed to have the patience. He would listen and try to figure out what I wasn’t understanding.

In her mom’s defense, Brenda tried to rationalize why her mother would express such frustration with her. She thought, at first, that Mom had worked eight hours and was tired, then she said maybe it was coming home to four kids. Next Brenda thought maybe mom didn’t know the math herself and had feelings of inadequacy. Maybe she was frustrated with herself for not being able to help her daughter.

   Me: So your dad was pretty patient
   B: Yeah, yeah
   Me: And mom was pretty frustrated, she wasn’t too comfortable with the math to begin with, so...
   B: That’s what I started realizing the older I’ve gotten. Maybe looking back, that maybe she didn’t know how to do it. And the best person I’ve ever had explain it to me my whole life is my best friend.

Interestingly, Mom had the same memory of the math homework sessions, the frustrations, but with a completely different perspective.

   Mom: Yeah, I loved math. I’m a great math person. The only thing is, I probably got straight As in math until I got to, let’s see, I did Algebra I, Algebra II, the only one I really had a problem with was geometry. I struggled through geometry because I swear it was the teacher. I was always good with numbers. Like remembering numbers. I was an elementary school secretary, so even parents’ home numbers for kids. Once I would see them I would remember them. So maybe that’s why math was easy.
   Me: Yeah, you were just comfortable with numbers. As far as your daughter in school, how did you feel she was doing in school?
   Mom: It was usually a struggle. It always seemed to take her a little bit longer to catch onto things. And even when we would sit with her at the kitchen table doing homework, I would sit with her for a while, and I would get frustrated. Then my husband would come out and sit with her for a while and try to work with her.
So in reality, perhaps the frustration was a bit of both stories. Brenda did not grasp concepts readily, in part because of her reading difficulties, and in part perhaps, by the teaching techniques used with her in the classroom. On the other hand, Mom appears to have equated having a good memory for numbers with being good at math. If she could perform the operations but not explain how or why she did them, both she and Brenda would have had a serious gap in communication.

Mom recalled at one point, after sharing her frustrations with a teacher in her building, she enlisted her help for Brenda.

Mom: I think it was frustrating because even the smallest things we tried to get through to her she was just so...I don’t know if she even remembers this, but when she was little and we were trying to teach her how to tell time on a clock, that I was so frustrated and a second grade teacher in my building was just the most fabulous teacher. She said to me, “Stop getting frustrated, let me work with her. Have her come over this week.” She went over to Mary’s house like twice and Mary was very calm and very patient and she came home and she knew. Mary had the skill and the patience.

Homework for Brenda was an entire family effort in elementary school and one point even enlisting the help of a teacher tutor. But finally, in 7th grade Brenda recalled she began working with her best friend, who would help her through college and her first 4 year degree.

B: She was the top of our class all the way through high school, we went to college together. She was a pre-med major and she’s in her second year of residency. She’s gonna be a pediatrician. But she had the patience I needed. She never gave up on me, and you’re gonna hate when I say this, but when it came to my advisor, my junior year, he said are you gonna be a bachelor of arts or a bachelor of science in psychology? And I said, “What’s the difference?” And he said if you want to be a bachelor of science you need a math class. And I said, “I’m not doin’ it.” What happened was the semester before I’d had a math class, and I don’t know what happened, but I got the first D of my life, and I was a college junior. Two of us went to the professor about it. I remember in your class, the algorithms, and you said as long as they can use their own way and come to the answer, how can you call that wrong? He would teach it this way, and I could get the answer to every single question, but I wouldn’t do it his way, because I couldn’t follow his reasoning, I would get everything wrong. And we went to an administrator in the math
department, and I don’t know if anything was ever done, but that right there defined that I was done with math in college. I’m done. No more. I’m never gonna use any of this again, and I talked to my advisor and I said, “No way, I’m not doin’ it.”

Thus ended Brenda’s story of math and math homework, until she found out she would have to take Math Methods to get her teaching degree.

Topic of Math Peers:

3. Brenda (interview 4/3/08)

Elementary school, for Brenda, must have been a heart-wrenching experience. She remembered most about Title I reading, not for its content but for the way she was ostracized by her peers.

_B: I went for Chapter 1. And I got pulled out for that. Me and one other boy. And I got made fun of. And I remember the teacher saying, “Hang in there, you’re gonna be so much better for it.” And now I love to read, and I know it helped me throughout school, but it was difficult._

As for math, she had no memory at all, other than the distaste it left in her mouth. She seemed to believe math and science were boy subjects although she had no idea where that notion originated.

_B: For some reason I always think boys are better at it. I don’t know why, because I can remember a lot of girls who did well at math. But I just feel like boys were...math was a boys’ subject to me. Math is for boys. I don’t know why. I don’t know if there were just more boys who did well, I don’t recall elementary school boy friends at all, but I can remember math being a boy subject to me. Same with science. Science is for boys. I don’t know what was for girls, ’cause I.... (laughs) I wasn’t good at either!_ 

But in 7th grade when she met Sherry, the girl who would become her lifelong friend, her school experience became more positive. As Brenda was gaining recognition for her success in athletics, an area where could contribute, she could shine, she could feel proud - she observed there were
consequences for Sherry being such a good student, particularly in science and math. Sherry was being socially ostracized by their peers.

B: You know, my best friend in high school was very good at math, and in science and math when she got back a test, and it was always a very good grade, it was always an A, she would tuck it away. When I look back now, it kind of made sense. Where in reading subjects, she wasn’t show offish by any means, she was very shy, but it was ok to leave a paper out and let other people see what she got. But in math and science, it was always, looking back now, even in college, people would look at her like, how in the world could you do this? She was very secretive. It was almost like she didn’t want people to know she would succeed and when she would it was like people would get mad. And teachers were curving it, and she was the one person who would wreck the curve every time.

Me: Do you think there were prices to be paid, you know, a girl beating the boys?

B: Definitely, but she was so shy and likeable, boys wouldn’t have done anything to her but they didn’t date her. She was self conscious. Definitely, she was the top of my class of 400 kids. My younger sister, who got all As in science and math, only the smart boys would date her. They were very intimidated by her. She was almost looked at like she was inhuman. A girl to take all the science and math subjects where girls weren’t doing well, she had problems dating. My older sister did well in science and math, but she didn’t have time for dating much. But my best friend, she would be embarrassed that she was the one that made the teacher not curve. And I can remember being upset with her some times. She would help me and I felt like I worked harder than her and she would get an A and I’d get a C.

Even though she sometimes resented Sherry, they remain best friends. However, Brenda is keenly aware that Sherry has made family sacrifices to pursue her career, and this too, makes her question her own career path as she gets closer to her own job quest.

Interview 2: Evaluating the Modern Classroom and Testing the Water

Topic of Math: The Subject

3. Brenda (interview 4/8/08)

Mom maybe said it best, “Brenda was drawn to kids who had problems with school. She could relate to them, and then working with preschool children after she was done with college
for a while. She realized how much she did like children and could work with them” (interview 4/20/08).

At our second meeting, Brenda was asked to discuss current mathematics as she had seen it in classrooms. Unfortunately, she had been to only one classroom other than mine, and that was not an academic observation.

B: I did one in a middle school. 6th 7th 8th. And that went ok there, but that was my first experience in school for educational psychology. The professor said to pick 6th 7th or 8th and pick the course or subject. So here I am panicking. I want to teach 2nd or 3rd, so why am I going there, and you’ve got to be kidding me… I’m not gonna pick math…..no way! So I went to him panicked, and he said, “Well you’re just observing,” so I said, “What are the other ones.” So you know what I picked? Gymnasium!

Looking back now, she laughed, and agreed she had passed up one of her few opportunities. The university she attended now didn’t even offer a teaching degree in physical education.

“So that’s why I tried to be a day student this year, so I really had to try to get into the classes so I could get into the school. Even though I taught preschool for years, that’s a lot different than teaching in a real school.

Last fall she had to teach a 4th grade math lesson. She was uneasy at this first assignment.

I remember leaving the classroom and going home to my husband and saying, “What am I gonna do? I don’t know how I’m gonna do this!” And then we got into groups and that went well because I got to ask questions, and I was afraid a 4th grader would outsmart me or something.

Me: That happens.

B: But I’d be so embarrassed if it did! I would be! (Laughs) Then I got in there and my confidence comes out. I had no problem controlling the kids. No problem running the activity. Coming up with the lesson was difficult with yours because it was so broad. We could have done just about anything. But I loved the math. Doing it was great. And then afterwards you said, “What would you have changed to make it better the second time?” And of course you would change it from the first time. But for teaching, that was about it. Then in the fall I student teach.

It seems an unfortunate shortcoming for prospective teachers, that they can go all the way to
student teaching without having set foot in a classroom. There is much more to teaching, Brenda was finding, than what she had seen from the other side of a classroom desk.

Topic of Materials:
3. Brenda (interview 4/8/08)

Again, without the experience in the classroom, Brenda turned the discussion to what she had observed my the Math Methods class.

_B_: Now I’ve learned to use dry erase boards, and the kids write their answer and hold it up, like you’re gonna know those who aren’t comprehending it. And I will work with those ones. But they also need the concrete objects in front of them to understand area and perimeter. And the worst thing you can do is ignore it. If your job as a teacher is to be sure they are grasping it...

_Me_: Well of all the people I’ve interviewed so far, only one had base ten blocks in school. _B_: I remember when you first started talking about it in class. I said, mom, did you ever hear of base ten blocks at your school? And she said no. I didn’t even know what they were. And the abacus...

_Me_: I just found the abacus not helpful to me because I like to see things in the size they are…base ten blocks you can see the actual sizes, this is ten times bigger or smaller than the place beside it. With the abacus, they are different color beads, but the beads are all the same size.

_B_: And the balancing thing you had…the things you were putting on it. It was weird that I was learning so much with things in front of me to look at. Like fractions, when you brought in pattern blocks. It was so sad...

So Brenda seemed convinced that math manipulatives are useful, but had no experience to share.

Topic of Teachers:
3. Brenda (interview 4/8/08)

For an example teaching style she admired, Brenda referred back to a teacher she had in high school.
B: I can’t remember her name. She was one of my earlier math courses as a freshman. Maybe since it was one of my earlier courses, because we were all young kids coming into the high school. She made me comfortable where I could raise my hand and say, “I don’t know the answer to this” or “Can you help me?” I remember her doing a lot of group pairings in that class. It was a very comfortable environment. And if you didn’t understand something you could get together with your group and you would get help that way sometimes. I remember nobody being embarrassed to ask for help.

Brenda seems fixated on students who don’t understand math. She is determined to address those children in ways she herself never received help. She seems determined to establish a nurturing, non-threatening classroom.

Topic of Homework:

3. Brenda (interview 4/8/08)

We spoke hypothetically about how she would address homework issues in her classroom. Apparently the issue had come up in another of her education classes, as well. And although Brenda seemed truly dedicated to making every effort to help the children in her classroom, she had little idea how to get parents and children to value assignments, especially if it was as much of a struggle for them as it was for her.

B: I have that in a class now. We were talking, “Do you give them all zeroes?” One thing I learned in the center, there was one parent who had kids who had to look perfect. I would go out of my way to please this parent. I always started out with the positives of what the child did that day. You need to earn their respect. Making an effort to contact them. It’s my job to make sure I help the child. Even if I have to stay after school with the child.

Me: And you don’t want to take recess to do math. What are the chances they won’t hate math? And when you have a planning period, they are in gym or music or art. You can’t pull them out of that.

B: And if they’re not doing their homework, you’d assume maybe they aren’t understanding the material.

At that point, Brenda turned the tables on me. I became the interviewee about homework.

B: How often do you give homework?
Me: Every day Monday through Thursday.
B: So how often do you do that [work with individuals]? Every day are you working on homework?
Me: Well lunch together is really my best choice. And the end of the day if there is orchestra, and those kids are not in the activity, I can pull them then, or while the others are watching a movie, or during learning centers.
B: There are some teachers who would say, “No, hand it in and take a zero.”
Me: Well, if they do the homework and get their planner initialed by a parent every night they get a gold card for the drawing on Friday. They love my very valuable worthless prizes. Like my luggage lock that I lost the combination to, they all wanted that!
B: Oh my God (laughing)
Me: It’s amazing what’s motivational to kids. It’s a lottery, the more you play the better your chances to win.
B: You can’t motivate kids with, “You’re gonna need this when you’re older.” That’s what I was told when I was young. That’s not gonna work. So you need something else to motivate them. Do you grade all the homework?
Me: It only counts 15%. This is the time to learn. So they correct their work, or fill it in now that they understand it better. We go over all the homework together. During the test is not the time to ask.

Sometimes it’s just the silliest things that get kids on your side. Some are intrinsically motivated at this age, and want to do well because they are competitive and have high standards for themselves. Others want to please their parents and teachers, or they just want to win prizes, so they are extrinsically motivated. Brenda hadn’t given this much thought. She had been too overwhelmed as a child, and only came to value the accomplishment and worth of the content much later.

She wondered if there was anyone else who could help those children. She had seen an aide in the classroom. She had Title I reading. We, too, had Title I reading but not Title I math.

B: Do you meet with them or do they have somebody else?
Me: There is an aide. She doesn’t have the same lunch we do so she can’t help them then, but she helps out in the classroom. Especially when I do differentiated instruction, and those kids are really far behind, she can pull them to the table in the hallway. I do the lesson planning for her. She is not a teacher. She isn’t certified.
B: Isn’t there anybody else who works with those kids?
Me: Not with math.
Topic of Math Peers:

3. Brenda (interview 4/8/08)

In her only teaching experience in the 4th grade, Brenda did use cooperative learning. She placed the children in groups of 3. She found the lesson manageable and the students cooperative, but had no other experiences other than the partnering she had previously discussed to use for comparison.

Interview 3: Where in the World are Women in Mathematics?

Topic of Career Opportunities

3. Brenda (interview 4/10/08)

At our third interview, we spoke about career opportunities for women today. I asked her if she thought there were different academic capabilities between men and women. She thought, more likely, they were gender expectations.

B: No, no, I don’t think there is anything to it. I think a lot of it is gender expectations. Like I feel that boys are just expected to do better in math and science. Genetically, do they have anything more than the women? No, not at all. Now granted some of them do and it goes both ways, like if the parent has that gene and you hope the kid gets the gene for science and math. But I don’t think there’s anything there.

She went on to describe the way children are stereotyped with the toys they receive and the games they play, then went on to describe teachers, and how it had been her impression that they chose helpers by gender and subject.

B: Right, because I can remember math and science as a kid that other kids would come and help you, and it was always a boy who would come over and help you. Rarely would I have a girl come and help me. I don’t know why. It could have been there were just more boys who understood but it would always be a boy who would come and help me. Me: So you were getting all these subtle messages. B: Right, right. That tell you what you are supposed to be.
She didn’t disagree that men and women are entering the math and science careers, but to her, it still didn’t feel as comfortable a fit.

Me: So you think that the idea that girls aren’t good at math and boys are is something we put on them. So when girls actually attempt those math careers, are we accepting of that? Are we accepting of both at the university?
B: I think we’re accepting of both, but boys are getting paid more for the exact same jobs. I don’t understand that, but it happens. I think we’re more accepting, but like today if I had a boy and girl in front of me and when I heard she was a biochemistry major I thought, “Whoa,” but if a boy said he was a biochemistry major I’d think, “Ok.” For some reason, hearing a girl or seeing a girl going into that field surprises me. And even last semester I met a girl and we were talking about what grades we wanted to teach, and she wanted to teach high school math. And I remember thinking, “Wow.” And my neighbor teaches high school math, “Wow, that’s impressive.” I don’t know why. I think it’s common. You see a lot of females doing it now, but I still think it’s kind of hard to believe. It just doesn’t seem like a good fit. It’s more prevalent now to see women going into those fields, but it isn’t equal. I think they have to work harder for it.

Interestingly, in Mom’s interview, (4/20/08), I got the same message of cultural stereotyping.

Me: Do you think, since I was in college in 1972 and that’s when Title IX was passed, there are equal opportunities for men and women? Do you think opportunities are more equal and women are taking advantage of those opportunities?
Mom: Hmmmm….they probably are not taking advantage as much as they should, especially in math. I just don’t think girls will ever think they’re good at math.
Me: Where do you think that comes from?
Mom: I don’t know.

And several minutes later, Mom even went so far as to admit she had probably perpetuated that cultural stereotyping herself in helping her son and daughters make career choices. But she shared that notion with the school, as well.

Mom: Probably cultural, I would think. The way that we were raised. Like I can remember, my son, he didn’t even have an idea of what he wanted to major in college, and I knew how good he was in math, so I pushed him in that direction. And none of the girls did I push in that direction. And I knew that. And Sheena [the youngest sister] could have done great in math. But she is the one who will someday be an attorney. I didn’t push her in math. And the older one, I thought science was a good field for her because she always liked science.
Me: Is she a biology teacher?
Mom: She was in education and was a class short of her master’s for teaching biology.
**Me:** So you think the opportunities are there.

**Mom:** And maybe it’s the schools that don’t encourage them, too. Most of the math and science teachers here at the high school are men, too. But then from my experience the one woman I had for geometry was horrible. That’s really sad.

Having opportunities and seizing them seem the issue for Brenda and her Mom. Both admitted women probably do not take advantage of the careers available, Brenda saw raising a family as a limiting factor and her mom did not. Brenda saw equality from a more global perspective. She was overwhelmed by the responsibilities of working and maintaining a home and raising a family. She had seen young families like Sherry’s and her older sister’s, compared them with her own upbringing, and found making the fit almost impossible.

**Topic of Equality**

3. Brenda (interview 4/10/08)

Brenda came back again to the fairness of job and family commitments on the part of men and women. Even if she could conceive of women entering traditionally men’s math and science jobs, she could not justify the inequality of what she saw as family obligations.

**Me:** You did say that you thought there were other jobs laid on women that aren’t on men.

**B:** Right, right. Men can focus more on work. Now I’m not saying men don’t help in odd ways, but it’s the women coming home and cooking, changing diapers, doing laundry. So they have a lot more on their minds. Whereas the man can just focus on his career and you see it more that the man is working and the woman is staying home. I think that now it’s even more prevalent. I know they say that women are more in the workforce, but I see a lot more women that I know, they’re all stay at home mothers with a college degree. They might go back after the kids get into school, but I see that more. The women are letting the man get the job and focus only on his career and the women stay at home. You know if I was going to get a job versus a man, you know, if they see that, hell yeah, I’d hire the man. I’d do it hands down, hire the man. They’ve asked me if I’d have a kid.

**K:** They asked you that? That’s not fair.

**B:** Do they ask men that? No, no. Now why? They’re not actually having the child, but it’s still their child.

**K:** So there’s a huge stereotype out there. Not so much math or science, but it’s a cultural
thing that men have the freedom to choose their profession and women have this other “baggage.”

B: Yeah, that’s what I say to my husband all the time.

That is what Brenda is struggling with now. She is starting a career, desiring to have children, and considering her biological limitations. She wants not only to start as a teacher, but to move on to school counseling, school psychology, or school administration some day.

B: I want to do different things. But with kids, it’s so hard to go back to school, so it’s almost like I have to make the choice, do I want to be a mother? Or do I want to have a career?

I asked her where her such strong feelings came from. She thought part of it was an American cultural tradition.

B: The women did everything in the home. They cooked, they cleaned…gosh, my mother in law still does that for her husband. Dinner is on the table every day at 4:15. I mean, it’s ridiculous. And the women now that do that, maybe the husbands don’t expect it, but the women want to do it, like maybe, they don’t want a job. I hate to say that, but maybe the women don’t want a job?

She went on to cite the example of her husband’s sister, who had finished college and never gone to work. Instead she had become a stay at home mom, and her sister, who also had a teaching degree in biology and opted to be a stay at home mom. Brenda actually wondered if they were using children as an excuse not to work. She was painfully torn between her personal goals and the expectations being placed on her by her family and friends.

B: I think that women that stay home with their children lay a guilt trip on women that can do it all. And I think that women that do it all............. think that women who stay home.... are lazy. Even my husband, and he has a stay at home sister, and my sister is a stay at home mom, says, “I don’t understand why they aren’t working? Why aren’t they helping out with the expenses?”

Me: Are their kids in school?

B: His sister just had a baby last week. She’s 38. She has a 12 year old, an 8 year old, and the one that was just born. And it has Down’s Syndrome. My sister has two, and I don’t know what she’ll do. A couple of months ago she told me she was going for a part time job. She got rejected from the job, and she called me, “I can’t do it, I can’t stand the rejection.” And I said, “Who are you?” And I can see with her kids, she’s thinking about
getting pregnant again, because her kids don’t need her at home, she’s home all day now. I wonder if she will. Does she want another kid because she wants to stay home? I don’t want to say some women take the easy way out, but why not help out if you can? I don’t know. But they have that mentality. They want to raise their kids, and yeah, I want to raise my kids and I want them to be smart. And granted, my sister’s kids are smart and love to read, and know their ABCs, and they do wonderfully, but someone else could have helped them with that. And, it’s all stereotypes. The boys play with boy toys. Someone noticed one is very good at counting so he’s good at math, and they’ve already noticed. The other one likes books. So...

It certainly seemed like, in Brenda’s experience, even young people were perpetuating the traditional stereotypes. She went on to describe her best friend, Sherry, who after receiving top honors in school and making it to her second year of pediatric residency, had misgivings.

B: Yeah, my best friend, in her second year of residency, wishes she’d never gone to medical school, and been a stay at home mom. And what do you say! Her husband is a teacher, and he has the good hours where he has summers off. And right now she is on call every other weekend, and she works 36 hour shifts. She doesn’t see her daughter as much, and she wishes she could take it all back and be a mom. And it’s frustrating. And I struggle with it. Am I doing the right thing? Am I gonna be a bad parent?

Brenda’s Mom offered similar observations about the stress Brenda was feeling and the pressures being placed on her by her friends and sister.

Mom: I think talking to our oldest daughter, and I think her friends have been talking to her, especially one who is in med school. She got married right out of college and had a child. And I know she sees how difficult it is for her best friend. She has a young girl. And I think that’s where she is coming from. They’re all telling her she is waiting too long. I never talk to her about that.

Brenda said she regretted not having gotten her education degree first. The four years has caused her additional stress. She said if she had done so, she would have had a child by now.

B: People say to me, “Look, you’re almost 27.” Am I that old? Am I gonna be an old mom? Am I gonna have a healthy child? I say to my husband, “It’s not fair, you focus on your career and that’s it. You’re not gonna get pregnant. You’re not gonna have to figure out when to take off from work. And that’s all I can think about now.”
The Topic of Measuring Success

3. Brenda (interview 4/10/08)

Because I got married when I was 19, and people kept asking me and I didn’t feel it was anybody’s business. And I didn’t have our first child until I was 26. So I was married for 7 years and we traveled the world, and we did what we wanted until we started our family, (interview with Mom 4/20/08).

