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Confident Conversations: Unpacking Emotions About Mathematics to Build Confidence among Preservice Teachers

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ABSTRACT Preservice teachers (PSTs) often enter mathematics methods courses with emotional histories that shape their engagement with mathematics and their learning to teach. This qualitative study explores how structured, reflective conversations can be used in mathematics teacher education to surface these emotions and support PST learning. The study reports on a mathematics confidence workshop with 25 PSTs in a post-undergraduate teacher education program in Eastern Canada. During the workshop, PSTs engaged in small-group dialogue using conversation cards designed to prompt reflection on mathematical beliefs, prior experiences, emotions, and conceptual understanding. Analysis of audio-recorded conversations and written reflections suggests that purposeful dialogue supported PSTs in articulating and re-examining their relationships with mathematics, recognizing shared experiences, and developing greater confidence as future teachers. The findings highlight reflective conversation as a pedagogical practice that attends to affect while supporting professional learning in mathematics teacher education.

KEYWORDS: *mathematics confidence, affect in mathematics education, reflective practice, classroom discourse*

Introduction

Reflecting on a conversation with peers about their emotions surrounding the teaching and learning of mathematics, preservice teacher (PST) Antonin (All names of the participants are pseudonyms) succinctly summarized a potential impact on future practice for all PSTs: "A key takeaway from the conversations was that every student must feel comfortable in math class and that each student is capable of understanding math." Many students, including PSTs like Antonin, enter their mathematics classrooms with feelings of trepidation and anxiety (Bosica, 2022). For PSTs to feel comfortable with and capable of doing and teaching mathematics, it is essential to create an environment in which they can openly discuss their emotions and experiences.

In this study, I report on efforts to unpack these emotions among PSTs through meaningful conversations, aiming to initiate a process that builds confidence among future mathematics teachers and their students. In what follows, I will explore the significance of addressing mathematics anxiety, the role of open dialogue in transforming PSTs' beliefs about mathematics, and the specific strategies employed in the workshop to facilitate these conversations.

Emotions Count

Students in elementary classrooms often exhibit a wide range of emotions when it comes to learning mathematics. While some express delight and enthusiasm for mathematical activities and problem solving, others display signs of panic and anxiety when faced with similar

tasks (Trezise & Reeve, 2014). Their confidence may be impacted by previous negative experiences, which may include lower-than-expected performance on assignments and instances of verbal or written mistreatment from teachers (Lott, 2003; Rossnan, 2006). If one of the primary objectives of mathematics education is to foster engagement in mathematical thinking and discourse (Bennett, 2014), addressing the emotional barriers paralyzing students in their mathematical endeavors is fundamental. Overcoming these barriers may afford students more opportunities to participate effectively in productive mathematical engagement.

PSTs often experience similar emotions when teaching mathematics (Boyd et al., 2014). Low confidence in their understanding of mathematical concepts, coupled with the pressures of increasing curricular demands and an emphasis on achievement scores, can lead to heightened anxiety when it comes time to teach mathematics (Boaler, 2022). Research supports the notion that mathematics anxiety is a pervasive issue among PSTs, manifesting as a barrier to effective teaching and learning (Beilock & Willingham, 2014). As a mathematics teacher educator (MTE) working with PSTs, I have observed firsthand the expressions of mathematics anxiety that can spread quickly among students. Addressing this concern requires a multifaceted approach that involves MTEs, teachers, and students collectively working to create a supportive and empowering learning environment.

This study responds to the call from Boyd et al. (2014) for MTEs to actively engage with and address the anxieties surrounding mathematics and its teaching among PSTs. By implementing strategies that promote mathematical confidence, we can begin to mitigate the challenges posed by mathematics anxiety and foster a more positive attitude toward mathematics education among future educators.

Shifting Anxiety to Building Mathematical Confidence

Initially, I sought to address teachers' negative attitudes toward mathematics by implementing workshops focused on mathematics anxiety. The objective of these workshops was to confront the issue directly, identify its underlying causes, and ease the impact of anxiety on students' learning experiences. However, despite these efforts, data indicated that anxiety levels among PSTs remained unchanged (Foley et al., 2017). This observation highlighted the need for a more effective intervention in my teaching practice.

In response, I shifted my focus from merely addressing the negativity surrounding mathematics to actively fostering mathematical confidence among PSTs. This change in approach led to the development of targeted workshops designed to promote discussions about PSTs' personal experiences with mathematics, their beliefs, and their emotional connections to the subject. The primary aim of these workshops was to help PSTs explore both their positive and negative emotions related to mathematics, with the aim of influencing their future teaching practices.

Relevant Literature

Building confidence in mathematics through classroom conversations is essential for PSTs, particularly in the context of addressing mathematics anxiety and the beliefs that shape their instructional practices. The following literature highlights key themes related to mathematics anxiety among PSTs, the impact of their beliefs about mathematics, and the importance of promoting mathematical discourse in the classroom.

Mathematics Anxiety

Mathematics anxiety is characterized by feelings of tension, apprehension, and fear related to mathematical tasks (Beilock & Willingham, 2014). Researchers have identified anxieties as significant psychological barriers that adversely affect individuals' performance and achievement in mathematics (Ashcraft & Ridley, 2005). The prevalence of mathematics anxiety among PSTs is well-established, indicating that many future educators grapple with similar emotional challenges when teaching mathematics (e.g., Brown et al., 2011; Gresham, 2007, 2018). Addressing this anxiety requires a multifaceted approach that considers cognitive, affective, and contextual factors (Peker & Ertekin, 2011). For instance, incorporating mindfulness-based practices into mathematics instruction can foster present-moment awareness and equip PSTs with adaptive coping strategies to manage their emotions (Samuel & Warner, 2021). Creating a supportive learning environment that emphasizes effort, a growth mindset, and collaboration may cultivate more positive attitudes toward mathematics, reducing the perceived threat of mathematical tasks, and ultimately building confidence.

