

Do I Have to Teach Math? Early Childhood Pre-Service Teachers' Fears of Teaching Mathematics

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Abstract

Eighty-nine early childhood pre-service teachers were asked to identify their specific fears towards mathematics and explain why they had those specific fears. The results showed that they possess a wide variety of fears towards mathematics including having a lack of confidence in their teaching ability, a lack of teaching methods, an inability to engage their students, and a lack of mathematical content knowledge. Their explanations as to why these fears exist were very closely related to what they feared and included responses related to teaching the content as well as having a lack of content knowledge. Implications on teacher education programs are also discussed.

Introduction

Fear associated with mathematics is not a new concept. It is common for teachers of all grade levels to hear their students make statements such as, "I hate mathematics," or "math is too hard." Research studies have documented that students fear mathematics due to their previous learning experiences and/or their feelings of incompetence with the subject matter (Brady & Bowd, 2005; Bramald, Hardman, & Leat, 1995; Scarpello, 2007). This fear or anxiety is defined by a variety of powerful emotions surrounding the application of math skills to both classroom applications and everyday life situations. These emotions can include dread, helplessness, frustration, and fear and can manifest themselves in a range of ways from avoidance of math usage and application to poor academic mathematics performance (Bekdemir, 2010; Gresham, 2008; Vinson, 2001; Zettle & Raines, 2002). Math anxiety is also affected by students' beliefs of their own math abilities; students who feel they are good at mathematics are less likely to express a fear of it (Cooper & Robinson, 1991; Hackett & Betz, 1989).

As a group, both practicing and pre-service teachers report high levels of anxiety toward mathematics (Bursal & Paznokas, 2006; Gresham, 2007; Vinson, 2001). In fact, pre-service teachers express higher levels of mathematics anxiety than other undergraduate majors (Cady & Rearden, 2007; Harper & Daane, 1998). They also describe negative views of mathematics such as "mathematics is my enemy" and "math is something I hate" (Cady & Rearden, 2007). These fears and negative views are often a result of their prior negative experiences with formal instruction (Brady & Bowd, 2005; Harper & Danne, 1998) and/or a lack of procedural and conceptual knowledge of the subject matter (Vinson, 2001).

Pre-service teachers' mathematics anxiety has also been found to be negatively correlated with their mathematics teaching efficacy (Bursal & Paznokas, 2006; Swars, Daane & Giesen, 2006). Mathematics teaching efficacy refers to one's beliefs in their ability to teach mathematics effectively (Enochs, Smith, & Huinker, 2000). According to Gresham (2008), pre-service teachers who demonstrated lower levels of mathematics anxiety had higher levels of mathematics teaching efficacy. Bursal and Paznokas (2006) found that half of the 65 pre-service

teachers in their study, who were enrolled in a mathematics methods course, felt that they would not be able to teach math effectively. Those pre-service teachers who identified themselves as having high math anxiety were less confident in their abilities than those students who identified themselves as having low or moderate math anxiety (Bursal & Paznokas, 2006). Other studies have found that pre-service teachers' mathematics self-efficacy influences their mathematics ability and mathematics anxiety, as well as their impact on classroom practices (Beswick, 2006; Cakiroglu, 2008; & Cooper & Robinson, 1991). In other words, having low mathematics self-efficacy may lead to less confidence overall which can hinder actual teaching performance.

Although there have been numerous studies examining pre-service teachers mathematics anxiety there are few studies that have asked specifically what pre-service teachers fear in regard to their future mathematics instruction. Some studies have included open-ended questions in regards to teachers' self-efficacy (Swars, 2005; Swars, Daane, & Giesen, 2006), but they do not specifically inquire about their fears of teaching mathematics. Additionally, most studies focus on elementary pre-service teachers (Isiksal, Curran, Koc, & Askun, 2009), but there have been few studies regarding the preparation of early childhood teachers in teaching mathematics, intensifying questions of their mathematics teaching preparation (Ginsburg, Lee, & Boyd, 2008). In one study, Johnson and VanderSandt (2011) found that early child pre-service teachers demonstrated higher mathematics anxiety than both elementary and special education pre-service teachers. There is also evidence that early childhood teachers have less content knowledge and more negative attitudes toward mathematics compared to upper elementary teachers (Wilkins, 2008). There is a need for examining pre-service teachers' fears of teaching mathematics to young children, especially in early childhood education. If early childhood pre-service teachers are fearful of mathematics themselves, how will this impact their ability to teach mathematics in the early childhood classroom? This study was guided by the following two research questions:

