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Mathematics Anxiety: Identity Work in a Gifted Prospective Elementary Teacher's Mathematics-related Personal Narratives

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Previous studies have focused on negative physiological sensations and psychological emotions of mathematics anxiety experienced in real time. Similarly, prior research has noted that prospective elementary teachers (PSTs) may experience such feelings of distress while learning to teach mathematics in their teacher-preparation programs. Mathematics teacher educators have sought to reduce elementary PSTs' mathematics anxiety by improving their mathematical content knowledge and discipline-specific pedagogical knowledge. But why might mathematics anxiety persist even after elementary PSTs have successfully completed such teacher-preparation coursework? Our case study of a female elementary PST, identified as *gifted*, illustrates how mathematics anxiety, when reinforced by personal narratives that create and reiterate patterns in past mathematics learning, can operate as an enduring identity (e.g., a mathematics-avoidant identity), long after the stressful events prompting that anxiety have ended. Thus, such narrative identities can engender new/similar experiences of anxiety in present and future mathematics learning/teaching and can ultimately influence the educational and professional decision-making of adult PSTs, even though such self-understanding is based in oft-told stories of childhood and adolescence. The influence of mathematics-anxiety identities merits further exploration, as most previous studies of mathematics anxiety have tended not to address the significant identity work that PSTs undertake during professional development.

Keywords • mathematics teacher education research • mathematics anxiety • mathematics identity • gifted and talented • prospective teachers

Introduction

Mathematics anxiety is "a state of discomfort that occurs in response to situations involving mathematical tasks that are perceived as threatening to self-esteem" (Trujillo & Hadfield, 1999, p. 173). Such experiences may produce "a general fear of contact with mathematics, including classes, homework, and tests" (Hembree, 1990, p. 34). For the past two decades, mathematics education researchers and teacher educators have given increased attention to mathematics anxiety (e.g., Brady & Bowd, 2005; Bursal & Paznokas, 2006; Gresham, 2007, 2017). Mathematics anxiety may not only impede K–16 students' learning of mathematics but may also hamper teachers' ability to provide effective mathematics instruction (e.g., Beilock et al., 2010; Luo et al., 2009; Sloan, 2010; Swars et al., 2006).

Mathematics Anxiety and Elementary PSTs

In particular, prospective elementary teachers (PSTs) are disproportionately affected by mathematics anxiety (e.g., Brady & Bowd, 2005; Bursal & Paznokas, 2006; Hembree, 1990). Most elementary teachers in the US are women and women are more likely to report mathematics anxiety (e.g., Beilock et al., 2010; Dowker et al., 2016). Gender-related discrimination in educational, professional, and broader cultural contexts discourages women from studying and pursuing careers in mathematics (e.g., Innabi & Dodeen, 2018; Xu, 2017). In a vicious circle, such limited experiences with successful participation in high-status mathematical activities may engender or intensify women's mathematics anxiety and may

preclude their future involvement in those endeavours (e.g., Brown & Bidy, 2010; Reid et al., 2018). On the whole, elementary PSTs do not specialise in mathematics during their undergraduate or graduate studies, in contrast with their secondary colleagues (e.g., Ball, 1988, 1990b). Accordingly, elementary PSTs generally exhibit less mathematical content knowledge and mathematics-specific pedagogical knowledge than do secondary mathematics PSTs (e.g., Ball, 1990b; Osana et al., 2006).

For this reason, mathematics teacher educators have sought to reduce elementary PSTs' mathematics anxiety by improving their mathematical knowledge for teaching (Hill & Ball, 2004) during their teacher-preparation programs (e.g., Gresham, 2007; Harper & Daane, 1998; Reid et al., 2018; Thames & Ball, 2010). In these efforts, particular attention has been given to elementary PSTs who have not excelled in their previous mathematics coursework (e.g., Ball, 1990a; Swars et al., 2009). Thus, opportunities remain to investigate mathematics anxiety in women elementary PSTs who, during their K–12 education, were identified as gifted and successfully completed challenging mathematics classes. For this study, we define the term gifted as a student who “performs or ha[s] the capability to perform at higher levels compared to others of the same age, experience, and environment in one or more domains” (National Association for Gifted Children, 2021). This is important to study as previous research has not examined the intersection between PSTs who were labelled as gifted early on in their educational experiences and mathematics anxiety and the influence these two variables may have on prospective elementary teachers' mathematical identity. In this study, we explore mathematics-related life stories recounted by one female prospective elementary teacher, Phoebe, across key phases in her teacher-preparation program.

Elementary Mathematics Methods Courses Focused on Reducing Mathematics Anxiety

Many previous studies have focused on constructing learning opportunities for elementary PSTs that address anxiety associated with learning and teaching mathematics (Gresham, 2007; Harper & Daane, 1998; McGlynn-Stewart, 2010; Sloan et al., 2010). For example, in Gresham's (2007), McGlynn-Stewart and Sloan's studies, the authors created mathematics methods courses that provided PSTs with opportunities to re-examine elementary mathematics content in supportive and collaborative ways. The mathematics methods courses concentrated on the use of manipulatives, cooperative learning experiences, and employing multiple teaching strategies as opposed to the more teacher directed experiences that many of the PSTs had experienced themselves.

