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Building a Community of Christ in a Mathematics Classroom

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Abstract

The prevalence of mathematics anxiety and math phobia is an accepted phenomenon in our culture today (Boaler, 2013; Kimball & Smith, 2013). Multiple research studies have been conducted investigating the levels of mathematics anxiety present in both preservice and in-service elementary education teachers (Bekdemir, 2010; Mizala, Martínez, & Martínez, 2015). This article describes how the creation of a learning community within a two-course sequence of mathematics content courses for elementary teachers addressed the fears and anxieties of a cohort of prospective female teachers. The learning community was founded on three perspectives: Palmer's (1989) community of truth, Paul's description of the church as a human body in 1 Corinthians 12, and Jolliff's (2009) reinterpretation of Guthrie's (1963) lonesome valley experience by a solitary traveler. Themes expressed by the students in their reflections after the second course included greater conceptual understanding, an emphasis on both individual and community learning, reduced anxiety, attention to multiple perspectives, and the ability to learn as both a teacher and a student.

You got to walk (you got to walk)

That lonesome valley (lonesome valley)

But you can't walk it (you can't walk it)

By yourself (by yourself)

We're many souls (many souls)

But just one body (just one body)

You can't walk it (you can't walk it)

By yourself (by yourself)

- Bill Jolliff (2009, see appendix for complete lyrics

Imitating the solitary walk through the lonesome valley described by Guthrie (1959), many students have travelled an individual path through their mathematics education sitting in classrooms with desks facing forward and few mathematical conversations occurring with their peers. The classroom was seen as a place for competition, individual achievement, and often-passive receptivity as the teacher stood at the front and talked. However, Jolliff's (2009) adaptation of the refrain paints a new image of the walk; it is a walk that is made in community with others. Adapting that refrain to the mathematics classroom envisions a new environment; an environment characterized by collaboration, conversation, and commitment to the community.

It is a changed paradigm for the focus is no longer the front of the room, but instead the individuals who are in the room. For me, as the professor, it meant re-envisioning my teaching to ensure that each student became, and was, a valued member of the community occupying the dual roles of student and teacher. Palmer (1989) conceptualized that vision as he wrote concerning the community of truth; a community in which truth became the focus with each person sharing his or her insight related to the truth. The community was essential for each member had the essence of God within; the underlying foundation of Quaker meetings. Within the mathematics class, it meant that I had to emphasize and recognize that each student brought a unique and valued perspective to the classroom that was to be shared and relished by all.

Closely aligned with Palmer's perspective is the symbiotic relationship of the church as presented by Paul in I Corinthians 12:12-26 with the necessity of all members as valued participants in the life of the community. Applying this imagery to the mathematics classroom demanded that I, and my students as my colleagues, no longer considered the worth of their mathematical knowledge on the basis of a grade, previous successes

or previous failures, but instead on the insight that each one brought to the problem under consideration. This community was born in a two-course sequence of mathematics content designed to prepare educators for the elementary classroom.

The Fruits of the Lonesome Walk

Emanating from, and abiding in the lonesome walk of the traditional mathematics classroom are emotional identities described by terms such as mathophobia (Lazarus, 1974). The price of mathophobia, and mathematics anxiety (Resnick, Viehe, & Segal, 1982; Richardson & Suinn, 1972; Young, Wu, & Menon, 2012), which emphasize the intense negative emotions that math arouses in some individuals. "An irrational and impeditive dread of mathematics" characterizes the perspective of the mathophobic (Lazarus, 1974, p. 16). Math is intentionally avoided by many in both the choice of classes and the choice of occupations. It is socially acceptable for an individual to proclaim a negative disposition concerning mathematics while also declaring one's own ineptitude in mathematics (Boaler, 2013; Kimball & Smith, 2013).

For teacher educators, the threat of mathematics anxiety or mathophobia reigning in the minds of prospective teachers is present, particularly if the prospective teacher is female (Bekdemir, 2010; Brady & Bowd, 2005; Chavez & Widmer, 1982; Cornell, 1999). Coexisting with the personal anxiety of the individual teacher is the fear that the teacher's anxiety will be transferred to her students, especially if the students are female (Beilock, Gunderson, Ramirez, & Levine, 2010; Mizala, Martínez, & Martínez, 2015). It is also hypothesized by some scholars that mathematically anxious teachers will continue the mathematics anxiety cycle as their classrooms are focused on basic skills, lecture, timed tests, and rote memorization (Swars, Daane, & Giesen, 2006).