1. What are pre-service teachers' greatest fears about teaching mathematics to their students?
2. Why are pre-service teachers' fearful of teaching mathematics?

Methodology

Participants

The participants for this study were 89 early childhood pre-service teachers from a large teacher preparation institution in the Midwest. This institution began as a school of education and has a long history of teacher preparation, preparing the majority of teachers in the state and a high percentage of practicing teachers nationwide. Early childhood teachers at this institution are certified to teach birth to 3rd grade.

All participants were female. In regards to racial identity, 81 of the participants were white, 5 were Black/Non-Hispanic, 2 were Hispanic and one reported herself as other. Forty-eight percent of the participants were juniors, and 52 % were seniors. Participants at the time of this study were in the first or second semester of their junior year or the first semester of their senior year, just prior to student teaching. Participants were recruited in the same semester through an early childhood issues and practices course, a mathematics methods course, and a social studies methods course.

Procedures

The researchers began this study by securing Institutional Review Board approval for research with human subjects. Since some of the possible study participants were recruited in

courses currently taught by the researchers, a graduate assistant recruited, secured consent, and administered the survey described. To avoid bias, the researchers were not present for this process and did not gain access to the data until the completion of the semester. All students present at the time of recruitment consented, removing any issues of bias concerning those who consented and those who did not.

As part of a larger study, which examined math ability and math teaching efficacy, an open-ended survey was used. This survey was developed by the researchers, sought to isolate specific mathematical fears for examination by included the following questions: 1) What are your greatest fears about teaching math to students? 2) Why do you think you are fearful about teaching math? 3) What tools do you think will be effective in helping you teach math? 4) What types of manipulatives do you think will be helpful in teaching math concepts such as addition and subtraction to young children? Participants were asked to respond openly, with no size or time limit. For the purposes of this study, responses to questions one and two were analyzed.

Data Analysis

Qualitative research methods were used in this study. Early childhood pre-service teachers' narrative responses to the two questions were coded and specific codes emerged from the analysis. The process of analysis began with open coding of the participant surveys. Grounded Theory methodology defines open coding as the process of developing categories of concepts and themes emerging from data (Bryman & Burgess, 1994). Data exploration is done without any prior assumptions about what might be discovered. In open coding the relationships among the data have yet to be discovered. According to Bryman and Burgess (1994) "categories are rarely known in advance of data exploration, and the relationships between categories must always be discovered during data analysis" (p. 168).

We began the process of open coding together by reading each participant comment. Each comment was discussed and a code was determined which captured the response. Each sentence in a participant's response was coded separately, and in some instances, more than one code was designated for each sentence. For example, one student provided the following mathematical fears in their response that resulted in the designation of three codes: fear of teaching success/lack of confidence; fear of negative impact; fear of mathematics content.

I am not very good at math. I would be afraid that my dislike of math would show to the students and that I would not be able to teach them effectively.

Question one resulted in ten open codes. Table 1 lists the codes resulting from the initial analysis of question one.

Question two resulted in nine open codes. Table 2 provides these codes. Codes for question two were very similar to question one, even though question one sought to determine specific candidate fears about teaching math and question two sought to determine the reasons behind those fears, very similar themes emerged as indicated below.

Table 1

Codes for Question One: What are your greatest fears about teaching math to students

Fear of Teaching Success/Lack of Confidence
Fear of Negative Impact on Student Success
Fear of Lack of Teaching Methods and Ideas
Fear of Mathematics Content/Personal Ability
Fear of Varying Ability of Students
Fear of Students Dislike of Math
Fear of Lack of Engagement/Interest
Fear of Discipline Classroom Management Issues
Fear of Parent Relationship Issues
No Fears

Table 2

Codes for Question Two: Why do you think you are fearful about teaching math?