All three studies revealed that overall; the PSTs' mathematics anxiety was reduced. The researchers attribute the decrease in anxiety to opportunities to clearly address and talk about learning and teaching mathematics. Moreover, they argued that (re)learning elementary mathematics content in a collaborative fashion that involved hands-on manipulatives while planning and presenting mathematics lessons decreased mathematics anxiety. Gresham (2007) shared that many PSTs reported “mathematics was now less foreign to them, noting that perceptions of their abilities to understand mathematics concepts were now enhanced” (p. 186). Taken together, these studies reveal that elementary mathematics methods courses may be an important space for PSTs who struggle with mathematics anxiety to begin to tackle and learn how to teach mathematics to their future students despite their own anxious feelings about mathematics.

Mathematics Identity in PSTs

Mathematics education researchers and teacher educators have highlighted the importance of identity—or a sense of belonging to communities, and of being able to participate fully and authentically in those communities' activities—as a mediating influence on PSTs' receptivity and/or resistance to learning knowledge, skills, and dispositions related to teaching particular subject areas, including mathematics (e.g., Gibbons et al. 2018; Philipp, 2007; Skott, 2019). Given that an individual's identity is complex and shaped by multiple experiences and situations (Canipe, 2020), Hodgen and Askew (2007) have proposed that:

Fundamental changes in teachers' beliefs and knowledge necessitate fundamental changes to teachers' identities involving far more than "fixing" or "topping up" teachers' "inadequate" knowledge. Professional change, then, involves at least in part becoming a "different" teacher and a "different" person. (p. 474)

Nevertheless, such simultaneous professional development and identity (trans)formation is complex: "Becoming 'different' involves letting go of what one has been at the same time as maintaining the more fundamental aspects of one's identity" (Hodgen & Askew, 2007, p. 474).

Mathematics teacher educators should have a deep understanding of the identities that elementary PSTs bring into their mathematics courses and how and if these identities change as they make their way through their teacher preparation programs (Gibbons et al., 2018). This is particularly important for elementary PSTs who possess a negative mathematics identity.

To facilitate teacher-identity work, mathematics education researchers and teacher educators have devised methods for integrating into teacher-preparation coursework elementary PSTs' critical and creative inquiries into their personal, educational, and professional lives. These efforts have centered on inviting elementary PSTs to recount their life experiences in written mathematics autobiographies (e.g., McCulloch et al., 2013) and in oral individual or focus-group interviews (e.g., Bjuland et al., 2012).

Some studies have specifically focused on how to create more positive mathematics identities for PSTs who possess a negative self-perception as mathematics learners and future mathematics teachers (Gibbons et al., 2018; Heffernan & Newton, 2019; Lutovac & Kaasila, 2014). For example, in Heffernan and Newton's (2019) study of sixteen PSTs, the PSTs completed multiple assignments (e.g., identity worksheets, reflective writing and identity mathematics exploration tasks) during a semester-long mathematics course to promote identity exploration. The findings from that study revealed that although the intervention shifted some of the PSTs' mathematics identity into a more positive direction, the intervention did not have this result for all of the PSTs.

Lutovac and Kaasila's (2014) study explored how six elementary PSTs who possessed a negative mathematics identity anticipated their future-oriented mathematics teacher identity. In the study, each PST was individually interviewed by the researcher and invited to tell their mathematics life story and how they envisioned themselves as a future mathematics teacher. Lutovac and Kaasila's study revealed that across the six PSTs, two categories emerged—decisive identity work and irresolute identity work. For the three teachers who were decisive about their identity work, they identified clear goals that included the need to work hard to overcome their fears and previous negative experiences of mathematics, the necessity to understand the mathematics content and a deep commitment to teach mathematics well. They had the expectation that they could reach their mathematical identity goals. The three teachers who were irresolute about their identity work lacked clear goals and were uncertain, fearful, and anxious about teaching mathematics in the future, especially as it related to being capable of explaining mathematics to their students. They struggled with believing that they could overcome their previous negative experiences with mathematics. Lutovac and Kaasila's work illustrates how some PSTs who possess a negative mathematics identity struggle to re-envision a more positive mathematics identity for themselves.

As illustrated above, previous studies have documented the extent to which negative mathematics experiences (including mathematics anxiety) shape elementary PSTs' personal identities (e.g., Brown et al., 2011, 2012; Gibbons et al., 2018; Heffernan & Newton, 2019; Lutovac & Kaasila, 2014; Stoehr, 2017a, 2017b). More research is needed to address how interpretive patterns in the recounting of such life stories can give rise to elementary PSTs' identities as students and teachers of mathematics to inform mathematics teacher-preparation courses that focus on elementary PSTs' identity work.

In this article, we begin to address the following questions:

1. How does a female elementary PST, identified as gifted during her K-12 school years, describe herself as a mathematics student and as a mathematics teacher?
2. What relationship(s), if any, does she draw among these identities and her experiences of mathematics anxiety at different moments in her education and career?