Mom went on to describe how every summer their family had vacations together because they both worked in the school. She said, it wasn’t a “fabulous life.” They drove older cars, but none of the kids ever wanted for necessities. It just took them a while to realize they had a good life. Brenda had said that, too, and given that as her reason for going into teaching. She saw a teaching job as a good compromise between working and raising a family because it had worked for her own family. Only as a result of our conversations had she learned some of the details of her parents’ family decisions.

B: You know, it’s weird, now, looking back, I consider my mom successful. Did she have a high paying job? No. She was the secretary of an elementary school for 25 years. She probably made less than I make now an hour, worked and came home to 4 children. And I think she was very successful as a mom. Now I did find out, and I never knew, that my mom took a year off with all of us. We were all two years apart and she would have one of us, take a year off, and go back. She always said she wanted to continue working, because she wanted to give us things she never had as a kid. She did not want us to live on one income. My dad was a big planner. When you’re gonna retire. You need to work this amount of years. And it worked out. Us kids went on vacation every summer with the both of them. We spent spring breaks together. I mean they really planned it. So when I look back, I look at my mom, and she did it all. I turned out great...all 4 of us turned out great, I feel like, and I didn’t have a stay at home mom, (4/10/08).

Brenda was the most opinionated and animated of the four participants. She shared the most troubled background of school experiences. She recognized her strengths in dealing with small children and her early weaknesses in reading and mathematics. Since changing career goals from psychology and re-entering college for a second undergraduate degree in elementary education, she was determined to make school a more successful place for children than it was for her.
She acknowledged that some individuals were more adept at mathematics, but did not separate them along gender lines, because apparently her brother, sister, and best friend were strong in math. She and her mother had the most difficulty verifying each other’s stories. Brenda grew up believing her mother disliked math and went to her father and best friend for help. Her mother denied this, saying she was strong in math, but lacked the patience to deal with Brenda. Brenda perceived opportunities for women as far more limited in STEM careers, and blamed society’s assumption that women in careers and family values were incompatible. Her mother saw opportunities becoming more available to women. Brenda was almost obsessed with the notion of starting a family, and turned the conversation to how and when this should be done in light of her age. She was conflicted about working and then defensive of working mothers, alternately, as she shared stories about her friend, her sister, sister-in law, in-laws, and parents. I finally opted to omit much of the discussion because she wanted my story, which I shared, and she sought advice from me, which I was reluctant to give.
Chapter 6: Alison

Subject’s Background Information

Alison is a petite Caucasian with shoulder-length straight brown hair, chocolate brown eyes, and a voice that could best be described as “falsetto.” It is in a high range, soft, and melodic when she speaks. Alison speaks without hesitation, smiles often, and seems quite sure of herself.

She is the second of two children. Her brother is two years older than she. Alison describes her family as very close, not only her immediate family, but cousins, aunts, and uncles, as well. They all live in close proximity on the outskirts of a metropolitan area on the east coast. She goes home from college often, and speaks with her mother every day by telephone.

Growing up, her family owned a catering business and a restaurant that was started by her mother. They employed several family members, and the children spent their time there cared for by an aunt. Mom said (interview 4/30/08) that they made it as much of a home for the children as it could be. She saw owning a business as an advantage for the family because she and her husband were both there to run the business and parent the children.

Mom: I was pregnant with her when we moved our business from catering to a restaurant catering facility. a huge facility, we went from one to 50 employees overnight, when we moved there, we designed a bedroom/playroom for the kids. I don’t think I ever thought of that. We were fortunate because we always had family working for us, so there was always family there, so I don’t think I compromised at all. Like if I couldn’t do it, my aunt worked for us for years, and she basically took care of my daughter. She would bathe her, she would do everything. The kids were right there, and my husband would take them home at night if I had to work, and take them to sports things. And if they both had things, one would go to one, and the other go to the other thing.

Alison agreed. She remembered that here she and her brother played restaurant and took orders and added them up in an special area set up like a part of home. She also remembers that her mother had a chalkboard for her there and she would play teacher, too. She described a family
room and beds where they took naps when they were young or when their parents worked late on the premises.

At about 7 years old, the business was sold. Mom was having serious health problems. Alison described (interview 4/16/08):

Me: Now when your mom and dad got rid of the catering business, was that a choice? A: My mom got ill, like her muscles shut down and she could hear you, but her whole body shut down so to speak. So when we had the business, and we were getting so big. She was working so much. She would even sleep at the playroom at the business. So what happened was the stress was getting to her so much that it was causing these...what are they called?...that makes me angry. Anyway, it was causing these attacks. It was happening like once a day, so she went to her doctor and a specialist, and they said they could either get worse until they eventually would be like killing yourself. Or you can choose between this lifestyle and your life. So it had to end. But that was my mom’s dream, to have a catering business and a restaurant, but she had a family and she knew that, talk about stress killing you...

That was when Dad went to work at the post office. He had a regular delivery route until he was hurt, and now he answers phones, according to Alison (interview 4/9/08). Recently Mom went back to work part time doing medical billing. She handles claims and deals with insurance companies.

Alison attended a small private Catholic school with two classes at each level. There were about thirty children in her class. Her Catholic high school class graduated between three and four hundred students. She is currently a college sophomore majoring in elementary education and minoring in mathematics. When asked why she hadn’t double majored, she admitted not enjoying the technology component required of a math major.

Me: You’ve taken a lot of math. A: Yeah, I took one over the summer and I’ve taken one every semester. I’ll take one both semesters next year and then I’ll be done. Me: That’s a major then, isn’t it? A: No, you have to take more computer or physics. I don’t think I could do that kind of stuff. I’m good with like the basic stuff. It’s more like just the basic math classes
Her brother is a senior biology major.

Interview 1: Personal Remembrances of Math in Their Pasts

Topic of Math: The Subject

4. Alison (interview 4/9/08)

Alison had said on her preliminary questionnaire that she enjoyed math so we began there.

Me: Do you feel really comfortable with math? You said you like math.
A: Yeah.
Me: So how did you get comfortable with math?
A: I just like, loved doing it. Even if the teacher didn’t explain it, I would always put more effort into it. I don’t think there was much of ‘This is why.’ I’d teach myself how to do it if they didn’t explain it enough. I guess I just always liked the math because it’s always come natural to me and I kind of just helped myself a lot.

Alison recalled a traditional approach to mathematics, everyone on the same page at the same time using textbook and workbook pages. Each child worked independently. There was no collaboration or group projects.

Me: So there wasn’t a lot of differentiation, then. So everybody learned kind of a standard, set, one way?
A: Exactly, yeah.

She remembered learning times tables without difficulty. And interestingly, she had discussion with other college friends about straight memorizing versus memorizing with an understanding how to figure out the math facts.

Me: How about memorizing facts, do you believe we should still be memorizing facts?
A: Like multiplication, like we did in third grade? I do, I feel that’s something like you have to memorize, but understand it as well. I remember in class when you said 3 groups of 2, I was never taught that. I thought 3 times 2 was the same as 2 times 3. But like, so that kind of thing, yes.
Me: Some people say, yeah, they can look that up. But in real life, think about how much
time you save.
A: Yeah, there are some things you just need to know. I remember talking to someone about that in your [Math Methods] class. They were using their fingers to do the nine times tables and I never learned that! I know the multiplication facts and I can pretty much do it in my head if I need them. But she struggled with it in class. She learned handy little tricks and never understood them.
Me: And if you couldn’t remember 6 times 7 but you knew 6 times 6, you could just add another 7.
A: Yeah, that’s what I learned, yeah.

She did remember struggling with conversions, though, and at about that time she began needing some help with her homework.

A: I remember changing fractions to decimals, it was like so stressful to me. It was like the hardest part, not just memorization, but you had to put the fraction on one side and turn it into a decimal...but math...math pretty much comes easily to me.

There was no grouping in math until she reached sixth grade and the children were split. She remembered an honors group of which she was not a part. Rather, she remembered being at the top of the second group in math. She hated taking notes from the board and learning math in isolation rather than as an application with other subjects. She described this in more detail when she compared her own experience to teachers she had observed recently.


Topic of Materials:

4. Alison (interview 4/9/08)

When asked whether she had used any concrete manipulatives to help learn math, she was able to recollect only two.

Me: So when you think of going through school, did you use many manipulatives?
A: No, I didn’t. Maybe in elementary we had base 10 blocks.
Me: Play money?
A: Yeah, we did play money. But we really didn’t have that much. I mean coming from a private school...we had some, yeah, play money and base ten blocks.
Me: Did you do a lot of memorization then, like with regrouping did you memorize, “You cross out the zeros and make them 10s...” Or did they spend a lot of time with place
value so you understood regrouping across the place values?
A: Yeah, I think it was more of cross it out.
Me: So they weren’t really open to alternative algorithms?
A: No

So for Alison, math was more a matter of learning facts, following steps, and getting arbitrary answers. She added that in her later math courses, math was more example based. She remembered a geometry teacher who had big figures and she tried to use them [her tone was sarcastic]. “Geometry was like my worst class ever, I think.” Algebra, when she first started out was tricky because she didn’t immediately catch on to balancing the sides because algebra was solving problems without application. I asked her if it was the subject matter or the teachers, perhaps.

Topic of Teachers:

4. Alison (interview 4/9/08)

A: A lot depended on the teacher, how well they could explain it. Like for example, this semester in college, the teacher doesn’t want to help you, he just gives you an example and then the homework. And I need more of an explanation. So the teachers who take the time and explain to the class, helping if you need the help, by going around giving help if you needed extra help.
Me: So your geometry teacher was not a helpful person?
A: I think it was a combination of the material, the concepts, and she didn’t really give a lot of one on one.
Me: Did you have the same math teacher for more than one year?
A: No, I had a different math teacher every year in high school.
Me: Were they mostly men or women?
A: It was two and two, actually, and the two higher ones were women.
Me: And their teaching styles were...
A: They put the notes on the board, you’d copy them, they’d show you an example, like that.

Personal attention seemed to Alison as important as subject matter if not more so. When asked to describe her favorite teacher she went into detail, with a smile. Her speech slowed and
she had a dreamy quality to her voice.

Me: Who was your favorite teacher?
A: Second grade, her name was Mrs. McGuire. She was so good, and loving. She was exactly like what I want to do when I get older. She just helped kids out all the time.

It was Alison’s mother who was able to add even more detail to her attachment to this particular teacher.

Mom: You know she really wanted to teach Catholic school for a while. And people told her you really don’t make a lot of money. You need to teach in public school because you make so much more money. Her whole thing was teaching, “That’s what I want to do. I want to be there for the religion. Help them make their Communion.” People kept talking her out of it, (4/30/08).

Alison shared one other thought about the way a teacher had used her in third grade on 4/15/08.

It actually affected her confidence about helping a room full of students when she had such little success with her classmate. It is one of the few times during the interviews that she registers doubt about her decision to become a teacher.

A: Well, when I was in 3rd grade, there was a little girl who was rarely there. And she’d been in my grade 4 years in a row. And she needed a lot of individual help. And the teacher asked me to do individual work with her. Like sitting by her on the floor, reading directions to the test, answering the questions and stuff. But it was hard, she had such a short attention span. And you know, you couldn’t like tell her what to write down, either. But when she asked questions, all I could do was read and repeat the question, then try to explain it a little bit more. And I’m not really knowledgeable about it yet, but I’m always, what can I say to kids without actually giving them the answer. I worked with her, and found it hard, and then with 20 other kids in the class.

However, as she continued to gather ideas and experience, she became more excited about teaching. She discussed these experiences in the next interview.

Topic of Homework:

4. Alison (interview 4/9/08)

Homework had an interesting tradition in Alison’s family. Her grandmother had dropped
out of school when she was in 8th grade to work in the family business, so she did not help Alison’s mother. Alison speculated that her mother, the youngest of five children had gotten some help from a brother two and a half years older than she. When she was in elementary school, her father had died, and the oldest children had moved out and taken jobs elsewhere. Alison’s grandmother had to take over the family business alone, a grocery store. Her Mom was able to clarify further and find several positive outcomes to her situation.

Me: What do you remember about your math education? Elementary school or high school?
Mom: In elementary school I remember in 5th grade I had a problem with it. And my mom owned a grocery store, and if I had a problem with it, she would say to ask one of the guys who came in.
Me: Oh really...
Mom: Because she didn’t go to high school. My brothers and sisters were older than I so they didn’t even live with us. I would ask customers as they’d come in the store, for help.
Me: Your daughter wasn’t sure. She thought maybe the older brothers and sisters would help you.
Mom: My one sister was four years older than I am, and she would help some. But the biggest thing I can remember was being in the store at night and having men help me with my math.
Me: So you were getting the impression that math was for men?
Mom: They taught me that there were lots of people who could help me, don’t be afraid to ask.

As our interview continued, I found that in many ways regarding business and raising a family, Alison’s mother was extremely supportive and open-minded. She not only recognized the necessity for women to have goals and ambitions outside of the family, but, from her own family experience, that to juggle a home and business was a way to strengthen character.

Me: And I guess that having your mom own a business like that you had the impression that the business world was ok for women too.
Mom: Actually, I owned my own business for 15 years. I graduated in business from high school and went to 2 year college and opened my business that same year.
Me: What was your associates degree in?
Mom: Hotel Restaurant Management
Me: So you must have had a lot of math.
Mom: Yeah, in high school I took like all business classes...accounting...and in college I had all business math.
Me: Sure.
Mom: But in high school I didn’t take all that math-math that they took. I didn’t take that because I was geared more toward business classes. It all made a little bit more sense because I could relate to it.
Mom: So you had a head for numbers in a practical sense. Rather than theoretical math.

But Alison’s mother had not helped her own children with math, either. I questioned both Alison (4/16/08), and her mother (4/30/08), further about homework in their households. Mom remembered Alison getting some help from her Dad, but primarily from her brother.

Me: So it seems as though the math you were doing you were very confident about.
Mom: Yes.
Me: Do you think that part of the reason your daughter is so confident with math is that you were comfortable with math. She is definitely comfortable with math.
Mom: And I think it is because her father loved math. He never finished his college degree. We met when I was in high school. We’re seven years apart. He was older. He started out as an accounting major. So he really loves math.
Me: So he was able to help her with the math he hadn’t even had. Or was he not in the business track in high school?
Mom: He took the regular math in high school.
Me: So he’d had the math she took.
Mom: Yes, he was able to help her out, and her older brother. I really don’t remember off hand what she had to ask on. I think her older brother helped more because he was 2 and a half years older.
Me: So it was still fresh in his mind.
Mom: More than her dad, I would have to say. She’s definitely not afraid to ask questions if she doesn’t understand it. And that’s a good thing with math.

Alison’s memories did not agree. She remembered the help her father had given her, recounting his patience and explanations.

Me: Did you have a lot of homework?
A: Yeah...Not that much in younger grades but as it got higher, worksheets, math problems in the book, yeah, I did a lot of those. Sometimes you were so worried about getting all the problems done, like it doesn’t even matter, like you aren’t even looking at the problems that much, you are just doing them to get things done. So, yeah, I had a lot of homework. So having a parent who was willing to sit down with you, and I mean, explain it more, um...I know that a lot of times I really had difficulty with that, like ratios, twenty over fifty. And my dad would sit me down and explain it to me. It would be like, this is the way like, I learned it this way, and so having that person who was really
willing to help you. I think really does help, like encourage you, kind of thing.

She spoke only of mom and dad, and the different tradition of math from which the women of
her family were a product, as though to excuse her mother for not helping her.

Me: To run businesses like that, they must both have been pretty good at math.
A: Yeah, my mom says she’s not good at it, but you’d have to be good at it to handle all
that money. But maybe she thinks of math in a different way. Like algebra and stuff not
money.
Me: That’s funny. And then with you, you said you got help from
A: My dad, definitely.

From her own experience, Alison had strong feelings about homework, its abuse, and the way
some of her teachers were not open to the alternative ways her father would teach her.

Me: So when you got help at home and you came in with your homework done a different
way, were your teachers open to that?
A: Pretty much, but I think a lot of the teachers are scared of something they don’t know,
so if you came in with the right answer, they’d say, “But you didn’t do it right.” But some
people did learn differently, and there might be a different algorithm that helped them
more than it helped you, but I think some were narrowminded to how they learned it.
Me: That can happen with math. If you’re not really comfortable with math, and you
don’t have a grip on what the process is, you can be intimidated by a different way.
A: And there were teachers in grade school, who, ya know, didn’t like math, and they
wanted to teach because they liked kids, and they did well in other classes, but they didn’t
like math so math was kind of like just on the side. They’d get through what they had to
get through for the PSSAs but like nothing big. Like I see math as my BIG class of the
day. Like, not like, we’ll do math if there’s time.

As a result of comparing her past with her recent experiences in classrooms, Alison had changes
in mind for the future. These she shared in the second interview.

Topic of Math Peers:

4. Alison (interview 4/9/08)

Alison probably had the least to share about her peers of all four students interviewed.

She had spent little time interacting during class, due to the teaching style of her elementary
teachers. She recalled being intimidated not by the math, but by the other children.

A: I know I never was one who would, like I knew my material but I never was so sure of it, like even in my classes now, like I know I’m intimidated by kids, they know their material. I might have a simple question but like I feel like, “Should I even ask?” Maybe I’m the only one out there. But now I’ve gotten to the point if I need the extra help, I go for it because in the long run, I know I need the explanation. It may take me a little more time, but I have to do that. If the other kids are raising their hands because they know it, and you may have an idea but you don’t know if it’s right, then you don’t want to take a risk in front of your peer. You don’t want to get called on and get told, “No, you’re wrong.”

She added that the lack of confidence contributed to later negative feelings toward math shared with her by some of her friends. We brought up my first question, “Who hates math?” at the beginning of the Math Methods class at the university.

A: Yeah, I think of lot of how you feel about math has to do with your confidence. If you had a bad experience when you were younger, and when you get older, you’re gonna feel like you can’t do it....so many of my friends hated math because they had bad experiences when they were younger. So if you feel kind of believe in yourself and you have confidence, then it helps you when you get older to succeed.
Me: Like how many kids, in our first class, when I said, “Be honest, who hates math?”
A: Yeah, exactly, almost everybody raised their hand.
Me: Yeah, at least half. (Both laugh).
A: And I thought I was the only one who didn’t raise my hand.

She did share a few general observations about boys and girls, as well. Later on, we would discuss gender differences again, and whether she felt there was anything genetic about the ways boys and girls approach math. On two different occasions she hinted at that belief stating first:

A: There were a few girls who were very good at it, but there were also some boys who were really fast with stuff.
Me: When you think about those kids in class, was there a difference in the way they responded?
A: Exactly. I was just gonna say that, yes. The girls were more like, ‘I wanna know, I wanna get it right.’ And the boys were just kind of like ‘Whatever.’ In eighth grade they actually split the class boys in one class and girls in the other. And it was kind of interesting because the girls were always more high strung, wanting to get it right and the boys were like, ‘Yeah, that’s how you do it, whatever.’
Me: So the girls stressed more over the math?
A: Or maybe the boys just didn’t show it.
And later, in the same interview in reference to her father’s math interest:

Me: So where did your dad get his math background?  
A: I don’t know. It was just the one subject he excelled in, so I don’t know if it just like  
runs in his family.  
Me: It was in his genes?  
A: Yeah, he was really good at it. He was the one I always went to... me and my brother  
always went to him with math questions.

Interview 2: Evaluating the Modern Classroom and Testing the Water

Topic of Math: The Subject

4. Alison (interview 4/15/08)

Alison noted several ways math curriculum had changed, not so much in content, but in  
emphasis. She liked the idea that teachers could be open to different ways of arriving at the  
answer.

Me: I think it’s great that you are so open to doing math in a different way.  
A: Yeah  
Me: Because some people only know it one way, not that they understand it, but that’s the  
way they can get the answer. And unfortunately the math books kind of support that.  
There’s an official algorithm that everybody has to learn. It’s not always the best way for  
everybody.  
A: I know  
Me: Sometimes you just have to say to the kids, “What would you do?” And they can  
explain it better than we can.  
A: Yeah, like you can ask them, and they can do it a different way that makes sense to  
them. And if it makes sense, “Good for you, you can explain your work.” But also, if they  
can explain it to the class, isn’t that better? Other kids can see it in a different way and it  
might help them. Then they might be able to figure it out.

She liked the emphasis on understanding math and was aware that children have different  
backgrounds, abilities, and ways of making their own sense of the world around them.

Me: So there’s lots of ways to get there, some faster, some slower, you can draw pictures  
to make more sense, but the important thing is that you got there.
Alison also pointed out the differences in her teacher training. Her university classes were encouraging prospective teachers to integrate subjects. This was something far removed from the way she had learned in school. She embraced the logic of applying concepts to real world situations.

Me: Sure, and you can integrate it into a lot of things. Graphing, time lines, all that stuff is math. Look at reading, how many numbers you come across.
A: Yeah, that’s what I was gonna say. Reading the numbers and discussing them like we did that octopus story in class. That was so cool!
Me: But so often you gloss over it because you think reading skills in reading.
A: Math is in math. [University name] does a really good job in the education department. I think every class I’ve been in, especially Methods of Math, and Geography, everything can integrate. In geography, in a lesson plan we would have to show two or three different subjects and the way they relate with geography. I thought it was so cool because you could do science, you could do math, you could do art. I would always do something different, but I never learned that before I came here. I never thought you could mix classes. Like this is math time, this is science time, this is reading.

She was pleased that what the university advocated she was witnessing and being encouraged to practice in the classroom. She mentioned an example integrating science, math and art, then spoke at length about her own teaching experience in 4th grade.

A: Exactly, but they don’t know everything is integrated. So the kids out there like math because you’re integrating it. We need more of that. And they’re learning more about it and they don’t realize they’re learning math and science too. So it’s not abstract and they’re not freaked out about it.
Me: Now, when you came in my classroom, what subjects did you integrate?
A: McDonald’s…math and health because we did calories. I did food and how you could get it cheaper. Well they loved it and they were absolutely, like the whole calorie thing, they all wanted a copy of it. They kept asking for it and Liz felt so bad because she didn’t have enough for everyone.
Me: Yeah, we ran off more at the end.
A: Yeah, they really like that kind of stuff. They actually liked working in groups and they could all relate to McDonald’s so they really wanted to do it.

