Mathematics autobiographies have the potential to help teachers reflect on their identities as mathematics learners and to understand their role in the development of their students’ mathematics identities. This paper reports on a professional development project for K-2 teachers (n = 41), in which participants were asked to write mathematics autobiographies. Using an adaptation of an existing framework for characterizing teachers’ mathematics stories, we describe the consistencies among the participants’ experiences as mathematics learners and the events that are identified as being the impetus for a transition from a negative to a positive attitude toward mathematics. Implications for both teachers and teacher educators are presented.

Early elementary mathematics experiences are very important for developing the foundations for students’ future mathematical success. Ironically, however, many early elementary teachers choose to teach young students specifically to avoid mathematics with which they are not comfortable (e.g., Dodd, 1992; Kelly & Tomhave, 1985). This is problematic for children, especially given the heightened role of mathematics in their futures because of the national push for STEM learning (Prabhu, 2009). As such, it is becoming increasingly clear that early elementary teachers must not only be comfortable with the mathematics they teach, but also exhibit a positive mathematics identity as a model for their students. While working with early elementary teachers, we wondered how personal mathematics stories would provide insight into both the development of mathematics identities and also how teacher educators might be able to best support teachers’ mathematics learning. In this paper, we report on a study of 41 K-2 teachers’ mathematics autobiographies and the insight this provided about their identities as mathematics learners. Specifically, we address the question: How can K-2 teachers’ mathematics identities be characterized through an analysis of their written mathematics autobiographies?

**Background Literature**

**Mathematics Identity**

What is a mathematics identity? To answer that question, we need to begin by defining identity. Identity is typically thought of as how one knows and sees oneself. It is socially constructed and constantly changing as individuals interact within the different communities in which they live, work, and learn (Holland & Lave, 2001). Like Sfard and Prusak (2005), we equate identity with stories individuals hear and tell about themselves. Specifically, identities are “collections of stories about persons or, more specifically, . . . narratives about individuals that are reifying, endorsable, and significant” (Sfard & Prusak, 2005, p. 16). Reifying refers to the aspects of stories that point to the repetitiveness of actions (e.g., always, never, usually). Endorsable stories are those that the individual would say accurately reflect the state of things. A significant story is one that “affects the storyteller’s feelings about the identified person.” For Sfard and Prusak, there are two types of identities: actual and designated. Actual identities are the stories about the “actual state of affairs,” while designated identities are stories that present a state of affairs, which “is expected to be the case, if not now then in the future” (p. 18). As such, an individual’s mathematics identity, the actual and the designated, is the collection of stories about the individual with respect to mathematics.

Mathematics identities include stories related to how one interacts with mathematics both in and out of school. For teachers, this means that the stories from their earliest mathematics experiences up to and including their experiences with mathematics as teachers. Actual identities are stories about how an individual has participated in mathematics. Designated identities are stories about anticipated participation in mathematics. For example, actual identities include the stories about an individual’s successes and failures in the mathematics classroom (e.g., I am good at math; I always struggle with fractions; She said I did really well on the math quiz.). On the other hand, designated identities can include the stories about future hopes or yarns about how gifted (or ungifted) an individual is in
mathematics whether or not it is grounded in truth (e.g., I am going to do far better in geometry; I will never be able to do high school math; You are not a math person). It is easy to imagine that these stories impact how an individual interacts in learning situations; therefore, it is useful for teacher education researchers to understand how they develop over time. As mathematics identities are stories, an appropriate methodology for revealing them is through storytelling.

**Autobiographical Storytelling**

Autobiographical storytelling, the telling of one’s personal experiences, has a rich history in research in the social sciences (Miller, 2000) and is increasingly common as a methodology in teacher identity research (Drake, Spillane, & Hufferd-Ackles, 2001; Ellsworth & Buss, 2000). Autobiographies serve as a reflection tool by providing a lens through which teachers understand themselves personally and professionally (Brunner, 1990; Casey, 1993; Connelly & Clandinin, 1999; McAdams, 1987). Although autobiographies most often encompass the events of a person’s lifetime (Miller, 2000), they can also focus on small segments of peoples’ lives or experiences in particular arenas. In addition, autobiographies can be captured in both oral and written formats. Oral autobiographies, in particular, are increasingly being used in mathematics education research (Drake, 2006; Drake et al., 2001; Gellert, 2000; Hauk, 2005; Sfard & Prusak, 2005). There are limited accounts, however, of the use of written autobiographies in mathematics teacher education. In the context of this study, a mathematics autobiography represented an individual’s retelling of her mathematics learning experiences using a written format.