Mathematics Beliefs

Beliefs about mathematics significantly influence instructional practices and, consequently, students' learning experiences and outcomes. PSTs' experiences with mathematics throughout their education shape their beliefs about the subject, where positive experiences can foster confidence and enthusiasm, while negative experiences

may lead to anxiety or feelings of inadequacy (Swars et al., 2009). Teacher education programs, along with ongoing professional development opportunities, play a vital role in positively shaping these beliefs about mathematics teaching and learning (Philipp et al., 2007; Ren & Smith, 2018). Understanding PSTs' beliefs regarding the nature and characteristics of mathematics—such as its coherence, usefulness, and certainty—can inform their instructional goals and approaches (Hughes et al., 2019). By recognizing the implications of these beliefs for teaching and learning, MTEs can promote effective mathematics education practices and support PSTs through focused professional development.

Mathematics Conversations and the Transformative Power of Open Dialogue

Mathematics teaching involves various modes of communication, with teachers' talk moves being a central component of classroom conversations. The way teachers communicate mathematical concepts, explanations, and strategies significantly influences students' understanding and engagement with the subject (Herbel-Eisenmann et al., 2015). Engaging in discussions about mathematical ideas allows PSTs to articulate their reasoning, justify solutions, and participate in mathematical argumentation (Woods, 2022). Further, PSTs' active engagement in conversation may support their development of mathematical facility and build confidence.

Research indicates that students learn effectively through sharing their ideas, listening to the perspectives of their peers, and critiquing the narratives presented by others (Gutiérrez et al., 2023). This collaborative discourse is further enhanced when PSTs engage in open dialogue that encourages emotional unpacking of their experiences with mathematics (Childs & Glenn-White, 2018). Such conversations hold transformative potential to foster a supportive learning environment and promote active participation, thereby empowering PSTs to confront and articulate their anxieties and beliefs about mathematics.

Purposeful facilitation of conversations by MTEs fosters confidence among PSTs, equipping them with the skills necessary for their future classrooms. This facilitation can take the form of structured discussions that guide PSTs in exploring their emotional connections to mathematics and help transform their anxieties into a more positive outlook. Shaughnessy et al. (2021) emphasize the importance of formatively assessing PSTs' skills in orchestrating discussions in mathematics, highlighting how effective dialogue can serve as a powerful tool for building confidence, and enhancing teaching practices.

The exploration of classroom conversations reveals several key components of mathematics education. Research identifies mathematics anxiety among PSTs as a significant barrier to effective teaching and learning (Itter & Meyers, 2017), underscoring the need for comprehensive strategies that address cognitive, affective, and contextual factors. Additionally, understanding and shaping PSTs' beliefs about mathematics is essential for promoting positive instructional practices and fostering student success. Promoting math conversations in the classroom is vital for not only enhancing engagement, reasoning, and problem-solving skills but also for addressing the emotional barriers that PSTs face. Through purposeful facilitation and support from MTEs, PSTs can develop the confidence and skills necessary to create enriching mathematical experiences for their future students. Open dialogue that encompasses emotional unpacking in classroom conversation fosters a nurturing and caring learning environment for students in mathematics education.

Purpose and Context

The purpose of this study is to introduce a communications strategy that MTEs can use to facilitate meaningful conversations about mathematics with PSTs. This strategy was selected based on its alignment with previous research, which highlights the positive impact of open dialogue on addressing mathematics anxiety and building confidence among PSTs. Specifically, this study aims to explore how these conversations influence PSTs' emotions regarding mathematics.

The precise objectives of these conversations are: (1) to articulate beliefs about mathematics; (2) to recognize the impact of previous experiences with mathematical contexts; and (3) to build confidence in understanding and applying mathematical concepts.

In the following sections, I report on a mathematics confidence workshop conducted with PSTs. Throughout the school term and prior to attending the workshop, PSTs worked in randomized groupings to complete rich mathematical tasks across various strands (i.e., numbers and operations, patterns and relations, measurement, geometry, and statistics) during each of the 17 classes they attended. The workshop occurred after the conclusion of the term and provided an opportunity for PSTs to reflect on their learning, growth, and future teaching practices.

By enhancing PSTs' confidence in mathematics through such workshops, it is my hope that they will, in turn, inspire and empower their future students, nurturing a sense of confidence in the subject. The research question

guiding this study is: How do structured conversations about mathematics influence preservice teachers' emotions and beliefs regarding their mathematical abilities?

Theoretical Framework

I integrated sociocultural perspectives on learning, complexity thinking, and discourse in mathematics education to create a conceptual lens that helped me understanding how mathematics conversations might promote rich classroom discourse and PSTs' growth as future mathematics educators.

Sociocultural Theory of Learning

At the core of fostering rich classroom discourse is Vygotsky's sociocultural theory of learning, which posits that knowledge construction is fundamentally a social process (Vygotsky, 1978). According to this theory, learning occurs within a classroom community through interaction, dialogue, and engagement with others during conversations about mathematics. Powell and Kalina (2009) explored the practical applications of social constructivism in educational settings, demonstrating how problem-solving and collaborative activities enable students to co-construct knowledge and develop higher-order thinking skills.

Conversations serve as essential tools for collaborative sense-making and the co-construction of mathematical understanding (Bergem & Klette, 2016). One aspect of Vygotsky's theory is the role of the *more knowledgeable other*, who facilitates learning by guiding interactions and supporting less experienced learners in their understanding of mathematical concepts. By focusing on classroom conversations, my aim is to afford PSTs opportunities to externalize their thought processes, share diverse perspectives, and negotiate meanings with the more knowledgeable other. This collaborative endeavour with MTEs allows mathematical ideas to be socially constructed and explored more deeply within the group, fostering a supportive environment for learning and teaching mathematics.