Changing the Environment of Learning

The application of a different paradigm of mathematics instruction to the university classroom disrupted the traditional power dynamic in which I was seen as the source of all knowledge concerning the subject and the students were passive recipients of that knowledge. Each student became a collaborator with me and with the other students in the classroom. While I retained the grading responsibilities as required by the university, the community (the students and I) was mutually responsible for the learning that occurred within the classroom. Students were expected to share their knowledge and expertise with one another. Students interacted with one another discussing mathematical scenarios, homework problems, mathematical ideas, and alternative problem solving methods. Whole class discussions were reserved for either the introduction of new foundational content or the clarification of concepts or processes.

The learning community emphasized the value of each member. A continuum of attitudes concerning mathematics, beliefs about individual mathematical efficacy, and coursework in mathematics required students to collaborate with one another, even though each student occupied a separate place on the continuum. Recognizing and valuing the individuality within the group processes was crucial for the students to learn, and teach one another, collaboratively.

I abandoned the traditional hierarchical university classroom model for a community in which both the students and I shared ownership of the classroom and its practices. Student ownership began with the students developing norms for classroom behaviors. The norms were developed with the expectation that both students and I were subject to the norms.

University classrooms can be spaces in which students remain anonymous except for those who have friends in the class or those students who are extroverts and easily connect with other students. Breaking down the walls of anonymity required two processes: I committed to learn each student's name by the third week of the semester and students were expected to know the names of the other students by the fifth week of the semester. I facilitated the learning of student names by the students through multiple student groupings that differed in either number or composition. The grouping of students would occur in tables with four, five, or six students sitting at each arrangement of tables in the classroom. Student intercession, prayer, and thanksgiving for one another occurred as I solicited prayer requests at the beginning of each class and then led the class in prayer.

Student ownership of the teaching process was explicit, not implicit. With 1st Corinthians 12 as the foundational element (each student is important), students were expected to be involved in teaching one another;

discussing mathematical concepts and solving mathematical tasks with their colleagues. Teaching occurred in multiple situations and focused on processes, rather than the correct answer. Articulating and sharing those processes with one another was an established practice.

Students also became teachers of one another through the jigsaw process (Aronson & Bridgeman, 1979) as groups were assigned specific articles to read and then taught their fellow students several times during the semester. Each group then collaborated to identify the essential points or processes that their colleagues needed to know from the assigned article. The groups were then dispersed into a second set of groups with each student being responsible for teaching the content to another set of colleagues. Through the collaboration and discussion, students who encountered difficulty reading the article were able to develop understanding before having to teach their peers. The articles exposed students to mathematical content, processes, or concepts that were related to classroom learning.

Each homework assignment became an opportunity for students to teach one another. Assignments occurred primarily in two formats: problems from the textbook and mathematical tasks. Previous practice for many students in solving textbook problems was to focus on the answer, rather than the process. All students were provided with the answer keys from the textbook so that classroom discussions could focus on the how and the why of the mathematical processes, rather than the correct answer. The role of each student was to ensure that each member of the group understood the processes involved in solving the problem.

My role was to assist each student in learning mathematics through the continued asking of probing questions, providing foundational knowledge, and supplementing learning when barriers occurred. Learning was focused on the interdependence of the students and the professor rather than solely on the expertise of the professor. Instead of the hierarchical model with the professor being the sole expert in the room, both the students and I could depend on multiple experts with each one providing a different perspective.

The Learning Community

I used a grounded theory approach (Creswell, 2012) to analyze the qualitative data collected from a survey conducted at the end of the two-course sequence. Themes were developed from multiple readings of the student responses with the importance of the learning community being expressed by multiple students as they described their experiences. Each student was invested in the learning of the other students in the classroom, according to one student, who stated that the focus was not on individual learning, but the learning of the other students. The distinctive characteristic of the class was "everyone wanted each other to understand and succeed, "a quality not seen in other mathematics classes, according to one student.

Students perceived one another as teachers. Rather than seeing me as the single source of understanding and insight dominating the classroom, the students felt that each student's ideas were valued and important to their learning. Answers were not the focus of the discussions as one student stated:

We are all trying to learn the same thing so people are learning how to teach the material when they are helping rather than just giving the students the answer. We can work together and find answers based on each other's strengths.

Closely aligned with this perspective is how the students viewed the input of their colleagues. Traditionally, singular thinking has dominated the understanding and solving of math problems with its belief that there is only one strategy or method of finding the solution. In this sequence of courses, the attitude changed. Working in a group of five students became the opportunity for the students to learn five different strategies or five different opinions, according to one student.

