

This is not how it should end: The role of mathematics teacher education in preparing teachers for sustainable careers

Andreas Ebbelind¹ and Tracy Helliwell^{*,2}

¹ Linnaeus University, Sweden

² University of Bristol, UK

Abstract: In this paper, we reflect on the role of teacher education in preparing prospective teachers of mathematics for sustainable and rewarding careers as teachers. The basis of this reflection is the case of Alva, a teacher who, after a promising start, decided to leave the profession. Through a process of analysing Alva's final interview before leaving teaching, we identify a set of interpretive repertoires relating to the notion of dissonance. These interpretive repertoires reveal several sources of tension for Alva some of which relate directly to the 'ideal mathematics classroom' promoted during Alva's teacher education. By asking the question, what could have been different for Alva? We consider the potential implications for mathematics teacher education and for us as mathematics teacher educators.

Keywords: mathematics teacher education, case study, discourse analysis, interpretive repertoires, sustainable careers

Correspondence: tracy.helliwell@bristol.ac.uk

1 The story begins

One morning, at the beginning of February 2023, Andreas entered his office. After fetching his morning coffee, he logged on to his computer and saw an email containing a familiar name. It was some time ago since he had last seen this person, although he had heard positive news of her teaching through local media reports. He was curious, so he began to read the email...

Dear Andreas, I hope everything is okay with you and your family. Please say hi to your wife. I still remember her as a passionate teacher. I was caught up in thoughts the other day out walking, thinking of my time during teacher education, you following my process of becoming a teacher and how I became the teacher I have been for the past eight years. You have always asked me about life after teacher education. Sometimes, you have implied that we should meet to do another interview. However, that time is now because I have just left the profession.

My best, Alva



The MAVI community have already met Alva (a pseudonym). She was one of four prospective primary school mathematics teachers from Sweden who featured in Ebbelind and Helliwell's (2022a) presentation at Gijon (MAVI28). In that study, we explored the prospective teacher's initial views on the teaching and learning of mathematics based on interviews that took place before the individuals entered teacher education. These prospective teachers were chosen because of their commitment, experience and a particular interest in mathematics and mathematics education. They regarded themselves to be knowledgeable in mathematics and served as critical cases (Flyvbjerg, 2006). Though Alva did not remember her own mathematics teachers from primary school, she did consider her classroom to be "traditional". She was able to recall (with great joy) the few opportunities she was given to engage with problem-solving. During her interview, prior to commencing teacher education, she concluded that although her teachers shared a single strategy for problem-solving, she had many. Beyond the opportunities she was given to engage in problem-solving, Alva did not particularly enjoy how mathematics was taught in school. As a result of her own experiences, she wanted to teach mathematics differently. Out of all of the teachers interviewed by Andreas for that study, we considered Alva as most closely aligned in values to those promoted by the reform agenda (Ebbelind & Helliwell, 2022a). Alva completed her teacher education and became a lower-primary school teacher, where she worked in two schools for a total of eight years. Having learned that Alva had left the teaching profession, we were compelled to ask what we might learn from Alva's case. What possible implications might there be for the wider mathematics teacher education community to consider? We regard Alva as a critical case (Flyvbjerg, 2006), as will be exemplified later in this paper. Such a (single) case permits analytic generalisation especially when a critical event is involved.

2 Background

Becoming a primary school teacher is regarded by some researchers as particularly challenging since many prospective primary teachers have had negative experiences of school mathematics (Hodgen & Askew, 2007). It has also been suggested that prospective teachers' schooling has a more significant influence on prospective teachers practices than teacher education does (Philipp, 2007). If this is the case, prospective teachers' who have had negative experiences of learning mathematics at school are likely to teach in ways that either protect students from, or defend them against, mathematics (Hodgen & Askew, 2007). Research in mathematics education often suggests this situation is problematic and describe prospective teachers, or teachers more generally, as having an insufficient (non-reform-oriented) view of mathematics teaching and learning.

