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The role of dissonance in mathematics teacher education

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In this paper, we explore issues relating to how certain social phenomena, such as the experiences of teachers, can be researched. In doing so, we consider questions about the status of research texts, how they are created, and what purposes they serve through examining the relationships between the researcher, the reader and the text. We argue for the legitimacy of fictionalising educational experiences and having done so present a fictionalised dialogue between two prospective mathematics teachers from Sweden who independently decide to leave their teacher education programmes. We use the notion of dissonance to provide a potential theory for the decisions made by the two prospective teachers and discuss implications of this theory for the design of mathematics teacher education programmes.

Keywords: Mathematics teacher education, reading otherwise, fictionalising, dissonance.

Introduction

As mathematics teacher educators, we are motivated to understand the experiences of prospective mathematics teachers in relation to their teacher education programmes. We feel that much can be learned from exploring the range of perspectives that prospective teachers have about their early encounters with mathematics teaching and teacher education, perspectives that help us to critically reflect on our practices as teacher educators. Furthermore, as mathematics teacher educators from two countries (Sweden and England) where mathematics teachers are in short supply, where recruitment into the profession is challenging, and retention is low (Ovenden-Hope & Passy, 2020), we are compelled to tell the stories of individuals who began teacher education but ultimately decided not to complete it, to learn from these stories about what could have been different.

To the purpose of understanding the experiences of prospective mathematics teachers in relation to their teacher education programmes, we tell the stories of two prospective mathematics teachers from Sweden, Lina and Alva. For Lina, leaving teacher education equated to leaving the teaching profession entirely, whereas for Alva, leaving meant transferring from upper primary (for students aged 10–12 years) teacher education to lower primary (for students aged 7–9 years) teacher education. Through the telling of these stories we hope to learn from Lina and Alva about their decisions to leave their teacher education programmes, to develop insights as teacher educators responsible for the design and enactment of our own teacher education programmes. We do not intend or expect to generalise from these two stories, about why a variety of individuals decide to leave teacher education or the teaching profession more generally. Instead, we use stories to explore the notion of *dissonance*, a powerful idea that we introduce towards the end of the paper, that presents a potential explanation for the decisions made by Lina and Alva and one which could suggest significant implications for the design of mathematics teacher education programmes.

Furthermore, we use the context of this study for another purpose, to explore some of the broader issues that relate to how social phenomena, such as the experiences of prospective mathematics teachers, can be researched. In doing so we consider questions about the status of research texts, how

they are created and what purposes they serve through examining the relationships between the researcher and the research text, and the reader and the research text (which we do in the next two sections). As a result of examining these relationships, we argue for the use of fiction-based research approaches as a way of improving the democracy of research findings, and as a way to urge readers to critically reflect on their own practices in relation to the subject of research. We exemplify this approach by presenting a fictionalised conversation between Lina and Alva as a way of exploring their experiences of teacher education.

The act of writing: The researcher in the text

Research concerning the teaching and learning of mathematics teachers usually aims, in some way, to describe and explain particular social phenomena. How teachers learn to teach, how they engage with materials, how they use technology, how they design tasks, how they facilitate mathematical problem-solving, what they notice about students' mathematical thinking, why they leave teaching, are all examples of social phenomena that, as a community of researchers, we want to better understand. This kind of research requires researchers to enter into social situations, utilise a variety of tools and methods, collect and analyse data and ultimately produce a *research text* which includes a set of research findings, that is, a 'way of seeing' the data, so that insights can be developed regarding the phenomenon in question.