Research on storytelling in mathematics education has revealed that individuals’ attitudes, beliefs, and identities about mathematics can be understood within the stories, much more so than with more traditional survey instruments (Ellsworth & Buss, 2000). In addition, stories have the potential to reveal teachers’ relationships with and incorporation of curricula materials (Drake, 2006; Drake et al., 2001) and affinity for particular teaching strategies (e.g., Ellsworth & Buss, 2000; Hauk, 2005). In their analysis of 98 elementary education majors’ mathematics and science autobiographies (they were asked to choose one to write), Ellsworth and Buss (2000) not only identified the prospective teachers’ overall attitudes toward the subject, but also identified five themes common across the autobiographies (p. 357): (a) the powerful effect of teachers, both positive and negative; (b) the impact of family members on attitudes toward mathematics and science; (c) the importance of content being relevant to real-life situations; (d) the problem of comprehension versus coverage of content; and (e) the effects of classroom emphasis on skills and memorization, predominantly in mathematics. We believe these themes, especially if proven to be consistent across populations, are important to share with both prospective and practicing K-12 mathematics teachers.

Potential outcomes of the analysis of math autobiographies that have yet to be capitalized on are those of identifying and characterizing transitions in mathematics stories (Drake, 2006; Ellsworth & Buss, 2000). In addition to the five themes they identified across mathematics and science stories, Ellsworth and Buss (2000) were also able to identify the events that triggered a transition from positive story (with respect to the subject) to negative story, or vice versa. They found that transitions in students’ stories were most often associated with individual teachers or their own confidence. Similarly, in her analysis of 20 elementary teachers’ math stories, Drake (2006) focused on “turning points,” events during which the teachers’ stories changed from negative to positive. Six of the 20 teachers identified such turning points. The turning points were varied in nature in that some stemmed from teaching mathematics and others from being a learner in either a course or a professional development program. What all of the teachers had in common, however, was that their turning points were recent (they occurred after years of bad experiences).

Autobiographies have the potential to allow for the characterization not only of transitions, but also of learner experiences over a long period of time. Such characterizations have been shown to be helpful in constructing and understanding the adoption of curriculum and even pedagogical orientations. For example, Drake et al.’s (2001) analysis of 10 elementary teachers’ math stories resulted in the identification of four types of learning experiences (to be discussed in detail in a later section). Drake et al. used this classification to look at commonalities across types of learning experiences and adoption of a standards-based mathematics curriculum. If those four categories were to prove to be consistent across a large group of math autobiographies, they may be quite useful for future studies and work with prospective and practicing teachers.

**Methodology**

**Participants**

Forty-one (41) K-2 teachers from six different elementary schools in a large urban district were the participating subjects in this study. These teachers were involved in a multiyear professional development research project called Nurturing Mathematics Dreamkeepers (NMD).
The teachers’ classroom experience ranged from 2 to 20+ years, with a mean of almost 10 years teaching experience. They were all women, with 20 teaching kindergarten, 15 teaching first grade, and 14 teaching second grade during their participation in the project. The focus of this study is an assignment that each teacher completed during one of the first NMD professional development retreats.

The Assignment

During an early NMD retreat, the teachers were provided laptop computers and were asked to write their mathematics autobiography. Approximately, two hours were set aside for this assignment; however, a few of the teachers did take longer. Those who were still working at the end of the allotted time were given permission to continue working. The assignment, as it was presented to the participants, follows:

The purpose of this assignment is to reflect on the experiences that helped to shape the mathematics teacher that you are today. As you write about your mathematical experiences please use specific examples (i.e. places, people, activities) and be honest about both what you did and how you felt. This autobiography is intended to span your earliest mathematical experiences through to the present...it is your story. Be sure to include the following: earliest memories of mathematics, elementary school mathematics experiences, middle school mathematics experiences, high school mathematics experiences, and most recent mathematical experiences. Now, the final touch...add a title to this paper that you believe captures your story. Be creative (McCulloch, Marshall, & DeCuir-Gunby, 2010).

