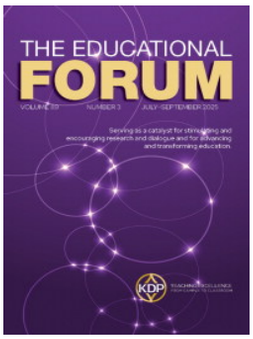

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Experimenting with Poeticizing to Open a Shared Space for Emotion and Mathematics in Preservice Teacher Education

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ABSTRACT

Poetry and mathematics are not typically encountered together. In this paper, we describe our experience of taking an arts-based approach to bringing together mathematics and poetry by poeticizing the qualitative survey responses of preservice teachers who were learning to teach mathematics in elementary classrooms. We argue that poeticizing can open up new spaces and lines of inquiry to invite a rethinking of the relationship between mathematics and emotions, and unsettle the associated dominant narratives.

KEYWORDS

poeticizing; emotion; mathematics education; qualitative methodology; poetic inquiry

Investigations of preservice teacher experiences in the context of mathematics education are highly relevant given renewed concerns in the English-speaking Western world over poor student achievement in mathematics. Governmental concerns, such as those from Australia, New Zealand, Britain, and the United States, inevitably devolve to political and professional calls to improve preservice mathematics teacher education, a key aspect of which is preservice teachers' mathematics-related emotions. Bellocchi (2019) noted the emergent and expanding field of emotion research in teacher education which to date has drawn on single self-report research methods, often employing Likert scales to rate an emotion related to experiences of mathematics. Conventionally, such Likert-type data are presented following a format of tables or graphs and associated commentary, with open responses analyzed and coded. We believe that traditional representations of data can obscure the complexities of preservice teachers' mathematics-related emotions and therefore, we are attracted to arts-based methodologies that present the opportunity to explore the nuances of preservice teachers' lived experiences.

Combining Emotion and Mathematics

Emotion is part of who we are as humans and is an ever-present part of learning anything. Emotions are often characterized as either positive and negative, with the underlying assumption that the former support learning and the latter do not. We argue that it is important to encourage learners to notice and reflect on their various emotional responses and how these are associated with their learning. In particular, more needs to be understood about the connection between emotion and mathematics. Emotion is part of the broader field of affect and

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mathematics education, discussed in the seminal work by McLeod (1992), whose framework identified three major categories of mathematics-related affect: beliefs, attitudes, and emotions. Studies of emotions in mathematics have until recently focused on individuals' anxiety and fear of mathematics, referred to for over 50 years as "mathematics anxiety" (Richardson & Suinn, 1972. p. 551), now more commonly, "maths anxiety" (e.g. Wilson, 2015, p. 643). We are concerned to observe maths anxiety becoming increasingly socially acceptable in New Zealand as a way of explaining negative relationships with mathematics.

Looking back to the 1970s and 1980s, intelligence, ability and related competence were often viewed as fixed. Therefore, the introduction of the idea of maths anxiety as a reason for avoiding mathematics (rather than a lack of competence) was thought of as a positive step forward because it was not fixed and—it was claimed—could be addressed. As Tobias (1987) explained nearly 40 years ago:

> At least we can do something about the emotional static that intrudes on concentration. We can do nothing about our brains. … Re-formulating the problem [maths avoidance] as one of anxiety rather than incompetence was the first—and indeed a most constructive—step. (p. 1556)

More recently, research has more closely examined the underlying causes of preservice teachers' maths anxiety and has identified clear links with negative experiences of learning mathematics at school (e.g. Bekdemir, 2010; Brady & Bowd, 2005), and more specifically, with their experiences with teachers (Wilson, 2015). Experiences of evaluations and particularly timed tests, along with an emphasis in mathematics learning on getting the correct answers, have also been identified as factors contributing to maths anxiety (Lorenzen & Lipscomb, 2021; Olson & Stoehr, 2019).

Recognizing the need for interventions to reduce preservice teachers' maths anxiety, a small number of studies with teacher educators have explored various strategies that might help alleviate this. Promising strategies have included focusing on inquiry-based learning rather than direct instruction (Lorenzen & Lipscomb, 2021), and using neuro-linguistic programming (Daharnis et al., 2019).