Complexity Thinking in Mathematics Education

Mathematics classrooms can be viewed as complex learning systems where various elements—students, teachers, tasks, and tools—interact dynamically (Davis & Sumara, 2006). Evidence of complexity occurring in the natural world (e.g., a hive of bees, a colony of ants, a flock of birds, etc.) draws attention to the interconnected and adaptive interactions among classroom learners which create rich discourse through mathematical conversations (Johnson, 2009). Rather than functioning as a linear or predictable environment, a mathematics classroom operates as a dynamic ecosystem where the exchange of ideas, feedback loops, and social interactions all contribute to learning outcomes (Davis & Simmt, 2003). A complexity thinking perspective encourages MTEs to facilitate open-ended discussions, problem-solving tasks, and inquiry-based learning with PSTs to bring about collectively what might not be possible as individuals. In such contexts, unpredictable yet productive discourse emerges as PSTs engage with mathematical ideas, allowing them to explore, negotiate, and refine their understanding of mathematics in a collaborative environment.

Discourse in Mathematics Education

Classroom discourse means more than communication; it serves as a complex means for learners to engage in higher-order thinking, critique reasoning, and build connections among mathematical concepts (Cazden, 2001). Classroom discourse in mathematics highlights the roles of language, argumentation, and reasoning in developing mathematical understanding (Sfard, 2007). A focus on classroom discourse also emphasizes the importance of conversations as a vehicle for engaging students in the language of mathematics, thereby fostering deeper conceptual understanding through dialogue (Herbel-Eisenmann & Cirillo, 2009). Effective discourse in mathematics education requires balancing open exploration with structured guidance, where MTEs orchestrate conversations, pose probing questions, and encourage PSTs to articulate, justify, and refine their mathematical ideas.

This theoretical framework provides a multifaceted lens for viewing how mathematics conversations can serve as a vital tool to promote meaningful classroom discourse and build PSTs' confidence in their mathematical abilities within a complex learning system. By fostering open, dynamic, and purposeful discourse, MTEs can create an environment that enhances PSTs' mathematical understandings while preparing them to teach in ways that give their future students opportunities to develop a positive relationship with mathematics.

Methods

Research Design

This study employs a qualitative research design to explore the impact of conversations on PSTs' emotional responses and beliefs about mathematics. The focus is on

understanding more fully how open dialogue can foster confidence and engagement in mathematics education.

Setting

The research was conducted at a small university in Eastern Canada, where the Faculty of Education offers a two-year post-undergraduate degree teacher education program. The study took place during a mathematics confidence workshop designed for PSTs nearing the completion of their professional certification program.

Participants

The participants in this study consisted of 25 PSTs enrolled in the second year of their teacher education program. These PSTs had recently completed their second curriculum and instruction course in mathematics education and their fourth and final practicum placement, providing them with relevant experiences to draw upon during the workshop. Participation in the workshop was offered after the completion of their course work and was entirely voluntary for all PSTs. PSTs' responses to conversation prompts and reflective feedback were anonymized with the help of a colleague not directly involved with the class.

Instruments

To facilitate open dialogue among PSTs, I developed three distinct sets of conversation cards, each containing 30 to 40 cards. These cards feature prompts, questions, and vocabulary aimed at exploring various aspects of mathematics learning, teaching practices, and personal experiences with the subject. The content of the cards is derived from my own research and includes responses, reactions, and emotions related to learning and teaching mathematics encountered in my role as a MTE. I designed the conversation cards to prompt PSTs to reflect on their beliefs about mathematics and reinforce their conceptual understanding through language. The conversation cards often spark positive and negative memories of mathematics from PSTs and sometimes emotional responses that are intense. I am mindful to caution PSTs of the strong feelings related to mathematics anxiety that some people may experience and remind myself as well as others to remain sensitive to their participation.

Procedures

During the mathematics confidence workshop, PSTs engaged in small-group discussions using the conversation cards. Each set of cards was utilized in specific activities (see Appendixes A, B and C) aimed at unpacking PSTs' individual perceptions of mathematics. The activities encouraged participants to share personal experiences, articulate their beliefs, and explore their emotional connections to the subject. Below, I outline three activity examples and offer samples from the conversation cards for reference as well as strategies for implementing the cards in practice. At the end of this paper, I provide the full sets of conversation cards that MTEs can use with their PSTs.

Data Collection

Data for this study were collected through multiple methods. Audio recordings of the small-group discussions were made to capture the conversations as PSTs interacted with the conversation cards. Additionally, participants were asked to write reflections following the workshop, allowing them to articulate their thoughts and feelings about their experiences during the activities. These reflections provided valuable insights into the emotional impact of the conversations on their beliefs about mathematics.

Data Analysis

The audio recordings of the discussions were transcribed and analyzed using thematic analysis to identify common themes and patterns in PSTs' emotional responses and beliefs. The themes were shared with PST participants for accuracy and verification. The written reflections were also examined to supplement the findings from the discussions, providing a comprehensive understanding of how the conversation cards influenced PSTs' confidence and engagement with mathematics.

Activities for Using Conversation Cards

I use a variety of activities with the conversation cards to stimulate dialogue among PSTs. To foster a trusting and supportive environment, I encourage PSTs to engage in discussions without a designated facilitator. This approach allows for organic conversation, where PSTs can freely participate while remaining sensitive to their peers' emotions and experiences. Establishing this trust is important, as it enables participants to share openly and feel comfortable expressing their thoughts.

The first activity involves using a specific set of conversation cards (see Appendix A), where PSTs take turns turning over one card at a time and discussing the statement written on it. After discussing the statement, if a participant agrees with it, they may choose to keep the card. If multiple participants wish to keep the same card, each must present a compelling argument for why they should have it. If no one agrees with the statement

or feels strongly about it, the card is placed in a discard pile. The objective is for each participant to select a set of cards (4 – 6) that best represent their thinking on the topic. As a follow-up, I encourage groups to examine the discard pile and reflect on their decision-making process regarding which cards to keep or discard.

