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HIGH SCHOOL FIELD EXPERIENCE PERSONNEL'S PERCEPTIONS ABOUT MATHEMATICS IDENTITY

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Field experience personnel, such as cooperating teachers (CTs) and university supervisors (USPs), play an important role in supporting mathematics pre-service teachers (PSTs) to learn about equitable teaching practices. We employed case study methodology to explore the perceptions of CTs and USPs about mathematics identity. A group of CTs and USPs participated in professional development during the Fall 2023 semester to learn about ways to develop students' mathematics identity. In this brief research report we share these CTs' and USPs' ideas about their own mathematics identity, their students' mathematics identity, and how these ideas influence their teaching practice. Our findings have implications for redesigning field experience in teacher education programs.

Keywords: Pre-service Teacher Education, Professional Development.

Objectives of the study

Field experience is an important component of teacher education (Butler & Cuenca, 2012). The various personnel involved in the field experience component of teacher education influence what student teachers learn when placed in actual K-12 classrooms. According to Anderson (2007), cooperating teachers (CTs) have a significant impact on pre-service teachers (PSTs). Moreover, Rozelle and Wilson (2012) reveal that PSTs' teaching practices and beliefs are strongly affected by cooperating teachers. University supervisors (USPs) also have a major impact on PSTs' thinking and their practice as they bridge theoretical learning with practical field experience (Cuenca et al., 2011). Thus, it is important to learn about the perceptions, practices, and beliefs of these field experience personnel to support PSTs' learning (Borko & Mayfield, 1995). In particular, when it comes to teaching mathematics PSTs about equitable teaching practices, it is important to develop a cohesive system of supports where PSTs get the same message from their courses and their field experience. Hence, collaborative work between university and school personnel is needed to prepare PSTs to teach diverse populations (Lee et al., 2010; Maher et al., 2022). Given the important role that field experience personnel play in supporting mathematics PSTs to incorporate these practices we wanted to learn about their own ideas about mathematics identity. In particular, our research question was: *What are field experience cooperating teachers' and university supervisors' perceptions about mathematics identity?*

Theoretical framework

Mathematics identity refers to “the dispositions and deeply held beliefs that students develop about their ability to participate and perform effectively in mathematical contexts and to use mathematics in powerful ways across the contexts of their lives.” (Aguirre et al., 2013, p. 14). This identity can influence the beliefs of a student as a, “competent performer who is able to do mathematics or as the kind of person who is unable to do mathematics.” (Aguirre et al., 2013, p.

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14). Students' mathematical identities are deeply connected to their other identities making it important to welcome all of their selves into the classroom (Ruef, 2020). The five practices of equity-based teaching can guide the development of classroom environments that allow students to feel welcomed and help build their mathematical identities (Aguirre et al., 2013). These practices are: Going deep with mathematics; Leveraging multiple mathematical competencies; Affirming mathematics learners' identities; Challenging spaces of marginality; and Drawing on multiple resources of knowledge. Various researchers have cited the importance of mathematics PSTs' learning about equitable teaching practices (Gutiérrez, 2002; Mintos et al., 2019). If we are to teach PSTs about these practices it is important to help them experience these practices in action during their field experience (Moldavan & Gonzalez, 2023; Sandoval et al., 2020).

Methods

We used case study methodology to highlight the ways in which CTs and USPs conceptualize mathematics identity (Yin, 2009). Our unit of analysis in this exploratory case study is a member of our field experience team: CT or USP. We aim to share their own perceptions about mathematics identity in order to expand existing understanding about how field experience personnel may influence PSTs' teaching practice.

Setting

The study took place at a university in the Mid-Atlantic region of the United States. The university is situated in a rural community. As part of an extended professional development (PD) program, the first author invited high school mathematics field experience personnel to meet virtually. The group met four times during the Fall 2023 semester and engaged in discussions about equitable teaching practices in mathematics classrooms, reading vignettes of classroom scenarios, sharing classroom activities, and providing feedback on each other's teaching practices.

Participants

The participants were three cooperating teachers (high school mathematics) hosting PSTs from the university's teacher education program, and one university supervisor teaching the field experience course for future high school mathematics teachers. The university supervisor was a former high school mathematics teacher. All participants had more than 10 years of teaching experience. Karla was teaching Geometry, Computer mathematics, and AP Calculus; Ranita was teaching Algebra I & II; and Jake was teaching Algebra I, Precalculus, and Data Science at the time of the study. Jake had also taught Geometry and Algebra II in past years. Lisa – the university supervisor – had taught Geometry, Computer math, and Algebra I when she was a high school teacher.

Data

All participants were interviewed at the beginning and end of the Fall 2023 semester. Semi-structured interviews were conducted, transcribed, and analyzed. In addition, the participants were asked to select at least one equity-based teaching practice to develop students' mathematics identity. They were also asked to share actionable steps that can be taken in their classrooms to support equitable mathematics teaching and develop their students' mathematics identity.

Analysis

Data were analyzed using open coding (Strauss & Corbin, 1998) to look for emergent themes about participants' perceptions of mathematics identity.

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Results

In this section we provide accounts of each participant's perceptions about mathematics identity. Data analyses revealed that teachers' mathematics identity may influence their teaching practice and their teaching goals for their students. Teachers' mathematics identity may also influence their opportunities for learning when engaging in PD.