Different learning styles and ways of understanding concepts were mentioned by several students who explained that the small group learning processes empowered students to either ask questions when they did not understand a concept or teach those who did not understand. "I think I understand the topics more because if you get stuck, you feel more free to ask your classmates questions that you may not know the answer to. It helps build one another up," wrote one student. The learning community created a safe

environment for the students to ask questions of one another and the teacher. Students distinguished their experiences by contrasting the learning environment with negative situations. Responses, such as being "not afraid to ask questions", being able to "ask their professor questions or any of their peers, and they will get an honest and helpful answer," and "it's a safe environment where no questions is [sic] a stupid one," were found as the students described the community.

I became a resource rather than the sole source of information. Terms like "facilitator," "guide in our learning," "discussion mediator," and "active participant" were used to describe how I functioned in the classroom. Asking questions of the students and their groups was my role, according to the students, who stated that while I would ask questions, I would not tell the students how to solve a problem. The students described how I would help struggling students and wanted to ensure that all students were learning the content.

Perceptions of Mathematics in the Community

Through the learning community, the students expressed that they saw themselves as teachers of one another. The environment of the classroom was seen as a safe setting in which the students felt confident to ask questions of one another and of the professor. "I used to have anxiety about math, but now I am confident in the classroom environment and the learning that will take place because I feel secure around my classmates and professor," wrote one student. Confidence, and the freedom to make mistakes, was developed through the relationships that this student developed with her colleagues as she explained in responding to a subsequent question.

Conceptual understanding occurred in the small group discussions as one student expressed her appreciation that the students worked together to develop the understanding. Another student described how the group processes allowed her to both help others understand the math concepts and provided her with the opportunity herself to ask questions so that she could understand the concepts. The discussion of different approaches to thinking and solving problems supported "a more solid understanding" of the math concepts stated another student. Collegial interactions with one another, rather than relying on the professor, became the source of learning as described by one student who wrote, "If someone learns better by explaining it to someone else, and if someone learns the best by getting it explained to them, then they have the option to get those needs met in the community."

Individuals' affective perspective in mathematics is a crucial element in preparing prospective elementary education teachers. Previous research has emphasized the prevalence of math anxiety and negative attitudes concerning mathematics among pre-service teachers (Boaler, 2013; Swars, Daane, & Giesen, 2006; Trujillo & Hadfield, 1999).

In this case, the learning community changed that negative perspective concerning math as students wrote about being engaged in the class, working together, being surprised that the 100-minute class period was over, enjoying class, and understanding mathematics concepts that had not occurred before. "Honestly, the classes helped me like math again where high school had taken that away from me," wrote one student. One of her colleagues described being less anxious about mathematics.

It has been so much better than my previous encounters with mathematics! It's still not my favorite subject, but I'm not nearly as scared of it anymore. In these classes, I got to learn at my own pace and discover why math rules work instead of just memorizing them. It was also a comfortable and safe environment to learn in. Even if I made a mistake, I knew I wouldn't be ridiculed for it. I really liked it!

The Learning Community Wins Out

The opening paragraphs of this article described the predicament facing many in teacher education today; the prevalence of mathematics anxiety and fear among teacher candidates, especially female candidates. Changing the classroom environment from a setting that emphasized solitary work to a learning community in which each voice is heard and appreciated, individual strengths are recognized and reinforced, and the students become teachers of one another had changed that cycle of anxiety and fear into a community in which mathematics could be learned.

The solitary journey through the lonesome valley had been eliminated. Instead, the journey through the lonesome valley became a sojourn taken in community; a community in which the members support one

another in accomplishing the goal.

References

Aronson, E., & Bridgeman, D. (1979). Jigsaw groups and the desegregated classroom: In pursuit of common goals. Personality and Social Psychology Bulletin, 5(4), 438-446. doi: 10.1177/014616727900500405

Beilock, S. L., Gunderson, E. A., Ramirez, G., & Levine, S. (2010). Female teachers' math anxiety affects girls' math achievement. Proceedings of the National Academy of Sciences of the United States, 107(5), 1860-1863. doi: 10.1073./pnas.0910967107

Bekdemir, M. (2010). The pre-service teachers' mathematics anxiety related to depth of negative experiences in mathematics classroom while they were students. Educational Studies in Mathematics, 75(3), 311-328. doi: 10.1007/s10649-010-9260-7

Boaler, J. (2013, November 12). The stereotypes that distort how Americans teach and learn math. The Atlantic. Retrieved from http://www.theatlantic.com/education/archive/2013/11/the-stereotypes-that-distort-how-americans-teach-and-learn-math/281303/

Brady, P., & Bowd, A. (2005). Mathematics anxiety, prior experience and confidence to teach mathematics among pre-service education students. Teachers and Teaching: Theory and Practice, 11(1), 37-46.