The second activity, using a different set of conversation cards (see Appendix B), involves spreading all the cards face down in front of the group. Each member randomly selects six cards. Participants take turns reading aloud the statements on their cards. After each reading, they may choose to keep the card as one of their six or discard it, selecting a new card in its place. This activity ensures that participants always hold six cards, facilitating a dynamic exploration of their beliefs and feelings about mathematics. Additionally, group members can engage in a collaborative discussion about each card, selecting those that most accurately represent the collective feelings or beliefs of the group. I encourage dialogue for each card to reach a consensus on whether to keep or discard it. This process allows for conversation and debate, enabling group members to discover additional meaningful cards. After groups finalize their selections, I ask each group to share their chosen six cards with the other groups. This sharing stimulates further discussion, comments, and questions, creating an enriching environment for collective learning.

The third activity, called The Word Sort (see Appendix C), is another engaging strategy where PSTs analyze the vocabulary associated with mathematical concepts. In this activity, participants consider words related to division, including everyday terms (e.g., share, group, equal, same) as well as technical vocabulary (e.g., divisor, dividend, quotient). By grouping and regrouping these words according to their own criteria, PSTs engage in discussions about the meanings and connections among them. This sorting activity often leads to rich conversations about the concept of division, drawing on PSTs' firsthand experiences and prompting new insights into the teaching and learning of the topic.

Findings

Following the conversation card activities, I prompted PSTs to reflect on the impact of their experience engaging in these discussions on their future teaching approaches and their relationship with mathematics. The voices of the PSTs who participated in these conversations reveal insights of interest to MTEs. Thematic analysis of the reflections yielded two primary categories: (1) PSTs expressing and unpacking their emotional reactions to mathematics, and (2) PSTs' desire to shift the conversation toward building confidence for themselves and their future students.

Unpacking Emotions

After engaging in conversations with their peers, PSTs wrote reflections that highlighted their emotional experiences. For example, Sandy expressed the shared emotions within the group, citing past encounters with inadequate teaching and the discomfort of "being put on the spot in class," which heightened her anxiety surrounding the subject. Alayne noted similar feelings, writing, "When we broke up into groups to discuss our conversation cards, I was surprised to hear how many of my classmates shared the same struggles and insecurities as I did throughout my education."

Iain remarked that the activities "would be beneficial for certain elementary grades (as well as being beneficial for anyone in general to express how they feel about math), as it allows students to realize they are not alone if they are struggling in some way." Similarly, Joannie emphasized, "They [future students] are able to talk out loud about their math anxieties if they are experiencing those feelings and realize that other students may be feeling the same way." Yannick found collaborating with peers on activities and participating in discussions transformative, stating, "Not only could I share my opinion but I could also listen to the opinions of others. This has helped me tremendously in terms of seeing things from a different perspective and to shine things in a different light than I am used to." Coral echoed this sentiment, writing, "We all benefit in not only becoming better learners but also better teachers," highlighting the value of collaborative learning experiences in fostering both personal growth and professional development.

These reflections collectively illustrate how the conversation card activities facilitated emotional unpacking and reinforced the importance of community among PSTs. By sharing their experiences and anxieties, PSTs gained insights into their own feelings about mathematics and recognized the shared nature of these emotions, thereby fostering a supportive environment that can enhance their confidence in teaching mathematics.

Building Confidence

PSTs conveyed a notable shift in their perceptions of mathematics, expressing increased confidence in the subject. For example, Corey articulated a connection with peers and a growing comfort with mathematics, stating, "By breaking it down and discussing how we felt about mathematics, both positively and negatively, I was able

to establish a sense of connection with my classmates, which in turn made me feel more comfortable making mistakes. This was definitely an 'aha' moment for me."

PSTs also reflected on the issue of mathematics anxiety and its implications for their future classrooms. Sharon noted that the sharing activity prompted PSTs to consider strategies for "alleviating math anxiety in our future students." Teo acknowledged the benefits of using the activities in future practice, stating, "Allowing students to talk about their feelings of math and their experiences will lead the way for them to create relationships to lean on one another in their future studies." Gurpreet emphasized the importance of addressing the "real issue of math anxiety" through open dialogue, recognizing the conversation cards as effective tools for facilitating these discussions and "promoting a safe learning environment."

These reflections from PSTs illuminate the pivotal role of conversations within a supportive environment in reshaping beliefs about mathematics and addressing mathematics anxiety in both current practice and future classrooms.

Discussion

PSTs' voices showed that using conversation card activities to unpack emotions related to mathematics may support confidence building and have implications for their future teaching approaches. Through peer discussions, PSTs such as Sandy and Alayne shared common experiences of anxiety and insecurity connected to past educational challenges, highlighting the importance of community in addressing these feelings. As Peker and Ertekin (2011) recommend, PSTs benefit from a comprehensive approach that focuses on cognitive, emotional, and contextual factors to help mitigate mathematics anxiety. The realization that many classmates echoed similar struggles fostered an environment of empathy and support, which Iain regarded as important for fostering resilience in young learners.

Joannie emphasized the significance of providing future students with opportunities to share their anxieties, a practice that could help counterbalance previous negative experiences with healthier narratives. This idea resonates with the findings from Gutiérrez et al. (2023), which advocate for the importance of emotional expression in the mathematics classroom. The collaborative nature of these activities transformed perspectives; for instance, Yannick noted that engaging in focused discussions allowed him to listen to diverse opinions, thereby broadening his understanding of mathematical challenges. This connection to collaborative conversation reflects the value of creating spaces where PSTs can articulate and negotiate their learning experiences together.

PSTs expressed a notable shift toward increased confidence in their mathematical abilities, as illustrated by Corey, who described how discussing their feelings led to greater comfort with making mistakes. While comfort with the subject is an important step, it is essential to recognize that confidence encompasses a broader belief in one's abilities to tackle mathematical tasks effectively (Ren & Smith, 2018). This newfound sense of comfort prompted critical reflections on their future classrooms, with Sharon and Gurpreet advocating for strategies to alleviate mathematics anxiety among their students.