Also contributing to what we know about the complexities of emotion and cognition, recent developments in neuro-science have shown that the brain is more malleable than was previously thought (Davidson & Begley, 2012) and "can change its ability and function in substantial ways. … Neuroplasticity provides new light on the dogma that everything we are is genetically based" (Calderón, 2021, p. 139). To avoid failure in mathematics being associated with perceived fixed ability, society has embraced the discourse of maths anxiety to explain avoidance of mathematics.

We think the time has come to disrupt the dichotomy between emotion and cognition that was socially constructed in a previous era, and instead focus on their intersectionality. To stimulate the kind of new perspectives that we believe are needed, researchers can employ fresh approaches in their investigations. One way we are doing this is to construct poems to capture the emotions expressed by mathematics learners in an authentic setting. We hope that bringing poetry and mathematics together in our research will invite a rethinking of the relationship between emotion and mathematics.

Essentially, we are trying to understand preservice teachers' lived experiences of mathematics education. We are interested in taking an under-utilized arts-based approach to data analysis and representation to illuminate the complexities and nuances of mathematics-related emotions. In this paper we address the questions: In what ways can poetry give voice to

preservice teachers' mathematics-related emotions? How does an arts-based approach to qualitative research enable us to re-imagine how data might be analyzed and represented? Specifically, we take up the question, what can poeticizing contribute to the field of mathematics education research? We argue for the power of poems to forefront the emotions of preservice teachers' experiences of mathematics education.

Employing Poetry in Research

Using poetry in research can open up new opportunities. Researchers have used poetry "as a means to enlarge understanding, resist clear undemanding interpretations, and move closer to what it means to be human" (Faulkner, 2019, p. 15). Furman et al. (2006) were also of the view that we can learn a lot about lived experience from research poems through the powerful insights they evoke. We interpret poeticizing as the creation of research poems that help us pull away from the many conventional ways of analyzing and presenting data typically associated with studies in the mathematics education field.

Views about whether a researcher should also be a poet to poeticize seem to differ according to the author's stance as a researcher and/or an experienced poet. Furman et al. (2006) explained that a key difference between a research poem and a literary poem is that the purpose of the former is explicitly to represent research data in a way that is faithful to participants' words, without embellishment. Research poems do not, for instance, alter the original data in significant ways or include fantasy, both of which are more in the realm of literary poems.

Poeticizing can take various forms, such as representing truncated interview transcripts, or being a reinterpretation of participants' words that identifies words that stand out in the data collection. "Poemish" or "poem-like" are terms used by experienced poets, Lahman et al. (2019), for research representations that interweave poetry's esthetics with the discipline involved in research. Glesne (1997) was describing what she termed "poetic transcription" when she said it "moves in the direction of poetry but is not necessarily poetry" (p. 213). Essentially, poeticizing provides a range of possibilities for researchers.

In contrast, Prendergast (2009) thought that it should not be possible to distinguish poetic inquiry from literary poetry and cautioned against it being used for research purposes where it did not also function as a successful poem in the reader's eyes. In addition, Lahman et al. (2019) urged anyone considering writing research poetry to read poetry extensively. We do not see these ideas as incompatible with those expressed by Furman et al. (2006) and we embrace the possibilities for blurring traditional boundaries between art and science by employing poetry in research.

Taking an Arts-Based Approach

In our arts-based approach, we took authentic inquiry (Alexakos, 2015) as our interpretive framing to encapsulate the participant-centred, polyphonic (multiple voices) and polysemic (multiple meanings) possibilities of poetic inquiry. In the spirit of authentic inquiry, we invite the reader to draw their own interpretations of the poeticizing. Our emergent hermeneutic phenomenological process was contingent on the concise nature of our dataset, which was a catalyst for considering poeticizing as a way of analyzing and presenting the emotions expressed by participants.

As part of a larger study examining emotions and mathematics (Bonne & Higgins, 2022; Higgins et al., 2024), in this paper we drew from responses of 19 preservice teachers who had completed a survey before their teacher education course began, and again after the course. The survey included open-response items such as asking respondents "In your opinion, what is a positive feature of mathematics?" followed by "Why?" Another question asked participants to give three words to describe their emotions about "mathematics" or "teaching mathematics." This resulted in qualitative data, some of which comprised short chunks of text.