It is important to note that these stories were written in one sitting and were not revised over time. As a result, they contained grammatical errors and thoughts that were not necessarily well organized. This restriction also meant that the stories were likely unadulterated expressions of the teachers’ memories in that moment. Thus, while we have no way of knowing whether the stories represent a “true” reflection of what happened in individual teachers’ experiences with math, we feel confident each autobiography embodies significant memories that have impacted them since and therefore make up an important part of their current mathematics story.

Autobiography Analysis

The autobiographies were carefully studied using the analysis of narratives approach, the examining of narrative data to identify common concepts and themes across autobiographical stories (Polkinghorne, 1995). The analysis process was data driven in that we allowed significant themes to emerge from the data. Also, they were theory driven in that we framed much of our analysis based upon the theoretical and empirical work of Drake et al. (2001). Our analysis of the mathematics autobiographies took place in five phases. During the first phase, three members of the research team completed an initial reading of each autobiography. This initial reading revealed that although they were asked to write about the people and the activities that shaped their experiences, the teachers’ stories focused on the people (i.e., self, family members, peers, and teachers) who had impact on their mathematical learning experiences both positively and negatively. This focus informed our next phase of analysis. To get a better sense of the influences on the teachers’ mathematical experiences over the years, in the second phase we developed a mapping rubric that captured each of the phases of one’s mathematical life and the influences, both positive and negative, as perceived by each teacher. This mapping also allowed for tracking any transitions in math stories (from positive to negative or vice versa). A sample mapping appears in Figure 1.

In addition to capturing the influences on the mathematical experiences of the teachers, in the third phase, we categorized the teachers’ experiences as learners of mathematics. This was done by using a framework developed by Drake et al. (2001) in which they categorized the K-12 mathematics learning experiences of 10 first- through fourth-grade teachers. Based on the analysis of a mathematics story interview, Drake et al. ultimately developed a coherent narrative of each story and then categorized each of the 10 teachers as either turning point learners, failing (or foreclosed) learners, or roller coaster learners. Turning point learners were those who had mostly negative experiences up to a certain point in time and then a positive experience changed their attitude toward success with mathematics from that point forward. Failing (or
foreclosed) learners were those who had mostly negative experiences throughout their mathematical lives. Roller coaster learners were those who had alternately positive and negative experiences. While these categories were quite helpful, they did not capture the full range of experiences that were evident among the autobiographies of the NMD teachers. Therefore, we adapted Drake et al.’s framework by modifying two category labels and adding two additional categories of learners.

Our data revealed that while some learners experienced turning points that resulted in more positive feelings about mathematics, others reported turning points that resulted in more negative feelings about mathematics. As a result, we changed the Drake et al. (2001) label of “turning point learner” to “positive turning point learner” as indicated by their definition and added the category of “negative turning point learner.” In addition, while the definition of a “failing (foreclosed) learner” did capture the essence of many of the participants’ stories, we found the label itself to be problematic. This is because the term “failing” suggests that the learner was never successful in mathematics, while in fact they all had earned bachelor’s degrees at minimum, which did require at least some amount of success in their mathematics courses. On the other hand, the term “foreclosed” presented a problem for us because of its rich history in the ego identity literature (e.g., Erikson, 1980; Kroger, 2000; Marcia, 1966). From this perspective, a person with a foreclosed identity is said to have made a commitment to goals without having fully explored the goals or the commitment. Additionally foreclosed identity is used in reference to a person who has adopted the goals of others (Marcia, 1966). For instance, a person who becomes a teacher without examining other options or because her parents suggested that she become a teacher exhibits a foreclosed identity. Because of this distinction, we have elected not to use the term “foreclosed” as employed by Drake et al. Instead, we propose “consistently frustrated” to describe a learner who had mostly negative (frustrating) experiences in mathematics learning, and who subsequently accepted that all future mathematics experiences would be frustrating as well. Our framework for characterizing teachers’ learning experiences appears in Table 1.