Theoretical Framework

In analysing the mathematics-related personal narratives of a gifted female elementary PST in the case study that follows, we draw on two related models of discursive identity formation, developed by education researchers, in light of previous research on the “narrative creation of self” (Bruner, 2002; see also Bruner, 1990; Holstein & Gubrium, 2000; Holland et al., 1998).

Identities as Socially “Recognised,” Culturally Mediated “Interpretations”

Gee (2001) has distinguished among four “perspectives on identity” (p. 100–107): Nature-identities, or biological traits (e.g., giftedness as innate intelligence); Institutional-identities, or social positions (e.g., giftedness as an academic ability group or school track); Affinity-identities, or ties of belonging (e.g., giftedness as membership in a peer group), and Discourse-identities (e.g., giftedness as a personal quality elicited, demonstrated, and validated through interactions with others—giftedness as an ongoing performative accomplishment). According to Gee, all four of these ways of understanding identity rely on interpretation; people draw on available cultural resources for meaning-making to recognise, describe, and explain patterns of being that they observe in others and in themselves. In this way, all four versions of identity rely on discourse (semiotic modes, social conventions, and cultural commonplaces) to signify at all, including those three that Gee does not explicitly label as “discourse-identities” (p. 109).

In this article, we present one female elementary PST’s personal narratives of her experiences with learning mathematics during her elementary, secondary, and undergraduate education; with learning to teach mathematics during her undergraduate teacher-preparation program; and with teaching mathematics during her semester-long fieldwork experience and student-teaching internship, both of which were required for the Elementary Education major. Through these accounts, Phoebe traced not only how she had been consistently designated as gifted by teachers and other school personnel through ability grouping and tracking in her elementary and secondary education, but also how she had come to appropriate this identity as a defining self-understanding. Moreover, in her personal narratives, Phoebe exercised all four of Gee’s (2001) perspectives on identity in describing her giftedness.

In addition, through our analysis below, we show how another important identity for Phoebe, “I’m not a math person,” conflicted with her “I’m gifted” identity in her accounts of her experiences both as a mathematics student and as a mathematics teacher. Much like her “I’m gifted” identity, Phoebe drew on all four of Gee’s (2001) approaches to present her “I’m not a math person” identity as a biological (in)capacity, a role established by school authorities and their evaluation systems, a way of (not) belonging with her peers, and an ongoing performance acknowledged by others through her (lack of) involvement in certain social activities.

Identities as Reifying, Significant, and Endorsable Narratives

In keeping with Gee’s (2001) discursive-psychological perspective, mathematics education researchers Sfard and Prusak (2005) argued that human beings learn who they are through participation in social interactions, during which they are defined—and come to define themselves—using cultural tools for sense-making. Whereas these researchers acknowledge opportunities for self-invention, Sfard and Prusak (2005) highlighted the differential interpretive power that significant narrators (authority figures) and institutional symbolic tools (e.g., diagnoses, certificates, nominations, diplomas, and licenses) may exercise in identity formation (p. 18), echoing Gee (2001)’s theorisation of institutional-identity.

According to Sfard and Prusak (2005), people may initially relate their experiences of events, both to themselves and to others, in narrative form; however, with time, they may come to reduce such detailed accounts (e.g., many examples of a student receiving an “A” grade for her school assignments and tests) to summative statements of being (e.g., “She is an A student”; “I am an A student”) (pp. 16–17). Moreover, people may then repeat such identity statements (implicit narratives) until they not only persuade themselves and others of their identity, but also use this sense of self to interpret their new

experiences, perhaps even embracing confirmations and dismissing contradictions of their self-understanding “in a direct, nonreflective way” (p. 17).

In this way, identities are *reifying*, they transform situated events into general patterns, then present those patterns as though they are real and predictive (Sfard & Prusak, 2005, p. 16). In particular, Sfard and Prusak have drawn attention to the reifying power of the verb “be, rather than do,” and of adverbs like “always,” “never,” and “usually,” which “stress repetitiveness of actions” (p. 16). Moreover, these researchers, like Gee (2001), have emphasised that identities are *endorsable*: identities must be recognised by others and/or claimed as our own to operate as effective descriptions of being (Sfard & Prusak, 2005). Finally, Sfard and Prusak have underscored that identities are *significant*: whether extended narratives, terse abstractions, or some other claim of being, identities influence how others engage with us and how we address ourselves: they are meaningful and meaning-generative.

In our analysis below of Phoebe’s personal narratives, we focus on her repeated assertion of two significant identities—“I’m gifted” and “I’m not a math person”—to describe, explain, and justify her experiences both as a mathematics student and as a mathematics teacher. We also consider them as reifying identities, as patterns of experience turned into symbolic tools of self-understanding. Moreover, we highlight how interpretations of Phoebe’s intellectual abilities, authored and endorsed by significant narrators whom Phoebe encountered during her K–12 education, dominate her accounts of her mathematical history, overwhelming alternative understandings of her knowledge, skills, and character offered by her teacher-preparation instructors and mentor teacher for her fieldwork experience and student-teaching internship. In addition, we show how Phoebe’s consistent use of her “I’m not a math person” identity was a strategy for coping with mathematics anxiety that she felt whenever she perceived a conflict between her “I’m gifted” identity and her sense that her mathematical performances on K–12 school assignments and tests did not match those of her gifted peers. We trace how Phoebe carried this coping strategy of mathematics avoidance forward into her work as a PST, long after her enrolment in mathematics courses had ended. In this way, we demonstrate how reiterated personal narratives can transform bounded experiences of mathematics anxiety into an enduring identity, which can then influence the educational and professional decision-making of a PST, even though that self-understanding is based in oft-told stories of childhood and adolescence.

