"I Felt Sad, Stupid, and Annoyed": Characterising Primary Pre-Service Teachers' School Mathematics Experiences Through Achievement Emotions

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Pre-service teachers' (PSTs) past mathematics experiences shape their future teaching. We analysed 266 Australian PSTs' written recollections of positive and negative school mathematics experiences using Pekrun's Achievement Emotions Framework. Negative memories evoked shame (41%) and anxiety (32%), while positive ones reflected enjoyment (50%). We interpreted these emotions through the lenses of self-efficacy and mathematical wellbeing to understand how PSTs' emotional experiences might influence their capacity to flourish as mathematics educators. Findings reveal the lasting impact of negative experiences and the importance of supporting PSTs' self-efficacy.

Introduction

Mathematics anxiety is a common issue among primary preservice teachers (PSTs), often linked to negative past experiences and the belief that being good at mathematics equates to being inherently smart (Jablon Stoehr, 2017; Lo, 2021). These perceptions can lower PSTs' confidence in both learning and teaching mathematics. The findings of this study aim to deepen understanding of how PSTs' mathematics anxiety and self-efficacy beliefs develop, in turn helping teacher educators consider how to design supportive programs that build PSTs' self-efficacy, confidence and effectiveness for teaching mathematics as well as their mathematical wellbeing. By examining the interplay between achievement emotions, self-efficacy, and mathematical wellbeing, this study provides a holistic understanding of how PSTs' past experiences shape their future capacity to flourish as mathematics educators.

Past learning experiences in mathematics create a filter through which PSTs view what they learn during their initial teacher education programs (Bloomfield, 2010). Negative experiences when learning mathematics, including poor grades, uninspiring instruction or unsupportive teachers, can contribute to anxiety, negative attitudes and lower self-efficacy (Mazana et al., 2019). These experiences also undermine mathematical wellbeing in PSTs, which encompasses feeling positive and functioning optimally when learning or teaching mathematics (Hill et al., 2021). Conversely, positive school experiences of learning mathematics can positively impact PSTs' engagement with mathematics during teacher education programs (Chalkiadaki, 2018). When PSTs encounter positive mathematics learning experiences, they tend to be more motivated and exert greater effort to persist with challenges, which increases the likelihood of increasing their self-efficacy for teaching mathematics (Schunk & DiBenedetto, 2020). In

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recognition of the importance of considering prior experiences in influencing mathematical wellbeing and self-efficacy, our study aimed to address the following research questions:

How do PSTs describe positive and negative experiences with learning school mathematics?

What positive and negative emotions are evident in PSTs' descriptions of their learning experiences?

Literature Review and Theoretical Framing

This study drew upon literature and theories related to achievement emotions, self-efficacy, and mathematical wellbeing to interpret PSTs' emotional experiences in learning mathematics at school. These three theoretical frameworks are interconnected and important for understanding how PSTs' past mathematical experiences may shape their future teaching practices. Specifically, achievement emotions provide the lens for categorising and analysing emotional responses, self-efficacy explains how these emotions translate into beliefs about teaching capability, and mathematical wellbeing encompasses the holistic impact on PSTs' long-term flourishing when teaching and learning mathematics.

Achievement Emotions

Achievement emotions are feelings people experience in relation to academic activities, such as learning mathematics, or in response to achievement outcomes, such as success or failure (Pekrun, 2019). These emotions arise when a person's performance is evaluated according to standards of competence. Achievement emotions can be intensely experienced and impact people's learning and wellbeing (Pekrun, 2006). Given that performance evaluations are a central feature of education settings, classrooms are common settings where these achievement emotions are frequently experienced (Pekrun, 2019).