During the fourth phase, the research team analyzed the mappings of mathematics learning experiences within each teacher category to look for emerging themes with respect to life influences and demographics. We created a spreadsheet where learner type, number, and types of relationships identified through the mapping, age, and years experience were all compiled and then ran descriptive

<table>
<thead>
<tr>
<th>Teacher Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smooth track</td>
<td>Teachers have no negative mathematics experiences.</td>
</tr>
<tr>
<td>Minor setback</td>
<td>Teachers may have experienced one or two negative math experiences; but those experiences are not detrimental to their personal growth in math. For example, these are teachers who had boring math teachers or just did not do well in the math class because they were lazy.</td>
</tr>
<tr>
<td>Roller coaster</td>
<td>Teachers have both positive and negative experiences throughout schooling.</td>
</tr>
<tr>
<td>Consistently frustrated</td>
<td>Teachers have primarily negative early experiences and accepted those early negative experiences learning math as a foreshadowing of lifelong mathematics weakness.</td>
</tr>
<tr>
<td>Positive turning point</td>
<td>Teachers have strongly negative memories of mathematics up until a particular point (a turning point) in which one specific positive experience resulted in a more positive attitude toward mathematics or a realization that it is possible to succeed at and even enjoy mathematics.</td>
</tr>
<tr>
<td>Negative turning point</td>
<td>Teachers have positive memories of mathematics up until a particular point (a turning point) in which one specific experience resulted in a more negative attitude toward mathematics.</td>
</tr>
</tbody>
</table>

statistics on each learner type. This step was important because it allowed us to establish patterns regarding life influences and demographics in relation to each respective teacher category. In our fifth and final phase of data analysis, the emerging themes were constantly compared between teacher categories and were often tracked back to the written autobiographies for further clarification (Glaser & Strauss, 1967). This process helped to assure that we were able to differentiate between categories.

**Looking Through the Window: K-2 Teachers as Mathematics Learners**

As noted by the title of this article, the math autobiographies provided the NMD research team with a window through which we were able to get a sense of the teachers’ experiences as learners of mathematics. Table 2 provides an overview of how each teacher was categorized as a math learner along with corresponding descriptive statistics. In this section, we describe the characteristics of each type of math learner that emerged among the K-2 teachers.

**Smooth Track Learners**

Smooth track learners are those that have had exclusively positive experiences as learners of mathematics.
This was expressed through statements like, “I always really liked math. I loved to solve problems. Math was definitely my favorite subject (Teacher 3-F-22, May 28, 2008),” “I remember that it came very natural for me (Teacher 3-K-30, May 28, 2008),” and “I do remember liking math all throughout school (Teacher 3-S-31, May 28, 2008).” Their positive feelings toward mathematics were also evident in the titles they assigned to their autobiographies (e.g., My Love Affair with Math; Me + Math = Good). Seven of the NMD teachers were categorized as smooth track learners. Of these seven teachers, all had been teaching for less than five years. Many of the smooth track learners reported taking advanced math classes both in high school and in college.

The smooth track learners wrote about their understanding of mathematics (as opposed to their feelings about mathematics). They noted understanding was important to them, and the teachers who had the most positive influence on them were those who expected understanding rather than memorizing. For example, one smooth track learner recalled a teacher who “kept asking why,” she recalled a particular lesson in which the teacher pushed her and her classmates: “He kept asking why. ‘Well, why does that work?’ and then he took the formulas and showed us how they work (Teacher 3-K-7, May 28, 2008).” In addition to a focus on understanding mathematics, the smooth track learners described their math experiences in such a way that suggests a sense of “fun.” Statements like, “I have always loved to solve problems (Teacher 3-F-22, May 28, 2008)” give the sense that the smooth track learners have always enjoyed learning math. Although they were occasionally frustrated with teachers whom they perceived to be unprepared, smooth track learners reported being successful with math and enjoying it throughout their school years.

Minor Setback Learners

Minor setback learners are those characterized by one or two negative math experiences during their school years; however, those negative experiences were not detrimental to their personal growth in mathematics. Eight of the NMD teachers were categorized as minor setback learners. Four of these teachers had less than five years of teaching experience; three had more than nine years. All of the teachers reported that their minor setbacks occurred during middle school, high school, or college. None occurred in elementary school.

The setbacks described by these learners varied. Some attributed their setbacks to their own laziness. This laziness was characterized by statements such as, “I think I enjoyed socializing more than learning...I was tired of working so hard so I slacked off (Teacher 2-F-3, May 28, 2008).” One attributed a setback to a school change during a difficult personal time. Many attributed at least one setback to a “bad teacher.” These “bad teachers” were described as either not being able to explain concepts well (e.g., “Pre-calculus was taught by an ex-air force pilot. He was very intelligent, but just expected us to know what to do and seemed frustrated when some of us didn’t get it [Teacher 3-S-14, May 28, 2008]”) or as difficult to connect with emotionally (e.g., “At one point my teacher asked me to go home and pray about my attitude toward math [Teacher 3-K-28, May 28, 2008]”). While these setbacks were significant enough to mention in their autobiographies, the teachers did not indicate that the setbacks had had a significant impact on their overall feelings about mathematics. Rather, the setbacks might be more adequately described as bumps along an otherwise smooth road.