These findings illustrate the transformative power of open dialogue and emotional unpacking, suggesting that creating supportive learning environments is essential for reshaping PSTs' beliefs about mathematics. By equipping PSTs with the tools to foster a positive mathematical experience in their future students, MTEs can contribute to a more favorable perception of mathematics education.

Strengths and Limitations

The findings from this study offer several key takeaways that support the formative education of PSTs. The findings encourage PSTs and potentially early-career mathematics educators to acknowledge their beliefs and emotional responses to learning, engaging with, and teaching mathematics. This self-awareness fosters a positive attitude toward mathematics education. As well, the study contributes to building confidence among PSTs, as they begin to recognize the complexities involved in learning and teaching mathematics. Engaging in conversations about their experiences allows PSTs to navigate their anxieties and develop a more nuanced understanding of their future roles as educators.

The study's limitations should also be acknowledged. The small sample size of PSTs who participated in the required mathematics methods course may restrict the breadth of the findings. Participation in the conversation prompts and reflective feedback was voluntary. Reflections were not part of class assignments which may have impacted the degree to which PSTs were willing to share. A more extensive and diverse sample to further explore the dynamics described in this study may potentially lead to richer insights into the experiences of PSTs in mathematics classrooms.

Concluding Thoughts and Future Considerations

Utilizing conversation cards has proven to be a valuable tool for engaging PSTs in meaningful exchanges (Throop-Robinson, 2020), thereby deepening understandings of the impact of mathematics anxiety on both teaching and learning. These activities facilitated rich discourse among PSTs, fostering a culture of empathy and mutual understanding as they listened to and responded to each other's feelings and ideas. Such collaborative discussions help create a supportive environment that allows PSTs to navigate their anxieties and build confidence in their mathematical abilities.

Moving forward, it is essential to acknowledge how emotional connections to mathematics contribute to classroom discourse and support these affective aspects of learning. Future research could focus specifically on individual PSTs who identify as experiencing mathematics anxiety and are willing to engage with the activities described in this study. Tracking their journeys from recognizing past experiences to forming new emotional connections with mathematics may provide valuable insights for others who share similar feelings.

Additionally, exploring the potential of conversation cards in formative assessment through ongoing dialogue and observation holds promise for enhancing teaching practices. This approach can empower PSTs to carry these strategies into their future classrooms, promoting an environment that addresses mathematics anxiety while fostering a positive mathematical identity among their students.

Lastly, I include complete sets of conversation cards for use with PSTs and other mathematics educators in Appendix D. I encourage MTEs to review the questions and prompts thoroughly before offering them for discussion with PSTs and to anticipate potential responses for each card individually. Please refer to the activities described above to orchestrate the conversations, being mindful that individual responses, questions, and comments will be unique to every situation. It is my hope that additional questions and prompts from PSTs will emerge and new cards added to these sets over time.

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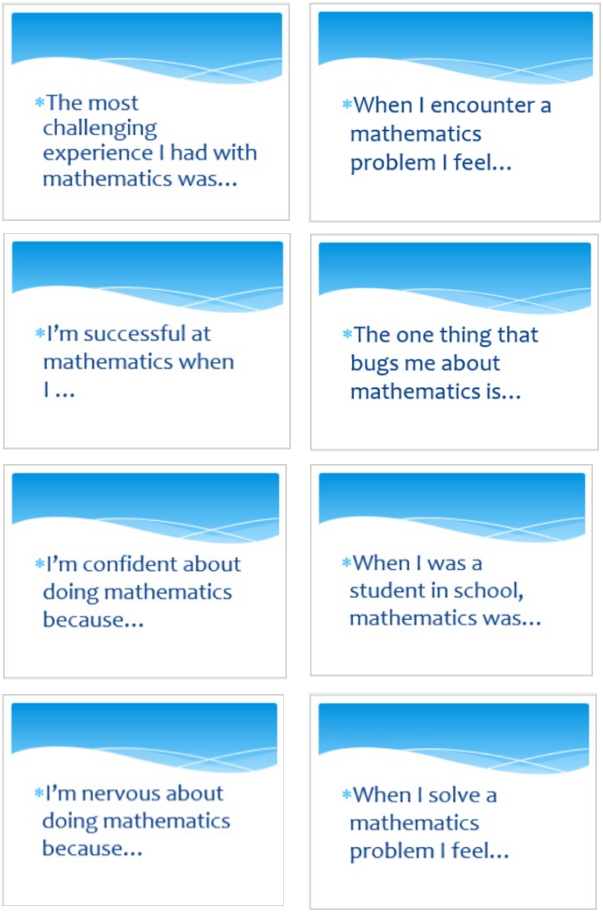
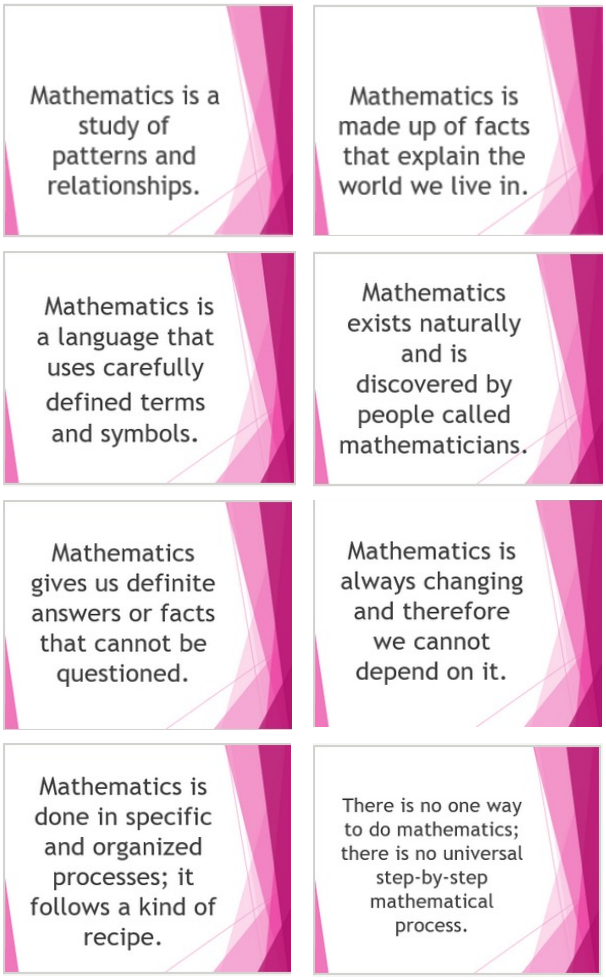
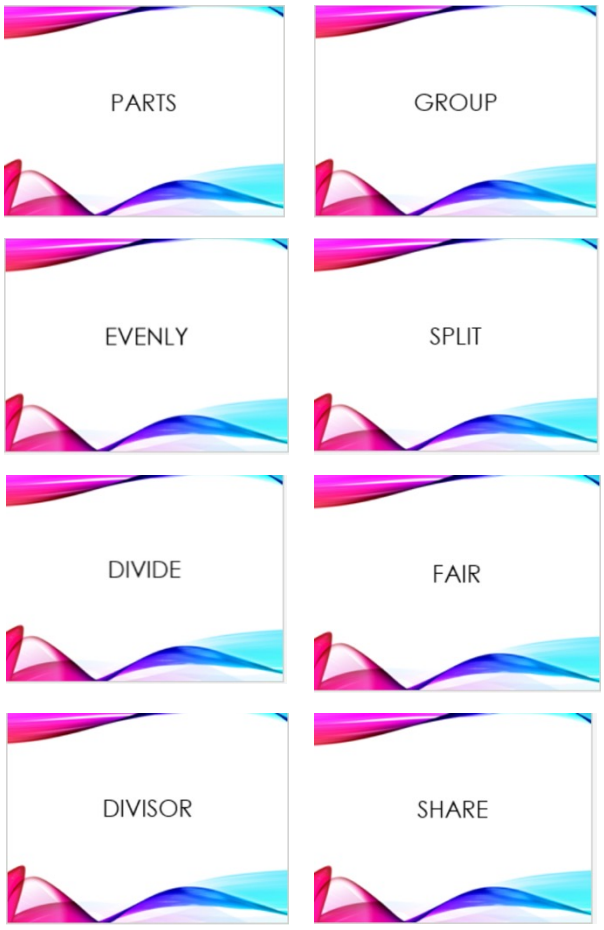
Appendix A
Conversation card activities: Beliefs about mathematics