Alison mentioned other things too, like the ways teachers motivated children. She liked using
something called 200 Marbles or Marbles for Manners. She liked the way teachers set up their
classrooms and allowed children additional responsibilities and choices. She was impressed that
children were working at different paces and on different levels.

A: ... I liked how kids have a little more freedom in the classroom. I always had to stay in
my seat. In both classes [a second and third grade] it was really cool because the kids
were allowed to get up and get a drink of water. I was never allowed to do that. And it
was interesting, like with spelling, kids would be on different levels. And they would
definitely work at their own pace, and they would have a partner. And working at their
own level they wouldn’t feel inferior.
Me: So the classes were very different from the classes you had. When you were growing
up did everybody do the same thing at the same time? Did they group?
A: Yeah, we all pretty much did the same thing at the same time. Like in reading or math.
The only time people would leave was like to go to the reading van.
Me: Like Title I reading?
A: Yeah, something like that, but we didn’t have Title I back then. I actually went back
and observed at the school where I went. There were a lot more people leaving the
classroom for individual time. We didn’t have that many people who got individual
attention.

Having also gone back to visit her own school recently, she was pleased that there was
more individualization there, too. We spoke further about pull out versus pull in programs to
help individualize services for children. Alison was also impressed with the aides in classrooms.
She spoke about a principal who had visited her class and described the grouping done in her
school for reading and math.

Overall, Alison was excited about the changes in the classroom and anxious to become
part of it. She liked the atmosphere and the tools she saw that were available for teaching. Alison
was clearly an advocate of hands-on learning.

Topic of Materials:

4. Alison (interview 4/15/08)
A: I think the kids enjoy it more, and I’ll do a lot of hands on things...

In several classrooms, Alison had seen students writing on white boards. She liked the idea of seeing children’s work, and the novelty of allowing them to use markers and erasers at their desks to gain their full engagement. She also liked the fact, that with partnering, students could share their understandings.

A: Hmmm....I’ve always wanted to do the whole white board thing. I see it all the time, and I tell my mom, I always wanted to do this when I was young. I could see how the kids are doing. But personally, I think we could all do things together, and I could also do groups ‘cause I feel like maybe the kids could help each other. I know sometimes we kind of just sat there and weren’t allowed to talk to your neighbor because you were working independently, like working together would help out. And one of the manipulatives I think would really help out is that balancing thing you brought into the classroom, for teaching algebra, I thought that was great. I mean... it would have helped me. Things like that.

Besides white boards, she mentioned Hands on Equations, balance scales used for teaching algebra, play money, and the Base 10 Blocks she referred to as placemats.

A: Exactly. Even with the placemats. We were never told you were taking a ten from the tens and putting it in the ones. I understood the concepts, but a lot of us weren’t actually understanding you were taking a ten from the twenty and putting it in the ones to make that ten in the ones column. For a long time we just memorized if you needed to carry you just moved the one over. I just think if we’d learned it that way, everyone would have thought it was easier.

She liked the idea that many manipulatives did not need to be purchased, but could be made with paper and then laminated for durability.

Alison also had no misconceptions that teaching would be easy. She went on to describe the time commitment and demands she was willing to accept in order to provide the best learning environment she could for her own students.

Topic of Teachers:

4. Alison (interview 4/15/08)
A: I think I’m going to be willing to sacrifice my time for those kids. Whether it be after school or during learning centers...I want to help make them feel comfortable. And I think I have to show them that we all make mistakes, like I still make mistakes, it’s alright. I didn’t understand that when I was in third grade. But I want to make them feel better. I don’t think you should give up on them. “Well, they didn’t learn that last year, so I’m gonna give up on them again and let them slip through the cracks.” I think you should at least give them the extra help to let them catch up.

She and I had discussed differentiation earlier and she revisited it again in describing how she viewed her job as a teacher.

Me: We’re getting more and more of those kids with learning disabilities. And I think we have to understand that they have to learn an alternative way. And that’s got to be ok.

A: Some kids can’t learn the way other people learn and you have to learn that’s part of your job. Teaching them in a different way that works for them and they understand.

Alison was passionate about not only helping children to learn, but making learning a valuable and exciting experience for students.

A: Yeah, I think of lot of how you feel about math has to do with your confidence. If you had a bad experience when you were younger, and when you get older, you’re gonna feel like you can’t do it...so many of my friends hated math because they had bad experiences when they were younger. So if you feel kind of believe in yourself and you have confidence, then it helps you when you get older to succeed.

She summed up her feelings and philosophy of teaching as she spoke about confidence. Like the teachers she admired from her own student desk, she would emulate the compassion, the one on one help, and the self confidence she could instill in each child.

Topic of Homework:

4. Alison (interview 4/15/08)

   Alison admitted that homework was necessary, but qualified her statement based on her own past experience.

   A: I think it’s needed, but only if it’s pertinent. It should be review, and you should review
it in class. If kids don’t want to do it and they know you aren’t going to go over it in class, then what’s the point. I see some of that review in class and it also has to be useful when they get older so they see the purpose to it.

And faced with the dilemma about what to do if students receive no support from home, she was unsure. She would try asking them to come in early, which she recognized as a problem if children are bussed. Then she remembered what the visiting principal had shared with her. Her school had a late bus for students who needed extra help after school. She liked that idea. She also remembered time during the school day if she used learning centers with her class, or students had band or orchestra at the upper levels. Those not attending would be available at those special times, too. We spoke about taking recess and she agreed that would only further alienate the student from the subject.

A: They can’t go in early. I did that a lot.
Me: So you don’t want to take their recess time.
A: Taking their recess time is almost like a crime. “We’re gonna do math? I’d rather be outside playing.” That’s horrible.
Me: So the lunch thing works for me
A: Yeah, that’s cool. I like that. I never thought of that. It’s not like you HAVE to eat lunch with me. You can bring a friend. And I’m sure they love doing things together. One on one time with the teacher.
Me: And those other kids who know it aren’t shouting out the answer.

Alison at least had some ideas to try, knowing that if she valued the homework she would need ways to ensure its completion with or without support from home.

Topic of Math Peers:

4. Alison (interview 4/15/08)

She was already thinking of ways to help every student feel successful in front of their peers. Although she herself had never admitted being humiliated, her comments about being intimidated were still on her mind. We had spoken about techniques for increasing participation,
and she brought one up as a technique she would use with sincere compassion in her voice.

A: Like the third grade class I was observing the kid could ask another kid for help, then the teacher would check to make sure the first kid understood it. The first kid would repeat it. I thought that was kind of...
Me: Like the wait time we talked about in class.
A: Exactly. Was it in your class that we learned that?
Me: Wait time and wait time extended?... so the teacher could go around and see that certain kids had it right, then she’d help the kids get the answer then go back and call on them first.
A: Yeah, exactly...to boost their confidence. Like someone will say, “What’s 2 plus 2?” and they give ’em like 2 seconds to answer and some kids have shouted it out already. And those other kids might need more than 2 seconds...they might have to use their hands to count.
Me: They’re all at different levels.

Alison also brought up scaffolding and the use of learning centers as ways she could accommodate her students. She would encourage cooperation and teaming to build confidence, class unity, and caring. She was truly worried about students being ostracized by their peers.

A: I could do some scaffolding, so they could teach each other. And I guess I could group them. But that’s kind of bad if they know, “Like I’m in the low group.” But sometimes they can’t learn at the level of the other kids, so if you can work with those kids individually, the important thing is to get them to understand this one idea, then the other kids who excel can be working on other material.
Me: What are some of the ways you could differentiate?
A: Oh, yeah, yeah. I just did this in my early childhood class. Absolutely, like learning centers. And obviously have the kids working at different levels, but everybody is doing it, so it’s not like, “You’re doing this because you’re lower.” Everyone’s doing the same idea but at different levels. Actually, I loved the learning center I made for your class. I saved it because I’m sure I’ll use it some day. I never had anything like that in my elementary levels. I think it’s so cool that you can do stuff like that.
Me: Then the teacher can pull the kids who need extra help while everyone else is busy.
A: And it’s not just busywork, it’s a lot of application. I just think it was so cool, with the mittens, putting them together (pairing math facts with their answers to make a pair). Something like that, the kids will just love to do that kind of stuff.

Alison has a positive outlook about what a classroom can be. She sees it as a safe haven, and under her leadership, a place where children can practice cooperation and partnership.
Interview 3: Where in the World are Women in Mathematics?

Topic of Career Opportunities

4. Alison (interview 4/16/08)

Alison’s family background and experience set her apart from the other women I interviewed. Because the two generations before her were matriarchies, with mother either by circumstances or by choice running a business and raising a family, Alison sees having both a career and a family as an option for herself. These women are her role models.

A: But the funny thing is we all knew what we wanted. No matter what age we got out of school. We all knew what we wanted. My mom was dead set on being in catering and she did that until I was seven. I always knew I wanted to be a teacher. My gram always knew she wanted to work in the business. I feel like it’s helped us all to get through, knowing what we wanted.

However, she is as distinctly opinionated as her mother on the subject of equal opportunity. And perhaps, partly because they speak to each other every day, our interviews merged on this point due to that constant communication between mother and daughter.

A: I had this talk with my mom. I think that girls do better in school with their grades and stuff, but once they graduate guys can get a job so much easier than the girls. I don’t know why, but the girls face so many obstacles. Like if they want to raise a family, too. And those are things they might hold against you. Are you gonna get pregnant soon? So I can’t hire you. And then there’s what can you do because you’re gonna have a family? You can’t get too involved in your job. I think women have a harder time with that. With guys they think they’re more reliable because they don’t have those kinds of things to worry about. So guys are hired more. So I definitely think it’s different. So...

Me: We claim that opportunities are equal...

A: No, I don’t think so. I think it’s almost getting worse. I think that once we tried to make it equal, and now we think it’s equal, but it’s NOT. So now it’s not getting any better because no one is working with it to make it better. So with the mindset that men work and women stay home with the kids, and men go out and get the jobs, I don’t think that it’s gotten any better.

Mom agreed with her daughter(4/30/08) in response to a question about whether or not she thought that our culture stereotyped men and women into certain roles.
Mom: I think so. I don’t think we have overcome them. It is still very stereotypical. Like......I just think... um...the whole thing I was saying like the way we learn in school. It seems like the girls are the better students but when you look at the world, you know, the guys, the men are the ones with the better jobs. And I don’t think...I can’t say that I...I just like to watch the neighbors and see the wife is out there with the two little kids and she is with them on the bikes, and the husband comes home in the suit, and I just think, I wonder what she was like in school? It’s just such a weird thing, and I don’t know if it’s because we as a culture put such an emphasis on the mother being home? Or being with the children?

Alison’s Mom (4/30/08) cited an example of her own situation with regard to gender, work, and pay. She did not feel that the workplace, once out of her business control, offered equality.

Mom: I guess I didn’t think of it that way before but, we were just talking about that at lunch. I just started a new job and 6 years I had been doing medical billing and I just got into the hospital system and I’m a collection analysis for the hospital, and um......we were talking about jobs and the money and I said, “It seems like I work so hard in my job, and I’m not saying anybody isn’t more important, but for what I do and what my husband does, you know, I’m the one bringing money into these businesses, finding out why things aren’t getting paid, and you know, my husband’s job is in the office, he was one of the carriers, he’s not now because he got hurt on the job, but......it’s not the severity of the physical labor, but it’s just like what takes more to be done that I should be getting paid more than him. And I don’t....

Mom added that increased demands for a four year education placed even more pressure on young women to make decisions about family and career options.

Mom: I was engaged at 21 and married at 22. Pregnant six months later and had my son. I know she thinks about that... My mom was pregnant with me she was just about 40. So when I was in grade school, it was like, “Oh, your grandmother’s here.” So I know my daughter says, “I want to be younger when I have my kids.” Yeah, we sacrificed a lot, but we are still young enough to enjoy it. Not like my mom, with me, because I was the youngest of 5. We didn’t have that relationship with my mom.
Me: Several of the girls have brought that up. That they’re gonna be older now when they graduate from college, and then the career thing, you really want to get tenure or something before you move on a family. That’s four more years. They’re feeling the pressure of how do you work your family in there, and keep your job and career alive.

Both mother and daughter agreed that although men and women may desire careers, the attitudes toward family responsibilities are not equally shared, thus putting an additional set of demands
and expectations on women.

Mom spoke with pride when she said that although she saw the pattern, her own family was certainly an exception.

Mom: Um... I think it might be true of some people. But if I relate it to my own self, I don’t think so. I was just talking about this with my husband last week, and now that I’m getting older, I look at my kids from outside. And I look at the younger people in the neighborhood, and I think it’s so weird. Like when they were in grade school and high school I heard who was the best students, whatever. I always heard that the girls were better. They are more conscientious about their work, whatever. But in the business world it is the guys who are getting the better jobs. And I was saying to my husband, that’s wrong if you really think about it. But I don’t relate that to my own life at all. Because, and I have to say that, I was a little bit of an exception, because I grew up in the business. By the time I was a senior in high school I had my business picked out and the name picked out. I knew this was what I wanted. This was what I was gonna get. I had set my goals and I achieved my goals. Then I got sick and we had to sell our business. But I think some of that is true, but I don’t think necessarily in stone it has to be true.

Alison concurred, standards set in families serve as role models for the next generation and she saw hers as positive. She and her mother never said that her father shared equally in the work and family arenas, but they both agreed that they made it work and were satisfied with the outcomes, particularly from the aspect that all the women she admired were strong, determined, and self-reliant.

A: I guess it’s how you were raised. I think that in my family it wasn’t that case. The women in my family were strong willed. They worked. I think it depends on how your family, the generations before you...
Me: So do you think it’s possible to juggle both?
A: Yeah, you see so many families, that if the mother does get a job like that, it seems like she has less time with the kids, and no one is having time with the kids, because the father is out there doing the job just as long. I don’t think that it should be like that, but I think that it does take a toll. I guess it’s how you were raised. What family you were raised in. I think that in my family it wasn’t that case.

Because they had made their niche in the business world and achieved community approval for their successes, Alison’s family was able to view gender equity with a critical eye.
Topic of Equality

4. Alison (interview 4/16/08)

When asked their opinions about gender, math and eventual business opportunity, it seemed the responses were conflicted. Particularly, in this family, there were women strong in math, both business or theoretical. Aptitude for math, for example, was not thought to be a male trait, but it could still be thought of as genetically inherited.

A: *I guess to an extent you have to get some of it from somewhere, like you’re born with it kind of.*

She elaborated from her own experience.

A: *I think girls are more technical.*
Me: *Do you think that’s a hang up?*
A: *I think it could be that. Like in geometry, the boys did better. Maybe it was a difference in the kinds of math. And girls do better like in algebra. Geometry was really hard for me, and now the multivariate postulates, so seeing the various objects is really hard for me. I just feel like the girls are better with the more structured...like these are the parts and you do this, and boys just pick up on other things.*

Mom agreed.

Mom: *I kind of think it’s partly genetic. I look at my sisters, they didn’t go to college. My brother has his own business. I think it has always been my dad, my husband, who loved math. I think that it has to be a little genetic. Then I think some of it is cultural.*

Although she did not give examples, she had previously spoken about how her mother had told her to ask men in the store for help on her homework. She had sent her daughter to her husband and son for math help. She was perpetuating the stereotype by not admitting that she was a very capable business mathematician, herself.

The Topic of Measuring Success

4. Alison (interview 4/16/08)
I asked Alison’s Mom if she ever felt her mom was chastised by the women of the community for not getting remarried and allowing a man to run the business so she could care for the five children. Her response, as I expected, was filled with pride.

Me: Now when you think back, to your mom’s generation, do you think that she was admired by other women back then? Or do you think that maybe she was chastised by women for going to work? How was she treated by women?

Mom: People in the community? She was looked at very highly. From what I can speak of, she was looked at very highly because I remember hearing people say, she was a strong community person. She employed a lot of people. Like if there was a child sick at night, I remember people knocking at our door, late at night, and they would say, “My baby’s sick, I need baby aspirin, and she would let them in. I remember that people admired her and her strength of having 5 children, and no husband, then a business and not giving up, and making something more of it.

Me: That’s great. She was really a role model very early in this whole thing.

MA: Yeah, yeah she was.

And it was not only the role modeling, but the encouragement that she received from her mother that helped Alison’s mother set her sights on owning her own business.

Mom: And my mom was completely the opposite. She was completely like, well, you can do both. She never said, “You aren’t gonna be able to do this.” My brothers and my sisters. My brothers definitely said, “You’re never gonna be able to do that.” The more they said that you’re not gonna be able to do that, the more I was determined. But my mom never was like that because I guess she did it. She just felt like, my mom was very supportive. If you put your mind to it you can get it done. Ya know. You have to really want it.

It is this will and strength of character that Alison’s mom has tried to instill in her daughter.

Mom shared stories of how she had taken a softball coach to court over a small claims issue, just to show her daughter that she could not allow herself to be bullied by another adult. She spoke at length how she counseled Alison about handling situations with her college roommates. Alison often complained on the telephone how she felt abused when roommates used her art supplies, jewelry, or electronic games. Mom closed with a mixed review of the situation for women today, in spite of the success the women in her family had been able to achieve.
Mom: I think it’s a long way off. I don’t know what is gonna change it, or it’s just a matter of time...and it slowly, over time, changes. I kind of think we’re a long way off.
Me: I wonder too, if women really want that. The more of these girls I talk to, they absolutely are not interested in being the president of a company, or the superintendent of schools.
Mom: I think it’s turning back around. Maybe 10, 15 years ago, there was more of a push for women to be the executives, but now they don’t want that. I think maybe that’s kind of a good thing that we are starting to go like that. My husband always says the problem with our society or our culture, and our world is that we are pulling away from the family. And I think that maybe it’s starting to turn around, and people are starting to realize that family is maybe the most important thing.

I didn’t detect regret in her voice. All along she had sung the praises of juggling a job and a family. She encouraged Alison to be strong and determined. Then, in her parting comments, she affirmed that motherhood might be just the right place for women. In stating that family was the most important thing, she never mentioned that men might play a larger role. In regard to women seeking high powered jobs, she said, “[Women] they don’t want that.” Perhaps she saw teaching as a compromise for her daughter? It was difficult to tell.

So Alison wants to be a teacher...and she wants a family...and she feels confident she can achieve both. She has searched for her role models, and chosen strong women in both her family and in the schools. She has found positive examples of how to teach and raise children, and made some astute observations about the world around her. Unlike some of the other interviewees, she never described her future as a compromise, but rather, as a path she has chosen to maximize her own strengths. She foresees no difficulty in managing a family and teaching, since the women in her family were all successful entrepreneurs. She believes women have opportunities in STEM fields, but her interest lies in teaching, unlike her mother, who feels women have advantages in their own businesses, but less upward mobility in established traditionally male operated businesses. Alison’s greatest concern at the present time is not over her ability to teach well, but rather, over wages and whether to accept a job in a
Catholic school where she can prepare students for First Communion, or in a public school where the pay scale is higher.
Chapter 7: Discussion of Themes

In depth interviewing generates an enormous amount of spoken material. That material, once tape recorded, becomes a vast resource of verbal material to which nonverbal supplement must be transcribed. Months after the interviews, as I reread the texts, I can still hear their voices in my head and see their expressions and gestures in my mind’s eye. Studying, reducing, and analyzing the text is the final stage in finding what is of interest and most significance in the study (Wolcott, 1990). And the topics of interest to me are those that might help me understand the aversion many of my teacher candidates in the college have for mathematics. Categories, having been identified individually, are compiled between and among the participants. I am interested in the beliefs these women hold about mathematics. Are their opinions based on family and personal experience? Is ability genetic or socially produced and perpetuated? Depending on their beliefs, have these women pursued or limited their ambitions involving mathematics? Why have they chosen elementary education as a career? Have these beliefs played a part in determining the grade levels they wish to teach? How will their beliefs impact the way they approach mathematics in their classrooms? And how do they predict they will portray math opportunities, particularly in the case of women in the STEM subjects, to students in their own classrooms?

Seidman says, “We interview in order to come to know the experience of the participants through their stories” (p. 119). Some stories are heart-wrenching, others, less interesting. It is not my intention to judge these individuals, but rather to better understand them. I used the conventional way of presenting and analyzing data, organizing the transcripts into categories. In addition, as Seidman suggests, I looked for connections between the categories and among the individuals. I discuss them here as themes. Often I quote the interviewees directly,
but when paraphrasing I try to remain true to the spirit of the conversation. Some passages are contradictory. I include them because there is perhaps further investigation required to fully understand a position or purposefully misleading position when verification is sought.

The following discussions are based on the understandings and appreciations I have found in the stories I have collected. The interviews have raised my awareness of particular issues, both private and social, that influence the stories and decision making processes of the participants. It has made me aware of the complexities of their mathematical experiences and in combination with their teaching intentions, given me a new respect for the situations of these students as they attempt to make mature decisions about their futures. Although I have made an attempt to follow a traditional dissertation format, the nature of my interview study has required some adjustment to include adequate quotations, intermediary reflections, and final discussion where existing research and personal sense making take place.

Theme 1
Beliefs about ability: Does Math come from Mars?

As a result of the interviews, a spectrum of interesting beliefs comes to light about math ability and where it originates. The four participants evidence varying degrees of belief in a “math gene.” It has been said that there are fixed biological differences in mathematical ability and that men are better (Gurian, 2003; Ernest, 1991). Some research shows differences in spacial abilities (Hoff Summers, 2000; Voyer et al, 1995) and cognition (Geary, 1996) while others claim boys are better at higher level math (Moir & Moir, 1999). Candy and her mother believe this, while Kathy and Alison believe in a math gene that is nondiscriminatory by gender.
Adopting beliefs, and acting upon them, these three women perpetuate important perceptions or misconceptions about women and mathematics.

Candy comes from a family where mom admits, “I’m not a big fan of math” (4/11/08). Both Candy and her sister learn early that dad is the math person in the family. She thinks there must be a math gene that enables males to be more successful in math than women.

Me: Some people say things about a math gene. Do you think there’s anything to that?  
C: Ummmm....I don’t know.....I think there is. (4/1/08)

She also feels girls learn these beliefs at home and apply them to their own lives. “I think whatever you grow up with, whatever you’re used to, you do it too” (4/1/08). Based on her experience, Candy’s beliefs are reinforced. Math is encouraged in males, not females.

C: ...As a girl if you’re disregarded and you’re not taught in a way that makes you want to be doing math, or liking math or understanding math...
Me: ...you’re picking up subtle hints all the time?  
C: I think so.

Candy operates under the assumption that not only is she not genetically endowed with math talent, but she should not seek to be mathematically advanced. Her attitude reveals an acceptance that a passing proficiency is adequate.