The reform agenda is a large part of Swedish mathematics teacher education (Hemmi & Ryve, 2014). The reform "focuses on students' creative engagement in exploratory and problem-solving activities as they develop their understandings of significant mathematical concepts and procedures" (Skott et al., 2018, p. 164), a vision of mathematics teaching and learning that cohered with Alva's perspective. Consequently, Alva did not fit the descriptions of prospective/practicing primary school teachers that viewed

mathematics as a set of fixed rules (Felton-Koestler, 2015) or that consider teaching mathematics as easy because teaching is seen as a process of telling (Cooney, 1999). In that sense, Alva's views could be considered as unproblematic and aligned with those that teacher educators would want to promote during their teacher education programmes. For this reason, Alva is a critical case. Alva's case is therefore likely to yield important information allowing us to develop knowledge as a community.

Research about prospective teachers' past school-related experiences and how these experiences can impact how they become teachers in different ways indicates that almost all prospective teachers' past school-related experiences must be regarded as important (Sowder, 2007), even those some might characterise as unproblematic. Sowder (2007) questions whether teacher education, in general, and mathematics education courses, are set up to meet the needs of all prospective teachers, since prospective teachers are not a homogenous group of individuals (Oliveira & Hannula, 2008).

3 Exploring this case

Since meeting at a conference in Utrecht in 2019, we (Andreas and Tracy) have elaborated on the lack of research concerning the role of mathematics teacher educators (MTEs) (Ebbelind & Helliwell, 2024) and related practices (Ebbelind & Helliwell, 2022b), prospective teachers' participation in relation to these practices (Ebbelind & Helliwell, 2022b), and the methodological and ethical challenges of researching mathematics teacher development (Ebbelind & Helliwell, 2022c). During this time, we have become aware of the conflicting stories concerning the effective teaching and learning of mathematics between various participants and stakeholders and raised questions of an ethical nature with regards to teacher education. Ultimately, we aim to explore how teacher education can prioritise making connections with and building on the varied experiences that prospective mathematics teachers bring so they no longer experience what has come to be known as the theory-practice divide. The case of Alva contributes to this aim.

In a previous paper (Ebbelind & Helliwell, 2023) we used the stories of two prospective mathematics teachers, Alva and Lina, to explore and develop our understanding of the notion of dissonance within the context of mathematics teacher education. In this paper we are using the notion of dissonance as a focal lens to analyse Alva's case. Festinger (1957) proposed that when individuals engage in practices that contradict their beliefs, values, or ideas, they are likely to experience cognitive dissonance—a psychological discomfort. Festinger's theory suggests that the (mental) distress caused by dissonance motivates us to seek a state of consonance or equilibrium. This state of consonance can be achieved through reducing dissonance by making behavioural changes, rationalising our thoughts, or intentionally avoiding situations where dissonance is likely to be triggered. Uncovering beliefs, values, or ideas through paying attention to moments of dissonance can be a powerful tool in mathematics teacher education. Brown and Dobson (1996), for example, suggest that provoking articulation through dissonance can reveal hidden values and facilitate conscious decision-making. Dissonance, when treated as a temporary disruption, can enhance teachers' awareness and intentionality in their

actions. By being attentive to moments of dissonance and acknowledging them consciously, teachers can identify their values and engage in resolution through open dialogue with others. However, if dissonance persists and becomes overwhelming, individuals may feel compelled to take more drastic measures, such as removing themselves from the situation entirely, for example, by leaving teacher education as Lina did, or, as in the case of Alva, by leaving the profession.

As MTEs conducting research in initial teacher education settings to better understand what matters in relation to the learning and development of mathematics teachers, we have become increasingly interested in developing ways of engaging more deeply with the phenomena of study. As researchers and practitioners, one methodological aim has been to inspire critical self-reflection in relation to our own practices and programme design. By communicating our research in alternative ways, we also hope to inspire such critical reflection in other members of the mathematics teacher education community. Consequently, we are drawn to “creative analytical practices” (Richardson & St. Pierre, 2018), which involve blending arts-based approaches with more formal analytical methods. These approaches have supported us in dwelling more deeply with our data in more ethical and humane ways (Ebbelind & Helliwell, 2022b).

We employ a case study methodology, often referred to as the *study of the particular*, with Alva as a critical case. Case study, as an approach (as opposed to a set of methods) is well-established in the social sciences when the researcher seeks to increase their understanding of the phenomena studied. The empirical basis of this paper is an interview that Andreas conducted with Alva in late March 2023. The interview was transcribed and later translated into English. We applied the notion of dissonance as an analytical lens, and those sections of the interview that were identified as significant, became the focus of further analysis. This process resembles some forms of discourse analysis (DA) which involves the identification and analysis of *interpretive repertoires*. Interpretive repertoires can “be seen as building blocks speakers use for constructing versions of actions, cognitive processes, and other phenomena” (Potter & Wetherell, 1987, p. 172) they are a basic unit of analysis that can be identified as a recurring pattern in the content of the material. The interpretive repertoires relating to the notion of dissonance that were identified through our process of analysis are presented and discussed in the following sections.