Chavez, A., & Widmer, C. C. (1982). Math anxiety: Elementary teachers speak for themselves. Educational Leadership, 39(5), 387-88.

Cornell, C. (1999). "I hate math!: I couldn't learn it, and I can't teach it!". Childhood Education, 75(4), 225-230. doi: 10.1080/00094056.1999.10522022

Creswell, J. W. (2012). Educational research: Planning, conducting, and evaluating quantitative and qualitative research (4th ed.). Boston, MA: Pearson.

Guthrie, A. (1963). Lonesome Valley. Retrieved from http://woodyguthrie.org/Lyrics/Lonesome_Valley.htm

Jolliff, B. (2009). That Not-So-Lonesome Valley. On Down Old 51 [CD]. Newberg, OR: Biggap.

Kimball, M., & Smith, N. (2013, October 28). The myth of 'I'm bad at math.' The Atlantic. Retrieved from http://www.theatlantic.com/education/archive/2013/10/the-myth-of-im-bad-at-math/280914/

Lazarus, M. (1974). Mathophobia: Some personal speculations. National Elementary Principal, 53(2), 16-22.

Mizala, A., Martínez, F., & Martínez, S. (2015). Pre-service elementary school teachers' expectations about student performance: How their beliefs are affected by their mathematics anxiety and student's gender. Teaching and Teacher Education, 50, 70-78. doi: 10.1016/j.tate.2015.04.006

Palmer, P. J. (1998). The courage to teach: Exploring the inner landscape of a teacher's life. San Francisco, CA: Jossey-Bass.

Resnick, H., Viehe, J., & Segal, S. (1982). Is math anxiety a local phenomenon? A study of prevalence and dimensionality. Journal of Counseling Psychology, 29(1), 39-47. doi:10.1037/0022-0167.29.1.39

Richardson, F. C., & Suinn, R. M. (1972). The mathematics anxiety rating scale: Psychometric data. Journal of Counseling Psychology, 19(6), 551-554. doi:10.1037/h0033456

Swars, S. L., Daane, C. J., & Giesen, J. (2006). Mathematics anxiety and mathematics teacher efficacy: What is the relationship in preservice teachers? School Science and Mathematics, 106(7), 306-315.

Trujillo, K. M., & Hadfield, O. D. (1999). Tracing the roots of mathematics anxiety through in-depth interviews with preservice elementary teachers. College Students Journal, 33(2), 219.

Young, C. B., Wu, S. S., & Menon, V. (2012). The neurodevelopmental basis of math anxiety. Psychological Science, 23(5), 492-501. doi: 10.1177/0956797611429134

The price of mathophobia. (1967). Time, 89(11), 70.

Appendix

That Not-So-Lonesome Valley

Bill Jolliff (2009)

You got to walk (you got to walk)
That lonesome valley (lonesome valley)
But you can't walk it (you can't walk it)
By yourself (by yourself)
We're many souls (many souls)
But just one body (just one body)
You can't walk it (you can't walk it)
By yourself (by yourself)
You got to walk (you got to walk)
That lonesome valley (lonesome valley)
But you can't walk it (you can't walk it)
By yourself (by yourself)
We're many souls (many souls)
But just one body (just one body)
You can't walk it (you can't walk it)
By yourself (by yourself)
Some may preach (some may preach)
Some work wonders (some work wonders)
Some may part (some may part)
The deep Red Sea (the deep Red Sea)
But each one serves (each one serves)
Some special purpose (special purpose)
And that means you (that means you)
And that means me (that means me)
Here's a hand (here's a hand)
There's an elbow (there's an elbow)
Here's a toe-bone (here's a toe-bone)
There's a tongue (there's a tongue)
It takes each part (takes each part)
To make a body (make a body)
To let it laugh (let it laugh)
And make it run (make it run)
It's tough to tell (tough to tell)
Which road to travel (road to travel)
Some dark days (some dark days)
We don't know how (don't know how)
But if we give (if we give)
What we've been given (we've been given)
Then we've found (then we've found)
God's kingdom now (God's kingdom now)