Pekrun (2006; 2019) developed a *Control-Value Theory of Achievement Em*otions (CVT) framework for conceptualising achievement emotions, which we draw upon in this study to guide our analysis. Rather than focusing on all three dimensions of CVT, we specifically utilise Pekrun's eight emotion categories (enjoyment, hope, pride, anger, anxiety, shame, hopelessness, and boredom) as our analytical framework. These categories enable systematic classification of PSTs' emotional recollections, providing insights into the valence and nature of their mathematical experiences. The three dimensions of CVT are: Valence classifies emotions as either positive (enjoyment, hope, pride) or negative (anger, anxiety, shame, hopelessness, boredom) based on subjective pleasantness. Activation differentiates emotions by arousal levels: activating emotions (enjoyment, pride, anger, anxiety) increase arousal and prepare learners, while deactivating emotions (boredom, hopelessness) decrease arousal and may cause withdrawal. Temporal classification categorises emotions by occurrence: prospective (before tasks), activity-related (during engagement), and retrospective (after completion).

Using CVT facilitates the analysis and interpretation of achievement emotions and supports understanding of how these emotions are experienced by learners. Analysis and interpretation can focus on how emotional experiences modulate cognition, information processing capabilities, motivation, and self-regulatory actions in learning situations (Pekrun, 2006; 2019).

Self-Efficacy

Bandura (1994) defines self-efficacy as a person's belief in their ability to perform a task to achieve a required or desired outcome. In the context of this study, self-efficacy serves as the bridge between PSTs' emotional experiences and their future teaching confidence. When PSTs experience negative achievement emotions such as shame or anxiety about mathematics, these emotions can diminish their self-efficacy beliefs when teaching mathematics effectively (Jablon Stoehr, 2017). Several factors contribute to a person's self-efficacy development, including mastery experiences (successful teaching opportunities), vicarious experiences (observing effective teaching), verbal persuasion (encouragement from mentors and peers), and

physiological factors (emotional responses to teaching challenges) (Bandura, 1994). Similarly, past experiences of learning mathematics can significantly shape PSTs' self-efficacy, influencing their confidence and approach to teaching the subject.

Mathematical Wellbeing

Mathematical wellbeing encompasses fulfilling one's core values whilst teaching and learning mathematics, contributing to positive feelings (e.g., enjoyment) and functioning (e.g., meaning, belonging) (Hill et al., 2021). This construct provides an overarching framework for understanding how emotional experiences influence PSTs' capacity to flourish as mathematics teachers. While achievement emotions capture immediate responses and self-efficacy addresses confidence and beliefs, mathematical wellbeing represents flourishing in mathematics, finding purpose, belonging, and sustained engagement. Research identifies seven core values supporting mathematical wellbeing: accomplishments, cognitions, engagement, meaning, perseverance, positive emotions, and relationships (Hill et al., 2021; Hunter & Hill, 2024). Pedagogies grounded in these values create enabling environments where students engage, perform well, persist through challenges, and feel a sense of belonging. Understanding PSTs' emotional recollections reveals how their mathematical wellbeing was shaped, potentially influencing their future teaching. In this study, enjoyment, hope, and pride indicated positive wellbeing, while shame, anxiety, anger, and hopelessness represent barriers. Hill and Hunter (2024) found positive emotions decline sharply from primary to secondary school, highlighting the critical importance of emotional experiences in mathematics classrooms.

Pre-Service Teachers' Past Experiences Learning Mathematics

Through recognising how prior learning experiences shape beliefs, attitudes, self-efficacy, and wellbeing in mathematics, we identify factors that could influence PSTs' pedagogical choices for teaching mathematics. PSTs' beliefs about teaching mathematics are likely shaped by their own mathematical learning experiences. They may employ familiar teaching practices they have observed or ignore them if they see little value in them (Brady, 2012). Similarly, when PSTs recall supportive, patient and enthusiastic teachers, they are more likely to associate mathematics with positive emotions such as enjoyment. This extends to teacher educators as well, with research showing that positive and enthusiastic role models and teachers at the tertiary level play a key role in enhancing PSTs' self-efficacy for teaching mathematics (Küçükalioğlu & Tuluk, 2021). Teacher educators can facilitate PSTs' development of strong self-efficacy in mathematics teaching by encouraging reflection on past learning experiences and modelling effective pedagogies.

