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POSITIVE TURNING POINTS FOR GIRLS IN MATHEMATICS: DO THEY STAND THE TEST OF TIME?

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The purpose of this study is to examine the equity issue in mathematics from perspectives not traditionally included in equity claims. This study offers a close up view of personal experiences that female preservice teachers have encountered in their own journey as students of mathematics as well as how they make sense of their experiences, especially as they learn to teach. Different themes that arise in this issue of mathematics equity were examined in a study conducted by Stoehr and Carter (2011). This paper extends the previous study by examining and discussing the data-derived theme that centers on girls who experienced positive turning points in mathematics.

Keywords: Gender; Teacher Education–Preservice

Literature Review and Theoretical Framework

Girls enter the mathematics classroom with just as much potential to excel as boys (Boaler, 2008; Huebner, 2009). However, the stories that some girls tell about their mathematical experiences in the classroom suggest that they do not believe that this is true (Stoehr & Carter, 2011). This can lead to girls bowing out or not pursuing higher-level mathematics classes in high school and college, which are required for the more lucrative careers in science, technology, mathematics, and engineering (Else-Quest, Hyde, & Linn, 2010).

Sometimes girls experience a positive turning point in their mathematics journey that puts them on a path to believing they can do well in mathematics. This generally occurs because of the efforts of caring and helpful mathematics teachers. It is these positive moments in time that can lead to a substantial change in how girls view their mathematical abilities, as teachers empower students to succeed (Drake, 2006). These events exemplify the belief in the power of education to truly change a person's life. Turning point stories in education give credit to educators being able to make a real difference in a student's life (Yair, 2009).

Teachers involved in the day-to-day school lives of students have the capacity to effect compelling turning points (Yair, 2009). Often this occurs in a student's educational career when a previously failing student is met with a new teacher. Suddenly someone new sees merit in the failing student and views the student as capable. The belief that the new teacher has in the student can lead to the student believing in herself. Trusting a new teacher is powerful and can lead to a turning point in a student's educational journey (Bryk & Schneider, 2002).

Lemke (2002) makes several valid points regarding the power of turning points events. He argues that fundamental changes in attitudes or habits of reasoning cannot happen on short timescales. What has to be evaluated is whether the turning point event fades away or gets erased by events that occur afterwards. The question to ponder is whether these turning points are in reality just pleasant anecdotes that occur rarely and are unable to be planned for and put into practice. Or are turning points that occur in the lives of students significant enough to lead to personal transformation and empowerment? (Yair, 2009). It is these events that must be examined in an effort to evaluate if the change has a longer-term agenda.

It is also the influence that one person has over another that is important to consider when looking at positive turning point events. If pre-service teachers who have experienced a positive turning point event due to the efforts of a teacher they had in their K–12 years, can identify and emulate in their own teaching the characteristics of the positive turning point teacher, then perhaps strides can be made to break down the barriers that often prevent girls from believing they are capable mathematic students.

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Methods

Participants and Setting

This preliminary study focused on women who experienced positive turning points in mathematics during their K–12 school years. This theme was derived from a larger qualitative study currently being conducted at a Research I University in the Southwestern United States. One hundred forty-nine narrative stories were prepared by a diverse group of female elementary pre-service teachers primarily in their early twenties. Twenty-one narratives revolved around the theme of positive turning points in mathematics.

Data Collection

The participants all wrote a mathematics narrative as part of a requirement for an introductory teacher education course. In these narratives, termed "Well-Remembered Events," the preservice teacher candidates were asked to describe and analyze a particularly salient mathematics event from their own experiences as students in K–12. This genre of personal narrative was derived from Carter's (1994) work on well-remembered events as windows into the understandings preservice teachers have of teaching. The task consisted of a 2–3 page paper organized around the following parts (1) the selection of a particularly salient mathematics event from one's past experiences in mathematics as a K–12 student; (2) a detailed description of the event; (3) an explanation of why the mathematics event was memorable; and (4) a statement of what impact this turning point experience might have on the writer's understanding of what it means to be a teacher and how she perceives it will affect her future teaching of mathematics.

Findings

This paper will briefly touch on the narrative writings of the stories told by the participants that related to a positive turning point experience in mathematics they recalled during their K–12 years. The research to date includes five main patterns and themes. They are as follows:

Theme 1: Thank You for Caring About Me

Nine participants wrote about how a caring and understanding teacher helped them work through the struggles they were having in mathematics. They described the impact it made on their mathematical performance. One participant who was struggling to learn how to add and subtract negative numbers in seventh grade wrote:

> I was too afraid to speak up and ask questions because I did not want to be the only student in the class who did not understand this concept. Mrs. Brown must have realized I was struggling and asked me to stay after school with her for a little while. Mrs. Brown was willing to give up her time after school to make sure that I understood the topic. We went through each problem and to this day, I can remember the feeling of accomplishment that I finally understood not only how to add and subtract negative numbers, but I also understood the concept of it. This gave me a ray of hope for my future math career.