Activity	Process	Sample Cards
Emotions Count: Reflecting on beliefs about mathematics	• The objective is for each PST to share from experience their emotions about mathematics. • Teachers alternate turning over one card at a time. • After reading the statement aloud, each teacher completes the phrase and offers a connection or a reflection about the sentence. • Teachers may comment or reflect on the contributions of others as the conversation unfolds. • NB: In some cases, groups may discuss several cards at once or, depending on individual experiences, focus specifically on just one or two.	

Appendix B
Conversation card activities: The nature of mathematics

Activity	Process	Sample Cards
What is mathematics?: Connecting with the nature of mathematics	• The objective is for each teacher to select a set of cards (4–6) that best represents their thinking about what they believe mathematics to be. • Teachers alternate turning over one card at a time. • After reading the statement aloud, teachers decide whether they agree with it or not, and why. • If more than one teacher agrees with the statement, each person will present a persuasive argument to decide who will hold the card in their hand. • If no one agrees with the statement or does not have strong feelings, the card is discarded.	

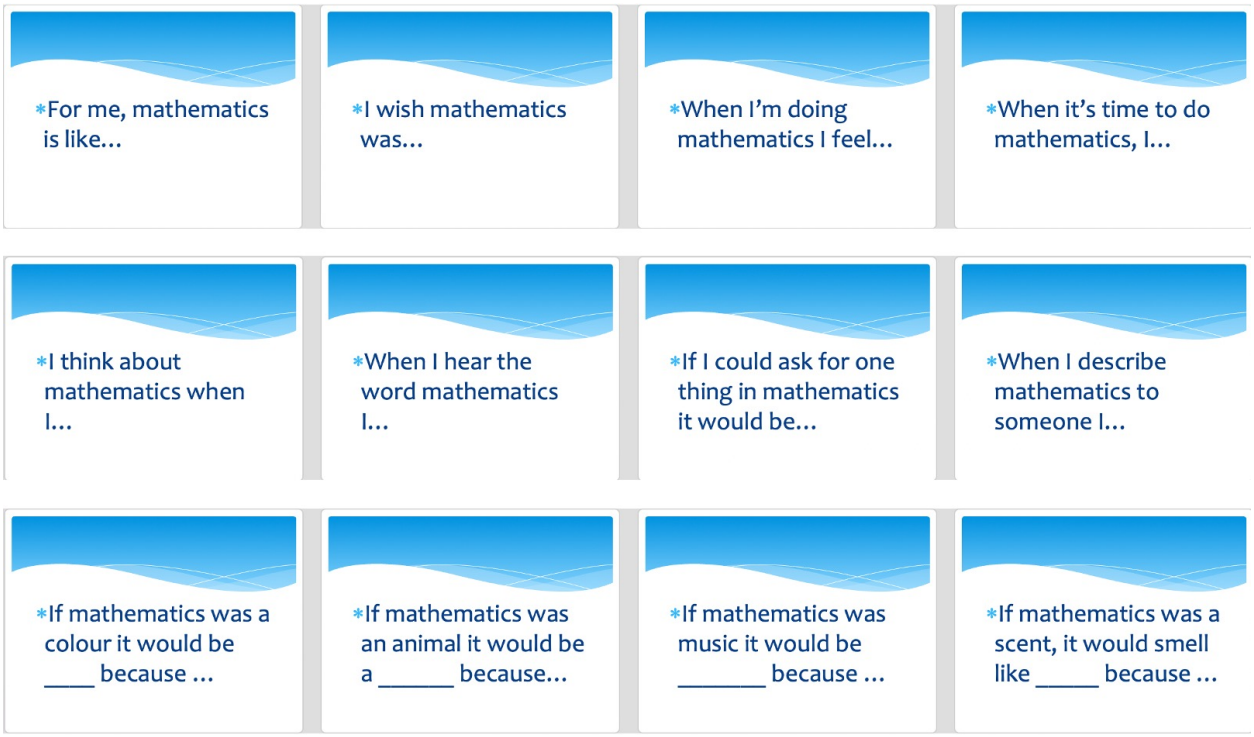
Appendix C
Conversation card activities: Mathematical vocabulary