Methodology

Following full ethical approval, a total of 266 PSTs from two Australian Universities across six campuses and four states or territories gave informed consent to participate in the study. Data were collected from 14 different cohorts of PSTs, who were enrolled in their first mathematics education pedagogy unit within an initial teacher education (ITE) degree for primary school teaching. All PSTs attended classes on campus and were asked to provide written responses to the following two prompts during their first class:

> Describe an *unpleasant* experience you can remember associated with mathematics during your school years. Try to describe why you felt as you did.
>
> Describe a *pleasant* experience you can remember associated with mathematics during your school years. Try to describe why you felt as you did.

The prompts were deliberately open-ended with 'school years' meaning they could recall experiences from primary or secondary school, or both. Minimal direction was provided by the respective tutors, other than explaining the purpose of the study and administering the

information sheet. PSTs were given 10-15 minutes to write their answers, but only responses provided by consenting participants were submitted to their respective tutors. Responses were anonymous and handwritten. Demographic details requested included first name (optional), gender, age range, and state or country of schooling. Initially, the data were inductively coded (Braun & Clarke, 2022), using NVivo to name categories and identify different themes. A codebook was developed, and a selection of 20 responses was coded by three authors. Discrepancies were discussed, some additional codes were added, and others were refined. Once reliability was established, the full dataset (n=266) was coded by the seventh author, with periodic reviews conducted by the first author to ensure accuracy and reliability. For this paper, all data were then deductively coded (Braun & Clarke, 2022), with responses coded to the eight categories of emotions as identified by Pekrun (2019).

Results

The results are reported in two parts: the frequency of codes and categories used to describe PSTs' written responses, and examples of positive and negative experiences.

Frequency of Categories of Experiences

When coding PSTs' pleasant and unpleasant experiences associated with learning mathematics at school, we were interested in analysing their written descriptions. Specifically, we focused on identifying the emotions associated with each description, categorising the recalled events as either positive or negative. Using Pekrun's (2006) achievement emotions framework, we conducted a frequency count of instances of each reference to the eight categories of emotions. Table 1 provides a brief description, a coding sample, and the frequency of responses that were coded positive (n=201) and negative (n=315). Some participants' responses were coded to more than one category (e.g., anger and hopelessness), and some responses were not coded to any of the eight categories.

Table 1

Emotion Categories and Frequency

Category	Description	Sample of coding	Frequency	Percentage*
Enjoyment	Happiness and delight	Hands on activities	132	50%
Shame	Guilt or embarrassment	Not know my times tables	110	41%
Anxiety	Unease or worry	Being put on the spot in front of the class	84	32%
Pride	A sense of accomplishment	Getting better with practice	62	23%
Anger	Displeasure or hostility	Frustrated and annoyed	56	21%
Hopelessness	Belief improvement is unlikely	Struggled to understand	38	14%
Boredom	Lack of interest or engagement	Doing boring worksheets	27	10%
Hope	Expectation of a positive outcome	Teacher cared about my learning	7	3%

* The percentage was calculated based on a total of 516 coded instances

Table 1 shows three positive emotions (enjoyment, hope, pride) and five negative emotions (anger, anxiety, boredom, hopelessness, shame) as reported by PSTs. Overall, enjoyment was the most frequent category for positive experiences (50%), and shame was the most frequent

category for negative experiences (41%). Negative emotions appeared more frequently than positive emotions, partly due to having two more categories. Additionally, the responses tended to be longer when recounting negative experiences.

Positive Experiences

Enjoyment was the most popular category (50%) for positive emotions. Examples included teachers who were encouraging and expressed pride in students' work, created caring environments, offered activities that enhanced understanding, avoided textbooks, and accommodated learning needs by providing multiple explanations from the teacher.

Teachers' dispositions were frequently noted:

> Having a passionate mathematics teacher who encouraged discussions about mathematics with friends made the subject more engaging.
>
> Knowing that the teacher genuinely loved mathematics inspired a deeper appreciation for the subject, helped make the subject enjoyable.