From a realist perspective that assumes the existence of an ontological reality independent of the researcher, research texts are considered to be purely a *product* of the research, and the medium through which to *demonstrate* what the researcher has *discovered*, 'out there'. From this perspective, there is an underlying assumption that the social phenomenon in question already exists in a fixed form prior to the production of the text. Richardson (2000) guides us not to think of writing solely as a way of telling *about* the social world, but that writing can be "a way of 'knowing'—a method of discovery and analysis" (p. 923). From this perspective, and one that we adopt in relation to our own research, the creation of the research text is a fundamental part of the research process and one that should be acknowledged. "[W]riting is always an ontological and ontologising activity" (Petersen, 2015, p. 149) as well as a knowledge-making activity. In other words, the act of writing brings social phenomena into existence that would otherwise not exist, and into awareness that would otherwise remain unknown. In this sense, reality is *created* through the process of writing/creating a research text, rather than *described* or *represented*. From this perspective (which we might label poststructural), all research texts, even those considered purely scientific, are "fabrications" (MacLure, 2003, p. 80). We certainly do not mean to suggest that researchers set out to 'make stuff up', rather, we mean to emphasise the point that a research text is not a mirror of some external reality and is always written from the perspective of the reality as perceived by the researcher. If there is a reality that the research text represents, it is not a reality independent of the researcher.

This so-called "crisis of representation" (Denzin, 1997) remains a considerable challenge for qualitative researchers to contend with. Most scholars who operate within a qualitative paradigm, recognise the inextricable link between the researcher and the research text and in doing so will acknowledge the 'situatedness' of their research as well as employ a range of research practices (e.g., triangulation, member-checking) in their endeavour to enhance the validity and reliability of their findings, to get closer to the truth of the situation. In the case of mathematics teacher education, where the majority of researchers are likely to also be practicing mathematics teacher educators, the

relationship between the researcher and the research text is of particular significance, especially when the subject of research are those we teach. Rather than aiming to minimise subjectivity in the quest to be more objective, how might we harness this subjectivity and create research texts that evoke, for the reader (other mathematics teacher educators), the reality as it appears to the researcher who, through ethnographic means, has come to understand, in a deep way, the experiences of the researched. To be clear, our aim is not to be critical of more conventional methods associated with qualitative research approaches. Our purpose is to contribute to a wider discussion on what else might be possible, by exploring other forms of research text.

The act of reading: The reader in the text

Readers of this research text (or any other) will interpret the content differently and find different meanings. Readers will have different responses to the research text depending on their history of experiences. Since our experiences determine what is possible for us to perceive, meaning emerges for the reader as they interact with the text. Rosenblatt (2014) proposes that every reading act is an interaction between a reader and a text, the two entities acting on one another create a dynamic situation. When a reader interacts with a research text, they adopt one of two possible stances, the “efferent” or the “aesthetic”. The efferent stance deals more with the cognitive and the quantitative aspects of meaning, while the aesthetic stance deals more with the sensuous and the qualitative. According to Rosenblatt, when readers read efferently, they read texts to extract information and purposefully narrow their focus to find specific information. When readers read aesthetically, however, they allow their minds and sensibilities to be open and experience the text both cognitively and affectively.

de Freitas (2007) draws on the motives of MacLure (2003) which she describes as a desire to “breach the usual authority of educational research texts and to generate a more critical reading habit on the part of those they aim to reach” (de Freitas, 2007, p. 336). This breach is about diffusing the power of the author, and improving the democracy of the findings. This is a shift from thinking about the researcher as the sole owner of the research text, to the reader as “actively construct[ing] possible counter-interpretations” (de Freitas, 2007, p. 336). The active construction by the reader is what de Freitas calls “reading *otherwise*” (p. 336, emphasis original) and is linked to reading aesthetically. She argues that it is through an approach to narrative research, where literary, fictional, or poetic strategies are employed by the researcher, that readers are most likely to engage in the act of reading otherwise. Texts themselves are neither efferent nor aesthetic. Instead, readers choose a predominant stance based on how they think a text should be read, and adjust their stance accordingly.

The lexical, grammatical and conceptual choices made by authors direct the attention of readers to experience the phenomena in the way the author chose to describe it. [...] As an author, I can position my chosen conceptual frame as natural or uncontested. Alternatively, I can recognise the choice involved and thus remind readers that other conceptual frames may be possible (Wagner, 2022, p. 50).