Activity	Process	Sample Cards
Word Sort: Reviewing conceptual understanding of mathematics	• The objective is for teachers to build their conceptual understanding of mathematics through exploration of the words commonly used with each topic. • As a group, teachers look at all the words on the cards and discuss their associations, similarities, and differences. • Round 1: Teachers make decisions about how to group the words together into four groups. They provide a title for each grouping. • Round 2: As above, making three groups and re-naming the groupings, as necessary. • Round 3: As above, making two groups.	

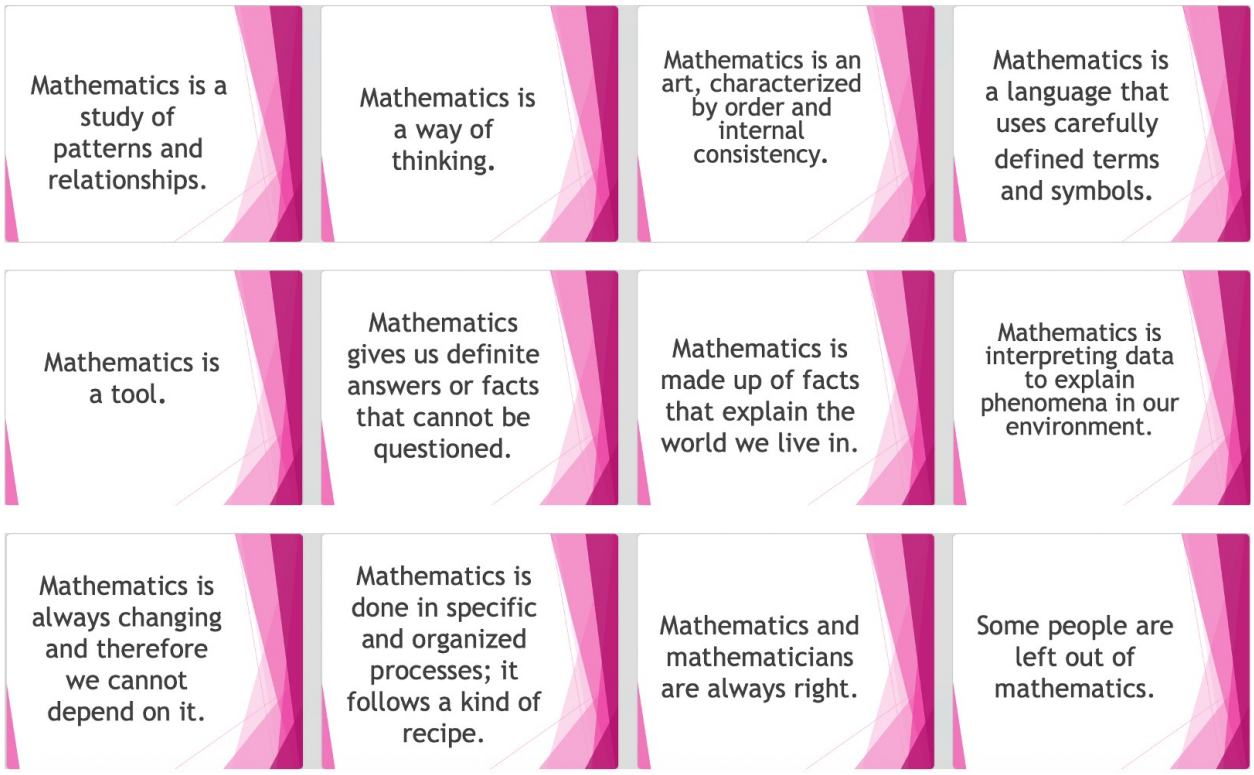
Appendix D
Conversation cards

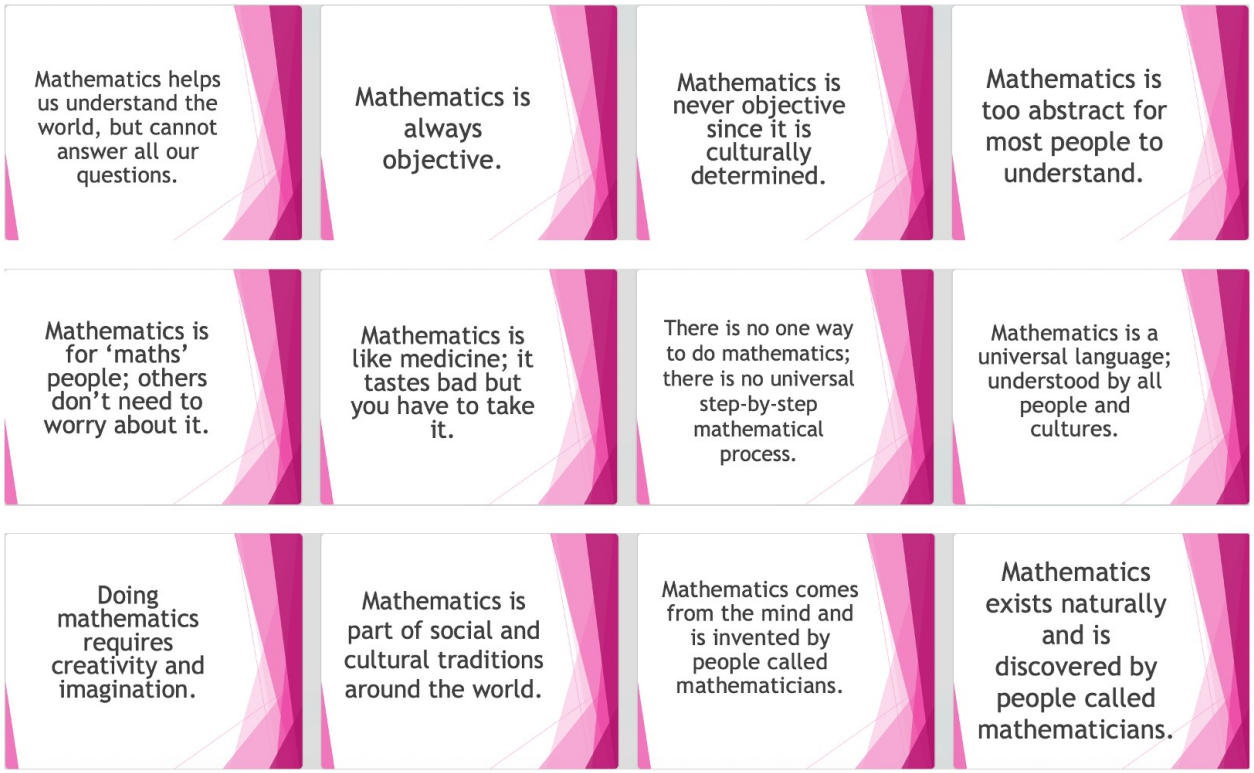
Emotions count: Reflecting on beliefs about mathematics

*My favorite thing in mathematics is…	*My learning style helps me learn mathematics because …	*My teacher supported me in mathematics learning because …	*I'm successful at mathematics when I …