Methodology

Site and Participant Selection

This article emerges from a larger, longitudinal, qualitative study of four female elementary PSTs enrolled in an undergraduate teacher-preparation program at a large public university located in the southwestern United States, all of whom reported having experienced mathematics anxiety (Stoehr, 2017a, 2017b). Phoebe’s participation in the study occurred in the final two years of her program, during which she completed her required teacher-preparation coursework for the undergraduate Elementary Education major and two fieldwork experiences and a student-teaching internship in local urban public schools. Identifying as a white native English speaker in her early twenties, Phoebe’s cultural background reflected that of the majority of elementary teachers in the United States (Beilock et al., 2010). Phoebe was initially selected as a participant in this study because her mathematics autobiography—a personal history of important experiences in her mathematical development, which she wrote for her mathematics teaching-methods course—clearly and powerfully described her experiences of mathematics anxiety, including her feelings of “fear,” “freezing up,” and “insecurity,” and her pervasive sense that she was “not smart” in mathematics and was a “weak” mathematics student.

Data Sources and Data Collection

Qualitative data collection for this longitudinal case-study research project (Dyson & Genishi, 2005) began when Phoebe was twenty-one and a college junior. It ended eighteen months later when she graduated with her Bachelor degree in Elementary Education. During this process, ongoing data sources

were gathered from Phoebe. In addition to her mathematics autobiography, which Phoebe wrote during the second semester of her junior year, Phoebe recounted personal narratives of her past, present, and projected future experiences related to mathematics learning and teaching in multiple interviews during Phoebe's final undergraduate years. Specifically, during her junior and senior years of college, Phoebe participated in four individual semi-structured life-story interviews (Atkinson, 1998; Seidman, 2006) conducted at her university. At the same time, during her fieldwork and internship semesters, Phoebe and the other three female elementary PSTs contributed to three semi-structured focus-group interviews (Morgan, 2001), one which took place in their mathematics methods classroom and two in a comfortable home site. All the individual and focus-group interviews were audio-recorded, then transcribed. Finally, as additional context for Phoebe's personal narratives of her experiences as a PST, Author 1 tracked Phoebe's progress through her teacher-preparation program and observed her as she taught one mathematics lesson to English-Spanish dual-language first/second graders during her fieldwork semester and three mathematics lessons to dual-language second/third graders during her student-teaching-internship semester. During these observations, Author 1 took detailed field notes (Emerson et al., 1995) and conducted three pre-observation interviews by phone and three post observation interviews at her student teaching school site. Moreover, the first author interviewed Ms. DeSoto, Phoebe's mentor teacher, during her student-teaching internship in Ms. Soto's classroom. This longitudinal collection of Phoebe's accounts of her mathematics-related experiences as a K-16 student and an elementary PST during this 18-month period allowed us to theorise how Phoebe's personal narratives functioned to interpret and make salient her experiences of mathematics anxiety, and how they reiterated and reinforced the mathematics-avoidant identity, "I'm not a math person," in response to those storied experiences.

Consistent with the informed consent procedures approved with the Human Subjects Institutional Review Board at the first author's institution, Author 1 was given permission to conduct this study. Permission was granted to collect written work, conduct multiple individual interviews, and several focus group interviews across the eighteen-month period with Phoebe, (a pseudonym that was given to protect the participant's identity). Additionally, the approval for this study also included interviewing Ms. DeSoto (pseudonym), who was Phoebe's mentor teacher.

Data Analysis

To investigate how Phoebe construed her experiences of learning and teaching mathematics, how she derived identities from those interpretations, and how she related those identities to her feelings of mathematics anxiety, if at all, we performed descriptive coding of her mathematics autobiography and transcripts of her individual and focus-group interviews (Saldaña, 2013), often using Phoebe's language to indicate topics. Examples of the words and phrases that Phoebe reported included feeling confused, discouraged, muddled, nervous, and uncomfortable. Simultaneously, we wrote memos to generate descriptive codes and thematic patterns (Saldaña, 2013). Regarding her significant identities, Phoebe repeatedly stated both "I'm gifted" and "I'm not a math person"—implicit narratives that she elaborated and made explicit by recounting events of her educational and professional history. Regarding her experiences of mathematics anxiety, some examples of Phoebe's language were "I was completely unsuccessful in math;" "I was grasping to understand;" "Math does not make sense to me;" "Math is just not my thing;" and "I shied away from math." Having completed this preliminary analysis, we engaged in focused coding, noting every example of a claim of identity or mathematics anxiety, the evidence used to support those assertions, and, when possible, the initial author of those arguments (e.g., Ms. DeSoto, Phoebe's mentor teacher during her fieldwork and student-teaching internship). To these theoretical codes (Saldaña, 2013), we added temporal subcodes to track when events occurred in Phoebe's storied life history. These "claim," "evidence," and "author" codes, in addition to the theme codes (e.g., "gifted," "mathematics anxiety"), facilitated our comparative analyses of their associated data. Again, memoing drove both our focused coding and comparative analyses (Saldaña, 2013).