Enjoyment was sometimes associated with rewards such as:

> If everyone in our class completed our times tables up to nine, we could have an ice cream party. This motivated me to do my best.
>
> My teacher used monopoly money … when you completed tasks/homework …. You could pay for things like lollies, moving seats, free time etc.

Interactive mathematics activities were also associated with enjoyment. Four PSTs remembered enjoying games, including when using technology, multiplication and group games, while another PST remembered enjoying learning times tables through songs.

Overall, enjoyment was associated with supportive teacher attitudes, creative and interactive learning experiences, and motivational strategies that made mathematics feel accessible, engaging, and rewarding.

While *hope* was not often explicitly mentioned (3%), some responses referred to enjoyment and implied feelings of hope. One student described themselves as scared of high school, but their Year 8 mathematics teacher *"… made me feel smart and included and that if I put my mind to it, I could do it.*"

Hope was associated with the expectation of positive outcomes, such as "… *the teacher believed in me.*"

PSTs, as students, also liked to feel they belonged:

> …. I had a few teachers over the years who supported my curiosity about the subject and made me feel confident that even though I wasn't the smartest maths student, I still had value in their classroom.

Pride concerns a sense of accomplishment, and 62 (23%) recollected experiencing pride.

PSTs felt pride when receiving a high score on a mathematics test or knowing solutions that others did not.

> I studied really hard and shocked my teacher with a 90%.
>
> I met with my friends to discuss homework and felt proud when I knew something they didn't.

As with enjoyment, pride and hope can also be closely associated, as reported in the above responses.

Negative Experiences

Shame. Of the 266 unpleasant responses, 41% were classified as shame. They often included a direct reference to embarrassment, humiliation or feelings of guilt. The following illustrative comments reflect the types of experiences described:

> When others understood the maths concepts, I felt ashamed and scared to ask questions.

> When the teacher divided high-ability and low-ability learners, and I wasn't chosen for the high-ability group. I felt ashamed as I was usually chosen for the high-ability group.
>
> In Year 9, I was moved to a lower maths class. I remember feeling embarrassed.

Anxiety. Perhaps not surprisingly, 32% recalled unpleasant experiences related to feelings of anxiety or worry. Many of these experiences were characterised by being singled out, having to perform or demonstrate in front of the class or when completing timed tests, especially in primary school. For example, students reported:

> When we had to do timed times-table tests in Grade 3 … the other students would finish … yell out 'done' and it would increase my stress … I would sit there crying rather than completing it.

Mathematics was also associated with anxiety in secondary school, especially with not understanding the content or feeling unsupported by the teacher. For example:

> [Specialist Year 11] I struggled with understanding the content but was too afraid to ask the teacher. I was falling behind. I felt scared and worried … I wanted to catch up, I didn't know where to start.

Anger. Responses classified as 'anger' stemmed from a sense of injustice and/or frustration at not receiving support or nurturing from the teacher in learning mathematics topics. For example, one student recounted an unpleasant experience in primary school when:

> My teacher would only go over certain topics once, like fractions, and then not repeat the learning. I felt frustrated and annoyed and I felt disadvantaged due to her teaching.

Limited teaching approaches added to their frustration:

> One of my teachers only taught one way … it was very frustrating if you didn't get something.

Others experienced anger at themselves for not performing successfully on tasks:

> Year 12 … failing my maths class. I did my work homework, got tutored and studied before exams … but would still fail each exam. I felt sad, stupid and annoyed and I hated maths more than ever.

Hopelessness. This was manifested in responses that indicated a belief that effort was futile and improvement unlikely. Responses such as "struggled with maths in primary school and never really understood it," with feelings of "being left behind" or told to "get a tutor because I'm not going to help you", removed the sense of hope of achieving success in mathematics. For many of these PSTs, it seemed that if they had received additional support rather than being 'disregarded', their learning experiences might have been more pleasant. Responses coded to hopelessness often included references or implications of anger. For example:

> Struggling to grasp concepts of algebra, calculus in later levels. I felt it lost relevance for me as I couldn't see the point of it in real life context. I felt frustrated and dumb and I fell behind.