The minor setback learners reported some support in their mathematics learning from multiple sources (i.e., family, peers, and teachers). There were many stories of “great” teachers such as, “Mr. Hammond made math fun and interesting. He showed us how we used math in our everyday lives (Teacher 3-K-11, May 28, 2008).” There were also stories of positive experiences with math at home. For example, Teacher 3-K-28 (May 28, 2008) noted “My dad was always great at numbers so it was fun to listen to him figure out a math problem. We would drive
around and he would ask us story problems and we would have to listen really carefully to figure out the answer.”

Overall, the minor setback learners recall their mathematics learning experiences as being relatively positive with the exception of a few minor events. As a matter of fact, many of the titles these learners assigned to their autobiographies suggested that their setbacks were helpful in their development either as math learners or as teachers of mathematics. Titles included: The Journey from Doing to Understanding; Beginnings Change Lives; Mathematics...From a Bored Student to an Exciting Teacher; and Creating a Compassionate Math Teacher.

**Consistently Frustrated Learners**

Consistently frustrated learners are characterized as having predominantly negative early experiences. Reflections such as “My earliest memories of math are quite negative” (Teacher 2-K-5, May 28, 2008) highlight their feelings from an early age. Their autobiography titles highlight their frustration (e.g., Left Behind and Still Catching Up; The Good, the Bad, and the Ugly). There were a total of six NMD consistently frustrated learners. Two had less than five years of teaching experience; three had at least five to nine years of experience; and one had more than ten years of teaching experience.

Consistently frustrated learners’ stories all seem to have an emotional root unrelated to the subject of math. The events they report were consistently negative and related to how they were treated by their teachers. For example, “My teacher was very mean. She would walk up and down the rows and columns of desks smacking a wooden ruler with a straight edge on it into the palm of her hand. She would say a math fact and point her ruler at the person meant to give an answer. If the student didn’t answer immediately, she would whack the back of the student’s hand with her ruler. All I did was sit quietly and motionlessly in my seat mentally repeating, ‘Please don’t pick me. Please don’t pick me.’ It doesn’t take a trained psychologist to deduce that this is the root of my math anxiety” (Teacher 3-S-17, May 28, 2008). Experiences similar to the one above lead many of the participants to feel as if teachers did not care about them and that those teachers perceived them to be mathematically inferior to their classmates. As a result, the consistently frustrated learners became fearful of being called on in class and discouraged from taking advanced math classes.

The consistently frustrated learners did write about receiving some social support outside of school, but not nearly as much as other groups. Caring teachers and family members contributed to the few small successes they experienced in math, but did not change their overall perspective of math or themselves as math learners. For instance, Teacher 3-F-24 (May 28, 2008) wrote, “My early year mathematical experiences told me to take the bare minimum in math in college. I got by with just the basics and then begun [sic] my teaching courses. My aunt, a middle school math teacher, tutored me for the math part of the Praxis and I passed with flying colors. I actually begun [sic] to understand some math while working with her. I have been out of college for 10 years now and don’t feel that I really use that much of the math that I had learn [sic].” For those consistently frustrated learners who had sporadic small successes, they were typically seen as minor successes and not viewed as having a lasting positive influence on their school mathematics experiences.

**Roller Coaster Learners**

In contrast to the minor setback learners, the roller coaster learners did not report just a few minor bad experiences, but instead they reported constant up and down feelings about mathematics throughout their schooling. The term “roller coaster” was actually used by many of these learners. For example, “High school math for me was kind of a roller coaster ride (Teacher 3-K-13, May 28, 2008).” Even when the term roller coaster was not used, the constant up and down was easily detectable in the learners’ descriptions. For example, Teacher 3-S-15 (May 28, 2008) wrote, “High school continued the downward trend. In ninth grade I had Mr. Skinner and he was awesome. I got a lot of my confidence back because he taught to the students not to the test. We did a lot with algebra and I fell in love with math again.” Nine of the NMD teachers were categorized as roller coaster learners. Six of these learners had less than five years teaching experience; one had nine years; and two had more than 15 years. The roller coaster learners typically reported both good and bad experiences at each level of schooling (i.e., elementary, middle school, high school, and college).