We chose to present our findings through the case study approach, as case studies offer a method of exploration of a particular time period that focuses on specific situations where a series of detailed

information is collected in a variety of ways (Sykes & Bird, 1992). This methodological device allowed us to present Phoebe's narratives of mathematics anxiety as substantive and as a distinct case of how her identity contributed to her mathematics anxiety and her mathematics teaching anxiety.

Our attention to Phoebe's argumentation in her personal narratives revealed that she based her identity claim "I'm not a math person" in her experiences of mathematics anxiety. Phoebe associated giftedness with ease of understanding and performance, concluding that any effort or struggle to learn and achieve indicated lack of giftedness. Accordingly, Phoebe's experiences of effort or struggle with mathematical work engendered her anxiety at the prospect of not being gifted, her most valued identity in her personal narratives. To compensate for this threat, Phoebe insisted that she was not a math person and attempted to avoid mathematical work, when possible, both as a K–16 student and as a PST. Moreover, our analysis of Phoebe's argumentation in her personal narratives exposed that her primary self-understandings ("I'm gifted;" "I'm not a math person")—interpretive tools that she used to make sense and decisions as a PST facilitating mathematics lessons for dual-language first-third-graders—were based in her own storied experiences as a second-grader, when she was identified by school authorities as gifted, yet did not seem to master every mathematical topic as effortlessly as her peers.

Findings

As a child, Phoebe attended a public elementary school in her urban hometown in the southwestern US. When Phoebe was in second grade, she was given an IQ assessment test, based on the recommendations of her K–2 teachers and her elementary school principal that she be considered for the school district's program for gifted students. The school psychologist who administered the IQ test concluded from Phoebe's score that she was gifted. Subsequently, Phoebe was placed in the gifted ability group in all core school subjects, including mathematics, throughout her elementary education. Thus, in second grade, Phoebe's gifted identity was first reified, endorsed, and made significant by school personnel and institutional conventions such as IQ tests and ability grouping.

Also in second grade, Phoebe first appropriated this institutional-identity, which was purportedly based in an accurate assessment of her natural-identity. In fact, Phoebe was so persuaded of this established identity that she even used it to define herself as a PST, long after she had graduated from gifted ability groups and honours academic tracks. During the final two years of her undergraduate teacher-preparation program, Phoebe no longer participated in a gifted peer group (Affinity-identity) or a broader sociocultural world that could recognise her conduct as evidence of giftedness (Discourse-identity). Nevertheless, she referred to herself most often as "gifted" in her mathematics autobiography and in some of her interviews. Indeed, across these data sources, Phoebe repeatedly recounted her educational and professional history as the story of a gifted individual, who felt confident and competent in all subject areas except for mathematics for which she stated, "math is just not my thing" and "I'm not a math person."

In our analysis below, we provide evidence of how Phoebe's reiterated personal narratives reinforced and made continuously relevant by her experiences of mathematics anxiety, which, for Phoebe, was an anxiety about not being gifted: if a student is not able to excel at all school subjects, including mathematics, is that student truly gifted? We show how Phoebe's personal narratives repeatedly linked lack of giftedness with any effort to learn mathematical concepts and disciplinary practices, and how Phoebe's retelling of her personal struggles to understand and participate in mathematics, both as a student and as a PST, activated and sustained her mathematics anxiety, transforming discrete distressing experiences into the defining identity, "I'm not a math person." Moreover, we demonstrate how Phoebe's general fear of encountering challenges in mathematics classes—and of confronting the possibility that she is not gifted—contributed to her decisions not to enrol in optional mathematics courses in high school and college and her determination to pursue Elementary Education as her undergraduate major, which she believed would require little mathematical work. Thus, we describe how personal narratives of mathematics anxiety, when repeatedly used to interpret life experiences, can give rise to a mathematics-avoidant identity ("I'm not a math person").

Learning Mathematics as an Elementary Student

Phoebe's personal narratives of her educational history often centered on her comparison of her academic performances with those of her gifted classmates:

"... It was so hard for me because all of my friends were of that same ["gifted"] status, I guess you could say. It was hard because I would think about them, and they were better at math than I was. That was hard."

For example, Phoebe described her experiences during a unit of study in her second grade gifted mathematics class, devoted to Roman numerals, which she struggled to learn:

I recall not understanding how to count or read Roman numerals and feeling as though the rest of my classmates understood it so easily. It was such a terrible feeling that it took me until I was in my sophomore year of college [during a required mathematics content course for my major in Elementary Education] that I was actually able to read and understand Roman numerals.

In her personal narratives, Phoebe associated ease at demonstrating mathematical competence with giftedness. When it took her more time and effort to learn a new mathematical topic than it did her gifted classmates, she felt anxiety that she might not be gifted like them. However, this was but one unit of study in second grade. Moreover, it was on a topic that might be more appropriately categorised as disciplinary literacy than as mathematics. Nevertheless, in her personal narratives, Phoebe used this situated evidence from a decade previously as support for her generalised identity claim, "I never picked up on math problems." Indeed, Phoebe referred to this "Roman numerals" experience occasionally across her mathematics autobiography as proof that she was "not a math person."