Fear of Teaching Success/Lack of Confidence
Fear of Negative Impact on Student Success
Fear of Lack of Teaching Methods and Ideas
Fear of Mathematics Content/Personal Ability
Fear of varying ability of Students
Fear of Math Strategies Unlike how the Candidate was originally taught
Candidate's Personal Math Experiences
Fear of lack of motivation
No Fear

The researchers worked together to analyze the open codes and collapse them into logical categories for further analyses. The ten open codes for question one were ultimately sorted into five categories. Table 3 shows how the ten open codes were collapsed into the five specific categories used for the final analysis for question one.

Table 3

Categories for Question One

Category	Code
Mathematical Teaching Fears (41.1%)	Fear of Teaching Success/Lack of Confidence
	Fear of Lack of Teaching Methods and Ideas
	Fear of Lack of Engagement/Interest
Student Success Fears (32%)	Fear of Negative Impact on Student Success
	Fear of varying ability of Students
	Fear of Students Dislike of Math
Math Content Fears (25%)	Fear of Mathematics Content/Personal Ability
Ancillary Fears (1%)	Fear of Discipline Classroom Management Issues
	Fear of Parent Relationship Issues
No Fear (.5%)	

Table 4 shows how the nine open codes were collapsed into the five specific categories used for the final analysis for question two.

Table 4
Categories for Question Two

Category	Code
Mathematical Teaching Fears (32%)	Fear of Teaching Success/Lack of Confidence
	Fear of Lack of Teaching Methods and Ideas
	Fear of Ability to Motivate Students
Student Success Fears (15.4%)	Fear of Negative Impact on Student Success
	Fear of varying ability of Students
Math Content Fears (35%)	Fear of Mathematics Content/Personal Ability
	Fear of Math Strategies Unlike how the Candidate was originally taught
Candidate's Personal Math Experiences (8%)	Candidate's Personal Math Experiences
No Fear (9%)	

Results

Research Question One: What are pre-service teachers' greatest fears about teaching mathematics to their students?

The purpose of research question one was to identify specific fears of teacher candidates prior to the culminating student teaching experience. As stated above, these responses resulted in 10 open codes, which were collapsed into five categories. Students most often articulated fears related to mathematical teaching. This category represented 41% (n=69) of the total responses for question one. Three codes made up this category; fear of teaching success/ lack of teaching confidence, lack of teaching methods and ideas, and lack of engagement/ interest. The first code, fear of teaching success/lack of teaching confidence, included candidate responses such as "I want to be able to successfully teach students the 'new' math we learned in class, but I'm afraid I won't teach it correctly." and "That I won't know what questions to ask to further their understanding." This code made up 41% (n=28) of the mathematical teaching category. The second code in the category, lack of teaching methods and ideas, made up 38% (n=26) of the mathematical teaching category. Students responded with fears such as, "I fear I won't think of enough different ways to explain a problem to all of the children in my class." Or "I will not be able to find different strategies that grab student's attention." Lastly, the fear of lack of engagement/ interest made up the remaining 22% (n=15) of the category. These responses included, for example, "making sure to actually make them excited about math." and "that I will not be able to teach kids about math in a fun, understandable way."

Category two provides examples of candidate responses, which related to their fears focusing on student's ability and perceptions. Thirty-two percent (n=54) of participants reported a fear in this category and three open codes were collapsed into this category. Fear of negative impact on student success responses made up 72% (n=39) of reported candidate fears and included, "my greatest fear is that I will explain the concepts to the best that I know how and in multiple ways but I will still have students that do not understand the concepts." or "students not learning to the best of their ability because of my lack of knowledge on how to effectively teach." The second code in the category, the fear of varying ability of students, demonstrated student fears related to meeting the varying ability levels of students. Candidates reported fears like "Having enough time to meet their very broad ability levels. There are so many different levels that need different levels of instruction." The fear of varying ability of students code made up 22% (n=12) of the total responses in the student ability and perceptions category. Finally, the student's dislike of

math code made up 6% (n=3) of the responses in this category and included fears such as “that students will have preconceived notions about math and not try.”