Kathy, a fraternal twin, has an interesting attitude toward math because her sister is a college math major. Her mother is happy to take the blame for Kathy’s mathematical shortcomings and give credit to her husband for having the math gene. “Her sister loves math...her sister’s more like my husband. Yeah, I say to her all the time, ‘You got my genes....poor kid’” (3/23/08). Kathy also has an excellent woman tutor for high school and college math. So even though math is believed to be genetically inherited, it can be passed to female siblings with equal probability.
Math ability, in Alison’s mind is genetic, but only partially sex-linked. Alison says, “You have to get it from somewhere, like you’re born with it” (4/16/08). She says, “It just like runs in his [Dad’s] family.” I ask if she means it is in his genes and she replies, “Yeah, he was really good at it” (4/9/08). She believes particular aptitudes in math are gendered. “I think girls are more technical...and girls do better in algebra,” coincidentally her favorite area of mathematics (4/16/08). Boys, she goes on to say, are better at geometry, which she found extremely difficult. Her mother agrees that genetics plays a role in mathematical ability. A successful business owner, and accountant, she differentiates practical math from the regular math Alison takes in school, “I couldn’t relate to it” (4/30/08). Alison has learned from her family that math is a genetic trait, and her experience has shown her that she has inherited the gene and its particular gendered manifestation. Not unlike Walkerdine’s (1990) findings, she believes algebra is for girls, while geometry is for boys.

In contrast to a deficit theory, you either have math ability or you do not, performance may be influenced by social expectations (Walkerdine, 1998; Shaw, 1995). Other researchers find no difference in mathematics aptitude based on biology (Shusterman, et al, 2006; Baillargeon & DeVos, 1991; Jacklin, 1989). Mathematics may be an established social male domain, excusing lower self-confidence, attainment, and participation by equally capable females (Hall, 1996; Bilken & Pollard,1993; Isaacson, 1989; Ruthven, 1987; Dweck, 1975). Brenda’s beliefs seem more likely to belong here.

Brenda and her mother refer to math ability as a product of readiness, rather than genetics. Brenda admits having difficulty with school overall. Her mother blames it on her early enrollment and maturity level. Both, however, allude to the strengths of mathematics on the male
side of the family. Her brother, two years younger, “Was a wiz in math. He could help me on concepts he hadn’t even learned yet” (4/3/08). And mom says, “His strength was always math” (4/20/08). Even as a child, he could do problems in his head and beat her. Mom says she loves math, with the exception of geometry, but doesn’t have the patience to help Brenda. Instead, Brenda turns eventually to her best friend, Sherry, for help in math. Sherry is an exceptional math student in high school and college. Brenda has strong male and female mathematical role models. Brenda does admit though, “For some reason I always think boys are better at it...Math is for boys. I don’t know why” (4/3/08). She does make a confusing comment that if either parent has the gene they hope the child gets it, but she reconsiders, more likely it is stereotyping that causes her to believe boys are better in math and science. “I think a lot of it is gender expectations. Like I feel that boys are just expected to do better in math and science” (4/10/08). Mom agrees, and gives an example of how she, herself, has followed an expectation. “Probably cultural...like the way we were raised. Like I can remember my son, he didn’t even have an idea of what he wanted to major in, in college, and I knew how good he was in math, so I pushed him in that direction. And I knew that. And Sheena could have done great in math...I didn’t push her in math” (4/20/08). Brenda’s mother implies that mathematics perceptions are socially constructed. Both Brenda and her mother appear to believe that male and female performances in mathematics are encouraged rather than inherited.

Walkerdine (1989) argues femininity is equated to poor performance even when the girl or woman is performing well , “A view that makes many of its members see this difference, even where none exists” (p. 9). The outcome of such social stereotyping creates a self fulfilling prophesy of lowered expectations for girls in mathematics (Hilke & Conway-Gerhardt, 1994;
Vandell & Fishbein, 1990; American Association of University Women, 1990) and in turn, lower performances. Research shows elementary girls are equal or ahead of boys in every academic area, even math and science; but as they progress through school, girls fall behind boys, especially in math and science. Middle school seems to be the point at which boys forge ahead and girls fall behind (Walkerdine, 1998; Association of University Women, 1990; Sadler & Sadler, 1994).

Davies (2003) refers to a male-female binary, where such attitudes and beliefs hold women in place. She finds it depressing to discover how “subtle, how invisible, how pervasive, and how much our own are the discursive mechanisms and structures through which we have learned to know our place and to remain within it” (p. 8). It seems evident that Brenda and her mother are products of a belief system where mothers and daughters make choices based on a set of values undermining women in the subject of mathematics.

Three of the participants are products of a biologically-based belief perpetuated within the family. They believe that mathematics ability is the product of genetic selection. It identifies men in one instance, and some women in the case of the other two. In the final participant, there is uncertainty, leaning more toward socialization.

Brain difference theory argues that the thinner corpus callosum in boys is why men often respond to problems using one side of their brain while women use both sides. This may create a linear approach to problem solving in boys versus a holistic approach in girls. Differences are slight, however. Neuroscience shows the brain also develops through social interaction. Connections may be strengthened by experience. Following social interaction, males and females perhaps do experience the world in different ways, not only because of their different bodies, but
also because of their different positions in society. If in fact there is merit to the brain difference theory (Coffield, Moseley, Hall & Ecclestone, 2004), it must also be argued that socialization influences the way women view themselves in relation to mathematics. Men and women are physically different, but gendered behavior is socially produced. “Gender encompasses not only the concept of sex, but also the social and cultural meanings attributed to being female or male” (Hilke & Conway-Gerhardt, 1994, p. 8). Embedded in every social interaction is an underlying sexuality which may seem to have no relation to what is going on but may actually be central to the interaction.

Neuroscientist Rogers observes, “even hormones may be affected by environmental factors. So even if a relation were eventually to be found between patterns of brain difference and gendered patterns in educational achievement, these gender differences in the brain might still be the result of social experiences rather than innate (and unalterable) factors” (Loyd & Deveen, 1992, p. 81).

Each participant believes in difference; and believing in difference, whether nature or nurture, creates the foundation for yet other beliefs about women and mathematics. Those beliefs may limit their expectations as women or create doubts about their abilities.

Theme 2

The Mathematics of Parenting: Whose job is it?

“As the twig is bent, so grows the branch” (Spelke, in Pinker & Spelke, 2005). Beliefs established in parents may be passed on to children. In spite of research that boys and girls have comparable test performances (Hyde et al, 2008; Walkerdine, 1998; Shaw 1995), fathers (Davis-Kean, 2007) and mother’s influence the actions of their daughters and effect their achievement and performance perceptions (Lindberg et al, 2008; Jacobs & Eccles, 1992; Frome & Eccles,
1998; Tenenbaum & Leaper, 2003), in some cases more than their actual performance in mathematics (Meece, Wigfield & Eccles, 1990).

From their earliest recollections of mathematics at home, Kathy equates math to grocery shopping and little else (3/17/08). Both she and Brenda remember playing store at home with their siblings. Research shows mothers do focus on domestic math, or caretaker math, with their daughters (Walkerdine, 1998; Shaw 1995), but then, in the case of all four participants, their mothers abandon role modeling in mathematics entirely.

Candy’s mother is quick to point out her own limitations in mathematics. “Very early on in elementary, I could probably handle that kind of stuff. Once they [Candy and her sister] started getting up into middle school, he [Dad] definitely took over...that’s definitely his thing” (4/11/08). Candy has comfortably internalized Mom’s position with math, “My mom could help me with some basic things, but my dad would always look over my homework and once I got older a lot of the math went straight to him” (3/11/08). She giggles nervously when she speaks of the homework sessions, remembering that dad wants her to understand the math. Candy does not seem overly concerned about mastering the math. She has an air of acceptance about her when she says, “I just remember being average and getting through it” (3/18/08).

Kathy’s mother is quick to point out her limitations in mathematics. “Yeah, and I think poor Kathy has my brain as far as that. She’s no good at math either” (3/23/08). Kathy has accepted the notion that she is like her mother, “I just realized I wasn’t good at it...They [Mom and Dad] were happy as long as I did my homework and tried as hard as I could” (3/17/08). Mom and Kathy remember that dad began helping with math in middle school when concepts became more abstract.
Brenda wants to rationalize her mother’s frustration with mathematics, but she too has a perception that her mother is incapable of helping her with math. “Mom was pretty frustrated, she wasn’t too comfortable with the math to begin with so...she’d have to leave the kitchen table so frustrated with me that I couldn’t comprehend it. I’d just give up” (4/3/08). Brenda’s mother has never revealed to her daughter that she loves math. Brenda grows up with the belief that she and her mother are both inadequate in math. She remembers, “Then my dad would come in, and other times, my brother would help me” (4/3/08).

Alison comes from two generations of businesswomen. Although each has run a store or restaurant/catering business, neither has modeled proficiency in mathematics for her daughter. Mom recalls her own experience with her mother, “In elementary school, I remember in 5th grade I had a problem with it [math]...My mom owned a grocery store. She would say to ask one of the guys who came in...I would ask customers as they came in the store” (4/30/08). Likewise, Alison’s mom, a woman with a degree in hotel/restaurant management, dismisses Alison’s math. “I didn’t take the math-math they took...her father loved math” (4/30/08). Alison and I spoke at length about her mother and grandmother and the math they must have been capable of, yet Alison excuses her mother in turn.

A: Maybe she thinks of math in a different way.
Me: That’s funny. And then with you, you said you got help from...
A: My Dad, definitely. (4/16/08)

At home, a framework of beliefs for mathematical expectations and achievement is in place.

Across researchers, parental involvement is essential (Marzano, 2003). It underlies attitudes and motivation. It plays a role in intentions and performance. Among the four participants there is a have/have not mentality about mathematics and women.
Theme 3
Math Friends and other Social Consequences

Peer groups are a function of the society in which they operate. Membership is determined by compliance or rejection of attributes taken from society at large or rejected. They form the parameters of the group and the standards to which members must strive. The identity of the membership is understood as determined by its membership as much as its members are fashioned by adherence to that entity. The stronger one’s identification with a group, the stronger one’s belief in the defining aspects of that group (Greenwald et al, 2002).

Perhaps the greatest of all pedagogical fallacies, Dewey wrote in 1938, is the notion that a person learns only the particular thing he is studying at the time. Collateral learning in the way of formation of enduring attitudes, of likes and dislikes, may be and often is much more important than the spelling lesson, or lesson in geography or history that is learned (p. 48).

School is a place where students “learn cooperation, build common associations around common problems, acquire common knowledge and common values” (Hlebowitsch, 2005, p. 4). The four participants have very different experiences at school, from strong peer group membership to virtually no membership at all.

Candy remembers her friends are in all her classes. “We were all pretty similar” (3/11/08). When I ask if any of her friends pursued a career related to mathematics she replies, “Nooooooooo,” with a huge smile that belies, perhaps, if I knew her friends I’d understand. “I’m the only one who wanted to be a teacher” (3/11/08), and her interest in math is limited to the lower elementary grades, which appears, from her perspective acceptable. Fay (2008) refers to this mentality as “slacker chic” (p. 3), part of a teen culture, stating that students want a less demanding lifestyle and work in the humanities and arts over the demands of science,
technology, engineering and math (STEM) careers.

Candy has one friend in high school who is a good math student. “She was teased a little bit,” she admits smiling, and looks down at the tablecloth embarrassed. She is reluctant to make these admissions.

During the same conversation she indicates a stronger prejudice and resentment toward the best math students in her classes. She postures herself to speak down on them sarcastically.

C: I thought of them as nerdy. Obviously they were getting it. They were doing something right but that whole factor of so many kids in class weren’t as fast or understanding it as quickly, will I guess they were jealous. But I think of them as just the nerdy kids. They sat with their calculators all day (3/11/08).

She, herself, does not admit to being jealous. “They” she says, in reference to her peers, perhaps, the group with whom she identifies, are jealous. She labels these math students “nerds;” a group to which she does not seek membership, adding additional insult with a stereotype. Nerds are loners whose best friend is a calculator. Interestingly, she remembers her sister, not a good math student herself, has friends in AP courses with “ridiculous high scores on the SAT’s...obviously different than the friends I had” (3/11/08). She clarifies that they are social friends, not academic ones.

Candy volunteers a story about a car trip they take with her dad. The same girls are bragging about their SAT scores and ask her father about his scores. He replies, “I don’t even remember. It just wasn’t important” (3/11/08). Candy is able to devalue the success of the girls with the support of her father, her math helpmate, the bearer of the family’s “math gene.” Candy’s negative attitude about math is strongly influenced by her peers, but her family is also apparently willing to forfeit math aptitude in women, just not so far as to stereotype mathematicians the way her peers do.
Kathy faces the dilemma of having an honors-math twin sister in the same grade. Although her parents are careful not to compare the girls, Kathy remembers needing extra help and feeling persecuted.

K: “They’d say, ‘You have to spend more time with that.’ And my sister was never like that...And I was like (whining), ‘Why.....’
Me: Did your sister ever help you?
K: Yes, she’s majoring in it. So (apologetically)....it was tough. I was horrible in it.”
(3/20/08)

Mom adds that dad helps with math mostly, but there is still rivalry between the girls. They share a few of the same friends at school, but her sister gravitates to the higher functioning academic students.

K: It was like some of the people in the group could help other people in the group. Like Lauren and her friends were really good at math and mine weren’t as interested in math.
Me: ...Ok then, so you had a mixture of friends and they helped you, or you helped each other. It wasn’t like if you weren’t good at math it wasn’t cool.
K: Yeah, we liked them because they helped us.
Me: So they weren’t like nerds out there.
K: Oh, we would joke about that...but then seriously, “We really do need your help.”
(3/20/08)

By her own admission, Kathy has a negative stereotype of successful math students that includes her sister. Kathy is quick to point out that they are fraternal twins, to emphasize the difference between them, and her mother adds, “They’re just totally different. They’re kind of like night and day” (3/23/08). While Kathy is outgoing and socially well connected, her sister and her friends are more introverted and shy. Kathy and her peers do not wish to align themselves in true friendship because they are aware of the jokes and stereotypes surrounding math. Rather, they seek a working relationship by which they can use Lauren and her friends to benefit academically without compromising their own perceived popularity.

Brenda’s experience in school is heart-breaking. She remembers being pulled out for
extra help and being made fun of by her peers. Observing her classmates she makes some
generalizations.

_B: For some reason I always think boys are better at it. I don’t know why, because I can
remember a lot of girls who did well at math...Math was for boys. I don’t know if there
were just more boys who did well. I don’t recall elementary school boy friends at all, but
I can remember math being a boy subject to me...I don’t know what was for girls, ‘cause
I...(laughs)...I wasn’t good at either!” (4/3/08)

Besides her sisters, the only person she remembers being outstanding in math is her best friend,
Sherry. Sherry is alienated because she does so well in math and science specifically. Brenda
remembers being annoyed with Sherry even though Sherry helps her through her math classes.

_B: You know my best friend in high school was very good at math, and in science and
math when she got back a test, and it was always a very good grade, it was always an A,
she would tuck it away. When I look back now, it kind of made sense. Where in reading
subjects, she wasn’t show offish by any means, she was very shy, but it was ok to leave a
paper out and let other people see what she got. But in math and science, it was always,
looking back now, even in college, people would look at her like, how in the world could
you succeed and when she would it was like people would get mad. And teachers were
curving it, and she was the one person who would wreck the curve every time...But my
best friend, she would be embarrassed that she was the one that made the teacher not
curve. And I can remember being upset with her some times. She would help me and I felt
like I worked harder than her and she would get an A and I’d get a C. (4/23/08)

It is important here that Sherry is self-conscious about her math performance, hiding papers for
popularly considered male subjects as Walkerdine suggests in her research (2003), and being
more open with those subjects classified for girls. Sherry, she remembers, attempts
unsuccessfully to hide her ability. Brown and Gilligan (1992) discovered in their research, by
silencing their voices and suppressing their talents, individuals conformed and fit in. Because
Sherry is marginalized by her abilities in mathematics, she tries to conceal them, prioritizing
acceptance by peers over pride in academic success. But in curving grades, teachers make
secrecy impossible. Individuals, like Sherry, might appear to be making free choices, but are
really making choices according to group membership (Nosek, Janaj, & Greenwald, 2002).

Brenda is a witness to an intricate negotiation of role making and role taking. Sherry’s interest in acceptance, however unsuccessful, and her understanding of gender stereotypes, exerts a powerful influence over her behavior, and for her ability Sherry pays social consequences, as well.

Me: Do you think there were prices to be paid, you know, a girl beating the boys?
B: Definitely, but she was so shy and likeable, boys wouldn’t have done anything to her but they didn’t date her. She was self-conscious.

Similarly, Brenda adds, her younger sister got all As in science and math.

B: Only the smart boys would date her. They were intimidated by her. She was almost looked at like she was inhuman. A girl to take all the science and math subjects where girls weren’t doing well, she had problems dating.

In Brenda’s experience, peers hold tremendous leverage over women. Either women choose to reject mathematics to gain acceptance and popularity, or embrace it and face the consequences of social retaliation (Gurian, 2002; Connell, 1995; Sayers, 1984). Brenda finds eventual acceptance in athletics where she can compete to a separate set of standards than her male counterparts.

Alison remembers little interaction in the private school due to the structured nature of the classroom. She recalls many of her classmates hated math because they had what she called bad experiences, but she doesn’t elaborate. She admits she was intimidated by the other children in class and still feels that way in her college classes.

A: “I know I was never one who would, like I knew my material, but I never was so sure of it, like...if the other kids are raising their hands because they know it, and you may have an idea but you don’t know if it’s right, then you don’t want to take a risk in front of your peer. You don’t want to get called on and get told, ‘No, you’re wrong’” (4/9/08).

From school, she and her brother go directly to the restaurant where they have only the
company of each other and adult care givers. When the business is sold, Alison and her family tighten their family circle around her mother. She and her brother currently attend the same university and remain very close. She speaks with her mother by telephone daily, and her parents visit campus often or Alison travels home on weekends. It appears Alison is influenced little by peers or peer group memberships outside her family.

Theme 4
Math: Mystery versus Mastery, Content Preparation for the Classroom

It has been determined that students in the U.S. have underperformed when compared to other math students around the world (Schmidt et al, 1999). In recent years, a more challenging mathematics curriculum has been developed, beginning with elementary school (NCTM, 2000; National Research Council, 1989). What it means to know and do math has been reshaped to include computing and estimating, reasoning about geometric relationships, organizing and analyzing data, probability, and measurement.

“Elementary students who experience narrow mathematics curriculum that consists only of rules, facts, and procedures and who ‘learn’ mathematics by memorizing and mimicking are unlikely to understand the power of mathematics or be interested in it in middle and high school” (Reys & Fennell, 2003).

Elementary classroom teachers are expected to master many subjects including reading, language arts, science, social studies, and mathematics. It is essential that elementary teachers have the mathematical knowledge to facilitate that instruction. A goal of the second interview is to compare each participant’s math background, as a student, with what she has observed and experienced in current elementary classrooms. By identifying her beliefs about teaching techniques, it might be possible to explore her personal challenges.
Candy admits she is uneasy with mathematics. She states, “I was in the average class. So that was ok” (3/18/08). Although Candy is adamant that she could not deal with the pressure of timed test situations where students are given math facts to complete in a number of minutes, she is interestingly, a math memorizer. “I did well if there was stuff with rules, some rhyme or some phrase to remember it” (3/18/08).

Kathy remembers being a B or C student who relies on memorization for success in mathematics, as well. “Definitely the memorization, and in third grade we would have to fill in the missing number, and I would LOVE doing them. LOVE THEM!” (3/17/08).

Brenda, a B or C student, too, says sadly, “I don’t honestly know how I managed” (4/3/08). When asked if she memorized her way through mathematics she replies without hesitation, “Ohhhhhhh I definitely did” (4/3/08).

Alison loves doing math, but her approach is based on memorization, as well. “Like multiplication, like we did in third grade? I do, I feel that’s something like you have to memorize, but understand it as well. I remember in class when you said 3 groups of 2. I was never taught that. I thought 3 times 2 was the same as 2 times 3” (4/9/08).

All four women self-report adequacy in mathematics, not mastery, and all rely on memorizing skills. Preparation in teaching strategies and mastery of techniques other than those they themselves learned in school are admittedly an issue of concern for all four women. Without exception, they remember few occasions where they used hands on materials to develop understanding of math concepts.

Candy: With math I can remember using cut out money. I remember the cubes, the base 10 blocks, ...a lot of it was right out of the book. (3/18/08)

Kathy: K to 2 there was a workbook and some manipulatives. But then third through pretty much high school was textbook style. I mean there were some worksheets we did,
there were textbook pages. (3/17/08)

Brenda: Base 10 blocks, no...do remember play money. That I do remember, you know, counting change...But I can remember mostly, “Take out your book, tonight’s assignment is chapter ten exercises one through ten.” (4/3/08)

Alison: Yeah, we did play money. But we really didn’t have that much. I mean coming from a private school...we had some, yeah, play money and base ten blocks. (4/9/08)

Taught in a lock-stepped tradition, with a text, workbook, and worksheets, math is mechanical and methodical, without application or interest.

Candy visits a third grade where she observes a textbook series in use, but the lesson begins with review of several topics first. She is impressed.

Me: Spiral review?
C: Yeah, right. They would do time or money with decimals and review so they didn’t forget everything that they were learning then. So that was something I really liked a lot.

She also sees a version of differentiation, where a group of students is pulled out for math. She comments that she would further individualize with learning centers, a technique she has modeled in her methods class. She also sees the advantage of using manipulatives in the classroom. She uses straws and twister ties to make geometric figures with the third graders and notes that the descriptions and definitions developed in their journals are much more meaningful than simply copying definitions. “The hands on was beneficial to a lot of kids” (3/31/08). Of largest concern, though, is teaching for understanding. As a product of math memorization without comprehension, Candy makes a significant realization.

Me: Do you feel memorization is important?
C: I think it’s important as long as they’re understanding the rules they’re memorizing, not just memorizing. Does that make sense? “Cause I feel like a lot of times they know how to do something but they don’t know when to apply it when something else comes along. It seems like they could save time, like if they memorize some things, but if they don’t know what to do, memorizing doesn’t help either. (3/31/08)
Not only does she now believe that teaching for understanding involves physical involvement with mathematical concepts, but she is also convinced that integration into other subjects makes math more interesting.

In fourth grade she teaches a lesson on graphing using classification of leaves she has collected on the university campus.