Theme 2: My Teacher Believed in Me

> Panic attack was the first thing that popped into my head when Mr. Granger informed my AP Calculus class that we were to have our first test at the end of the next class period. I stayed after class and explained that I was very overwhelmed with the fast pace. Mr. Granger told me I should attempt the homework study guide to the best of my ability, and come into his classroom at lunch for help. After going over the homework the next day, he assured me I had nothing to worry about. When Mr. Granger passed out the tests, I went into panic-mode. He reassured me that I knew what I was doing. He had me take slow breaths to calm myself down. After putting a smiley face on each page, I dove right into the test and received my first A in the course. By believing in me Mr. Granger helped me to be more confident in my knowledge of the subject.

This participant's response is shared and reflected in the writings of three other women who wrote about how having their mathematics teacher believe in them changed how they viewed their mathematical

abilities. One participant said, "Teachers have the ability to make students believe in themselves like no other person can."

Theme 3: My Teacher Showed Me How To "Do Math"

Four participants recalled successful mathematics experiences as a result of a teacher's ability to show them how to do a particular mathematics problem. This led to positive mathematical feelings. One participant talked about how her sixth grade teacher drew pictures so that she could visually see the math. She wrote:

> I was working on mathematical story problems and I was feeling anxious and worried because I knew I was not going to get the assignment finished before the bell rang.
>
> As Mr. West was walking through mathematical story problems and I was feeling anxious and worried because I knew I was not going to get the assignment the rows of desks to check on our progress, he noticed that I was having some trouble. I remember him asking me to walk back to his desk with him. It was there that Mr. West taught me one of the ways that I could go about solving story problems. We read the problem together and then he asked me to draw a picture of what I thought was occurring in the problem. From there we walked through each step of the problem, each with little drawings. I will never forget him saying to me that I was a concrete thinker that needed to see things for them to make sense. I remember feeling more confident with math after this point in the school year.

Theme 4: Math Does Not Need to be Scary

Two preservice teachers recalled mathematics stories that revolved around mathematics being scary and something they could not master. With the help of a teacher they were able to see mathematics in a positive and accessible manner. One participant wrote about a third grade mathematics experience:

> It was after lunch that we worked on mathematics. I dreaded it during recess wondering what was wrong with me and why I could not comprehend it. In fact I felt like a failure. Long division was getting the best of me. The student teacher, Mrs. Allen, noticed how I struggled with it. She asked me to come back to the classroom after lunch instead of going to recess. I remember sitting there looking at the board as we worked on long division problems and being so terrified. She helped me to understand that long division was simply backwards multiplication. More importantly, she allowed a young girl with glasses to see that mathematics is not a scary subject.

Theme 5: A Calm and Approachable Mathematics Teacher Makes a Difference

Two participants wrote about how having a teacher who was calm and who offered extra support helped them to see they could be successful in mathematics. As one participant said, "My teacher gave me the courage and strength to succeed in mathematics. If it wasn't for her, I would still be the student sitting in the third row of the class in fear of asking for help."

Discussion

The preliminary results of this study revealed promising findings in relation to positive turning point events in mathematics. All participants reported a surge of confidence and a more positive attitude in mathematics as a result of a teacher's supportive efforts. The amount of detail these preservice teachers can remember years after the turning point experience took place exemplifies the power that these experiences can have on girls and how they view mathematics. Allowing girls to see themselves as capable mathematics students through the eyes of a positive turning point teacher offers a glimpse of how important and significant these experiences can be.

All participants in the study wrote about how significant it was that their teachers believed in them and gave them opportunities to be successful mathematics students in their class. Teachers empower students in these magical types of moments (Yair, 2009). This pilot study seems to suggest that positive turning point events in mathematics can make an impact on some individuals who experience them.

Conclusion

There is great optimism for girls in mathematics (Huebner, 2009). This pilot study suggests that girls who have struggled in mathematics can be positively affected by teachers who believe they can be successful mathematics students. The participants in the study identified characteristics that are important for mathematics teachers to possess in order to successfully meet the learning needs of their students as well as have confidence in their students and offer them the chance to succeed in their class. Identifying positive factors and teaching characteristics that this study uncovered is a step in the right direction. Teachers must embrace the critical role of encouraging girls in mathematics (Gavin & Reis, 2003). It is important for mathematics teacher "to help girls to find the spark" that can lead to success in mathematics (James, 2009, p. 158).

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