Roller coaster learners reported having quite a bit of support from parents, family, and teachers throughout their school years. They reported far more support than was noted by any other learner group. For example, Teacher 3-F-3 (May 28, 2008) wrote about the importance of a study group to her success in a high school mathematics class, “That was also the year a group of friends in the class and I started organizing study groups before our tests. One of the girls worked at ‘I Can’t Believe It’s Not Yogurt’ so we would all meet there and study.” Most of the significant high moments reported were the result of a relationship with special teacher. For example, Teacher 3-K-13 (May 28, 2008) wrote about her favorite elementary school teacher. She wrote:
Since I had a hard time with learning, our school offered a slower learning math class, so me and a few more of my classmates went to a room behind the office and had math there. Ironically by this time, my third grade teacher had been promoted to vice principal, and she taught us math which I really enjoyed... This teacher was a blast and made math fun for all of us.

Unfortunately, the roller coaster learners’ stories were also significant in that they reported quite a few bad memories of math over the years. There were many instances of family members being perceived as negative influences. For example, Teacher 3-F-3 (May 28, 2008) noted being very frustrated and turned off by math in middle school when she had to go to her father for help. She wrote, “But the thing that stands out most is that at some point, I could no longer go to my mom for math help, I had to go to dad. My dad was a math whiz and expected me to get the answer right off the bat, after his first explanation, but I didn’t always see it his way.”

The roller coaster learners all reported instances in which a particular teacher impacted both their mathematical success and their attitude toward mathematics. For example, Teacher 3-F-1 (May 28, 2008) noted “hating” math in middle school because of a particular teacher who did not “teach.” She wrote about her sixth-grade teacher and how he would lecture straight from the textbook and then leave the room while they did class work. “He did not make us show our work either. That was to be done on scrap paper then thrown away. I didn’t do well that year in the math class. I made good grades; however, I didn’t learn anything.” This type of story was told over and over again, one in which a teacher was perceived not to care about student success. Other stories were more dramatic, and noted a teacher treating the students rather poorly. For example, Teacher 3-S-15 (May 28, 2008) wrote:

Sixth grade was murder! I had Mr. K and he was mean. If you asked a question that he thought was stupid he would say “Dairy Queen,” which stood for DQ – dumb question. I was so scared to ask for help and if you weren’t focused and alert at all times, he took this big stick and banged it on your desk. I remember sitting there realizing that I was not going to ace a test and being terrified.

The roller coaster learners’ autobiography titles tended to express their frustration with this up and down journey (e.g., The Rocky Roller Coaster of Math; Why I Am Not a Mathematical Genius). However, it is notable that many of the negative experiences they wrote about were similar to those written by the consistently frustrated learners. So, it is likely that the only reason these learners did not end up consistently frustrated was because of a critical intervening variable or set of experiences, with respect to their mathematics learning, over their school years.

Negative Turning Point Learners

The participants classified as negative turning point learners recalled positive experiences and feelings toward mathematics from an early age, but somewhere in their schooling, a negative event changed their outlook on math. Seven of the NMD participants were categorized as negative turning point learners. On the whole, these were experienced teachers with only two teachers that had less than 10 years of teaching experience. The negative turning points they report occurred at various times in their schooling: one in elementary school (5th grade), three in middle school, and three in high school.

All seven of the negative turning point learners pointed to a particular teacher, and how they were treated by that teacher, as the point in which they began to dislike mathematics. The types of experiences they described ranged from verbal and physical mistreatment to being ignored. For example, when writing about a high school math class, Teacher 1-F-8 (May 28, 2008) explained that she began to dislike math during this particular class because of the teacher. She wrote, “The teacher was a white 6 feet 6 inches tall man who scared us to death. He would throw erasers at us and chase us around the room if we missed math problems or were not attentive.” Similarly, Teacher 2-K-8 (May 28, 2008) recalled, “My 12th grade trig teacher called the class ‘dumb a...’ one time because we didn’t understand the lesson.” These learners were not commenting on the way the teacher taught or the difficulty of the subject itself, but specifically about the way they were treated.