The third resulting category was very straightforward and was derived from only one code. This category captured responses related to candidates’ fears about their own mathematical ability or content knowledge. Twenty-five percent (n=42) of respondents gave a fear in this category, examples included “my biggest fear would be teaching a concept I am not familiar with.” or “not being able to explain a concept to its fullest.”

Two participants gave answers not included in the above categories relating to behavior challenges in the classroom and parent relationships. One candidate reported having no fears.

Research Question Two: Why are pre-service teachers’ fearful of teaching mathematics?

Question two was intended to determine reasons why candidates were fearful of the things they identified in question one. Nine open codes resulted and were collapsed into five categories, very similar to question one. However question two provided some insight into reasons why students fear what they fear.

Interestingly, the math content category resulted in the highest number of responses with 35% (n=45). Two codes made up this category: reasons related to mathematics content/ personal ability made up 84% (n=38) of the total category and fear of math strategies unlike how the candidate was originally taught made up 16% (n=7). These responses included, “the way problems are solved now is completely different from how we learned.” and “because it is not my strongest subject and I don’t enjoy it.”

Mathematical teaching fears category, also similar to question one, made up the second largest group of responses for this question at 32% (n=42). Three codes made up this category. First, teaching success/ lack of confidence, made up 74% (n=31) of the responses in this category and included, “I have not had many experiences teaching it.” and “experience in clinical, the lessons did not go well.” The second code that emerged for this category represented candidate’s reasons related to a lack of teaching methods and ideas. This code made up 17% (n=7) of the category and included responses such as “math is an area that is very difficult for many children to understand, and I just hope I can learn different ways in order to teach them.” Lastly, 9% of candidate’s articulated reasons related to motivating students (n=4) like, “some kids get bored and don’t pay attention during math.”

Twenty responses communicated reasons related to student ability and candidates’ fears of negatively impacting students. These responses (15%) made up the third category for question two. Two similar codes provided the data for this category. Reasons related to having a negative impact on student success (65% n=13) provided insights like, “I do not want my struggles to affect the learning of my students.” The remaining responses in the category were reasons related to varying student ability (35%, n=7). Not surprisingly, students confided reasons such as “because I know every child may learn differently and I don’t want to confuse them.” in this code.

A fourth category that was not evident in question one articulated reasons related to the candidate’s personal math experiences. Eight percent of candidates gave a reason for their fears such as “because I was taught poorly in junior high and high school.” or “because I didn’t like math”

Lastly, 9% of candidates stated no reasons for any mathematical fears.

Discussion

As illustrated in the results above, similar categories emerged in the responses to the two questions even though one question focused on “what” candidates fear, and the second on “why” they fear the things they fear. The similarities in responses and some important differences will be discussed here.

Math Content Knowledge

The math content knowledge category includes the largest number of responses when asked why they feared what they fear. However, it was only the third highest occurring response when students were asked what they fear. So when asked what they fear, candidates do not fear content most, but do believe it is the main reason behind their reported fears. This could be due to a stigma around admitting a fear of math content at the early childhood level. However, when asked to provide reasons for admitted fears, content serves as the foundation for both their fears related to teaching confidence and fears related to having a negative impact on student learning. These findings confirm the connection between math content knowledge and math fears related to teaching.

Math Teaching Fears

Math teaching ability fears were highly reported for both what candidates fear and why. This could be simply related to the point they are at in their teacher education program. At the point of this data collection, students had not yet student taught but had completed some clinical experiences. With student teaching looming ahead, perhaps the fear becomes more evident of their responsibility to assess children’s math ability and meet them instructionally where they are using a variety of teaching methods. This fear is compounded by the unknown age group they will teach with a certificate spanning zero through eight years.