*I am persistent in mathematics because …	*I like mathematics drills because …	*For me, knowing how to solve a problem is important because …	*I take my time in mathematics because …
*I take pleasure in solving problems because …	*The one thing I love about mathematics is…	*I like mathematics because…	*I love mathematics because…
*My least favorite thing in mathematics is…	*My teacher didn't support me in mathematics learning because …	*My patience wears thin in mathematics because …	*My learning style doesn't support mathematics learning because …
*I cringe at solving problems because …	*One negative word that describes mathematics is _____ because …	*I feel rushed in mathematics because …	*I don't like mathematics drills because …
*The one thing that bugs me about mathematics is…	*Mathematics is hard because…	*I avoid mathematics when…	*I am mathematics anxious because…

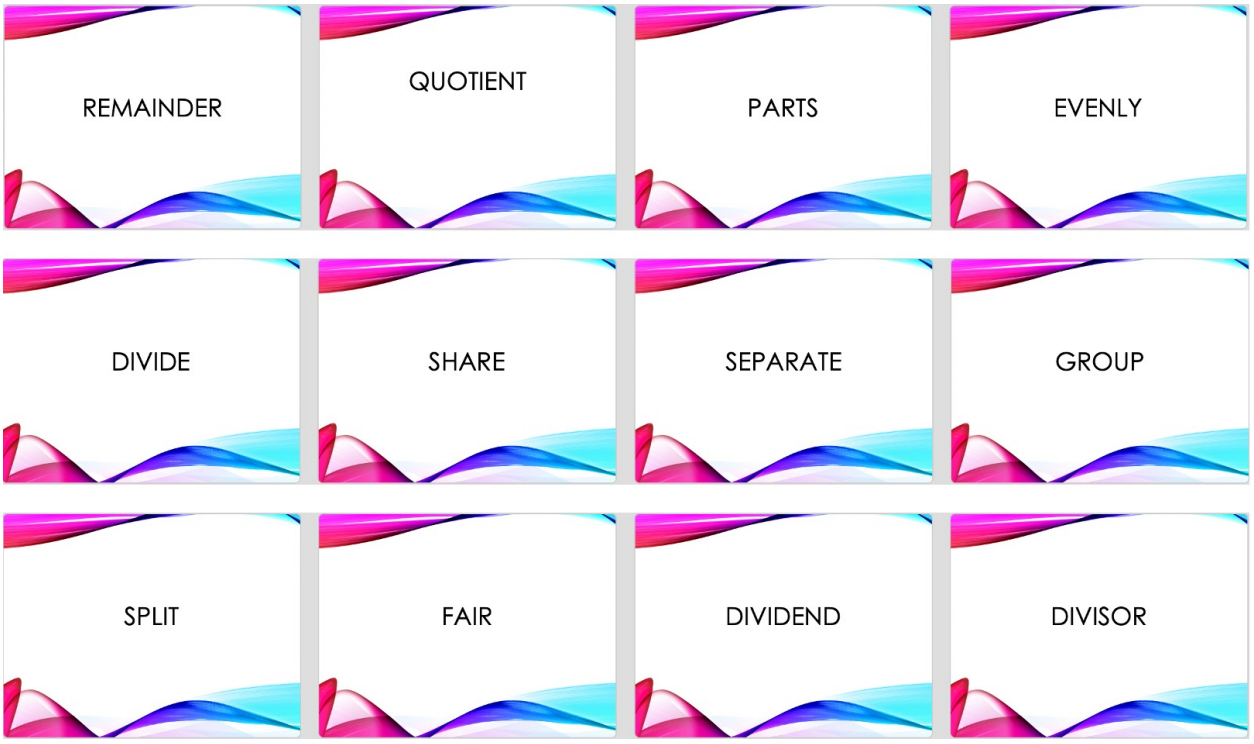


What is mathematics?: Connecting with the nature of mathematics





Word sort: Reviewing conceptual understanding of mathematics—Division



Word sort: Reviewing conceptual understanding of mathematics—Multiplication