Learning Mathematics as a Secondary Student

In recounting her experiences during her secondary mathematics education, Phoebe compared selected memories of her academic achievement with the purported successes of her gifted classmates. For example,

In high school, when I would get like a D on the test or something, and the [other honours-track] kids would just, no problem, get As and Bs, and it just made sense [to them], I just remember thinking, I just remember not understanding how it made sense to them and not to me.

In this personal narrative, Phoebe assumed that her honours-track mathematics classmates all earned "A" and "B" grades on every test. Moreover, she made the question of her "giftedness," in light of her meagre performance on a mathematics test, the central conflict of this story. Phoebe, however, could have interpreted and responded to this experience differently. For example, she could have focused on her own mathematical learning and taken steps to improve her understanding of certain curricular content. Instead of seeking help from her high-school mathematics teachers, whom she reported were often "a hindrance on my math education," Phoebe relied on casual support from a peer.

One of my good friends in my sophomore year of high school was in my math class. She got it more than I did, and she always did better than me on the tests and stuff. I remember she would try to explain, I mean, she was that kind of person. She would try to help me learn it and explain it to me. She just, yeah, she just understood it, and could do it, and knew what, yeah—wouldn't make the same mistakes I would, I guess.

Phoebe's high-school friend conveyed to Phoebe's confidence in her ability to learn mathematics, proposing and endorsing an alternative mathematical identity for Phoebe. Nevertheless, Phoebe continued to base her understanding of her mathematical competence in comparisons of her own challenges with her honours-track classmates' supposed ease in mastering mathematical topics. She associated effortful learning with lack of aptitude. Ultimately, Phoebe insisted, "I was completely unsuccessful in math," even though her high-school mathematics grade point average (GPA) was 3.0 ("B") and her overall high-school GPA was 3.7 ("A").

To cope with her experiences of mathematics anxiety that emerged when her giftedness was threatened, Phoebe developed an identity of mathematics avoidance by claiming, "I'm not a math person." This identity was so compelling for Phoebe that once she had met her high-school mathematics

requirement, she chose not to enrol in additional secondary mathematics classes, citing her previous struggles with the subject as the reason. Indeed, in none of her personal narratives did Phoebe acknowledge or embrace the possibility that struggle is inherent in any learning process, even for gifted students.

Learning Mathematics as an Undergraduate Elementary PST

With a broad brushstroke, Phoebe's personal narratives portrayed her mathematics educational history as a story of failure. However, this lessened in her accounts of her participation in two mathematics content courses for elementary teachers, required as part of her undergraduate teacher-preparation program:

I had the worst education when it came to math ... I had almost given up on math entirely by the time I got to the university ... Thankfully, my attitude was changed when I had to take the [first required] math course. Thanks to my wonderful teacher, my confidence in my math skills was restored to a certain degree. She was so patient and went through the lessons very thoroughly. Somehow, she shed new light on a subject that I could never quite understand. Things that I had struggled with as a kid were explained to me in a different way, [so] that they were suddenly very clear to me. Finally, I became the student who had the answer before the rest of my classmates and hardly ever struggled to understand a concept.

Consistent with her other personal narratives, this account focused not so much on Phoebe's newfound understanding of mathematical topics as on her experiences of outperforming her classmates with little effort—evidence that Phoebe interpreted as confirmation of her giftedness. In other words, Phoebe felt less mathematics anxiety in this undergraduate course because her gifted identity was not questioned in that context. Despite this boost in her confidence regarding her mathematical abilities, Phoebe maintained that nothing could “erase the old insecure feelings of being a weak math student.” Beyond the two required mathematics content courses for her teacher-preparation program, Phoebe did not enrol in any additional college mathematics courses, even though she had earned an “A” grade in both of the courses studied.

Learning to Teach Mathematics as an Undergraduate Elementary PST: Fieldwork

A major component of Phoebe's mathematics teaching-methods course during her junior year was a semester-long fieldwork experience in a local public elementary school. Phoebe was assigned to Ms. DeSoto's bilingual first/second-grade classroom in an urban Title I¹ elementary school serving socioeconomically challenged children and families. Ms. DeSoto was considered to be an expert teacher, as defined by her school district. Moreover, Ms. DeSoto was a supportive mentor to Phoebe, inviting and implementing Phoebe's contributions to mathematics lesson plans, and allowing Phoebe to tutor individual students in mathematics and facilitate small groups' collaborations on mathematical tasks. In her interviews, Phoebe expressed her respect for Ms. DeSoto and claimed that she had learned a lot about teaching by observing her mentor teacher. In particular, Phoebe highlighted Ms. DeSoto's talent for making mathematics comprehensible and relevant to culturally and linguistically diverse students.