Me: So you are obviously getting comfortable with manipulatives.
C: I also liked the lesson because we tied a few different subjects. I think that’s important. It was a lesson in math, but we tied in science, and that really worked.
Me: So do you think you will use a lot of manipulatives in your own classroom?
C: I think so. Um....I said, for me, I’m a real hands on person, so I don’t see myself teaching another way when I know it was better for me.

Candy seems much more positive in her outlook toward mathematics now than she was in describing herself as a student. She is convinced that she can make math a subject both enjoyable and understandable using techniques other than those she experienced in school. She seems determined to better comprehend concepts herself so she can share them in a more meaningful way with her students. However, as determined as she is to become a teacher, to use manipulatives, learning centers and group activities, her nervousness belies a shaky confidence level in mathematics, “I like lower elementary,” she says. Regardless of her confidence, though, her Pennsylvania teaching certification will read Kindergarten through 6th grade.

Kathy expresses interest in teaching any grade up to 5th, but she too is not confident about her personal understanding of math concepts.

K: What I’m feeling now, I think I understand it now. I hope I can understand it. Just bringing myself back now, and thinking in a mathematical way is completely like torturing your mind. And being able to do it myself, and I think sometimes I still find it difficult. (3/20/08).
On her visit to a third grade classroom, Kathy sees a teacher using colored noodles to make math fun and demonstrate patterns. The children can touch and feel the connections. She teaches a lesson on weight in the fourth grade, combining science with math strategies. Remembering that she herself was not a problem solver, she is conscious of differences between boys’ and girls’ approaches to learning. She identifies with the uneasiness the girls show at not having a single correct answer to the problem. In a way, Kathy seems somewhat resistant to change. She sees a place for memorization in mathematics. Memorization of facts, she says, is “like sight words. There are math facts you will use in your everyday life. I mean it’s just easier to learn the math facts because you use them so often” (3/20/08), but she has also come to appreciate that manipulatives can play a role in understanding math. She speaks specifically about smart board technology.

Me: Do you think it’s an advantage to use a lot of manipulatives? I mean, you, yourself, didn’t experience a lot of them...
K: I think it is...They can physically just touch the board, move it over, those things really help people.

Kathy says she is willing to teach any grade from K through 5, but by her own admission she lacks confidence in her personal mastery of mathematics. Where will she acquire the content knowledge and the techniques to lead mathematics instruction in her own classroom?

Brenda is quick to admit her shortcomings as she shares her intentions about teaching.

“And that’s what my husband said, ‘I understand it...you just memorized the formula and plugged in the numbers.’” (4/3/08) She is not only taking our conversations to heart, but sharing them with her husband for feedback and advice. We discuss the advantages of maturity and experience when compared with her classmates who are earning their first college degree.
B: ...Same thing with your course. You go back and you’re leaning things you didn’t grasp or fully appreciate.
Me: I think a lot of the kids in class were taking the class because they had to, they weren’t really thinking about, “Am I gonna be able to stand up in front of a classroom of kids and explain this?” They all thought they could do it, but doing it and teaching it are two different things.
B: And they don’t understand that you’re actually gonna use it...But now going back, studying education, I know that every single thing I have learned starting last summer to this point is gonna determine how good a teacher I am, every bit of it. (4/3/08)

Due to her sequence as a special university student, she has little experience in the classroom, but from her math methods class she recognizes the importance of concrete materials to demonstrate math concepts. “Like I told my husband, I must need visual things, because like in your class I learned a lot using visual things. And maybe I didn’t have them as a kid, and now I need them to comprehend so many things I should have learned so long ago” (4/3/08). She likes using individual dry erase boards when she visits the 4th grade. She sees benefits using base 10 blocks and has already purchased play money for her own future classroom. She comments about the teeter totters used to balance equations and pattern blocks we use in methods class. “It was weird that I was learning so much with things in front of me to look at. Like fractions, when you brought in pattern blocks. It was so sad...” (4/8/08). Her voice trails off. She seems always to be comparing what could be in math with what was, for her. And each time her memories grow more weighted with a mixture of regret and frustration. Brenda is invested in making school different for her students than it was for her. However, she also admits that she eventually has ambitions beyond the classroom.

Allison says she wanted to be a teacher since she was in second grade and never wavered in her ambition. She is a good student, but notes that math has changed.

Me: I think it’s great that you are open to doing math in a different way.
A: Yeah, like you can ask them, and they can do it a different way that makes sense to
them. And if it makes sense, “Good for you, you can explain your work.” But also, if they can explain it to class, isn’t that better? Other kids can see it in a different way and it might help them.

Alison does not seem intimidated by the mathematics. She recognizes that logic and application are keys to mathematical understanding. She sees a freedom in the classroom quite unlike her own experience, where children work on different levels and at their own pace alone, at learning centers, with a partner or in groups. She sees discussion as vital to understanding, and manipulatives as tools that would have aided her own comprehension of concepts.

A: And one of the manipulatives I think would really help out is that balancing thing you brought into the classroom for teaching algebra. I thought that was great. I mean…it would have helped me.

She also mentions white boards, scales, play money, and base 10 blocks she refers to as place value placemats. In describing their use, she reiterates the importance of teaching for understanding.

A: Even with the placemats. We were never told you were taking a ten from the tens and putting it in the ones. I understood the concepts, but a lot of us weren’t actually understanding you were taking a ten from the twenty and putting it in the ones to make that ten in the ones column. For a long time we just memorized if you needed to carry you just moved the one over. I just think if we’d learned it that way, everyone would have thought it was easier.

Her own experience in the fourth grade classroom integrates science with mathematics. Children work in cooperative groups and learn about nutrition using a McDonald’s menu calorie chart.

She is determined to do more of that in her own classroom, “So the kids out there like math because you’re integrating it. It’s not abstract and they’re not freaked out about it” (4/15/08).

Alison is passionate about helping children learn. She is self-confident and appears comfortable with the organization and structure of mathematics.
The four participants vary widely in their backgrounds and mathematical competence, but all four seem to have defined their beliefs about teaching the concepts of mathematics. All agree that mathematics must be presented in an understandable way. All find hands on materials a valuable resource. Some even admit they understand concepts better now, having used the materials in the methods class. Each sees merit to grouping and pacing according to student needs. None, however, has a plan for how or when they will accomplish mastery of their own content knowledge.

Theme 5
Math Teachers as Role Models—the Good, the Bad and the Ugly

Another goal of the second interview is to compare previous teachers with those they are observing in current elementary classrooms. By identifying their beliefs about teachers, it might also be possible to identify their own pedagogical challenges.

Each of the participants has specific memories of teachers they have liked or admired. Candy has no memories to share about any of her elementary teachers. Yet, interestingly, she wants to teach lower elementary school. Her mother, perhaps, explains it best.

Mom: Well, it’s certainly been her dream, oh my gosh for as long as I can remember. She’s always talked about it, played school for hours...She tends to, no matter where we are, gravitate to children. She plays with them. She’s drawn to the little ones. She loves babysitting. (4/11/08)

Perhaps Candy is guilty of the wrongful motivation Reys and Fennell (2003) suspect in so many preservice elementary teachers. Does Candy realize the vital role she will play in teaching mathematics to her students? If so, does she recognize in herself, her mathematical shortcomings in content preparation? Is that why she has set her sights on lower elementary school where
content is less demanding? She reveals her self-assessment as she speaks of her favorite teacher.

Candy remembers her 8th grade teacher, Mr. Malore with fondness and enthusiasm. “His classroom was really loud and he got really excited about math. It was fun going into class but if I wasn’t understanding it, I just tried to get through it” (3/18/08). Her parents arrange for Mr. Malore to tutor Candy. She goes in before school and he reviews the homework and what will be going on in class that day. She cannot remember the topics of the tutoring. I ask if she is more confident to participate in class, and she replies, “Yeah...right” (3/18/08). It is hard for me to tell from her smile and tone if she is agreeing or being sarcastic. “I understood it enough to get through it, but if I had to sit down to explain it....I’m not sure I would be able to do that” (3/18/08). It seems obvious Candy is not enjoying Mr. Malore’s curriculum, more likely it is his pedagogy. He is personable and his presentations are fun. Mr. Malore is approachable and is invested in her success, perhaps more than Candy, herself.

Kathy has a detached attitude about her math teachers. She too, has no recollection of her elementary teachers. From seventh grade on they are all men, and she describes their teaching styles more than their personalities; overheads, chalkboards, lectures.

That’s when I started to realize, in seventh grade, if you don’t get it, we’re moving on. And I mean, I was told that in the classroom, they would say that. If you don’t get it you have to come in for help because we’re moving on” (3/17/08).

There is only one positive recollection of a math teacher. She is most impressed with the freshman math teacher. “The freshman teacher was more outgoing, verbal, more extraverted, more energetic in the classroom” (3/17/08). Yet, he delegates responsibility for learning to the students, appearing unapproachable, as well. He shows no favoritism towards Kathy, in particular, as Gavin and Reis (2005) recommend.

Alison’s favorite teacher is her second grade teacher, Mrs. McGuire. “She was so good
and loving. She was exactly like what I want to do when I get older. She just helped kids out all the time” (4/9/08). Alison’s mom adds that second grade in Catholic school is very important because you make your First Communion that year. She feels Alison is also very connected to her religion (4/30/08).

*I think I’m going to be willing to sacrifice my time for those kids. Whether it be after school or during learning centers...I want to help make them feel comfortable...I don’t think you should give up on them and let them slip through the cracks. I think you should at least give them the extra help to let them catch up.* (4/15/08)

Alison intends to nurture her students, like Mrs. McGuire cared for her. She has taken this role model and built upon it with techniques she is learning in her methods classes. She intends to group her students and use scaffolding to allow students opportunities to teach each other. Her outlook is positive, and her confidence in math is strong. “I have to show them that we all make mistakes, like I still make mistakes, it’s alright. I didn’t understand that when I was in third grade. But I want to make them feel better” (4/15/08). Alison is invested in creating a safe caring environment where children can feel they belong and that learning is accessible for each one of them.

She is unlike Candy and Kathy because she has come to enjoy mathematics and understand its logic. One way her teachers encourage her mathematics as a female is with separate math groups for boys and girls. “In 8th grade they actually split the boys into one class and the girls in the other. And it was kind of interesting because the girls were always more high strung, wanting to get it right and the boys were like, ‘Yeah, that’s how you do it, whatever.’” (4/9/08). Her teachers are aware that girls learn differently, an observation Alison has also noted in her teaching experience in the 4th grade. Girls relinquish power and allow boys to physically dominate hands on activities in mixed-sex groups throughout their educational careers
(Francis & Skelton, 2005; Skelton & Francis, 2003). Alison has greater proficiency, a higher confidence level, and demonstrates less influence of stereotypes than the other participants.

Brenda has mostly men math teachers through high school and college, and finds women teaching math remarkable, as gender stereotype research suggests (Lee, 1997). Although traditional stereotyping is viewed as unnatural, outdated, and harmful because it restricts behavior, it persists (Grossman & Grossman, 1994).

“And even last semester I met a girl and we were talking about what grades we wanted to teach, and she wanted to teach high school math. And I remember thinking ‘Wow, that’s impressive.’ I don’t know why. I think it’s common. You see a lot of females doing it now, but I still think it’s kind of hard to believe. It just doesn’t seem like a good fit.”

Brenda has deeply embedded beliefs about women and mathematics, and in defense of her best friend, Sherry, who is an outstanding mathematician, she adds,

“It’s more prevalent now to see women going into those fields, but it isn’t equal. I think they [women] have to work harder for it.” (4/10/08)

Her mother agrees, reinforcing Brenda’s beliefs, “And maybe it’s the schools that don’t encourage them [women], too. Most of the math and science teachers here at the high school are men, too. But then from my experience the one women I had for geometry was horrible. That’s really sad” (4/20/08). Parents with more traditional gender schemas have children with gender-typed cognitions (Tenenbaum & Leaper, 2002). It is difficult for Brenda to accommodate her own experience, struggling throughout elementary school when two teachers finally do take an interest in helping her in math. She suspects one of ulterior motives.

Well, one of them was the track coach. He knew I had to get that grade or I was gone. So he helped me a lot more...The other male was a biology teacher. He was a marathon runner. He didn’t coach, but he knew where I was coming from.

The other, she feels, because he understands her athletics and the demands of training as a runner, takes an interest in her. This makes her want to try harder in his class. She is
externally motivated to persevere in math.

Brenda, like Kathy, has no fond memories of an elementary teacher, yet she wants to nurture learning in young children, building on her own experience as a nursery school teacher. She remembers a second grade teacher who “enjoyed kids” (4/3/08), but the teacher she remembers best is her freshman teacher from high school. She has the qualities of caring and personal investment the participants value.

*She made me comfortable where I could raise my hand and say, ‘I don’t know what the answer to this’ or ‘Can you help me?’ I remember her doing a lot of group pairings in that class. I was very comfortable in that environment. And if you didn’t understand something you could get together with your group and you would get help that way sometimes.” (4/8/08)*

Each of the participants also has specific criticisms of teachers. Candy is quick to remember two teachers. The first is her middle school math teacher, Miss Hauck. “She was no treat. She was known as a really bitter lady” (3/18/08). Candy does go to school early for extra help. For her efforts she is labeled a teacher’s pet by her classmates, increasing her feelings of resentment. “... She was definitely tough,” Candy adds (3/18/08).

The other was her precalculus teacher. “He was terrible and he was a male...he didn’t study to be a math teacher and just decided he wanted to get into teaching. He was very hard to approach...that whole year was a waste” (3/18/08). Candy does not feel a personal connection with either teacher. She may go so far as to condemn the subject because of the teacher. Since neither teacher shows concern for her, and in the case of the precalculus teacher, concern for the subject, Candy follows suit. She is there because it is a requirement, not a choice.

Kathy is the first to admit that teachers, including herself, aren’t perfect (3/20/08). Rather than naming a specific math teacher, she speaks in generalities about her teachers, dividing them into three groups. The first group teaches for understanding. She recognizes the importance
of presenting the material and also applying it. It doesn’t matter to Kathy if these teachers make personal connections with her, as long as they make student connections to the subject. The second group is more dictatorial in their approach to curriculum dissemination. Learn the material for the test, it does not seem to matter if it has relevance to the students. She values these teachers less. It is the final group of which she is most critical. She has clearly experienced teachers who are not invested in what they do with students. She compliments them for their personal math abilities, and accuses them of collecting a paycheck. These teachers show neither the concern nor the pedagogy to share their talents with students.

“No, I think it was just a random draw of all kinds of people. I just think of teachers and their attitudes toward the subject. Ya know, it seemed like maybe, the way they said, “This is important and you have to learn this, and it’s important in everyday life.” And there were those teachers who would do that too, but they would just list off random things and you needed to know it, but they’re not really showing students why. There were other teachers who just showed up for their job and did their job and went home. Even though they were very intelligent in their subject, and they knew the math, it just didn’t seem they put 110% into their job. I don’t know...it’s hard to show people you love everything you do all day. (3/17/08)

Is Kathy being kind with her final comment? Or is she allowing teachers to show favoritism to subjects they teach? Or is she applying her own attitude about mathematics to the kind of teacher she may be? Kathy had no fond feeling about math, she has admitted this, but to prioritize her subject likes and dislikes so early in her training could be a mistake. “In the United States, elementary classroom teachers are expected to be masters of many subjects” (Reis & Fennell, 2003, p. 277), including mathematics in kindergarten through sixth grade.

Kathy does share one other experience with a math teacher, though not her classroom teacher. Her father has a patient in his dental practice who is a woman high school math teacher. He arranges for her to tutor Kathy. Kathy recalls help in geometry and algebra II specifically.
Mom remembers.

*Kathy didn’t like her because she thought she was sarcastic, and she probably was a little bit, but she knows her stuff, and...I think when she got past, “I’m just dumb,” and realized this lady is here to help me, and got to know her personality, she did a lot better with her.* (3/23/08)

Kathy prioritizes her teachers by their content delivery and teaching relevance. She appears also to need teachers to personally connect with her as an individual. Like Candy, the attitude of the teacher, in this case, the tutor, inhibits Kathy’s investment in the mathematics she is learning.

Alison names one teacher in college who exemplifies the qualities she dislikes in teachers. “The teacher doesn’t want to help you, he just gives you an example and then the homework. And I need more of an explanation” (4/9/08). Her teachers were a mixture of men and women, but none has a teaching style she admires. “They put the notes on the board, you’d copy them, they’d show you an example, like that” (4/9/08). She states that she needs more one on one, especially when the concepts get more complex.

After giving it more thought, she sees another reason teachers may not make themselves approachable. The conversation is in reference to the help her father gives her on her homework. He does not always follow the examples in the book. He shows her alternative algorithms.

*I think a lot of the teachers are scared of something they don’t know, so if you came in with the right answer, they’d say, “But you didn’t do it right.” But some people learn differently, and there might be a different algorithm that helped them more than it helped you, but I think some were narrow-minded to how THEY learned it.* (4/9/08)

She considers further, reaching back from high school to elementary school. Here too, she recalls teachers who were uncomfortable with math. Alison wonders if they did not consider that part of
their teaching job would include mathematics.

And there were teachers in grade school, who, ya know, didn’t like math and they wanted to teach because they liked kids, and they did well in other classes, but they didn’t like math so math was kind of on the side. I see math as my BIG class of the day. Like, not like, we’ll do math if there’s time. (4/9/08)

Alison’s criticism of some elementary teachers is shared by Brenda.

Brenda’s face sours as she remembers her first grade teacher. “...My first grade teacher didn’t really like kids. It was her job” (4/3/08). Her experiences that year, being identified for Title I reading and being pulled out of class for remedial help, the unchecked ridicule from her classmates, all make her bitter and determined to be a different kind of teacher.

At the same time, they forge in Brenda lowered expectations of her own ability. Mom agrees. “I just don’t think girls will ever think they’re good at math” (4/20/08).

Kathy shares her experience on 3/21/08. Even though she doesn’t personalize the statement, it seems obvious this happened to her. The long pause while she retrieves the memory brings back not only the words but the hurt.

K: Yeah, I would say that because just talking about boys and how they, I feel like there’s always a positive said to them in a way, whereas even if the negative is said, like there’s a negative comment there’s always the positive behind it. Well, maybe not all the time, but I feel like with girls...............if there’s a negative there’s not always a positive behind it, too. Like with boys on a test, ‘You did this wrong, but I know you know how to do it.’ But with girls, ‘You did this wrong, maybe you need a tutor to help.’ Which is another negative.

Me: So emotionally....

K: Yeah, I think it would be more emotional for a girl than a boy.

Their teachers give boys more acknowledgment, praise, encouragement, corrective feedback, opportunities to answer correctly, and social interaction. Brenda notices this in her elementary school experiences.
B: ...I can remember math and science as a kid that other kids would come and help you, and it was always a boy who would come over and help you. Rarely would I have a girl come and help me. I don’t know why. It could have been there were just more boys who understood but it would always be a boy who would come and help me.

Me: So you were getting all these subtle messages...

B: Right, right. That tell you what you are supposed to be. (4/10/08)

It is interesting that Candy makes an observation concerning some researchers, as well.

Me: Are you going to baby the girls and give them more help and nurture them along?

C: I don’t know, if I do that, I think it might flip, and eventually it might come around that girls are better and then boys will be the ones that need help in math. (4/1/08)

Teachers can reinforce gender differences by acting in accordance with society’s gender stereotypes and biases or they can discourage them by presenting alternatives. Candy, Kathy, and Brenda have not encountered the number of alternative teacher and teaching models Alison has. Alison operates under a different set of assumptions about her mathematical abilities and the positive ways in which she can manipulate her plans and career.

Theme 6

Beliefs about Equity: In two generations. Has life changed so very much?

Gender undermines educational opportunities which according to Title IX are, theoretically, equal (Hilke & Conway-Gerhardt, 1994). Title IX of the Education Amendments of 1972, also now known as the Patsy T. Mink Equal Opportunity in Education Act in honor of its principal author, enacted June 23, states that “No person in the Unites States shall on the basis of sex be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance.”

Our final conversations focus on the current perceptions of the participants. They have
previously discussed their beliefs about gender, roles, and stereotypes at home and at school.
Now we explore their notions of the opportunities available in society at large. Their mothers share their viewpoints, as well, to allow for comparison. Do they believe opportunities have changed or remained the same?

Candy and I begin our talk with women in science, technology, engineering and math (STEM) subjects. Both our fathers are engineers. Candy does not see women being treated as equals in the company her father owns.

*C: My dad’s an engineer. And his company’s not very large, but a woman engineer was working there, and she might have been working there when she was in college, but she was mainly doing receptionist jobs, answering phones, and things like that, but she wasn’t allowed to get into the heart of engineering work. And there’s a woman working there now, and again, she’s doing a lot of the secretarial work, things around the office, but she’s not taking advantage of her degree. And the rest of the office is men.* (4/1/08)

She continues to support her beliefs of male dominance in business with another observation from school.

*C: I think there’s something to say about the different genders as teachers. A lot of the younger grades are women, and a lot of the middle, a lot of the high school are male teachers.*

*Me: Do you think it’s a status thing?*

*C: Yeah, I think there’s a lot to that.* (4/1/08)

I ask her if she thinks people are still of the mind set that math and science are for boys more than for girls. Are careers dominated by one sex or the other?

*C: I think so....I think it’s still out there (long pause)...a lot of times when I think of business, I think of a businessMAN....I think women have the house, they are definitely the nurterers, and you choose a profession that fits that, and that’s why women are the elementary teachers. They want to work with children. Pediatricians are working with children. Yeah, I think that has a lot to do with it.*
Me: Then look at Oprah Winfrey. Look how successful she is, but she’s done it on her own.
C: I don’t know a lot about Oprah and her family background...but I feel like if you’re a big name in the business world......(long pause) like you can be a successful business person or whatever career you’re in...but like being a mother also..........(another long pause) it’s not both. Either you’re one or the other to be real high up in whatever career you’re in. You can’t have a family or raise children. Yeah....it kind of dribbles back around to do you want children or do you want a career?
I just heard a pastor at a church near me, they’re both pastors. She had a baby and took leave. Then he took a leave for child rearing. It just seemed so different to me to hear that. The man is leaving his job.
Me: But do you think it’s changing?
C: But it’s not enough. (4/1/08)

Candy believes men and women are different in capability and behavior. She feels this gives them advantages and inclinations in the jobs they seek. She also feels that a woman should not divide her attentions between a demanding job and a family. The woman is the nurturer, and in spite of some changes in society, still largely responsible for the family. In Theme 7, she goes into detail describing her personal ambitions. Candy uses her beliefs as a structure upon which to hang the proof she sees in society around her. In her limited experience, Candy seems more rigid in her perceptions than her mother, whose responses are sometimes contradictory.