4 The case of Alva

Alva articulates a sense of confidence in relation to her experience of mathematics teacher education. She had no problems as a prospective teacher and her view of teaching in general and mathematics in particular aligned well with the intentions of Alva’s MTEs. As she put it, “I was the kind of teacher that teacher educators wanted”. During her final year of teacher education, she worked with children who, for various reasons, did not fit within mainstream classroom settings. This experience led to her getting her first teaching post, teaching students in grade one (aged 7-8 years) who “needed some attention”. She found this particular situation challenging and after one year she moved to a different school called Oakby (a pseudonym). At Oakby, they have a two-teacher

system where both teachers are responsible for each class, which sometimes involves co-teaching. After a few years, Alva was broadly regarded as an excellent teacher and a role model for her colleagues. She has featured in the local news on more than one occasion in recognition of her outstanding teaching of mathematics and her interest in students' learning.

Andreas first met Alva in August 2011 and followed her closely throughout her teacher education and for several years afterwards as a part of his doctoral studies (Ebbelind, 2020). She did not, however, make it into his thesis since she transferred from upper primary to lower primary teacher education (Ebbelind & Helliwell, 2023) and no longer fitted the profile of participating prospective teachers. She was a highly committed prospective teacher who was engaged in the primary school programme council working with questions of quality concerning teacher education. She was an authority during the mathematics education course and highly valued amongst the MTEs. Thus, she was justified in saying she was the kind of mathematics teacher that teacher educators considered to be highly effective.

5 A story of dissonance

From our analysis, we identified three repertoires that relate to the notion of dissonance. We refer to these repertoires as: 1) How I am as a mathematics teacher and as a person; 2) Being a mathematics teacher: an impossible mission; 3) Teacher education: a fiction, or? In this section we present Alva's story in relation to each of these repertoires constructing interpretive accounts and drawing directly on Alva's story reflecting explicitly on the notion of dissonance as it manifests in each case. Finally, we discuss these interpretive accounts and consider consequences for mathematics teacher education.

5.1 How I am as a mathematics teacher and as a person

During the interview, Alva spoke several times about what she is like as a person both inside and outside of the mathematics classroom. She is unable to go into a mathematics classroom and not be herself, something she perceived many of her colleagues as doing. To Alva, these individuals are playing a game, the game of being a mathematics teacher. She considers her authenticity to be the reason why she connects to her students, saying, "I see myself as one of the teachers who is willing to be myself in the mathematics classroom, and I can joke around with the children". In contrast, she describes her newest colleague as "correct, a strict teacher, so to speak". This way of being herself in the classroom allows her to meet the needs of the students because she is there for them "mentally" as they work. She is adaptable to the teaching context.

Alva experiences a tension between being herself, being the mathematics teacher she wants to be, and being a mathematics teacher like some others she works with. She wants to start projects, plan themed days, start collaborations, and so on. "I think it's boring if we just work from the same mathematics book every day and don't do anything fun, even though it might be better for me in terms of my energy levels". But she knows

that being “fun” is not always the best choice in the long run and so over the years, has become more careful. “Even if we’re having fun, there should be a connection to the mathematics curriculum”. She has worked with teachers who spend too much time on activities that do not relate to the curriculum, “it can be like free-time during school hours”.

She has been referred to as “Miss PP, Miss Perfect Pedagogue”. She reasons that she follows the intended mathematics curriculum and concludes that she’s “like a teacher should be”. She says that things have to be done properly. “I see so many children in other classrooms, just sitting there”. Even though she feels that she is inadequate she says “I think I must have been a good mathematics teacher. That’s what everyone always said, including during teacher education”. Alva knows more teachers that have quit the profession. She thinks they might have had the same experience. “In some settings, you go against the flow, and people like me give up and think, OK, we’ll do those pages in the mathematics textbook, and that’s it. Some of us want a little more out of the teaching profession. Yes, we want to work more practically, allowing students to develop skills to think mathematically as the curriculum intends”. She describes how some of her colleagues talk like they care about the children, say the right things, but she knows how they are in the classroom, how they talk about the children during breaks and so on. “Probably, they know what they are doing. They are not stupid, but I cannot bear it”. So, Alva “basically hit a wall”. According to Alva, to survive as a teacher you cannot care too much for the children. You need to be able to shut off and go home.