An extreme way to ‘remind readers’ that other interpretations might be possible, is to disclose to them that a text is (partly) a work of fiction, or (partly) based on imagination. By disclosing this information, readers will literally read the text differently having acknowledged the distinct claim about the nature of truth that the author is making. If the purpose of research is to prompt practitioners

(i.e., mathematics teacher educators) to critically reflect on their own practices in relation to the subject of research (i.e., prospective mathematics teachers), then we would argue for the inclusion of more research texts that are created using ideas from literary composition (including the process of fictionalising accounts).

The act of fictionalising: The subject in the text

Fiction-based research is a coupling of ‘the real’ (i.e., observable by others) and ‘the imaginary’. The act of fictionalising entails the “rigorous incorporation of real-world details into fictional rendering” (Leavy, 2018, p. 195) where the use of real-world details “eases readers into the work of fiction, while allowing writers to imagine what ‘real-words’ are” (p. 195). Fictionalising experiences therefore allows us to present an authentic story, while inviting readers to read otherwise. The fictionalisation of educational experience “offers researchers the opportunity to import fragments of data from various real events in order to speak to the heart of social consciousness” (Clough, 2002, p. 8), it involves combining different empirical elements or details:

The bits of data, empirical elements, or details we select may come from qualitative research practices (e.g., interviews or field research) or they may come to us more abstractly or imaginatively through the accumulation of research, teaching, and personal experiences (Leavy, 2018, p. 195).

Various mathematics education researchers have turned to fictionalising experiences to create research texts. For example, Leron and Hazzan (1997) use “virtual monologue” as a tool for exploring the affective aspects of mathematical problem-solving, which consists of a monologue in the student’s voice given in first person, where the researchers’ aim is to present their view of what might be going on in the mind of the student. Drawing on this work, Zazkis and Koichu (2015) develop a novel research approach which they call “virtual duoethnography” where they produce a dialogue in the voices of fictional characters that reflect the researchers’ experiences gained during the research process. According to Zazkis and Koichu, reading such a story makes the reader less judgmental, more empathetic through focusing less on students’ failures and more on their sense-making efforts. A final example of the use of fiction in mathematics education research comes from the work of Hannula (2003) who presents a ‘real’ transcript from a mathematics classroom alongside what he calls the inner monologue of the student, Helena, as a way of creating “connections that do not exist in the original data” (p. 32). He does this to illustrate Helena’s anxiety with mathematics and how this anxiety influences her interaction with her teacher. In Hannula’s use of fiction, he demonstrates how to go beyond what is possible to communicate with transcript alone.

In our case, we present a ‘virtual dialogue’ between the Lina and Alva. This virtual dialogue was created by combining empirical elements from separate interviews between Andreas and the two prospective teachers and from his detailed field observations with his personal experiences from numerous encounters and conversations with both individuals. Rather than delineating the ‘real’ aspects from the ‘imagined’ or ‘augmented’ we chose to weave aspects of transcripts from interviews throughout the imagined dialogue. To encourage the readers of this research text to read otherwise, we have made two conscious decisions. Firstly, to disclose to the reader that we have utilised fictionalising techniques to create the story of Lina and Alva. Secondly, to introduce our conceptual devices (i.e., the notion of *dissonance*) *after* having presented the virtual dialogue itself. We speculate

that by engaging with the theoretical notions in an efferent way this will disrupt the act of reading otherwise that we invite readers of the virtual dialogue to engage in. Thus, we decided to further disturb the usual conventions of the research text by embedding theoretical notions at points where such notions are actually useful (i.e., after the virtual dialogue).