Boredom. Recounted experiences classified as 'boring' often included references to worksheets and textbooks. For example:

> Throughout year 10 I was in a mathematics class with a teacher who did not explain the content well and always gave us boring worksheets to complete. I always went to class bored and left feeling I had learnt nothing.
>
> During secondary school, the teaching was boring, disengaging and mostly rote learning with worksheets.
>
> Most of my high school experience was using the textbook in class and just doing textbook questions rather than having more interesting and engaging tasks.

Discussion and Conclusions

This study was designed to explore PSTs' emotional responses to their mathematical learning experiences during their schooling. In total, 266 PSTs provided responses that were categorised as corresponding to eight emotions as identified in Pekrun's Achievement Emotions Framework (2019). Our analysis reveals that achievement emotions can serve as the foundation for understanding PSTs' mathematical experiences, which may, in turn, subsequently influence their self-efficacy beliefs and overall mathematical wellbeing. This imbalance suggests that

negative emotional experiences in primary and secondary mathematics classrooms may leave more enduring impressions than positive ones, reinforcing the need for targeted attention within teacher education for our PSTs.

Impacts on Self-Efficacy, Mathematical Wellbeing, and Teaching Practices

The prevalence of shame (41%) and anxiety (32%) aligns with previous studies on mathematics anxiety and low self-efficacy beliefs among PSTs (Jablon Stoehr, 2017; Hill & Hunter, 2024). The negative experiences described by participants, particularly being singled out, humiliated, or unable to grasp concepts despite effort, represent significant barriers to developing positive self-efficacy (Bandura, 1994). These negative achievement emotions directly undermine the development of self-efficacy, as PSTs internalise their emotional responses into beliefs about their mathematical capabilities. These findings support Lo's (2021) assertion that past experiences shape not only PSTs' engagement with their mathematical learning but also impact their self-efficacy for teaching mathematics. Our findings suggest that pedagogical approaches that PSTs encountered during their schooling, including the dominance of worksheets (identified in the boredom category), the lack of differentiated instruction (noted in the anger category), and the public nature of mathematical performance (highlighted in anxiety and shame categories) all contributed to negative emotional associations with mathematics. These instructional approaches not only created negative emotions but also failed to create enabling environments for mathematical wellbeing to emerge. The accumulation of negative achievement emotions and diminished self-efficacy ultimately compromises PSTs' mathematical wellbeing, limiting their capacity to find meaning, purpose, and enjoyment in mathematics teaching—essential elements for flourishing as educators. Consistent with Brady's (2012) findings, these experiences likely shaped the PSTs' views of mathematics education and may potentially influence their future teaching practices.

The Role of Positive Teacher-Student Relationships

A counterpoint to the dominance of negative emotions was found in the enjoyment category, comprising 50% of positive responses. These reflections frequently emphasised caring, supportive, and passionate mathematics teachers. These responses support Chalkiadaki's (2018) views that positive learning experiences are influenced by how teachers construct lessons and the teaching strategies they employ. Conversely, many negative experiences centred on feeling unsupported or even disregarded by teachers. The prominence of relationship-focused responses suggests that the quality of teacher-student interactions may be a powerful contributor to positive mathematical learning experiences and mathematical wellbeing (Hunter & Hill, 2024).

Implications for Teacher Education, Limitations, and Future Research

The experiences recounted by PSTs provide a valuable lens which likely shape their future teaching practices. By explicitly acknowledging and discussing PSTs' prior experiences with mathematics, teacher educators can help PSTs critically reflect on how their experiences are likely to influence their relationships with their future students. The findings also highlighted the importance of developing PSTs' awareness of the emotional dimensions of mathematics learning. Understanding how practices such as public performance, ability grouping, and limited teaching approaches can evoke shame, anxiety, and anger in students may help PSTs create more emotionally supportive classroom environments that foster positive mathematical wellbeing (Hill et al., 2021; Hunter & Hill, 2024).