Taking a sociological view of emotions (Turner, 2007, 2009), we re-presented preservice teachers' responses in poetic forms to emphasize the role of emotions in learning to teach mathematics. Here we present four poems as a cross-section of a larger collection of poems, which includes responses from all participants. By using only respondents' words verbatim, our intention was to capture their essence, rather than inferring what respondents might have intended. In crafting poetic constructions, we paid attention to the visual layout and how the words flowed on the page (Lemon et al., 2023). Poeticizing was a way to honor participants' voices by re-presenting their words in poetic constructions.

Entertaining Poetic Inquiry

We were drawn to poeticizing because of its creative nature and because we saw it "potentially transforming the routine and mundane into the epic" (Saldaña, 2014, p. 41). Poetic inquiry appealed to us as an authentic approach to connect emotions and mathematics. At the same time, it was confronting for us to consider using poetry to present our research data, particularly in a mathematics context. However, within that context we were investigating preservice teachers' emotions associated with mathematics, so we were already working on the periphery of "regular" research in this area. To use poems to present participants' emotions seemed appropriate to us. We saw possibilities for blurring the boundaries between mathematics as a cognitive discipline and poetry as an embodiment of emotion, thereby pushing back against an arts-mathematics dichotomy.

We saw the potential of poetic inquiry to shine the spotlight on the emotions expressed by our participants in a mathematics education context. As Prendergast's (2009) survey of the use of poetry in social science qualitative research identified, poetic inquiry is typically employed for topics with clear affective aspects. In our research context of mathematics education, affective aspects encompass the beliefs, attitudes, and emotions relating to mathematics that were described by McLeod (1992). Our specific area of focus was preservice teachers' emotions associated with mathematics as a discipline and with the prospect of teaching mathematics themselves. As expressed by Lemon (2021), from whose work we have learned much, "in choosing poetic representation as a means of sharing our data, we have made a decision to invite readers to engage with both the emotional and cognitive dimensions of the work" (p. 321).

Poetic inquiry breaks away from the more conventional qualitative methods used in the field of mathematics education research (e.g. no poeticizing/poem/poetry was found by using the search function on the site of the Mathematics Education Research Group of Australasia). One question we had was: Why were none of our colleagues already doing this? This was one of the initial concerns we experienced as we wondered whether this approach could withstand the critique of our mathematics education researcher colleagues. For instance, we knew that

creating poems from research data was not an undertaking that could be systematically replicated by other researchers and therefore, might raise questions relating to the trustworthiness of our findings. Suspending our unease about how our work might be received, the next section details how we proceeded and how we experienced our experimenting with poeticizing as novices.

Stepping Into Poeticizing

After reading the data several times, we used NVivo R1 (also referred to as NVivo 13) to code data and from which to identify themes in the responses. It was at this point that Saldaña's (2014) work drew our attention to the possibility of applying the qualitative data analysis strategy of poeticizing. Saldaña (2014) explained that an aim of poeticizing in a qualitative data analysis context is "to create an evocative literary representation and presentation of the data in the form of poetry" (p. 40). We decided to explore poeticizing using the survey responses and an iterative process followed, assembling words and phrases from responses into theme-based poems, and at other times assembling poems from responses across the survey from which new themes emerged. In doing so, we were developing our nascent understanding of the possibilities of poeticizing as an analytical approach.

To support our initial step into poeticizing, Joanna arranged for the three of us to meet virtually with a colleague, Narelle Lemon, who has recently published her research work in the form of poetic representations (e.g. Lemon, 2021). This memorable conversation helped accelerate our understanding of the value of presenting research in poems. In preparation for the meeting and even more so afterwards, we studied the work of Narelle and her colleagues. Subsequently, Narelle was a visiting scholar at Victoria University of Wellington. During her visit, she was able to discuss and make suggestions about a conference presentation the authors were preparing to make, further developing our thinking about poeticizing.

Several months after our first meeting with Narelle, the first two authors met with another colleague, Ben Egerton, who is a published poet (e.g. 2022, 2023). By this point, we were able to discuss several draft poems with Ben and invite his questions and suggestions to continue developing our thinking. Key points we discussed were:

- What are our intentions with poeticizing the data?
- To what extent should we intervene with the raw data, or should we only curate and organize it?
- What is our rationale for selecting raw data to include in (and exclude from) our poems?
- Related to the first point, how much interpreting of the data do we want to leave to readers, and how much do we want to tell them?