The story of Alva and Lina

Alva and Lina met once before with two other prospective teachers, Evie and Lisa (Ebbelind & Helliwell, 2022). Through dialogue, the four individuals shared their experiences of mathematics and mathematics teaching and learning just before they started teacher education. They had an interest in mathematics in common, but their reasons for entering teacher education differed. Alva's priority as a teacher was to take care of the children, Lina wanted her vision of mathematics teaching, based on her own experiences of learning mathematics, to be recognised as valid. Evie had always wanted to be a teacher, and Lisa had no particular plans for the future and had therefore turned to teaching as something she could try. Through their conversation, they realised that they all enjoyed learning mathematics, but for different reasons. While Evie and Lisa enjoyed learning mathematics in a more traditional classroom setting where they had themselves found success, Alva and Lina enjoyed mathematics for other reasons. For Alva, this enjoyment related to the process of problem-solving. She considered the process of problem-solving as a logical one which she wished she had been given more opportunities to engage with at school. Lina enjoyed the subject because of the structured nature of the lessons and the engagement in multiple mathematical representations while learning. We might consider Alva and Lina as most closely aligned regarding values to those promoted by the reform agenda, we might expect them, therefore, to feel comfortable with the content and teaching of the mathematics education course at the university.

Before entering teacher education, Lina remembered one exceptionally skilled and inspiring teacher. This teacher let her students explore and develop multiple representation skills but within a highly disciplined classroom. Lina learned mathematics by moving around and experiencing mathematics through different resources and materials. She had the idea that you learn mathematics through your senses but that mathematics ultimately has a logical structure. Because of this, Lina thinks that teaching mathematics is not complicated. While Lina clearly remembered her teachers, Alva struggled to do so. She did not like the way she was taught mathematics at school, but she loved solving problems. There were too few problems to solve at school, so her father created problems for her to solve at home. Alva described solving problems logically and saw this as different from regular mathematics teaching, where you solve mathematics by routine. Alva emphasised that her teachers only seemed to have one strategy, but that she had many when doing mathematics. Alva had high hopes for the future, which is that mathematics teaching could be more like her experience of solving problems. Interestingly, Alva and Lina struggled more in the earlier parts of their teacher education programmes. They did not struggle with passing courses. Quite the opposite, they tended to be awarded the highest grades. However, they struggled with the content taught at university as well as the teaching they experienced in schools. A year on from their initial conversation, Lina and Alva met up again, to talk about their first year as prospective teachers. By this point, Lina had left teaching entirely and Alva has decided to move from upper to lower primary teacher education.

Lina: When I think back, I was struck by our differences. We were there because we liked mathematics, we agreed that mathematics was fun, but it turns out we were talking

about different things, we were also referring to different classrooms, do you remember that?

Alva: Yes, I think so. I remember the other student teachers saying they related to the classrooms that teacher educators seem to use as ‘bad examples’ of teaching, a kind of old traditional way. I imagine a classroom that *looks* traditional, with my desk at the front, you know, but the teaching and learning is different. I see myself as having a warm, welcoming classroom where I am the sole teacher, the one who really knows the children. I want to make a difference in those children’s lives.

Lina: We did like the same mathematics teaching, you and me, but I think I experienced that at school, and you didn’t. Actually, that became problematic for me. I thought primary school classrooms would be the same as they were when I was at school, and I thought I could be a teacher that lets children explore and feel the mathematics that we do together, in the same way that I did. I know everyone learns mathematics in different ways, but I think my experience of learning mathematics was completely different to other people’s. I realise that classrooms like that don’t actually exist.

Alva: It’s such a shame you left teaching. You really seemed to be looking forward to becoming a teacher and teaching mathematics. Why did you decide to leave?

Lina: Where should I start? Well, first of all, the general impression of teaching seems to be a negative one. Everyone I spoke to about my decision to get into teaching said it was a bad idea.

Alva: I think that was worse for me. Both my parents are teachers, and neither of them wanted me to become one. They didn’t advocate the profession, but in the end, I decided to become a teacher regardless. I remember my father when he became a teacher, he had so many visions, but in the end, he just became tired. I am terrified of becoming tired, like he has.