But I couldn’t do that because there are people involved. I think the job is too much for me because I want to be a professional. I want to do an excellent job in relation to the curriculum. I think that many people, like some of my older colleagues, don’t have anything left in them for relationships or emotion. That’s why they are able to stay in the profession. And that’s why I think I cannot be a teacher. I can’t handle that.

In terms of dissonance, we recognise multiple sources of tension or contradiction as articulated by Alva. Firstly, in relation to wanting to be herself, when she views colleagues as doing something other. Secondly, in her desire for students to enjoy mathematics (have “fun”) whilst adhering to what she perceives the expectations of the curriculum to be. Thirdly, and perhaps most profoundly, her necessity to be there for her students, to build strong relationships with them, which she feels the burden of. She feels like the only solution is not to care, and assumes this is how other teachers must cope.

5.2 Being a mathematics teacher: An impossible mission

For Alva, teaching is an impossible mission, impossible to meet the needs of every child whilst enacting the reform-oriented teaching practices that she values. Regardless of how hard she tries; she feels she is unable to reach everyone. “My mission has been to reach everyone, but that’s sometimes too difficult. You try, but you know that you can’t do it”. She talks a lot about relationships, those she has built over the years with the students she has taught, there seems to be an underlying assumption that Alva “sees” the

students that others do not. “I notice everyone, especially those who fall behind. I think that’s what I’ve come to realise, I just had to accept that I can’t do more than what I am already doing if I’m going to survive, but I’m not that person. I don’t think I can become that person either, so you have to do a lousy job to survive”,

The possibility of not doing a good job, however, is unbearable for Alva. In contrast, she says she has colleagues that do not seem to experience the same problems. For Alva, it is hard to understand how some teachers might not see the problem in all of this.

Teachers like me, who people think are good teachers, are not supported to stay that way. Sometimes that’s why I don’t want to stay. I could become a really good teacher if the conditions were right. I would be the teacher you wanted me to be during teacher education. I can’t accept not being the best teacher I can be. And there are two ways of dealing with this. Either I can get annoyed that other people don’t understand, since to me it is obvious, or I somehow accept it and do a lousy job.

Alva perceives her necessity to meet the needs of all of her students, both mathematically and pastorally, as incompatible with the reform-oriented practices that she values, a tension which causes Alva to experience a strong sense of dissonance. She views the only sustainable response to this dilemma as doing a “lousy job” which she is unwilling to do. She is desperate to be a good teacher in relation to her own set of criteria, but sees this as impossible.

5.3 Teacher education: A fiction, or?

Alva refers back to teacher education throughout the interview in relation to several different topics. She is both critical and positive at the same time. Critical in the sense that she thinks teacher education gives the wrong image of mathematics teaching but positive for the same reason. For Alva, teacher education presented a version of mathematics teaching as it *should* be, an image of teaching that she concurs with, but one she feels is not attainable as a practicing teacher. She suggested that the image of teaching mathematics as promoted by teacher educators, along with her eagerness to become this teacher, made her question her ability to teach. She is troubled by the suggestion that you can “reach every student” which she views as a lie, “a pure lie”. Alva concludes that this principle embodies the very essence of teacher education:

You learn this by heart during teacher education, but it is impossible. Teaching is an exclusive profession, and we need to know that, not hear all the lies about inclusion and reaching every student. We need to try reaching all students, but we also need to hear from you that it is impossible. Many of us are sick of trying to be the teacher that teacher educators promote.

Having said that, Alva still believes that inclusive, reform-oriented teaching is indeed the best way to teach mathematics. She is convinced that it is, but “the rest of the school system is not yet there”. Alva suggests to the mathematics teacher education community

that when we promote inclusion and “reaching every child”, that we “get the opposite of what is intended... and that’s ironic”. What we actually end up with, according to Alva, is traditional classrooms “where everyone sits and does their own thing, that does not cohere with the curriculum”. Alva says she has been thinking a lot about these things, concluding that her “school-based mentors turned out to be right when they said that teacher education is not the reality of teaching”. In Alva’s view, teacher education can do more to prepare teachers for teaching and becoming a mathematics teacher:

They need more elements of modelling teaching, and more problematising in relation to our different school experiences. Five weeks of using a textbook, that was it for me. Then I felt like, well, I don’t want to become a teacher.