While this study offers valuable insights into PSTs' mathematical experiences, it was limited in that only two open-ended questions provided a snapshot of PSTs' self-reported experiences. Future research might include follow-up focus groups or one-on-one interviews to gain deeper

insights into PSTs' experiences and their perceived impact on teaching intentions. Additionally, the study primarily focused on emotional recall rather than analysing how these experiences might translate into teaching practices. Future research could explore how beginning teachers' practices evolve, investigating whether they replicate or diverge from the positive and negative experiences they encountered as students.

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References

Bandura, A. (1994). *Self-efficacy*. In V. Ramachaudran (Ed.), *Encyclopedia of human behaviour, 4,* 71-81. Academic Press.

Bloomfield, D. (2010). Emotions and 'getting by': A pre-service teacher navigating professional experience. *Asia-Pacific Journal of Teacher Education*, *38*(3), 221-234. https://doi.org/10.1080/1359866X.2010.494005

Brady, K. (2012). Stories from the classroom: The developing beliefs and practices of beginning primary mathematics teachers. In J. Dindyal, L. P. Cheng & S. F. Ng (Eds.), *Mathematics education: Expanding horizons*, Mathematics Education Research Group of Australasia. Proceedings of the 35th annual conference of the Mathematics Education Research Group of Australasia. MERGA.

Braun, V., & Clarke, V. (2022). *Thematic analysis*. Sage.

Chalkiadaki, A. (2018). A systematic literature review of 21st century skills and competencies in primary education. *International Journal of Instruction*, *11*(3), 1-16. doi.org/10.12973/iji.2018.1131a

Hill, J. L. & Hunter, J. (2024) Student mathematical wellbeing across schools in New Zealand. *New Zealand Journal of Educational Studies, 59,* 211–234. https://doi.org/10.1007/s40841-024-00318-6

Hill J. L., Kern M. L., Seah WT, & van Driel J. (2021). Feeling good and functioning well in mathematics education: Exploring students' conceptions of mathematical well-being and values. *ECNU Review of Education*. 4(2), 349-375. https://doi.org/10.1177/2096531120928084

Hunter, J., & Hill, J. L. (2024). Exploring mathematical wellbeing across cultures: Insights from diverse students. *Mathematics Education Research Journal.* https://doi.org/10.1007/s13394-024-00500-5

Jablon Stoehr, K. (2017). Mathematics anxiety: One size does not fit all. *Journal of Teacher Education, 68*(1), 69-84. https://doi.org/10.1177/0022487116676316

Küçükalioğlu, T., & Tuluk, G. (2021). The effect of mathematics teachers' self-efficacy and leadership styles on students' mathematical achievement and attitudes. *Athens Journal of Education*, *8*(3), 221-238. https://doi.org/10.30958/aje.8-3-1

Lo, W. Y. (2021). Pre-service teachers' prior learning experiences of mathematics and the influences on their beliefs about mathematics teaching. *International Journal of Instruction, 14*(1), 795-812. https://doi.org/10.29333/iji.2021.14148a

Mazana, Y. M., Suero Montero, C., & Olifage, C. R. (2019). Investigating students' attitude towards learning mathematics. *International Electronic Journal of Mathematics Education, 14*(1), 207-231. https://doi.org/10.29333/iejme/3997

Pekrun, R. (2006). The control-value theory of achievement emotions: Assumptions, corollaries, and implications for educational research and practice. *Educational Psychology Review, 18*(4), 315-341. https://doi.org/10.1007/s10648-006-9029-9

Pekrun, R. (2019). Achievement emotions: A control-value theory perspective. In R. Patulny, A. Bellocchi, R. E. Olson, S. Khorana, J. McKenzie, & M. Peterie (Eds.), *Emotions in late modernity* (pp. 142-157). Routledge.

Schunk, D., & DiBenedetto, M. (2020). Motivation and social cognitive theory. *Contemporary Educational Psychology*, 1-9. https://doi.org/10.1016/j.cedpsych.2019.101832