On the other end of the spectrum were learners reported being virtually ignored by a teacher as causing their difficulties with and dislike of math. For example, Teacher 2-K-4 (May 28, 2008) wrote:

In 7th grade is when it all changed. I was the ONLY person of color in an advanced math class with a prejudice teacher. She would hardly call on me to answer questions and when she did she would say “wrong” or “that’s incorrect.” So that began to take a toll on me especially when someone would say the exact answer and she would praise them. So this experience had a long term traumatic affect on the relationship I had with math.
Similarly, Teacher 3-F-8 (May 28, 2008) explained, “No one ever pulled me aside and said, ‘Do you want some extra help?’ I just sat in the front and smiled sweetly. Maybe they thought I was just not a ‘math person’ either and let me focus on my strengths.” She went on to share that from that point on math was “awful” for her.

The titles assigned to the autobiographies of the negative turning point learners varied. Some signified their frustration with mathematics (e.g., Math: The Four Letter Word; My Never Ending Math Journey). In contrast, others exhibited a sense of perseverance and a note of some possible positive feelings toward mathematics despite the negative turning point (e.g., Many Times Struggles Lead to Success; Math (subject) Over Mind; and Shaken and Stirred But Not Broken). Either way, the titles all point out the significant impact these learners perceive the mistreatment they experienced at the hands of their teachers had on their ultimate feelings about and success with mathematics.

Positive Turning Point Learners

Autobiography titles such as This Old House Made New Again, A Long Road to Successful Math, and Math . . . Ahh! That’s It! capture well the overall experience of a positive turning point learner. A positive turning point learner is characterized by strong negative memories of mathematics up until a particular point (a turning point) in which one specific positive experience results in a more positive attitude toward mathematics. The four teachers in this category all had at least 10 years of teaching experience. The positive turning point learners often wrote about very early unpleasant math experiences; these sometimes occurred even before formal schooling age. For example, Teacher 3-K-18 (May 28, 2008) wrote, “My earliest memories of math are sitting on the floor in the kitchen of our house being drilled with flash cards. It was painful.”

For all of the positive turning point learners, the pivotal point with respect to their mathematics experiences occurred relatively late in their schooling years, one in high school and the remaining three in college. They all attributed their change in perspective about themselves as math learners, from negative to positive, to a caring teacher who took a personal interest in them as students. For example, Teacher 3-K-12 (May 28, 2008) wrote:

I almost quit upper level math at one time but I had a teacher that wouldn’t let me. She was convinced that I was capable. My mom even tried to convince her that I should quit because I convinced my mom that I couldn’t do it. She then helped me after school. This was my first real memory of a teacher that really cared about me and my academic success. I grew to like math and was successful on my own eventually.

In this case, it is notable that even the learner’s mother believed she was not capable, but the action of a caring teacher who believed in her was so impactful that it changed her long-held feelings about mathematics and herself as a mathematics learner from quite negative to positive. Positive experiences like this were explained to have sparked a lasting interest in mathematics.

Story Transitions

Among the 41 NMD teachers, there were many examples of transitions from negative math stories to positive, especially among the minor setback, roller coaster, and positive turning point learners ($n = 21$). A closer look at the nature of these transitions revealed that they tended to be attributable to either a relationship with a particular teacher, high teacher expectations, or the incorporation of a teaching strategy that made math fun. Although the focus of each is a bit different (and sometimes difficult to discern), they are all ultimately related to the practice of a particular teacher.

Participants wrote about special relationships they had with special teachers in their lives as being the impetus for a story transition. This sometimes referred to having a personal relationship with the teacher outside of school (e.g., family friend or relative). Other times, it was simply the actions taken by the teacher that showed caring, such as Teacher 3-S-4 (May 28, 2008): “she made a real effort to make a connection with me and tell me she believed that I could do better (because I wasn’t doing very well). After that she helped me during study hall and I did pretty well that quarter.” Those participants who noted that a particular teacher had high expectations for them wrote about being encouraged to take additional mathematics courses, being expected to “understand and explain rather than just do,” and not allowing students to quit. Finally, other participants noted that the teacher made math “fun,” which resulted in their enjoyment and engagement. One example that typifies this sentiment was from Teacher 3-K-13 (May 28, 2008) who stated: “We would have math skill races on the board. This teacher was a blast and made math fun for all of us.” Although the methods were not all the same, the promotion of a fun atmosphere around mathematics learning was the impetus for a transition, from negative to positive, in these teachers’ math stories.