Regarding Ms. DeSoto as a “gifted mathematics teacher,” Phoebe compared her first solo whole-class lesson to that high standard without considering that she was a novice teacher in the process of learning to teach mathematics. This lesson focused on geometry, a mathematical topic that evoked mathematics anxiety for Phoebe; “It makes me really uncomfortable.” According to Phoebe, she learned “next to nothing” about geometry during her elementary and secondary education, though her grade reports would contradict her self-assessment. Specifically, through this lesson, Phoebe aimed to teach the bilingual first/second-graders the distinctive characteristics of three-dimensional shapes (e.g., cube,

¹ Title I schools are comprised of children from low-income families that make up at least 40 percent of enrollment. Government funds are provided to operate schoolwide programs that serve all children in the school to raise the achievement of the lowest-achieving students. Further explanation of Title I schools available at <https://nces.ed.gov/fastfacts/display.asp?id=158>

triangular prism, rectangular prism). First, Phoebe presented the shapes of the faces of three-dimensional shapes (e.g., square, triangle, rectangle). Second, she indicated their vertices, and asked students to consider the number and relative length of each shape's sides. Finally, Phoebe invited students to describe "real world" examples of three-dimensional shapes, using mathematical vocabulary. As Phoebe was teaching the lesson, she became worried that the disciplinary terminology was too abstract and potentially confusing for her young bilingual students. Wanting to ensure student success, Phoebe used ordinary, concrete synonyms in her lesson, as well as the technical vocabulary. In doing so, Phoebe attempted to emulate a common pedagogical discourse strategy of her mentor teacher, Ms. DeSoto. Nevertheless, by the end of Phoebe's lesson, only a few of the students named correctly distinctive features of three-dimensional shapes. Based on this outcome, Phoebe concluded that she had failed.

During her debriefing of the lesson with Ms. DeSoto, her mentor teacher assured Phoebe that students often need more than one lesson to learn a new mathematical concept. Ms. DeSoto had observed Phoebe's mathematics-oriented interactions with students twice per week during the six weeks preceding the lesson, and was "impressed" by Phoebe's pedagogical ability, citing evidence of Phoebe's "organization" and "great rapport with the students." Thus, during this debriefing, Ms. DeSoto offered Phoebe the opportunity to identify and endorse herself as a competent elementary mathematics PST. Yet despite this positive feedback, Phoebe interpreted the students' performances as confirmation of her own lack of aptitude for the profession, as well as interpreting Ms. DeSoto's expertise as "innate" and not the result of more than twenty years of professional inquiry and experimentation. As a K–12 student, Phoebe experienced mathematics anxiety whenever her gifted identity was threatened by her unfavourable comparisons of her own work with that of her peers. Later, as a PST, she similarly reported mathematics teaching anxiety when she judged her first whole-class lesson against the mature teaching of her mentor and projected a bleak professional future for herself:

I am worried that I am not going to be able to do it. I'm not going to get the information or knowledge I need to bring it to my students ... I am worried that I am not going to know enough. I won't have a deep enough knowledge to help my students learn ... I'm nervous about math teaching.

Learning to Teach Mathematics as an Undergraduate Elementary PST: Internship

In her last semester of her teacher-preparation program, Phoebe completed her student-teaching internship, again with Ms. DeSoto as her mentor teacher, yet in a different dual-language second/third-grade class in another urban Title I elementary school. One of the whole-class mathematics lessons that Phoebe delivered independently during her internship focused on how increasing or decreasing the numbers in a subtraction problem affects the difference. Using the interactive white board, Phoebe drew her students' attention to a word problem about stickers. Phoebe asked the class to solve and explain which person would have more stickers left over:

A person who had ninety stickers, then gave away thirty-five; or a person who had ninety stickers, then gave away forty?

Although the class arrived at the correct answer, the students struggled to articulate why that answer was the solution to the problem. Phoebe attempted to clarify the target concept for the class but felt that her explanation was "muddled" and "confusing." Reflecting on this lesson, Phoebe recounted, "I remember feeling like I was struggling to find the words. I was grasping at what I was trying to say to make it clear." As in her earlier fieldwork lesson, Phoebe compared her novice pedagogical discourse to the expert communication of her mentor teacher, Ms. DeSoto. According to Phoebe, her "struggling" and "grasping" for instructive language indicated her reifying identity of "I am not a math person" to describe her lack of giftedness as a prospective elementary mathematics teacher. Moreover, she interpreted the students' participation in a learning process during the lesson (vs. their immediate, effortless understanding of the material) as evidence of her own teaching failure, even

though Ms. DeSoto insisted that the lesson was effective—"They [the students] got it!"—and that Phoebe was a talented new teacher.

By the end of her student-teaching internship, Phoebe was awarded the title "Student-teacher of the Year" by her teacher-preparation instructors for her outstanding achievements as an elementary PST. Nevertheless, Phoebe's personal narratives of her experiences with teaching mathematics, which extended her mathematics anxiety to encompass mathematics teaching anxiety, functioned to reinforce her significant mathematics-avoidant identity, "I'm not a math person," which she used as a coping strategy to maintain her most valued identity, "I'm gifted." Indeed, as symbolic tools of self-understanding, these narrative identities exercised such interpretive power for Phoebe that upon graduating from college, she did not immediately pursue an elementary teaching position. It was not until two years later that Phoebe accepted an elementary teaching position and taught for one year.