A theme that emerged during our discussion related to parallels between poetry and mathematics, particularly that the effect of being taught procedures for either subject can be to reduce the opportunities for both understanding and joy. Each of us was able to describe personal experiences of a teacher at secondary school wanting us to analyze either poetry or mathematics to identify its component parts—supposedly to help us understand it—and the effect this instrumental approach had on reducing the enjoyment we had previously (and subsequently) experienced. Identifying patterns and anomalies was another parallel we saw

across learning in both areas. For instance, as novices we are likely to attend to consistent patterns rather than to the contradictions or outliers—and this can also be the case with research. Ironically, during the particularly uncomfortable initial stages of exploring how we might poeticize our data, we had wanted someone to "please just give us the rules!"

Following this discussion, we revised some of our first attempts at poems, taking into consideration the bullet-points above. We have made only minor changes or additions to responses included in the raw data, which we hope uphold the collective meaning of participants' words. In one case, we have repeated a short piece of text for emphasis. When selecting raw data to present in our poems, we considered the need to include high frequency language, to authentically represent participants' voices with as few adjustments as possible, and to encompass a range of perspectives.

The poems that follow draw on the preservice teachers' survey responses. The surveys were completed at the start and conclusion of an 8-week mathematics education course (comprising 16 sessions) to prepare preservice teachers to teach in elementary and secondary schools.

While developing the poems, we took into consideration:

- themes emerging from preservice teachers' responses (prior to poeticizing, we had explored coding the data)
- how we represent mathematics in a way that does not exclusively reinforce negative narratives
- layout to include meaning, e.g., spaces between text, use of mathematical images,
- repetition
- our intentional use of titles (or not)
- what changes we allowed to the original text.

We chose to give poems titles that have connections to mathematics and to the creative research process of crafting each poem. We invite you now to contemplate the poems as entry points for thinking about emotions preservice teachers associate with mathematics. After each poem, we provide a brief commentary to provide context and illuminate the process of developing each piece.

right or wrong

I liked maths because there was only one answer

the sense of achievement when getting the answer

you know for a fact if you are right or wrong, nothing really subjective

there's only one right answer

if you use the right method

happiness

(when you finally get the right answer)

some teachers demand you work out a problem their way or it's wrong

(even if you get the answer right)

In the process of developing the poem above, we explored the binary right/wrong typically included in discourse about mathematics. While evidently appealing to some students, this binary was problematic for others. To build explanatory depth we bracketed student responses to highlight that they add nuance to the phrase that precedes them. The final two lines illustrate a tension between providing right answers and showing how a problem is worked out, adding further complexity to the binary of right or wrong.

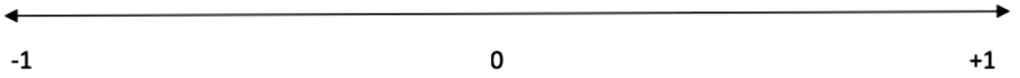
life lines

The worst lie a teacher can tell

is that they are used in real life

people don't see the relevance

I got bluntly told by the teacher that calculus will never come in handy in life



basics are actually used in real life

come best in handy when shopping, calculating percentages on the spot

applicable in everyday life and frequently used in numerous ways

relate to real life complex problems

can be used for everything

anything in the world

We chose the structure of a number line as a mathematical and visual representation to depict the positive and negative ideas expressed by the preservice teachers about the relevance of mathematics to life. The left and right justification of the two stanzas, in line with the positive and negative numbers, emphasizes the participants' contrasting responses. "Life lines" as a title is intended to encapsulate discourse about the importance of mathematics for success in life.

exploring space

I'm worried

I'll teach it wrong worried
I won't have the content knowledge worried
I won't be able to remember all the different rules
involved worried

stressed, unsure - I feel these with older (intermediate) students
as I didn't do well at school
I am not confident
not confident in teaching maths

Worried Nervous Anxious Confused … *hesitant* …
that's how I feel when I practice mathematics

I don't even like maths!