Me: Let’s talk a little bit beyond school. Do you see opportunities for girls in math, well, we call them the STEM subjects, science, technology, engineering and math, do you see opportunities for girls changing? Say from your generation to your daughter’s generation?
Mom: I definitely think there’s a lot more opportunities for girls out there now. And I do think girls are going for the more detailed jobs, more so than my generation. My generation was more a secretary or receptionist. Now the opportunities are endless for these girls. Amongst my girls’ friends I see them going more into the statistical kinds of things, analytical kinds of jobs. I definitely think...in my husband’s business. He has an engineering business, there have already been three girls, he offers internships. And one of them is still there. (4/11/08)

It is striking that even their perceptions of the women in their engineering business are so
different. Candy sees the women as overqualified receptionists, while mom sees women in receptionist jobs as a thing of the past.

There is another contradiction as my discussion with Candy’s mother continues. Candy has previously stated that her friends are much like herself, average math students, and none has entered a STEM career. First, her mother says her friends are entering statistical and analytical jobs. Now Candy’s mother agrees.

Mom: I kind of think her girlfriends are pretty much at the same level. I can’t think of any going into anything too involved. (4/11/08)

Candy comments that women cannot be successful businesswomen and mothers at the same time. In feels that for her generation, the demands of a college education add four years of emotional stress and delay entrance to motherhood.

C: So many more people are going from high school to college. That it’s not even really a question. If you want to do something, you have to go to college. And there’s even a lot of them going on to grad school. There doesn’t seem like there’s much of an option if you want to have a career.
Me: But there’s the pressure about having kids by the time you’re 35.
C: Tremendous pressure....yeah. (4/1/08)

Mom is sympathetic, but her situation is very different. She did not attend college after taking business preparation courses in high school. “I worked for three years and then I had my first daughter and never worked after that. I was a stay at home mother after that” (4/11/08). Candy wants a job and a family, but sees that job as a compromise. Like the role models in her family, her grandmother and mother before her, they relinquish their jobs when they have children. Candy does not wish to pursue a job that will overburden the family responsibilities she envisions, responsibilities not shared equally by a man.
To Candy’s way of thinking, life has not changed so very much in two generations, other than to have increased the pressure on women to get an education. Child rearing, she feels, is the natural role of the woman. As nurturer, she is responsible. Although her mother sees new job opportunities available to women, she too, does not see substantial changes in traditional parenting roles.

Kathy and I begin our discussion about equal opportunities with Title IX, since as a teenager, her mother would have been impacted by the legislation.

Me: Although it started out in athletics... do you think there are attitudes that men and women are equal in the business world?
K: You mean as far as like if a man and a woman are applying for a job? Like if there were a male candidate...No, I think men have more of an advantage. I definitely think there are advantages and disadvantages by gender. Like a lot of careers are dependent on career interruption and the desire to have a family. Boys don’t necessarily have to do that as much, unless they are the one who is going to stay at home. But I don’t think for the most part the majority of males would do that. So just knowing that you would want to have a family and a career could alter what you want to do. For me, I know I want to have a family and it would be beneficial for me to want to be there and to have a tight family, and for my career to be a teacher. (3/21/08)

Like Candy, she is already convinced that the traditional role of mother belongs to the female, and career choices are somewhat determined by the time a woman wants to commit to the family. She also believes that employers are biased and comparable pay is unlikely.

K: No, like in certain fields, because I think people who interview for a job now what they’re looking for right away. If they are looking for a female they lean more toward that, but for teachers, I would hope that they are looking for the person who could best do the job. But I think a lot of jobs out there are for the males. Equality wise, even salary, I suspect that males are being paid higher than females. (3/21/08)

She adds that they have been discussing the “glass ceiling” in sociology class, and she believes that there are barriers women cannot penetrate in corporate America. I ask if she thinks women
shy away from some career choices because they are aware of that and she agrees.

Many of Kathy’s beliefs are also shared by her mother, but like Candy’s mother, she has a more positive outlook toward change. I ask if she thinks math is a boys’ subject.

Mom: Not so much now, it’s just as much both. But when I was in school, only the really smart girls did well in math. A couple of my friends were really smart and one is a chemical engineer now, really good in math.

Me: Did you find it was frowned on to be good at math if you were a girl?

Mom: No, I don’t think that girls were interested in that when I was in school. I graduated in ’78. I think the guys were pushed more in math. They were pushed into engineering, things that went with math. (3/23/08)

Like Candy’s mother, she believes opportunities are improving. There are more possibilities for girls. Kathy’s mother mentions that Kathy’s twin is an honors math major, as an example. She is unwilling to discuss Kathy’s belief that women’s careers are compromised to accommodate a family. This is apparently a point of personal contention between Kathy and her mother, and is discussed in more detail in Theme 7.

Alison not only believes that opportunities are not equal, but since the advent of Title IX, things have actually grown worse. She feels that after the flurry of initial interest assumptions were made that the problem had been solved. In actuality, she says, things are quite the contrary.

Me: We claim that things are equal...

A: No, I don’t think so. I think it’s getting worse. I think that once we tried to make it equal, and now we think it’s equal, but it’s NOT. So now it’s not getting any better because no one is working with it to make it better. So with the mind set that men work and women stay home with the kids, and men go out and get the jobs, I don’t think that it’s gotten any better. (4/16/08)

Alison has daily talks with her mother, and says she has recently had just this conversation.

A: I think that girls do better in school with their grades and stuff, but once they graduate, guys can get a job so much easier than girls. (4/16/08)
There is an unmistakable similarity in their thinking.

*Mom:* It’s still very stereotypical. I was just talking about this to my husband last week, and now that I’m getting older, I look at my kids from outside. And I look at the younger people in the neighborhood, and I think it’s so weird. Like when they were in grade school and high school, I heard who was the best students, whatever. I always heard the girls were better. But in the business world it is the guys who are getting the better jobs. I just watch the neighbor’s wife out there with the two little kids and the husband comes home in his suit, and I just think, I wonder what she was like in school. I don’t know if it’s because we as a culture put such emphasis on mother being home? Or being with the children? (4/30/08)

Alison, like Candy and Kathy, feels there are more pressures on women than there are on men to juggle both a family and a career.

*A:* I don’t know why, but the girls face so many obstacles. Like if they want to raise a family, too. And those are things they might hold against you. Are you gonna get pregnant soon? And then there’s what can you do because you’re gonna have a family? You can’t get too involved in your job. I think women have a harder time with that. With guys they think they’re more reliable because they don’t have those kinds of things to worry about. So guys are hired more. So I definitely think it’s different. I don’t even know if they know they’re putting that pressure on women. I think it’s just something that’s natural. (4/16/08)

Although her mother has never faced the sex biases in hiring Alison speaks of, she does speak about what she sees as unfair pay for services.

*Mom:* I didn’t think of it that way before, but just started a new job [in the hospital system doing collection analysis], we were talking about jobs and money and I said, “It seems like I work so hard in my job, and my husband is a mail carrier, it’s just like what takes more to be done that I should be getting paid more than him. And I don’t. (4/30/08)

Both Alison and her mother share common beliefs there are business pressures and social practices that inhibit and restrict the ambitions of women unless they create their own independent opportunities. Alison comes from a family that is exceptional. Her mother and grandmother both own their own businesses. They are also mothers. Alison is somewhat
conflicted. She sees her own family as successful, raising a family and running a business, but she is critical of parents who focus too much on business.

A: I guess it’s how you were raised. I think that in my family that wasn’t the case. The women in my family...worked. My mom grew up working, my grandma started at a young age. I think it depends on how your family, how the generations before you...

A: You see so many families, that if the mother does get a higher job like that, it seems like she has less time with the kids, and no one is having time with the kids, because the father is out there doing the job just as long. I don’t think it should be like that, but I think it does take a toll. Definitely. (4/16/08)

Alison’s mother describes the same beliefs. She is thoroughly satisfied with their family and business and sees herself as a successful business woman. She has previously noted that delegation of child care to close family is no compromise in her view.

Mom: I don’t relate that to my own life at all. I have to say that, I was a little bit of an exception because I grew up in a business, and by the time I was a senior in high school I had my business picked out and the name picked out. I had set my goals and I achieved my goals. (4/30/08)

Although she is more positive in her outlook that women have made strides in achieving equality, she also speaks of a regression in womens’ interest in business. While her daughter is critical of this movement, her mother sees it as positive.

Mom: I think it’s turning back around. Maybe 10, 15 years ago, there was more of a push for women to be executives, but now they don’t want that. I think maybe that’s kind of a good thing that we are starting to go like that. My husband always says the problem with out society or our culture, and our world is that we are pulling away from the family. And I think that maybe it’s starting to turn around, and people are starting to realize that family is maybe the most important thing. (4/30/08)

From her comments, it sounds as though the only people making that effort are the women. I ask for clarification.
Mom: I think a little bit of that is changing. There are a little bit more men moms.
Me: It’s still the exception?
Mom: Yeah, I think so. My daughter probably says my mother did everything, and it’s funny because basically I did. But now that my husband is on disability, he does everything around the house. I know a couple of people where the men do the cooking. I think a little of that has changed.
Me: But it’s not 50/50.
Mom: No. (4/30/08)

Although my conversations with Alison and her mother are two weeks apart, I fear that some of their comments are contaminated by their daily conversations. With the exception of their perspectives, they even agree on the regression of women’s ambitions and participation in business.

Brenda’s shares many perceptions with the other participants. She believes there are sex biases in hiring and is able to elaborate based on her personal experience.

B: You know if I was going to get a job versus a man, you know, hell yeah, I’d hire the man, I’d do it hands down, hire the man. They’ve asked me if I’d have a kid. Do they ask men that? No, no. Now why? They’re not actually having the child, but it’s still their child. (4/10/08)

She, too, believes that men are paid more for the same jobs, even though females are becoming better represented in math and science.

B: ...but it isn’t equal. I think when they go into those fields they have to work harder for it. I think a lot of it is your sex and your race...It’s not fair that they’re [men] looked at as dominant and hard working. Unlike a woman who is probably gonna be a mother and leave.

She demonstrates similar thinking to the other participants.

B: You know, there’s a lot more things with women as opposed to a man. And I know, even nowadays, if you’re a male elementary teacher major, you’re gonna get hired like that (snaps her fingers), because they want male elementary teachers. But they have an advantage at the top of the spectrum, the big jobs, they have the advantage, and even at
the low paying teacher jobs, it’s like they have the advantage everywhere, and it has to do with gender. (4/10/08)

Brenda is also aware of the stereotypical roles placed on men and women. She expresses them very much like Candy, Kathy, and Alison. She acknowledges that gendered expectations have changed slightly.

B: Men can focus more on work. Now I’m not saying that men don’t help in odd ways, but it’s the women coming home and cooking, changing diapers, doing laundry. So they have a lot more on their minds. Whereas them an can just focus on his career and you see it more that the man is working and the women are staying home. I think that now it’s even more prevalent. I know they say that women are more in the workforce, but I see a lot more women that I know, they’re all stay at home mothers with a college degree. Gosh, my mother in law still does that for her husband. Dinner is on the table every day at 4:15. I hate to say that, but maybe the women don’t want a job? (4/10/08)

To a greater extent, her beliefs are based on personal experience. Unlike the other participants, of her associations with female college graduates, only one works outside the home. Brenda generalizes this as a trend in her generation, sharing a viewpoint with Alison and her mother. When women prioritize their jobs, to have ambitions as a high ranking executive, for example, they sacrifice their families. Although Alison’s mother sees herself as an exception, Brenda would, likely, put Alison’s mother in this group.

B: If you’re a female who owns a company and you’re working 10 hour days, you have to have someone else raising your kids. You get home and they’re already in bed. Whether it’s your husband doing it or the nanny, because those people can afford a nanny. And they’re able to focus more on their career. (4/10/08)

But within her circle of experience, Brenda sees women choosing to stay at home and prioritize their families. She speaks faster and more emotionally as she explains her feelings and adds the viewpoint of her husband.
B: I think that women that stay at home with their children lay a guilt trip on women that can do it all. And I think that women that do it all...(long pause) think that women who stay home.....are lazy. Even my husband, and he has a stay at home sister, and my sister is a stay at home mom, says, “I don’t understand why they aren’t working? Why aren’t they helping out with the expenses? Why not help out if you can. It’s all stereotypes!

Me: So on the one hand we say we’re trying to get rid of stereotypes, and on the other hand, even young people are perpetuating them.

B: Yeah, because my best friend...wishes she’d never gone to medical school and been a stay at home mom. (4/10/08)

Brenda is trying to reconcile her husband’s point of view with her own beliefs, and struggling for a compromise. Coincidentally, Sherry’s husband is a teacher. Brenda says he has “the good hours where he has summers off.” One can not help but wonder if she has abandoned psychology and entered teaching for this reason. As she elaborates in Theme 7, the beliefs she generalizes here become very personal.

Brenda’s mother thinks women today are probably not taking advantage of opportunities as much as they should.

Mom: And she has two cousins that have doctorates now...a little older than her...females. She’s had education all around her, that’s for sure.

She says little else about equal opportunities without getting very specific to Brenda’s situation in discussion point 7 other than to add she still thinks girls don’t think they are good at math (4/20/08).

All four women share the belief that women are, and should be, the primary caretakers of children. This notion alone influences, and in Brenda’s and perhaps Kathy’s case, dominates their career decision-making. If equal opportunity is legislated, but undermined by unwritten laws of social responsibility, as these women seem to believe, then women fight a subconscious
battle; a battle based on sexist values not required of their male counterparts. They are victims of a guilt trip that may contribute to the perpetuation of patriarchy in our country, in spite of legislative efforts to the contrary.

Theme 7
Seizing the Possibilities

Yates (1998) summarizes the most recent stages of women’s encounters with education as follows. In the 1970s women were portrayed as disadvantaged, yet equally human. In the early 1980s school was girl friendly, yet girl was still treated as other. The late 1980s girls became diverse, different. The 1990s began an upheaval in the roles of women and men forcing us to face past assumptions, and recognize that social and political contexts are not static, however, neither are they quick to change. All four participants are formulating short-range plans, looking not much further than five years into their futures. The change they envision in classroom pedagogy is drastic, found in Theme 4. Their beliefs about their personal abilities and the roles for which they prepare accommodate much more traditional values.

Candy says, “I’ve always wanted to be a teacher. I’ve always known I wanted a lot of kids. And I do want to get married” (4/1/08). Her role models were her mother and grandmother before her. Although her mother and grandmother did not attend college, both worked until they had children. Candy sees a logic in following a pattern that appears to have been successful. “If your mom’s doin’ it and it works for her, they you’ll probably do it too” (4/1/08). Candy’s mother agrees that women in Candy’s generation are likely to compromise their career ambitions
with their family responsibilities.

C: There are all those roles at home. Even that is dependent on the woman doing that.  
Me: So you think that society isn’t walking the walk that we’re talking?  
C: Yeah. (4/1/08)

It appears that Candy will not be the one to break with tradition. She will begin as a teacher with marriage and motherhood in mind. Likely, when she has the opportunity to begin a family, she will discontinue teaching as did the women in the family before her.

Kathy has reflected on where the inequality between home and school originates. The reason it is so well accepted is that there is a long tradition of stereotyping men’s and women’s roles that she is willing to accept.

K: Back when the agricultural rise, like more men had the means of, not technology, but they would make the money while the women did the chores at home and the men had the advantage to go out and gain knowledge. So women were always doing something at home, feeding the family, and the men had the opportunity to go out...  
Me: So the stereotype goes way back?  
K: Yeah, and I think we’re slowly starting to break that in a way. Bit it’s still held in a way. It would be a huge movement to change that. (3/21/08)

She goes on to share about the women in the generations before her. None of her grandmothers have college degrees. One works for the telephone company and the other in real estate.

K: My mom, when she got home, had to start dinner. Her brother didn’t, like he’d come home and ya know, he wouldn’t be starting dinner. So men wouldn’t do those sorts of things and carry out what my mom was expected to do. (3/21/08)

Kathy recognizes the inequity in her own family, even growing up, her mother is expected to do the domestic chores and shoulder responsibilities beyond those of her equally capable brother. Her mother’s solution to handling a job and family is to get a degree in physical therapy, and work until Kathy’s and her twin are born.
K: She stayed at home until pretty much all of us were out of middle school. Then she went back to work. So I think it’s beneficial in life to have a structured person so that it’s not, other siblings when you come home. I think it’s beneficial to them. (3/21/08)

We continue the conversation, because I am curious if she feels responsible to be that person, even though she speaks generally of either parent being at home.

Me: So the stereotypes still work?
K: Yeah, either way, it didn’t have to be your mom. It’s just nice to come home to someone whether it’s your dad or your mom.
Me: But it’s kind of more expected of mom than of dad?
K: Yeah
Me: How many fathers would have done that?
K: Of course they would have said they’d have loved to do that but…. (both laugh)
(3/21/08)

It seems Kathy is trying to give her generation the benefit of being more liberal in their approach to parenting, so I finally ask her the question bluntly.

Me: So you don’t think men and women are treated on equal terms with equal expectations and responsibilities? So would that be part of the reason you chose teaching? The hours? The summers off?
K: Oh, I think it was, because otherwise I’d have entered broadcasting, but working your way up, that kind of thing. I was thinking of doing something like that then I thought about a large part of it was family and not having to travel to or live in a city, so that was a central idea in my decision to…. (3/21/08)

Kathy’s mother is abrupt when I ask about her switch from journalism to teaching. Kathy’s mother does not seem willing to discuss Kathy’s career goals. She remembers Kathy’s plans to enter journalism and broadcasting in high school, “Then I don’t know where the change came from to be a teacher” (3/23/08). It seems that Kathy is accepting a career compromise to accommodate her fiancé and his plans. He is a second year law student. When she alludes to someone being home with the children, it is now more apparent that she will be that someone.
She is willing to talk about lifestyle changes from the generations before her, but at the same time, she is following the very traditional expectation she describes in her historical reference.

We follow that train of thought to the man’s point of view.

*Me:* Do you think family is part of a man’s decision making?

*K:* (laughs) No. I mean it’s not that I’m not doing what I want, but, I really just know... There was other things that just weigh out, and you want to do both and you have to find that balance...so...I don’t know.... (3/21/08)

I might seem that she has had this conversation with her fiancé. Is she really doing what she wants? Her voice is almost weighted with regret. Perhaps Kathy’s mother has detected this act of compromise on Kathy’s part as self-sacrificing and that is the reason for her terse reply.

Ultimately though, Kathy’s mother is supportive of her daughter’s plans restating her beliefs that certain subjects are genetically inherited. “My husband excelled in math more than I...with reading or like crafts...that’s my thing. I’ll help [Kathy] with stuff like that” (3/23/08).

Before ending the interview, we visit one last time, the notion that some women are choosing less competitive careers because of the additional family responsibilities they shoulder seemingly without question.

*K:* If they [women] want to be career driven, that’s just an aspect, different priorities. I choose I want to have kids, and they choose something else. You have to justify your decisions in what you want to do.

*Me:* Do you think men have to defend themselves? It seems like women have to defend themselves for their decisions.

*K:* No, I don’t think they’re under peer pressure as much like that. (3/21/08)

Kathy understands and accepts a set of beliefs that stereotype women as workers of less social and economic status because they are also expected to be mothers. She is willing to undertake
this role because she feels it has been a successful model in her own family, and a good fit with the career goals of her fiancé.

Brenda is also strongly influenced by her already established partnership and her husband’s ambitious career.

_B: I was engaged right after graduation, and I remember my three girlfriends saying they didn’t want to get married until they were older and right now they have their careers. I remember when I graduated from college I wanted a family. I wanted to be a mom. I didn’t want to be a scientist or a teacher, I wanted to be a mom. Then I realized I am nowhere ready to have children and that I wanted to have my career first. My husband and I argue about that now, that with his job and his career. I know it’s always what he wanted to do from the day I met him._ (4/10/08)

There seems no doubt in her mind that raising children is primarily the responsibility of the mother. She considers her predicament a result of her age and the complications of getting a teaching degree.

_B: I want to become a teacher, but I want to have children. I feel I want a career, something that’s mine. I don’t want to be sitting at home at all. I have the choice to be a teacher for 25 to 30 years, or do a principal, or part of the school board, or superintendent. I can to that path. I’d love to move up. I never wanted to be one thing._
_Me: Then you do to a 12 month job?_  
_B: And the second I do that my chance of being a mother is going down the drain. If I choose a career that’s not the schedule my children are on._
_Me: So you’re choosing to limit yourself while the kids are young, and then once they become more independent..._  
_B: Yeah, I don’t know if it will be counseling or a psychologist with my psychology background._ (4/10/08)

Brenda shares a mixed message. She wants a career she can call her own, but in the end, she prioritizes being a mother.

_B: I think now that I’ve started my career I’ve seen I’m gonna have to make a choice, do my teaching now, and when my kids get older take on more responsibility. Because being a mother is way more important than being a teacher. Your family should always be
important. But I feel I’m always going to struggle with that. I feel it now, at my age, and I don’t even have children. (4/10/08)

The responsibility she alludes to is apparently economic. Later in her conversation she speaks of the financial pressures she feels in their marriage. This too is of concern if she takes time off to have children.

Me: Some women feel they have to work.
B: ...That would put a lot of pressure on my husband. I don’t think it’s fair for him to have to work extra shifts so our family can take a vacation. I feel like I have to pull my weight to help support the family. (4/10/08)

Brenda has learned this from the example set in her family. Her father is a teacher and her mother an elementary school secretary. Mom shares (4/20/08) that they always had summers together, and they took the four children on vacation. They drove older cars. “None of our kids wanted to do that [to be teachers] until they got older and realized that we really did have a good life. It just takes them a while to realize. Brenda adds that all four children are two years apart, and that her mother took a year off after each of them, and worked for a year in between.

But Brenda continues to hark back to the issue of her age and the complications of waiting to begin a family. “I wish I could go back, that I would have done teaching from the beginning. Then I would be able to have a child by now” (4/10/08). In frustration she turns to me. Obviously, she has asked this question and received mixed advice from friends and family.

B: I wish somebody would tell me what to do. Should I start my career? Should I have children first? Then start teaching? It’s so hard. People say to me, “Look, you’re almost 27.” Am I that old? Oh my gosh! Am I gonna be an old mom? Oh my gosh! (4/10/08)

Her mother has obviously heard this concern, and blames her older daughter and Brenda’s friends for causing her such stress. “They’re all telling her she is waiting too long” (4/20/08).
Brenda’s mother married at 19 and suffered the same relentless questions. “People kept asking me and I didn’t feel it was anybody’s business. I always hated when family members...that’s why I never talk to her about that” (4/20/08). Mom had her first child when she was 26.