Karla

Karla is a cooperating teacher hosting our PSTs in her classrooms. Thinking about her own mathematics identity, Karla shared that she always identified as being good at mathematics. She liked seeing mathematics as a language and loved the precision mathematics provided to communicate ideas and concepts. Mathematics always made sense to her and was "straightforward to understand." In addition, she enjoyed teaching mathematics to peers. She described her students' mathematics identity as procedure followers who want to memorize algorithms and follow them rather than think through mathematics problems. Karla's goal is to provide students with mathematics problems that foster their problem-solving mindset as she wants them to become "problem solvers and critical thinkers." She mentioned that "giving them (students) a lot of examples of problems that do not have a straightforward algorithm" is needed to help students develop their mathematics identity. She selected going deep with mathematics as her preferred equity-based teaching practice. We see an alignment between Karla's own mathematics identity, her teaching practice and how she resolves challenges in her practice to help students become successful at doing mathematics.

Jake

Jake, a cooperating teacher, always liked to solve real word problems using mathematics and found numbers comforting. When talking about his own mathematics identity he said, "Well, my mathematics identity goes back to when I was in elementary school, I think about third grade when I was required to learn how to add, subtract, multiply and divide fractions. And so I found success in that, I found comfort in that!" In addition to finding numbers comforting, Jake also saw himself as a problem solver. He liked to play problem solving games and explained, "One of my more recent musings about mathematics is that all mathematicians are Gamesman. And I love games. And I love creating parameters and saying, Now, what can I do with that?" His goal is to help students change the narrative about mathematics, and to help them be successful. Jake did not select an equity-based mathematics practice but based on his conversations he seems to be leaning towards affirming mathematics learners identities and challenging spaces of marginality. We see an alignment between Jake's own mathematics identity, and his teaching practice. Jake wishes for his students to see the world through a lens of mathematics and wants them to have discussions about real world problems.

Lisa

Lisa is a university supervisor in the teacher education program. Up until last year she was a high school mathematics teacher and recently took on the role of a university supervisor. She described herself as a problem solver because she likes to think mathematically when encountering challenges. Lisa said that mathematics is "part of who I am, my identity." She always enjoyed teaching mathematics even when in school and liked to help her friends learn math. In contrast she feels that her students (high school) hate math, they don't have any interest in doing mathematics and don't understand why they have to do it. Her teaching focuses on motivating students and helping them reach aha moments. Her goals to develop students'

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mathematics identity include having students feel good about themselves when doing math. She selected, affirming mathematics learners' identities as her favored equity-based teaching practice. In her current role as a university supervisor, Lisa encourages her PSTs to work with students who struggle with mathematics. She uses her own experience to guide her PSTs in supporting their students.

Ranita

Ranita a cooperating teacher, recalled that she found mathematics to be challenging and did not feel like she was good at math. She shared, "I do math every day but I still really feel like deep down, I was never good at math." Her challenges learning mathematics earlier on in life allow her to empathize with her students when they say they don't like math. She shared that her students lack prerequisite mathematics knowledge and her goal is to develop students' mathematics identity by helping students feel confident and to help them experience success. Based on her own experiences learning mathematics, Ranita believes that helping students feel confident in mathematics is crucial. This motivates her to focus on supporting students to experience success in mathematics exams. She gives them chances to redo their assignments and provides scaffolded practice exercises because she believes that passing mathematics exams will allow students to experience success and develop a positive mathematics identity. Ranita's teaching practice is based on empathy for her students. She believes in building relationships with her students and learning about them. She selected leveraging multiple mathematical competencies as her preferred equity-based teaching practice.

Discussion and conclusions

There were similarities and differences between the four cases. In terms of similarities, all participants except for Karla shared that their students had a strong dislike for mathematics, that it was important to develop relationships with students and to help them experience success. For all the cases, the participants' interest, perception, and background influenced what they learned from the PD meetings. All the participants were able to learn from each other about strategies, tasks, and norms that worked for their students. They were all similar in their goal to help their students be successful, but their teaching practice, understanding of student success, and perception of their role as a teacher differed from each other.

Our findings have implications for PSTs' field experience. CTs and USPs guide PSTs as they try to connect their coursework-related learning to the teaching practice experienced in actual field experience classrooms. PSTs may learn new pedagogical ideas in their methods courses but it is important that these ideas are reinforced and modeled during their field experience (Matsko et al., 2020). For instance, if we want our PSTs to develop equitable teaching practices that support the development of students' mathematics identity, we must learn about pedagogical beliefs held by CTs and USPs. We noticed that all participants were deeply interested in supporting their students' learning; however, they had different ideas about what it meant to develop their students' mathematics identity. Some believed that experiencing success on state tests would do the trick, while others believed that being able to solve real life problems using mathematics might help their students develop a positive mathematics identity. Work is needed to support field experience personnel in their development of equity-based practices. In addition, continued collaboration is needed between MTEs, CTs, USPs, as well as PSTs.

Kosko, K. W., Caniglia, J., Courtney, S., Zolfaghari, M., & Morris, G. A., (2024). *Proceedings of the forty-sixth annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*. Kent State University.

It is through a cohesive network of support that our PSTs can be successful in developing equitable teaching practices. Field experience personnel can influence PSTs' sense of preparedness as teachers (Ambrosetti & Dekkers, 2010; Hamman et al., 2006). MTEs, CTs and USPs must collaborate, to develop tools and procedures in order to become effective mentors for PSTs. This collaboration can help align PSTs coursework and field related experiences. In particular, such an alignment is needed to support PSTs' development of equitable teaching practices that can support the development of students' mathematics identities.

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