This poem focuses on the preservice teachers' worries about teaching mathematics. Spaces, line breaks, and repetition are used to convey the pervasiveness of worry in the preservice teachers' responses and generate tension when the poem is read aloud. Including a range of negative feelings in the poem underscores the complexity of relationships the preservice teachers had with mathematics.

Considering Poeticizing as an Arts-Based Approach

Poeticizing has enabled us to represent our participants' expressed emotions about mathematics in forms that can open a space for new audiences and conversations. Using poeticizing to make sense of the emotions expressed by preservice teachers in a mathematics education course enabled us to portray the rawness of the emotions they associated with the prospect of teaching mathematics. Taking an arts-based approach to qualitative research has enabled us to re-imagine how survey data might be analyzed and represented. Blurring boundaries between mathematics and emotion through poeticizing helped us to disrupt stubborn discourses in which mathematics is positioned as a purely cognitive enterprise. By creating poems, we have brought emotions about mathematics to the forefront, and we hope that these in turn have the power to elicit emotions from readers. In choosing to poeticize, we have experimented with an unconventional approach, not yet seen in mathematics education research, and invite our research colleagues to join us in this space.

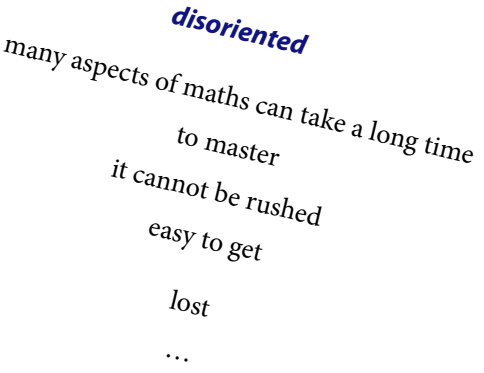
Returning to Saldaña's (2014) point about poeticizing creating an evocative literary representation, reminded us of the importance of an alternative vantage point to illuminate the relationships between emotions and mathematics. The emotions expressed in the poems traversed preservice teachers' lingering memories of lived classroom experiences to their concerns about becoming teachers of mathematics. Taking an arts-based approach, poeticizing preservice teachers' expressed emotions gave voice to their often raw emotions and experiences that have tended to be obscured by more conventional data representations. By putting emotions at the forefront, the socially constructed dichotomy between emotion and cognition is unsettled.

Furthermore, if we accept the view that emotions are not just to do with an individual, but are a social phenomenon (Bellocchi, 2019), then the poems can expose common discourses associated with mathematics education. Unraveling the complexities through poeticizing of, in many cases, deeply felt emotions suggests the usefulness of including emotional literacy as part of preservice teaching courses. Such knowledge and understanding of emotions is important to the generation of productive relationships with mathematics, underscored in current political calls to revitalize mathematics education. From our early experiences of poeticizing, we see further possibilities for teacher educators to use poems to spark dialogue to support preservice teachers to address the emotional and cognitive demands of teaching and learning mathematics.

Looking ahead, we will continue developing our use of poetry as an insightful representation of participants' voices, portraying the rawness of the emotions they associate with the prospect of teaching mathematics. In spaces where mathematics and poetry are not typically encountered together, we have offered research poems. In our continuing program of research, we have started to explore the efficacy of the poems as provocations for preservice teachers' reflections about emotions in mathematics teacher education. In a future paper we will describe our initial experience of using a structured reflection protocol which draws from the *lectio divina* tradition (Dalton et al., 2021) as a pedagogical tool for teaching. Using the protocol, preservice teachers were invited to listen, reflect on, and respond creatively to the poem, "Exploring space." Our early analysis of their responses suggests this protocol could be productively applied beyond the context of preservice mathematics education to support the development of reflective processes and provide an opportunity to combine affective and cognitive considerations.

As we refine our use of poeticizing as a strategy for qualitative data analysis and for lifting up the voices of research participants, a number of questions remain:

- What challenges might be raised about poeticizing as a research approach, especially in the mathematics education research community?
- Could/should we (as mathematics education researchers) create poems?
- Who might now be included in the audience for our writing who previously has not been, because of poeticizing—perhaps people who might not usually read more conventional mathematics education research articles?
- What opportunities might additional arts-based approaches present for mathematics education researchers to help us move beyond existing narratives?



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