Discussion

Looking across all 41 autobiographies, the importance of interpersonal relationships in these teachers’ mathematics stories is clear. We asked them to write about the people and
the activities, but most focused on the people. As can be seen in the mapping rubric, relationships with self, family, peers, and most importantly, teachers, seemed to be the most influential aspects on the teachers’ mathematics stories.

The majority of the stories focused on actual identities; however, some revealed designated identities. These stories were usually “secondhand,” meaning the storytellers were relaying a story about themselves as told by someone else. These designated identities were all significant in very negative ways. They included stories of teachers being explicit about how “dumb” an individual was, or a parent saying, “you should quit, you can’t do it,” and even teasing from peers about always being wrong. Sfard and Prusak (2005) note, “The most significant stories are often those that imply one’s memberships in, or exclusions from, various communities” (p. 17). These stories were certainly stating an exclusion from a community of math learners.

A comparison among the learner groups revealed that the biggest difference among the minor setback, rollercoaster, negative turning point, and consistently frustrated learners appears to have been the amount of support they received from teachers, family, and peers. For example, the minor setback and roller coaster learners wrote about multiple people in their lives who provided much-needed support when they were struggling. In contrast, the consistently frustrated learners did not write about receiving any notable support, and instead focused solely on the people in their lives who had negative impacts on their mathematics experiences. The damaging experiences the negative turning point learners wrote about were very similar to those reported by the consistently frustrated learners. So, it is likely that the only reason these learners did not end up consistently frustrated was due to the numerous positive influences they had, with respect to their mathematics learning, over the years.

As teachers and teacher educators, we were most interested in the impetus for change in a story, specifically from a negative story to a positive one. Our analysis of these positive transitions within the participants stories revealed that positive changes were always related to a particular teacher who made them feel comfortable, cared about, and believed in. This was done through setting high expectations, learning about the students, and creating activities to make engaging in mathematics fun, and developing personal relationships.

**Implications**

Our findings suggest some important implications for mathematics teachers and teacher educators. Since conducting this study, we have used this framework with elementary teachers in workshops in which there was limited time for writing autobiographies (McCulloch et al., 2010). Participants were instructed instead to jot down a few key memories of their experiences as mathematics learners and to formulate a title that captured the overall essence of their mathematics “story.” Next, we described the six categories and asked participants to place themselves into one of the six (or none). All of the participants identified their stories with one of the categories. We then discussed how these experiences might be influencing their mathematics teaching, the ways in which they work on mathematics planning with their colleagues, and even the way they currently act as mathematics learners themselves. This activity allowed for a meaningful, but quick reflection on their experiences and possible implications that their experiences have for teaching.

In view of the fact that it was found that positive transitions in mathematics stories typically occurred in the later grades, we believe it would be helpful for practicing and prospective middle and secondary mathematics teachers to read about these mathematics stories. While standards such as the National Council of Teachers of Mathematics (NCTM) Principals and Standards for School Mathematics (NCTM, 2000) and the Common Core State Standards for Mathematical Practice (Common Core State Standards Initiative, 2010) promote the importance of connecting with students on a personal level, we believe that reading these excerpts from actual mathematics autobiographies may help to highlight the difference such actions can make in students’ mathematical lives, especially in middle school and high school.

Although it is not surprising that relationships have great influence (both positive and negative) on one’s mathematics story (and thus mathematics identity), the literature on the nature of early elementary teachers’ mathematics stories is limited. The consistency between our results and previous studies adds to the validity of this body of research. In addition, researchers such as Drake et al. (2001) have begun connecting types of learner stories to adoption of standards-based teaching and curriculum implementation. At this point, such research has been limited to small groups of teachers (n = 10). Our use (and adaptation) of their framework with a comparatively larger group of teachers (n = 41) shows a consistency in elementary teachers’ types of learning stories that will be helpful in future research of this type. This suggests that as a field, we can really put some stock into what we have learned about teachers’ storied mathematics identities and
continue to consider the relationships between mathematics identity and teacher practice on a larger scale.

References


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Corresponding author: Allison W. McCulloch, North Carolina State University, Department of STEM Education, 502 L Poe Hall, Campus Box 7801, Raleigh, North Carolina 27695-7801, USA. Email: allison_mcculloch@ncsu.edu