Alva feels that teacher education sometimes paints a picture of the teaching profession that is too romantic, that it “presents the teaching profession as if it works perfectly in some kind of perfect context, but it’s not that at all. They cannot keep on doing that”. Alva wants teacher education to be more “grounded in reality”, but at the same time:

This school that [teacher educators] promote should exist, but it doesn’t, and the problem is that we are too many trying to do the things you say because we think it is the right thing. I think it is, but look what has happened to me trying to follow that dream. We could scare people away from what we said was the reality. Well, I don’t know. If you think about it, that school could exist. Yes, that’s true. Maybe that’s the problem.

We observe here several sources of dissonance for Alva who feels that the reality of mathematics teaching is not reflected in the romanticised ideals she perceived as being promoted during her teacher education. At the same time, she admits the value of reform-oriented practices, and so is not rejecting this ideal vision but appealing for teacher education to allow for “more problematising” in relation to what prospective teachers experience during their internships. In a somewhat contradictory sense, Alva sees what she has tried to achieve in her teaching of mathematics as resulting in a less inclusive classroom, she sees the ideal vision of teaching as ultimately excluding some of her students.

6 Discussion

It might be easy to dismiss Alva’s story as an account of a frustrated and overworked teacher, yet, like all teachers who decide to leave the profession, Alva’s case is both unique and important and one we feel provides us with much to think about. As MTEs, it is vital that we continually reflect on how we embody the principles that we value in mathematics classrooms and where we might ourselves contradict them. This inquiry invites us to examine the ways in which we enact our values, navigate moments of dissonance, and utilise them as opportunities for growth and development (as opposed to letting them manifest as unbearable tensions that could result in such drastic measures as leaving the teaching profession). We ask ourselves, in what ways could we, as MTEs,

support our prospective teachers in joining the teaching profession in a way that remains both sustainable and rewarding?

From Alva's case we learn some of the potential dangers if the dominant vision of mathematics teaching is perceived by teachers as the 'ideal' way of teaching mathematics. What happens in those cases where the ideal image of teaching feels too far removed from what teachers experience in schools, or where the ideal teacher is something teachers judge themselves against? As MTEs, we might well believe there is a most effective, inclusive, socially just way of teaching mathematics, yet if we consider this as a template to be applied it is unlikely to be a good fit across all school contexts and all teachers. This does not mean that anything goes, or that we abandon what we know about the benefits of, for example, reform-oriented practices, but that we might focus our attention on how we can support prospective teachers in becoming the teachers they want to become, to uncover and hold up for question any assumptions they may have relating to the nature of mathematics and mathematics teaching and learning and to make sense of this in the reality of the school contexts they find themselves in.

The so-called theory-practice divide does not exist in and of itself, but it can be created in different ways for different reasons and be experienced as dissonance. As a prospective teacher, you might identify with the views promoted during your time at university and feel, when in school, that your vision of teaching mathematics is not attainable and find yourself teaching in ways that triggers in you a sense of dissonance. On the other hand, you might value more traditional methods of teaching and position some of the ideas promoted by MTEs as irrelevant, but at the same time might feel pressured to conform. These are of course only two possibilities amongst many and all teachers are different. By framing prospective teachers as learners (i.e., the focus of teacher education is on learning to learn to teach rather than learning to teach in certain ways) prospective teacher become producers of knowledge as opposed to consumers. The challenge of mathematics teacher education is a complex one and potentially requires a shift in focus from promoting particular practices to working at a meta-level across all schools and contexts, like Alva suggests, to share and problematise a range of models of teaching mathematics. We hope to engage the teacher education community in such discussions as we have found ourselves having in the writing of this paper.

Research ethics

Author contributions

A.E: project administration, investigation, methodology, formal analysis, writing—original draft preparation, writing—review and editing.

T.H: project administration, investigation, methodology, formal analysis, writing—original draft preparation, writing—review and editing.

All authors have read and agreed to the published version of the manuscript.

Informed consent statement

Informed consent was obtained from all research participants.

Conflicts of Interest

The authors declare no conflicts of interest.

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