Discussion & Implications

In this article, we have described how Phoebe used her personal narratives to make sense of her past, present, and projected future experiences with mathematics learning and teaching. Indeed, she derived reifying, endorsable, and significant identities from those life stories (Sfard & Prusak, 2005) by claiming, "I'm gifted" and "I'm not a math person." Moreover, we have highlighted important educational and professional decisions that Phoebe made in light of those discursive interpretations of her mathematics education history and learning potential. Thus, our case study suggests that mathematical identities based in habitual narratives of personal experience can influence mathematics learning and teaching. Lawrence (2015) made a similar claim regarding literacy narratives and identities construed by those life stories. The research reported in this paper extends Lawrence's work by showcasing this phenomenon in mathematics education.

In addition, we have demonstrated how personal narratives of mathematics anxiety have the potential to extend the relevance and revelatory power of such experiences during teacher preparation, years after formal mathematics coursework and accompanying high-stakes tests have been completed. In other words, storied histories of mathematics anxiety can give rise to new experiences and tales of mathematics teaching anxiety. Previous studies have focused on the negative physiological sensations and psychological emotions of mathematics anxiety experienced in real time (e.g., Ganley et al., 2019; Harper & Daane, 1998; Hembree, 1990; Luo et al., 2009; Trujillo & Hadfield, 1999). Similarly, prior research has noted that elementary PSTs may experience such feelings of distress while learning to teach mathematics in their teacher-preparation programs (e.g., Brady & Bowd, 2005; Bursal & Paznokas, 2007; Dowker et al., 2016; Hadley & Dorward, 2011; Sloan, 2010; Swars et al., 2006). Our case study illustrated how mathematics anxiety, when reinforced by personal narratives that create and reiterate patterns in past mathematics learning, can operate as an enduring identity (e.g., a mathematics-avoidant identity), long after the stressful events prompting that anxiety have ended. Thus, such narrative identities can engender new/similar experiences of anxiety in present and future mathematics learning and teaching.

This research also suggests why mathematics anxiety and/or mathematics teaching anxiety (e.g., Brown et al., 2011, 2012) may persist even after (gifted) elementary PSTs have successfully completed teacher-preparation coursework in mathematics content knowledge and discipline-specific pedagogical knowledge (e.g., Hill & Ball, 2004; Thames & Ball, 2010). The influence of mathematics (teaching) anxiety as a narrative identity merits further exploration, as most previous studies of mathematics anxiety have tended not to specifically address the significant identity work that PSTs undertake during professional development. For the most part, mathematics anxiety has been studied from the perspectives of pre-service teachers (e.g., Gresham, 2007, 2017; Osana et al., 2006; Reid et al., 2018; Swars et al., 2009). This study explored one PST's mathematical identity through the identity lens of Gee (2001) and Sfard and Prusak (2005). Future research on elementary mathematics teacher education might address how mathematics-avoidant or adverse identities contribute to teacher attrition after graduation, as in Phoebe's case. Another rich line of inquiry opened by our research is how comparisons drawn by

elementary PSTs between themselves and their mentor teachers may affect both their experiences of mathematics (teaching) anxiety and their professional identity work during their teacher-preparation program and the beginning years of teaching.

Mathematics education researchers and teacher educators have called for sustained critical inquiry into elementary PSTs' personal narratives of learning mathematics, learning to teach mathematics, and teaching mathematics (e.g., Bjuland et al., 2012; Heffernan & Newton, 2019; Lutovac & Kaasila, 2014; McCulloch et al., 2013; Stoehr, 2017a, 2017b). In response to our case study, such efforts might include tracking how such life stories reveal perceptions of particular mathematical topics (e.g., geometry for Phoebe). Given that this study solely focused on Gee's (2001) and Sfard and Prusak's (2005) identity theories, there may be other identity lenses that could be considered as a means to explore tenets of PSTs' identity and mathematics anxiety.

Moreover, focused attention might be drawn to new sources of evidence and interpretive feedback on elementary PSTs' mathematical (teaching) performances, generated in their teacher-preparation coursework, field experiences, and student-teaching internships. Phoebe's case indicates that teacher educators and other mentors proposing alternative mathematical identities gleaned from observations and grades to elementary PSTs who experience mathematics (teaching) anxiety, may not be enough to disrupt their long-standing habits of self-understanding. Although mathematics teacher educators cannot go back in time and change elementary PSTs' anxiety-provoking experiences of learning mathematics, nor can they totally prevent new episodes of mathematics (teaching) anxiety, teacher educators can offer PSTs opportunities to explore, question, and revise their habits of narrating their mathematics-related experiences. Such critical inquiry might expose the limits of well-established interpretive perspectives for describing, explaining, and justifying elementary PSTs' thoughts, feelings, decisions, and actions. In providing explicit guidance for elementary PSTs' narrative identity work during their teacher-preparation programs, mathematics teacher educators might also consciously investigate for themselves their own role as significant narrators (Sfard & Prusak, 2005) of those storied lives, as authority figures representing the academic institution and the teaching profession. In this way, both elementary PSTs and mathematics teacher educators might respond to personal narratives and identities of mathematics (teaching) anxiety with greater compassion and responsibility.

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