Lina: Yes that’s understandable. I do have other reasons for leaving, including the teacher education programme. The teacher educators are of a different kind, probably not good at teaching themselves, which is why they ended up in teacher education. They are genuine images of what we should not be, terrible. Teacher educators do traditional teaching but smile and say that we should not. I do not get that. Are they not interested in teaching their subjects? I realised that teacher education is about writing the right thing at the right moment, not developing as a teacher. It is too far away from the classroom. Where is the complexity of the content? We did everything on the surface, it was completely pointless.

Alva: I agree with everything you say. Knowing about Swedish school history and how children got lice baths doesn’t make you a better teacher. The things we read at the beginning were not right, and I agree the teacher educators seem to come from another planet. But lots of us on the course objected to the way the teacher education programme began, that can’t be the main reason you decided to leave teaching altogether?

Lina: No, I guess not. Actually I knew it would be hard to get children in upper primary to speak and engage in mathematics, but my goodness, they were all over the place during my first teaching placement. The most devastating of all is that the teachers were doing nothing about it. They did not engage the children in mathematics. They only tried to get them quiet and working from textbooks. Is mathematics teaching like that? That is not the teaching I want to do. That is not me at all. This is too far away from the way I experienced mathematics teaching as a child. And then, returning to university and going on as if nothing had happened was tough, so eventually I just left.

Alva: Well, I guess I kind of dropped out too, but not out of teaching entirely. I moved to lower primary teacher education. I just realised one day that the teacher I want to become does not exist at upper primary level. During my teaching placement, I experienced a very traditional classroom, but they were not all over the place. They were quiet, passive, and there were reasons for that. I became really afraid of becoming a traditional teacher because I wanted to care for the children and let them work with the kinds of problems that inspired them. I realised the classroom I want is not valid in upper primary. So, I moved to where it is valid.

A story of dissonance?

According to Festinger (1957), dissonance (often experienced as a moment of psychological discomfort) occurs when a person participates in an action that goes against one or more of their beliefs, values, or ideas. Festinger's psychological perspective is based on his hypothesis that the mental stress associated with dissonance motivates us to seek a state of consonance (or equilibrium) either by reducing dissonance (i.e., through a change in our actions or through a process of mental reasoning), or by intentionally avoiding situations where dissonance is likely to be triggered. A useful and related idea, from an educational perspective, comes from Whitehead's "living educational theory" (2000, p. 92) in his phrase "living contradiction", which he uses to express the experience of "holding together two mutually exclusive opposite values" (p. 93). Whitehead claims that he experiences himself (a teacher educator) as a living contradiction when he recognises that he holds a value (such as fairness or enquiry), yet denies it in his practice, a description close to that of Festinger's (1957) theory of dissonance, but framed as a possibility for learning. For Whitehead, experiencing himself as a living contradiction is the "logical point of departure for [his] analysis" (p. 99), when it comes to improving his practice. In other words, by uncovering contradictions, he is identifying opportunities to further enact practices that align with his values. In Festinger's language, Whitehead is identifying 'moments of dissonance' and using these moments as a source for reflection and growth, an idea that has already been articulated in the context of mathematics teacher education:

Provoked articulation through the use of dissonance is a powerful tool for uncovering implicit theories and beliefs, and thereby creating the platform from which the individual can move to a new position of conscious decision making. (Brown & Dobson, 1996, p. 215)

On the one hand, we have a view of dissonance as a momentary disturbance to our otherwise smooth flow of actions. In this form, dissonance has the potential to be harnessed as a tool for becoming more deliberate in our actions as teachers (and as teacher educators). By being alert to moments of dissonance and bringing these moments into conscious awareness, it can also be possible to uncover values that we may not realise we hold. By making these values explicit, with others, we are open to the possibility of finding resolution. On the other hand, if dissonance is experienced as persistent and overwhelming we may find ourselves compelled to take more considerable actions, such as removing ourselves from the situation entirely, as was potentially the case for both Lina and Alva. In our reading of their stories, Lina and Alva both refer to values associated with reform-oriented mathematics classrooms. Lina had a positive experience of mathematics teaching as a student, while Alva did not. It is likely that both Lina and Alva encountered several contradictions during their teacher education programmes. Although they shared the values espoused during their teacher education programme, they did not perceive these values as being enacted, not at university nor in the schools where they were placed. Perhaps they were quick to form assumptions and generalisations about the nature of upper primary classrooms. We wonder how their stories may have been different if the dissonance that each of them experienced at different points throughout their teacher education, had been brought into conscious awareness in conversation with others. Of course every individual story is complex and there will be individuals who are not ready to become mathematics teachers. There will, however, also be those individuals who could have stayed in teaching, and that is our loss. There are implications for mathematics teacher education if we decide to take seriously the role of dissonance. As a result of creating this particular research text we are left asking ourselves the following