Brenda admits that she considers her mom successful, having accomplished a secretarial career and motherhood. “So when I look back, I look at my mom, and she did it all...all 4 of us turned out great, and I didn’t have a stay at home mom, so I don’t see why it can’t work for me too” (4/10/08). Brenda believes that raising children is her responsibility, and for her the issue is not whether to have children or a career, but when to have children. She is committed to helping the family financially by working, but ultimately, the career must work around the schedule they establish for their family. This, too, is a model her own family has set for her, and one with which she finds little fault. Brenda, like Candy and Kathy, is satisfied to emulate the stereotypes she believes socially appropriate for women.

Like Brenda, Alison comes from a family of working mothers. Alison’s grandmother runs a grocery store. Her mother, nineteen years younger than her oldest sibling, in lieu of nonexistent daycare, spends time in the store after school. Alison’s mother works long hours as well. She does not take time off when she has children. Her son and daughter spend time after school in a daycare playroom the family creates at the restaurant. Alison sees herself maintaining a full time job while raising a family, as well.

Me: So it doesn’t seem like they held back on their careers.
A: Yeah, no. I hope to teach for a while. But I wonder if I’d like to go into administration like when I get older. (4/16/08)

Alison, by her own admission is a product of the family in which she is raised. Her mother says
proudly, “She wants the whole...she wants a career and a family, because of all we went
through” (4/30/08). The women in this family are driven by their ambitions.

Me: Do you think we’re putting more pressure on women?  
A: Maybe it’s the competition. And maybe we wanted to succeed more and that’s how it
started. I guess it’s how you were raised. The family you were raised in...The women in
my family were strong willed. They worked. (4/16/08)

Alison’s mother sees growing up with a family business an advantage for women. “I don’t think
I compromised at all” (4/30/08). She is able to control her own career path and have her children
around her. “The kids were right there, and my husband would take them home at night if I
had to work” (4/30/08). She never takes time off from the business when she has the children.
She admits it is difficult at times, but she is the first woman in the study who takes exception to
the role model of her own mother.

Mom: I was engaged at 21 and married at 22. Pregnant six months later and had my son.
I know she [Alison] thinks about that because she says to me...it was hard for me when I
was younger, but there was really no time. You do this and you do that, but I feel like I’m
still young with my kids. My mom was pregnant with me she was just about 40. So when I
was in grade school, it was like, “Oh, your grandmother’s here.” So I know my daughter
says, “I want to be younger when I have my kids.” I was the youngest of five. We didn’t
have that relationship with my mom. (4/30/08)

Both Alison and Brenda want to maintain careers and have children, but Brenda chooses to
interrupt her career as her mother did to accommodate young children. Alison’s family role
models worked continuously during motherhood. In addition, Brenda is feeling more pressure to
begin her family immediately, since she is nearly six years older than the other participants.
Although for different reasons, Brenda’s being an additional four years of college, she voices the
same concern as Alison’s mother. Brenda worries about being an older mom.
Alison’s mother and grandmother are extremely supportive women having careers and families. Speaking of her own mother, Alison’s mother says, “My mom was completely the opposite. She was completely like, well, you can do both. She never said, ‘You aren’t gonna be able to do this’ (4/30/08). Alison’s mother also shares the support they had from the community.

Mom: I remember hearing people say, she was a strong community person. She employed a lot of people. Like if there was a child sick at night, I remember people knocking at the door, and they would say, ‘My baby’s sick, I need baby aspirin,’ and she would let them in. I remember people admired her and her strength of having 5 children, no husband, then a business and not giving up, and making something more of it. There’s something to be said for learning to juggle everything. It makes you a different person, but better. (4/30/08)

Alison is being brought up with the same standards and strength of character. Her mother is an advocate for her family. It isn’t simply about monetary success, it is about the principles and beliefs they value.

Mom: I just want them to know if you don’t believe in yourself, nobody else is going to. I think she knows...she might be delicate in one sense, but she does stick up for herself. You can’t let people push you around. (4/30/08)

Alison wants to teach second grade. Eventually she wants to have a family. She is neither concerned nor conflicted by doing both. She also has ambitions of assuming a more demanding administrative job in time. Already she is talking of working on her master’s degree. Her confidence level as a student and as a business woman are based on her successes throughout school and the support and examples of the women in whose discourses she follows.

Why teaching? For the love of children? To create a better world? To improve upon their own educational experiences? Altruistic to be sure…and a good fit with motherhood, several of
the participants stated. The notion arises again. Is it nature or nurture that draws women to elementary school careers? Or is it perhaps convenience? It is also mentioned by participants that teaching is a career that can be interrupted. It shares the same hours as children. You have summers off. Are these women seizing the possibilities available to women, or have they intentionally narrowed their focus in light of other discourses that drive their lives? With the exception of Alison, whose family provided other alternatives, each participant does not stray far from the social traditions and role modeling in her own family.
Chapter 8: Conclusions

Already established test scores show that women, although performing equally well in mathematics in elementary school, begin to decline in performance and participation in STEM subjects as they enter middle school and continue this trend in college. In pursuing this quantitative research phenomenon beyond test scores, it was my intention, through human science narrative research, to delve into the perceptions and mathematical attitudes of four collegiate women and their mothers. It was an effort to collect stories and search for individual categories and assemble themes in order to better understand the origins and reinforcement of their beliefs.

The stories were tape recorded on three separate occasions, individually with each participant and once with her mother. Each interview lasted about ninety minutes and had a focus on past, present and future implications of mathematics employing member checking at the beginning of each subsequent interview. Interviews with their respective mothers took place by telephone at the conclusion of each set of individual interviews and were tape recorded. The mothers shared additional and related background and contributed to my efforts to member check, as well. As faithfully as possible, I added notable observations, throughout the transcription of the interviews. Analysis of the collected information was first directed to each individual, organizing and integrating the mother and daughter collective memories around events and in categories. Then, in discussion of themes, recurring issues were organized for consideration either for their agreement or differing points of view.

Finally, I returned to the original intent of the study, to draw conclusions about
the mathematics beliefs of these four women. To reconcile the past, I considered not only the development of mathematics students like the women interviewed, but the attitudes and practices of their teachers, and the pedagogy used in administering the curriculum. How the attitudes and abilities of these students played out in the past was important because it distinguished them as teachers of the next generations of students. Additionally, the attitudes of young women like those I interviewed should be of concern to educators like myself as a basis for self-reflection and growth, as both elementary educators and as teacher educators.

There are many sites of belonging, and for each of the participants they form a complex web. Each strand, or discourse, positions and differentiates them in peer groups, school, family, and community. Lacomte and Schensul (1999) liken the analysis of data to the assembly of a jigsaw puzzle. First you take a glimpse of the picture on the box, then find the edge pieces, and locate chunks of pieces that fit together. Compare, contrast, integrate the patterns. This is the approach to compiling the experiences of the participants. As they share sites where they construct their mathematical beliefs, gradually a picture comes together. These themes are the threads that both distinguish and bind these four women together. Theme 1 addresses the beliefs of the participants concerning gender and mathematical ability. Theme 2 discusses mathematics in terms of related roles of parents and family members. In Theme 3, math is tied to friendships, and the social implications of mathematics are explored. Themes 4 and 5 involve math content and the context of mathematical preparation for teaching in the classroom, with particular emphasis on math teachers in Theme 5. Theme 6 involves equity and opportunity for women in mathematics. Theme 7 is a discussion of whether or not the participants feel women are taking
advantage of opportunities in mathematics today. Finally, Theme 8 concludes with a
discussion of the findings of the study in an attempt to interrelate the themes.

Lather (2001) calls it a mosaic, an “assemblage of fragments, a methodological,
continuous experiment of conjunction... jammed ideas, texts, traditions, and procedures
together” (p. 9). As children, beliefs are difficult to understand. Parents, teachers, and other
adults impose upon children the values of the discourses within which they themselves reside.
Theme 1 contains the discussion of the four participants, all beginning with each describing her
values and beliefs about women and mathematics as those passed on to them in the words and
examples set by their families. Being raised within traditions provides the foundation upon which
later discourses will be fitted and made available. Theme 2, the role of parenting, and Theme 5,
developing personal visions of themselves and role models in the teaching profession, become
intertwined here, as these women give voice their plans as teachers and mothers. The discussions
in Theme 3, 6, and 7, about friends and social consequences, intertwine with math success and
perceived consequences of achieving success as a woman.

The ways these young women situate themselves throughout their lives, Themes 1, 2 and
3, are the result and availability of discourse shifts, affecting the life decisions they make for
themselves, their future offspring, and their students as described in Themes 4 and 5. Finally,
each woman considers the role of teacher and mother, and pieces together the essence of each
theme as she understands it, in combination with her understanding of equity and
opportunity discussed in Themes 6 and 7. She makes assumptions about the conditions under
which she will prioritize her future. Each participant is different because her opportunities or
rejections have come at different times and in different ways. But many of the discourses are
shared, providing them with common ground. The four participants in the study are individuals,
yet many of their beliefs about women and mathematics are similar. In fact, they echo many of
the same beliefs as their mothers. We live in a “tightly knit fabric of conformity...(which) cannot
be shrugged off so easily as one might think. Neither can the old gender music be so easily
switched off” (Davies, 2003, p. 138).

Persistence of Math Beliefs and Resistance to Change

Although stereotype changes in women have been implemented over time, these implicit
attitudes still persist (Dasgupta & Asagari, 2004; Diekman & Eagly, 2000; Dasgupta &
Greenwald, 2001). Women, including the four participants, not only set goals according to their
beliefs about their math abilities, but perform accordingly (Keller & Molix, 2008; Good et al,
2008; Bonnot & Croizet, 2007:Quinn & Spencer, 2001; Spencer & Steele, 1999). Whether
biological or social, boys and girls are not treated with the same expectations. And in the case
of these participants, by their actions or words, mothers send their daughters clear messages
about support and achievement in school. These mothers appear to set limits on their own
mathematical usefulness and in doing so model for their daughters achievement-related
perceptions in Themes 1 and 2.

The four participants also have interactions outside the home and family. In Theme 3, the
actions and attitudes of schoolmates impact their developing belief systems about women
and mathematics. Three of the four girls not only witness, but participate in peer groups
that discourage mathematical success in women. All will accept the help of what
Candy goes so far as to call “nerds,” but none wishes to be included in that category. Each seeks to succeed in math, but only so far as the peer group sees necessary, reinforcing Candy and Kathy in their beliefs that they cannot and should not do too well in math; and Brenda, in her belief that society generates attitudes encouraging math successes in boys and discouraging them in girls. Candy, Kathy and Brenda are convinced of their limitations in mathematical ability. Alison, alone, has the support and example of women, and command and confidence in mathematics to believe she can be successful.

Some researchers suggest girls experience high levels of anxiety in school. They must combine the understandings they bring from home, their personal vision of the role of women in academics, with those of their peers. Peers are all too willing to accept communication subjects as “feminine” and math and sciences as “masculine” (Walkerdine, 2003; Seidler, 1989). In generating group attitudes, by incorporating or rejecting those of others, even stronger values become embedded in the behaviors and academic expectations of girls. Their lives are a mixture of feelings and fears. Francis (2002) suggests that gender equity to be like men is stressful. They must be attractive and academically high achievers (p. 107), and even then, there may be social prices to be paid for success.

The Impact of Math Beliefs on Teaching

Jussim and Eccles (1992) call it a self-fulfilling prophecy. Teacher expectations predict student achievement, and student achievement is influenced by teacher expectations and perceptions. Research shows attention to males is especially clear in science and math. When
boys and girls have similar math scores, boys are more likely to be assigned to the highest ability group than girls. According to Scott and McCollum (1993) during science projects, “girls spent 25% less time than boys manipulating the equipment and four times as much time watching and listening” (p.179). Teachers ask boys more questions and give them more individual instruction. Teachers wait longer for males to answer questions before calling on someone else. They reward females for performing computational skills and males for higher level cognitive skills, demonstrate more concern for male remedial help, and expect males to be more proficient in math. Just the opposite is true in reading, traditionally seen as a female domain (Hilton & GerGlund, 1974; Sadker, Sadker, & Klein, 1991; WalkerDine, 1998).

As children, in Theme 5, the four women all value the personal care and individual concern shown them by one or more of their teachers. Teachers who provide a warm, uninhibiting environment; who are caring and approachable; seem to provide an atmosphere that is conducive to girls’ learning (Leroux & Ho, 1994). In their article on ways to encourage girls in mathematics, Gavin and Reis (2005) emphasize a safe, caring, and supportive environment.

By assuming personal responsibility for girls, particularly those showing interest and talent in mathematics, teachers can help to counteract mixed messages they might be receiving from parents, peer group, and society in general. Gavin and Reis (2005) insist girls need specific support to help them believe they are truly talented in mathematics and to encourage them to continue to pursue these areas. Even as young adults, it is personal encouragement more than content of the mathematics, evidenced in Theme 4, that inspires the study participants to persevere. Motivation, it seems, for these women is derived extrinsically from their teachers. As they share their stories in Theme 5, from middle school and high school, where
teachers deal with classes involving hundreds of students, rather than the twenty-five more common in the elementary school, it is evident that for these four women, the teacher’s care and concern is even more vital.

Achieving equivalent outcomes in mathematics education for males and females may require that teachers actually treat boys and girls somewhat differently. Small-group work is recommended, especially for female students (Gavin & Reis, 2005; Wood, 2000). Valid teaching strategies are needed to motivate female students (Cavanaugh, 2005). All-female groups increase confidence levels (Sharpa & Keating, 2003; Dasgupta & Asagari, 2004; Volpe, 1999). While Hilke and Conway-Gerhardt (1994) advise against it, others find gender stereotypes are less automatic in single-sex than in coeducational classrooms (Moir & Moir, 1999; Gurian, 2003; Lavigne, 1980), where girls perform better than boys. And, although he does not recommend separation of boys and girls, as was the case with one participant, the more students encounter course instructors who are women, the less automatic explicit gender stereotypes are expressed (Lee, 1997).

Beliefs underpin thoughts and behavior. They underlie dispositions to engage in certain practices and not others. Beliefs help teachers understand themselves and make sense of their environment. Social group memberships as family members in Themes 1 and 2, friends in Theme 3, and teaching colleagues in themes 4 and 5, are based on shared values where in the case of teachers, Swan (2006) finds they become comfortable with the way things are and are resistant to change. Jussim and Eccles (1992) find that teachers seem to base their perceptions of students on those students’ actual performance and motivation, while on the contrary, Tiedemann
(2002) finds that teachers endorse the culturally dominant gender-role stereotype, regardless of the distribution of talent between males and females, and distort their perceptions of student abilities to be consistent with stereotyped expectations, particularly in low and average students. Interestingly, three of the four women classify themselves as low and average. In either case, it is important that teachers and teacher educators recognize the discourses that shape their attitudes about the roles of men and women in mathematics, and recognize their personal position in the discourse of mathematics.

Teachers must identify their feelings about the subject in order to consider how those feelings might consciously or unconsciously be passed on to students. They must challenge stereotypes and have equal expectations (Middleton & Midgley, 2002); use gender fair materials citing the Equity Resource Report of 1999 that less than 3% of U.S. history texts focus on women, and in science texts 2/3 to 3/4 of the pictures are men (Wood, 2000); and encourage participation of all students (Ambrose et al, 1997). Teachers need to increase their interactions with girls on high cognitive level mathematics activities, to expect girls to be able to solve mathematics problems and then to praise them for doing so. Further, when girls respond incorrectly in mathematics class, the teacher needs to encourage divergent and independent thinking in girls by giving them hints on the mathematics strategy they might use, rather than telling them the answer or strategy (Fennema & Meyer, 1989).

Insights About Careers and Success for Women in Mathematics

While men are positioned to pursue math related career paths, women are conflicted. They are positioned between motherhood and career goals, academic success or failure in certain
subjects, and belief in their limited capabilities. In spite of widespread rejection of gender/math stereotypes (Bussey & Bandura, 1999; Hyde, Fennema, Ryan, Frost & Hopp, 1990), they continue to express the dominant leadership of males and their role in mathematics (Eagly & Karau, 2002; Lummis & Stevenson, 1990) and the imbalance of male female participation in math related coursework and careers stands in sharp contrast (NSF, 1996). Clearly, sexism and patriarchy are at play in the lives of these four women. They and their role models are both aware of, and in some cases victims of patriarchal practices that continue to influence and determine the choices these women make.

“A dichotomy manifests whereby ‘natural’ academic brilliance, rationality and incisiveness is located in the male (females were positioned as better communicators, but also as achieving through ‘plodding’ diligence rather than innate ability)” (Francis & Skelton, 2005, p. 32). So men are seen as having more innate potential, but not as necessarily realizing this potential. There are claims in Themes 6 and 7, that gender undermines educational opportunities and career advancement, which are, theoretically, equal, creating current concern about boys’ declining performance. Francis and Skelton (2005) claim feminists are apprehensive about the concern with boys’ achievement because it will mask the continuing problems faced by girls in school and justify greater expenditure on boys achievement. Perhaps boys’ performance is not necessarily getting worse, it is that girls’ performances are continuing to get better. Even so, the performance dichotomy persists. When we deconstruct gender, we eliminate misleading socially constructed roles and expectations (Davies, 1989; Walkerdine, 2003).

Now we are confronted with a paradigm breakdown. One that perhaps dislodges the
gender power structure (Shaw, 1995). There is long term precedent according to gender in the subjects which young people pursue, and the varying status ascribed to these. “Girls tend now to aspire to careers, and to see their future jobs as indicative of their identity, in a way that was not the case 20 years ago” (AAUW, 1990). They call them circular relationships. Further, the Francis and Skelton (2005) find girls and boys who like math and science have higher levels of self-esteem; and girls and boys with higher levels of self-esteem like math and science. Girls and boys who like math and science are more likely to aspire to careers in occupations where these subjects are essential. Girls and boys who like math and science are more likely to aspire to careers as professionals. This relationship is stronger for girls than for boys. Girls who like math are more confident about their appearance and worry less about others liking them. Girls and boys who like math and science hold onto their career dreams more stubbornly. They are less likely to believe that they will be something different from what they want to be.

The majority of teachers entering elementary school teaching have college entrance scores in math and verbal content that measure lower than the national averages in both areas (Guarino et al, 2006). Believing less math is required of an elementary education degree, many women enter that preparation only to discover they need to develop an understanding of mathematics (Austin & Wadlington, 1992). Candy, Kathy, and Brenda are products of weak mathematics backgrounds, have performed poorly on standardized tests, and come to the conclusion that they must master their own understandings before they can teach others. When and where are these gaps identified and rectified? If not in K-12, when and how within the college elementary education program? Alison is the exception, but she too admits the need for
better teaching techniques. For this we have math methods classes, but are these classes focused for the future, or are they revisiting traditional mathematics with a nod toward differentiation?

Given the tenuous foundation of three of my subjects’ mathematics teaching abilities, and reasons for choosing teaching as a career, of concern, as well, must be the reasons teachers leave the profession and what characteristics the four candidates might share with research findings, because research by the U.S. National Commission on Teaching estimates that teacher attrition over the last fifteen years has grown by 50% (Kopkowski, 2008). In their first five years of teaching, 46% to 50% will leave the profession (Jalongo, 2006; Chase, 2000; Ingersol, 2001), with the majority of those leaving after their first year (Anhorn, 2008; Guarino et al, 2006).

College graduates with higher academic ability, particularly in math and science, are less likely to enter teaching and are more likely to leave teaching than are other college graduates. Alison falls in this category. Her math ability may prove, ultimately, more marketable elsewhere. Since she is highly motivated by the women in her family to have a career, this may become an even stronger possibility. Other reasons for leaving the profession are low salaries, unsatisfactory working conditions, inadequate preparation, and work/life imbalances. Brenda has already shown concern for meeting expenses as a couple and ultimately a family. She has also shared ambitions beyond the classroom in psychology or administration where salaries are higher. Inadequate preparation beginning in their own elementary educations worries Candy, Kathy, and Brenda, who memorized their math, and are now struggling to understand concepts and strategies, as well as master effective forms of pedagogy to use with their future students. They receive training in hands-on teaching methods, higher order thinking, and teaching diverse learners, but still admit they lack confidence (Darling-Hammond, 2007; 2006). Although they
are part of programs with increased liberal arts coursework and clinical experience, this may not be enough when compared with the most successful programs offering five year preservice teaching plans with extended classroom experience (Anhorn, 2008; Guarino et al, 2006; Darling-Hammond, 2003; 2006; 2007).

How then, are we to deal with the negative attitudes and beliefs discussed in Themes 1, 2, and 3, and years of poorly attained mathematical training on the part of candidates like Candy, Brenda and Kathy? How can their experience be reshaped so they and their students experience success? Can these teacher candidates be inspired to teach differently than they learned or were taught mathematics in Themes 4 and 5? Beliefs influence choices (Simkins, Davis-Kean & Eccles, 2006). Without exception, these young women believe in Theme 4, that there is a better way to teach mathematics. Reys and Fennell (2003) make several recommendations, from revising teacher preparatory requirements to establishing teacher subject specialists in schools. “To improve the quality of mathematics instruction at the elementary school level, we must acknowledge that teachers are the key” (p. 281).

Making Choices-Competencies and Careers

Not simply for the love of children can teachers enter the education profession. All four participants have an altruistic desire to give children the help and support they need to have a successful school experience. Guarino et al (2006) find 72% of the teachers they survey enter the profession to contribute to society and help others. These women must also embrace the notion that they are teachers of subjects. It is important that they understand mathematics content, and they are prepared with strategies to enable them to pass those understandings to their students.
The four participants see teaching as a good match with marriage and motherhood in Themes 6 and 7. Eighty-one percent say that is absolutely essential that the job allow time for family (Guarino et al., 2006). The majority of those entering elementary education are women, and women cite vacation time and the ability to combine teaching with child rearing as important motivators. The authors couple this with the conceptual framework that historically there are higher opportunities in the form of attractive alternatives to teaching available to men. These beliefs are shared, as well, by the women in the study, and several of their mothers.

“Heterosexual codes and patriarchal power limit and construct girls and women, whilst they enhance the power available to boys” (Shaw, 1995, p. 123). Not only do the participants believe this, but Brenda has already experienced discrimination based on her gender and intentions to have children. There may be evidence that when motherhood becomes a descriptor of a worker, discriminatory biases may result (Ridgeway & Correll, 2004; Williams & Cooper, 2004). The four participants strongly believe women’s career paths are substantially diminished particularly if they desire to have children. In spite of legislation to the contrary, the position of girls and women in family, education and the workplace influences their interest and achievement, and vice versa (Connell, 1995). Although drawn to teaching at different points in their lives and for different reasons, all feel the teaching schedule is a good fit with motherhood. Although two of the four participants would consider twelve month jobs, they would probably not do so early in their careers or early in the lives of their children. Their careers are not based on advancement, but rather accommodation of other priorities, like marriage and children.