Student Success Fears and Fears of Personal Math Experiences

Candidates reported fears related to possible negative impacts they may have on student math success. They attributed these fears to children’s varying ability levels, candidate’s negative impact on student success, and student’s dislike of math. Candidate’s fear of varying ability levels reflected their worries concerning effectively teaching all students, while their comments regarding negatively impacting student success reflected being able to meet student’s differing levels of understanding as well as the time needed to truly differentiate instruction. Perhaps these fears related to student success and student’s dislike of math should be examined through the lens of their personal math experiences. Students reported their own personal negative math experiences as one of the reasons behind their fears. These personal experiences could cause fears related to student success responsibility as they view how negative personal experiences impacted their own math success or confidence. In addition they could be afraid their own self-reported dislike of math could be evident and contagious.

No Math Related Fears

In question one, almost all participants stated that they had some math related fears. However, these same participants failed to report any fears when asked why they fear what they fear. Perhaps this difference can be explained by simply a lack of ability to specifically describe reasons or justifications for fears they claimed in question one. It is possible that students who

had fears related to student performance or engagement did not see these fears as relating to themselves but instead placed the why on the side of the students. This could explain why more often candidate's who responded with no fears in question two, reported a fear of negative impact on student success in question one.

Implications and Future Research

These findings provide interesting implications for early childhood teacher preparation as well as early childhood teacher educators. Based on the literature about early childhood teachers, their feelings towards mathematics, and the importance of mathematics for young children, it is imperative that this line of research continues. It can provide valuable information, so teacher preparation programs can provide the necessary training to produce the highest quality early childhood teachers possible. It is imperative that teacher educators and pre-service teachers work together towards this goal. Future early childhood teachers must be taught the importance of mathematics for their students, and must learn to believe that they are capable, and their important role in young children's understanding of mathematics.

Teacher preparation programs must examine their general education mathematics expectations along with their mathematics pedagogy courses to identify opportunities to modify curricular expectations which allow pre-service teachers' hand-on experiences to build their efficacy in regards to both content and teaching mathematics. It is simply not enough to put them in a classroom to observe the teaching of mathematics. Pre-service teachers must show how they can make an impact and be given the opportunities to do so. These experiences should occur prior to culminating experiences such as student teaching and should include additional opportunities to reduce fears related to teaching and lack of experience. Furthermore, these experiences must also focus on undergirding pre-service teachers' confidence in their ability to powerfully and positively impact student learning.

This study can serve as a springboard for future research that examines the changes in teacher's fears both longitudinally and at differing levels of experience. Additional research examining the impact of more math content courses, methods courses, and clinically focused math experiences could also enhance our understanding of candidates' math fears. As state boards of education increase content knowledge expectations of teacher candidates, future research in this area can pair with those changing mandates to positively impact teacher efficacy, reduce candidate fears and enhance student learning.

Conclusion

Research examining pre-service teachers' mathematics anxiety has consistently found that pre-service teachers possess high levels of mathematics anxiety and often demonstrate a dislike towards mathematics. This study examined, specifically, early childhood pre-service teachers and the types of fears they have in regards to teaching mathematics and why they have those fears. Pre-service teachers reported many different types of fears relating to their own knowledge and feelings towards mathematics as well as their students' success and abilities. More specifically, the participants demonstrated a lack of confidence towards teaching mathematics and often mentioned their lack of knowledge in teaching methods and their low ability of engaging their future students. Mathematical content was often given as both an answer to what their fears were as well as to why they feared mathematics.

The results of this study clearly demonstrate that early childhood pre-service teachers possess many types of fears towards mathematics. Although some fears were provided more often than

others, it is evident that there are many elements of teaching math that could be fearful and many reasons why pre-service teachers may fear math. This makes it extremely difficult for teacher educators to help pre-service teachers with their specific fears. We, as educators of teachers, must realize that one of our main roles is to help lower their anxiety when teaching not only mathematics but in all content areas. In order to begin this process we must understand the underlying factors and reasons for that anxiety and take that into consideration when devising our courses and instructional methods. The current study is a further step into understanding pre-service teachers' specific mathematical fears.

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