questions: *In what ways do we, as mathematics teacher educators, enact the principles that we value in mathematics classrooms, and in what ways do we not? How can we use dissonance as a mechanism within mathematics teacher education programmes to support prospective teachers in developing their practices rather than reasons to leave?*

References

- Brown, L., & Dobson, A. (1996). Using dissonance—finding the grit in the oyster. In G. Claxton, T. Atkinson, M. Osborn, & M. Wallace (Eds.), *Liberating the learner: Lessons for professional development in education* (pp. 212–227). Routledge.
- Clough, P. (2002). *Narratives and fictions in educational research*. Open University Press.
- de Freitas, E. (2007). Research fictions: Arts-informed narratives that disrupt the authority of the text. *Interchange*, 38(4), 335–350. <https://doi.org/10.1007/s10780-007-9035-y>
- Denzin, N. K. (1997). *Interpretive ethnography: Ethnographic practices for the 21st century*. Sage. <https://doi.org/10.4135/9781452243672>
- Ebbelind, A., & Helliwell, T. (2022). *Exploring prospective teachers' initial views on the teaching and learning of mathematics: A narrative approach*. [Paper presentation]. MAVI28, Gijon, Spain.
- Festinger, L. (1957). *A theory of cognitive dissonance*. Stanford University Press.
- Hannula, M. S. (2003). Fictionalising experiences—experiencing through fiction. *For the Learning of Mathematics*, 23(3), 31–37. <https://www.jstor.org/stable/40248432>
- Leavy, P. (2018). Fiction-based research. In P. Leavy (Ed.), *Handbook of arts-based research* (pp. 190–207). Guilford.
- Leron, U., & Hazzan, O. (1997). The world according to Johnny: A coping perspective in mathematics education. *Educational Studies in Mathematics*, 32(3), 265–292. <https://doi.org/10.1023/A:1002908608251>
- MacLure, M. (2003). *Discourse in educational and social research*. Open University Press.
- Ovenden-Hope, T., & Passy, R. (Eds.). (2020). *Exploring teacher recruitment and retention: Contextual challenges from international perspectives*. Routledge. <https://doi.org/10.4324/9780429021824>
- Petersen, E. B. (2015). What crisis of representation? Challenging the realism of post-structuralist policy research in education. *Critical Studies in Education*, 56(1), 147–160. <https://doi.org/10.1080/17508487.2015.983940>
- Richardson, L. (2000). Writing: A method of inquiry. In N. Denzin & Y. Lincoln (Eds.), *Handbook of Qualitative Research* (2nd ed., pp. 923–948). Sage.
- Rosenblatt, L. M. (2014). *Literature as exploration*. Modern Language Association.
- Wagner, D. (2022). Communication: What does the dichotomy do? *For the Learning of Mathematics* 42(3), 50.
- Whitehead, J. (2000). How do I improve my practice? Creating and legitimating an epistemology of practice. *Reflective Practice*, 1(1), 91–104. <https://doi.org/10.1080/713693129>
- Zazkis, R., & Koichu, B. (2015). A fictional dialogue on infinitude of primes: Introducing virtual duoethnography. *Educational Studies in Mathematics*, 88(2), 163–181. <https://doi.org/10.1007/s10649-014-9580-0>