Their attitudes belie that teaching is a compatible occupation. They are not necessarily
interested in accessing a career with upward mobility, increasing demands, and personal goal setting. They view teaching as a partial investment, and in doing so admit to a confusion of priorities. Each speaks of plans: teaching for a time, marriage and children; or marriage, teaching, then children; or marriage and children, then teaching; or teaching while juggling the demands of marriage and children. Brenda and Alison appear career oriented, taking the examples of their mothers. Still, they see themselves as carrying the majority of responsibility at home. The attitudes these women share about teaching and family are so steeped in tradition I am, quite frankly, amazed.

Men and women are physically different, but some feel gendered behavior is socially produced (Loyd & Deveen, 1992). Many of the math beliefs of the participants are based on perpetuated stereotypes and role modeling. These are evidenced in Themes 1 and 2 within the family, Theme 3 with their friends, and Theme 5, by the teachers they have experienced as students in school. Social conditions then, not intelligence, may inhibit girls’ achievements (Walkerdine, 1990). Researchers claim girls have become career oriented, seeing their careers as reflecting their identities and future fulfillment (Francis & Skelton, 2005; Walkerdine, 2003). An increasing number of women are receiving college degrees, but up to one third may be opting out of professional life (Gilbert, 2005). These women seem not to value careers, but rather, the need to share in the financial responsibility of the family. In Brenda’s experience, the majority of women college graduates are stay at home mothers. Two of the other participants admit they would either interrupt their teaching careers or discontinue teaching when they have children.

The four participants share pessimism about women in business, particularly careers involving mathematics. Not only do they envision fewer opportunities, but greater sacrifices on
behalf of the women. They believe discriminatory hiring practices and inequitable sharing of family obligations place an added burden on women who juggle a job and a family. All agree that family roles are largely unchanged, and that women handle the majority of household and child rearing responsibilities. Their mothers, having tempered their viewpoints with time, see opportunities for women in a more positive light. All their mothers agree that change is taking place, but changes are very gradual. New roles are emerging, outside the realm of their four daughters’ choices, but none suggests their daughters pursue any of those opportunities.

Suggesting the imbalance continues today, that women continue to bear the greater share of child rearing responsibilities, the four women participants choose teaching, given their narrow choice set (Guarino et al, 2006). Although Candy and Alison decide to teach very early, Kathy and Brenda seem more motivated to teach after weighing options compatible with raising a family.

Identity is learned as children model their behavior after same-sex members of the family, peer group, local community, and teachers, as well as stereotypes in media like books and television (Paechter, 1998; Epstein et al, 1998). Each participant discusses how she models herself after the example set in her own family. Young girls learn how to be a girl by receiving approval for feminine traits such as caring, gentleness, and helpfulness. Each participant admittedly takes the example and advice of her mother over that of other relatives and peers (Thomas, 2008).

Women are socially manipulated to adopt helping and facilitating roles (Connell, 1995; Walkerdine, 1990). All four want to help children as teachers, and all want their own children. They believe nurturing is an important attribute of an elementary school teacher, and of a mother. All feel the biological pressures of having children while they are young. All four
believe their ambitions are being molded and compromised around those family priorities.

They struggle with the notion of career and family, and like many of today’s women some may still hold the detrimental beliefs that women belong in the home and men are more suited to the workplace (Barnett, 2004). All, but perhaps Alison, are willing to temporarily if not permanently relinquish their careers during child rearing years. Research suggests working mothers may experience guilt resulting from the social constrictions of a traditional model of intensive mothering (Guendouzi, 2006). Alison and Brenda admit their concerns when parents prioritize work over family.

Because none of the four participants are entering a primarily math or science career, it is difficult to say they are seizing possibilities or entertaining new beliefs about the roles of women in the workplace and in STEM careers. All intend to enter lower level elementary education positions, traditionally held by women. All hold firmly to the role models set by their mothers, either accommodating child rearing in lieu of, or in addition to maintaining a career involving limited mathematics.

Responding to the Findings

The intent of this study has been to explore the mathematical beliefs and attitudes of four preservice elementary school teachers. In addition, these findings have been juxtaposed with the attitudes and beliefs of the participants’ mothers for purposes of both verification and longitudinal interest. The first conversations revolved around the development of mathematical beliefs during childhood, and extended into experiences in the school and with teachers. Also discussed were the friends and acquaintances who contributed to the development of their mathematics attitudes. Subsequent conversations explored current collegiate and classroom
experiences with mathematics as preservice teachers, an assessment of their current mathematical skills, and finally, their intentions for future exercise of mathematics in their own careers in the classroom. Although conversations were motivated by themes concerning mathematics, related and more personal themes were spontaneously drawn upon by participants themselves, particularly in the final conversations as they envisioned themselves as teachers, wives, and mothers.

The personal way in which the four young women and their mothers shared their stories; their fears, their disappointments, their hopes, and their dreams, had a profoundly emotional and deeply motivational effect on me, both as a teacher of elementary school children and as an instructor of preservice elementary teachers.

If the understanding of mathematics, is not necessarily reflected in test scores, investigation into what truly underlies confidence and the pursuit of mathematics careers must further be explored. As a result of the discussions with these four preservice teachers, I recognize the impact of several of the themes in the study on my own career as an elementary classroom teacher and a college instructor of math methods. I may have little influence over the beliefs and examples set by parents and the friends of my students outside my classroom, but I can, as a teacher, influence them with my actions in the classroom. Clearly, Themes 4 and 5 suggest that the way I share my enthusiasm, connect with my students, individualize and encourage them, does have a positive impact on their beliefs about their abilities and their subsequent performance. I am not suggesting artificially inflating the confidence of girls and women in mathematics, but restructuring our approach to mathematics to identify and accommodate those students. One way may be with additional small group instruction and alternative algorithms that may be more appropriate in helping them to understand and use the tools mathematics provides.
Beyond the scores, beyond the numbers on report cards, perhaps it is not so much a matter of rating of cognitive deficiencies, but of valuing different strategies (Halpern, 2000). The beliefs expressed by the participants cannot compatibly merge with current mathematics emphasis, when a multitude of problem solving strategies are valued over skills like memorization (Swan, 2006; Friesen, 2005/6; Marshall, 2006; Paulsen, 2005). In addition, studies show that different items on the SAT, for instance, are better solved using strategies preferred by males than by females (Lubinski, Wai, & Benbow, 2005; Brody & Benbow, 1990). These women intend to become teachers of mathematics for young boys and girls alike, with what is by their own admission in Themes 1 and 4, limited preparation. To repeat an often used phrase, the future is now. If we are to prepare thinkers and planners for problems and challenges, some of which we cannot fully conceive, we must equip them with the understandings and the means to creatively speak about their world. The language of mathematics is one of the most important tools for describing.

Obviously, this means getting to know our students and their families in a more academically personal way. It is evident that for these four women, a teacher’s care and concern in the classroom is vital. I have already become more proactive, taking initial steps in previewing and targeting remedial instruction with small groups of students. We call it “Lunch Bunch.” For my struggling math students at the elementary level, it is not a punishment, but a head start some of the time, and a second chance at others. They enjoy recess with their friends, then, with special passes, go to the front of the lunch line with permission to bring their food back to the classroom. They do math with me using flourescent pens and personal whiteboards. We investigate alternative algorithms, at the pace they require, between bites of our sandwiches. My
measure of success is the positive change in their attitudes. They ask to come and complain
when I cannot be meet with them. But clearly, more investigation into how we identify and deal
with students like the participants of my study, as children, and as young adults, is required.

Perhaps it means investing more than one educational year with a group of students, or
reconfiguring the way we look at divisions between grades. But, if this were to become a goal of
education, it would seem, we might need to consider the restructuring of middle and high school,
as well. Could core teams of teachers working with smaller groups of students create the
opportunity to know and support students better? Would a different structure allow teachers to
share insights and interact with students in more academically specific ways, beyond the subject
of mathematics alone? Could this approach to giving students greater attention help not only
those struggling academically, but also identify those who appear adequate but are not achieving
up to their potential? Would making a greater investment in informing young women of the
opportunities available to them, and providing them with emotional and academic support,
encourage greater numbers to enter those STEM fields with more confidence in their ability to
succeed.

Another option, then, may be to consider a design not unlike that used in special
education. Individual education programs (IEP’s), is another model to meet the needs
of students. Perhaps we must abandon the contradictory one size fits all mentality of
teaching mathematics, with its one algorithm fits all mentality, using a single textbook as the
gospel approach. In the spirit of leaving no child behind, perhaps we must consider this a
model for all students, regardless of their beliefs or gender. Mathematics must make personal
sense, and in doing so, all students require mathematics experiences that include relevant and
understandable presentation of concepts. This is not a new notion. Prominent mathematicians
and researchers have written about it for years. (Brownell, 1947; 1949; Kamii, 1993). As teachers, we must have a command of mathematics that enables us to explore or present alternative algorithms (Phillip, 1996; NCTM 1989, 2000), and even embrace the invented algorithms of our students.

Regardless of whether math ability is genetic, sex-linked, or socially acquired, as discussed in Theme 1, I am concerned that in classrooms today, and in the college math methods courses required of preservice teachers, the focus remains on performing traditional algorithms. I, too, may neglect the fears and limitations expressed in Theme 4, in the weak understanding of my college students simply because they have fulfilled prerequisite studies. Is it responsible of me, as an educator, to make assumptions about their conceptual mathematical understandings and move on?

As a result of this study, I have begun to reconsider the premise of my college methods course. I can not make assumptions that these formative teachers can make the leap from the memorization they relied on in their pasts, to an ability to instill insights that they themselves do not possess. Themes 1, 2 and 5 have made this fact clear. I cannot assume that the prior mathematics instruction has been thorough enough to meet the needs of all my students, regardless of even the best intentioned teachers.

“Wishing doesn’t make it so,” is an overused cliché, but perhaps appropriate here. Metaphorically speaking, if you want to hit homeruns, you have to step up to the plate and swing the bat. In the case of three of these young women, they did not believe they could hit the ball, so they sat in the dugout, memorized the rules, and watched the game, believing they were not capable of contributing. Now they want to be coaches. I wonder whether reading a manual about
the game and requiring the team to memorize the rules of play, they way they did, will provide
the team with the ability to situationalize and negotiate the rules effectively during the play of the
game. The metaphor ends here because mathematics isn’t limited to a field of play, as it is
portrayed in the classroom. It is pervasive throughout life, and participation is required.

*The United States is one of the few countries in the world that continues to pretend-despite substantial evidence to the contrary—that elementary school teachers are able to teach all subjects equally well. It is time that we identify a cadre of teachers with special interests in mathematics and science who would be well prepared to teach young children both mathematics and science in an integrated, discovery-based environment.*

(National Research Council, 1989, p. 64)

I understand this may be an idea frightening to some educators already in practice or preparing
for teaching careers who share backgrounds similar to three of the women I interviewed. As
educators, we must be much clearer about the goals of education, kinds of change we
want to make in our schools, and most importantly, how the effectiveness of those changes will
be measured. Quantitative measures may neither be the best way to identify, nor to develop, the
type of mathematical thinkers required in the future.

At their university, these four women are required to take only two mathematics courses
in their elementary education program; a four credit math methods class and an elective math
course, either history of mathematics or a college level mathematics course, neither of which
address foundational concepts and meaningful applications. Elementary mathematics
instruction, and teacher preparatory mathematics instruction must take place in an environment
that includes a personal curriculum mastery. Only then can mathematics methods courses deal
with the pedagogical techniques that make mathematics accessible to children in
ways they can relate to numbers and concepts. It would seem the needs of the four candidates
are not currently being met.

Each of these women, without exception, admitted that she was a memorizer of mathematics, and that in memorizing mathematics algorithms she had fulfilled the mathematics required of her. According to research, most elementary teachers take six to nine hours of college mathematics to fulfill their program requirements (Reys & Fennell, 2003). Simply taking more college-level mathematics does not ensure teachers focus on the mathematical knowledge necessary to teach elementary school children (Battista, 1994; Ball, 1991). Can we expect prospective teachers to take the initiative alone to identify their strengths and weaknesses and correct misconceptions and remediate their own skills? I think not. Perhaps the subject of teacher preparation in mathematics requires restructuring of the elementary education program, not just in further splitting certification between upper and lower elementary grades, but rather, in individually tailoring the program to include coursework specific to individual strengths and weaknesses. Methods courses cannot accomplish pedagogical goals if the content knowledge and higher order thinking assumed, are not truly present.

Furthermore, past practice is likely not the practice required of problem solvers in the future. If elementary teachers are expected to adjust their thinking and change their approach to educating students I wonder that we do not, as college educators practice what we preach. If pre-assessment, differentiated instruction (Tomlinson, 2003; 2004) and individualization are the order of the day, why do we not pre-assess and differentiate at the college level according to the needs of our students? Differentiation and individualization are not only for special interests, independent study and enrichment, but also for accommodation of specific deficiencies.

Summative testing does not reveal insecurities and misconceptions with the aim to
identify and remEDIATE them. Its purpose is to concludE, to give a final assessment of a student’s degree of success. Could pre-testing take place in subject courses at the college level; specifically mathematics concept and application courses meant to explore and remEDIATE personal mathematical skills that would precede the actual teaching methods courses? Why should students wait until they have financially invested in the Praxis Exams to find out what skills they should have mastered?

Already, I have initiated pretests and begun conversations in my college math methods classes to explore the mathematical competence of my students. We investigate both their conceptual understandings and their competence with traditional algorithms. In addition, we develop and share alternative and invented strategies for solving mathematical problems. When students identify weaknesses, remedial help can be found with me, or in the future, at the tutoring center with near peer math students.

The future is a slippery slope to navigate, each trail posted with signs suggesting what if and then how? Each of these women fits into a multitude of statistical categories, but no single statistic alone can predict her future. Paths are chosen in accordance with beliefs, passed by or blocked by conflicting values; advice and counsel bombarding her along the way. How she adjusts, rejects, and accommodates all make her like and unlike other women. That is the value in sharing their stories. In an attempt to listen and understand the person behind the statistics, there lies depth and dimension, and a lesson in the danger of oversimplification. No one is who they are by superficial inspection...no one fails or succeeds for one reason alone.

Mathematics, the word alone conjures an emotional response. That response is founded in threads of experience from earliest childhood. And over time, those threads are woven neatly
into a pattern or logic, or snarled and knotted into a tangle of misconceptions and misunderstandings. It has been the intent of this study to listen to and record the mathematical rationalizations and sense-making process of the participants, through the stories they have chosen to share. It has been an effort to find uniqueness and similarities between and among the participants. Then, finally, it has been my hope to find the spaces, where their experiences might inform my efforts to become a better practitioner of mathematics both with elementary school children and preservice elementary teachers in my own classroom, and by so doing, offer that experience for others like myself, for their consideration.
Appendix Listings

Appendix A: Screening Survey for Potential Candidates for the Study

*Only female elementary education majors, students at the university who had completed the Math Methods course in their sequence, were eligible to participate in the study.*

Appendix B: E-mail Follow-up to Survey

*Once willingness to participate was obtained, students were given additional details of the project and asked for their availability.*

Appendix C: Consent Form to Interview and Tape Record for Purposes of Research Study

*Both college students and their mothers signed a permission form allowing me to interview and tape record their conversations. The form assured them that their confidentiality would be protected and the originals of any documentation would be safely stored and then destroyed.*
Pennsylvania State University
Doctoral Research in Mathematics Background - Preliminary Survey

1. Was your elementary school (circle one) public private
2. Where was your elementary school located? rural/small town city
3. Who taught your mathematics in elementary school? The same teacher who handled the other subjects like reading, science and social studies or a specialist? single teacher departmentalized
4. When and with whom did you do your homework?
5. Were you part of an accelerated mathematics program? yes no
6. Estimate the population of your high school. 50-499 500-1200 1200+
7. What courses in mathematics did you take in high school? (circle all that apply)

<table>
<thead>
<tr>
<th>Business Math</th>
<th>Accounting</th>
<th>Algebra 1</th>
<th>Algebra 2</th>
<th>Geometry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trigonometry</td>
<td>Calculus</td>
<td>others</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8. Did you enjoy mathematics? yes no

Explain briefly

9. What courses of mathematics have you taken in college?

10. Will you take additional math courses before graduation? yes no

11. Can you describe your favorite math class or lesson?

Thank you for your input.
Kathleen Schanbacher

Would you be willing to be interviewed further about your mathematics education for this research project? yes no

Your name: ________________________________
Email: ________________________________
Informed Consent Form for Social Science Research

The Pennsylvania State University

Title of Project: Intergenerational Study of the Math Attitudes of Preservice Women Teachers and Their Mothers

Principal Investigator: Kathleen Schanbacher
147 Wilbur Way
Cogan Station, PA 17728
kathmath52@aol.com
(w) 570-523-3220 x3084
(c) 570-971-0316
(h) 570-998-9009

Advisor: Dr. Patrick Shannon
211 Chambers Bldg
University Park, PA 16802
pxs15@psu.edu
814-865-0069

Dear Participant,

I would like to invite you to take part in an interview study for the purpose of doctoral research at Penn State University. The purpose of this research is to identify and analyze women’s attitudes towards mathematics that are often oversimplified to numbers or letters on test scores and report cards. It involves a study over time, to explore the possibilities women saw for themselves, and those they see as possibilities for women now, and to discover whether they feel society has evolved in ways that help or hinder women in mathematics in the future.

You will be asked to participate in tape-recorded interviews. Three tape-recorded interviews will be conducted with each prospective teacher, in person, at a public place accessible to both parties, lasting no more than 90 minutes each. One interview (or two if necessary), also be tape recorded, with each prospective teacher’s mother, by telephone, lasting no more then 90 minutes. Conversations will center on mathematical experiences as they relate to participants as students, or teachers, or parents interacting with their children.

There are no risks in participating in this research beyond those experienced in everyday life. Your decision to be in this research is voluntary. You can stop at any time. You do not have to answer any questions you do not want to answer. Refusal to take part in or withdrawing from this study will involve no penalty.

Personal information will not be made public. Your identity will be protected. Pseudonyms will be used. Data will remain in my direct possession in a locked safe and/or password protected computer file. Information will be destroyed upon acceptance of the dissertation.

Experiences are the foundations for our development. Revisiting what underlies our actions and our attitudes deepens our understanding of ourselves, others, and the world in which we live.

Thank you,
Kathleen Schanbacher
You must be 18 years of age or older to consent to take part in this research study. If you agree to take part in this research study and the information outlined above, please sign your name and indicate the date below. You will be given a copy of this consent form for your records.

Participant Signature ________________________________ Date ________________

___ Yes, I give my permission to be audio-recorded.
___ No, I do not wish to be audio-recorded.

Person Obtaining Consent __________________________ Date ________________

Questions about your rights as a research participant may be directed to Penn State University’s Office for Research Protections at (814) 865-1775. Further information can be obtained at www.research.psu.edu. The following may review and copy records related to this research:
• The office of Human Research Protections in the U.S. Department of Health and Human Services
• Penn State University's Social Science Institutional Review Board
• Penn State University's Office for Research Protections

May the researcher use your research recordings for future research purposes? Please place your initials in front of the statement(s) for which you provide permission.
___ I do not give permission for my recordings to be archived for future projects. I understand the tapes will be destroyed on 12/31/09.
___ I do not give permission for my recordings to be archived for educational and training purposes. I understand the tapes will be destroyed on 12/31/09.
___ I give permission for my recordings to be archived for use in future research projects in the area of mathematics education.
___ I give permission for my recordings to be archived for educational and training purposes.
Bibliography


Isaacson, Z. (1989) Of course you could be an engineer, dear, but wouldn’t you rather be a nurse


Kogan Page.


Swan, M. (2006). Designing and using research instruments to describe the beliefs and practices


Kathleen Ann Schanbacher  
147 Wilbur Way  
Cogan Station, PA 17728  
(570) 998-9009  

BUSINESS EXPERIENCE  
• 1999-Present: **Curriculum design and instruction for Carnegie Mellon University gifted program, C-MITES**, Pittsburgh, Philadelphia, and Lewisburg, PA  
• 1989-Present: **Susquehanna University Dept. of Education, adjunct professor, Selinsgrove, PA “Math Methods for Elementary and Middle School Teachers”**  
  -Math Fair creator/director, LASD elementary/intermediate/Susquehanna University program, Lewisburg, PA  
• 1979-Present: **Teacher grades 3, 4, 5, 6, Lewisburg Area School District**, Lewisburg, PA  
  -NASA Meteorite/Moon Rock certified district coordinator  
  -Science Curriculum Coordinator LASD  
  -Presenter PA Council of Teachers of Mathematics conferences  
  -Listening Post coordinator for near peer counseling with Bucknell University  
  -winner PA Reading Association innovative teaching grant  
• 1974-8: Classroom Teacher grade 3, Medford Area School District, Medford, PA  
  -winner NJ Educational Grant for cross-grade reading program  
  -district planning and implementation team for gifted education (Renzulli)  

EDUCATION  
• B.A. – Gettysburg College, Gettysburg, PA, 1974 – English/Education K-8  
• M. Ed. – Trenton State College, Trenton, NJ – Special Education/Gifted Education  
• Supplemental Coursework – Monmouth College, Bloomsburg, Bucknell, Carlow College, Indiana Wesleyan, Indiana, Cheney, and Penn State University  
• PhD – Pennsylvania State University, University Park, PA, 2009 – Curriculum and Instruction  

PROFESSIONAL  
• Kappa Delta Pi  
• PA Council of Teachers of Mathematics/National Council of Teachers of Mathematics  
• Pennsylvania Science Teachers Association/National Science Teachers Association  
• Pennsylvania State Teachers Association/National Education Association  
• Pi Lambda Theta  

PERSONAL  
• Born: February 29, 1952  
• Married, one son, one daughter  

OTHER COMMUNITY INVOLVEMENT  
• 1998 to present: Member Roman Catholic Church-Eucharist minister, CCD teacher  
• Girl Scout assistant leader - badges/Silver Award/religious award  
• Boy Scouts – instructor for badges/religious award  
• 1990 to present: Published “Scherenschnitte” original patterns in *Back Street Designs*, local community presentations  
• Retired: American Red Cross Lifeguard, Water Safety, First Aid and CPR instructor and instructor trainer.