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Storylines in Voices of Frustration: Implications for Mathematics Teacher Education in Changing Times

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Abstract: We have interviewed becoming mathematics teachers, in the last semester of their education, asking how they experience their time as teacher students with the focus on inclusive teaching. In their forthcoming daily work, they will be responsible for arranging for inclusive teaching that addresses all the learners' needs in mathematics. We believe the voices of future teachers are important to include in conversations about how programs prepare future mathematics teachers for the work of teaching in today's schools and classrooms. We used storylines as a theoretical construct to discuss the socio-political aspects of mathematics teacher education through the lens of two research questions: What storylines emerged in interviews with becoming mathematics teachers in their last semester of teacher education when they talked about teaching in diverse classrooms? What implications might these storylines have on mathematics teacher education? Our analysis made us aware of three important storylines: (1) storylines about the importance of language in mathematics education; (2) storylines about the importance of accepting diverse methods when doing mathematics; and (3) storylines about issues of invisibility at play in mathematics classrooms. In this paper, we discuss the importance of creating space for discussions in teacher education about issues that may challenge inclusive practices in mathematics classrooms.

Keywords: diversity; teacher education; minoritized students; mathematics; storylines; language

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1. Introduction

Teacher education and schools need to lead the way in the changing times. Over the last decades, Norwegian society, like that of many other countries, has experienced demographic changes. Diversity in the population has become much more prominent and visual [1]. Norwegian schools and classrooms mirror the demographic structure of todays' society. Newly educated teachers in their forthcoming professional years will meet multilingual and multicultural classrooms, which we will refer to as diverse classrooms. They will be responsible for arranging daily inclusive teaching that addresses all learners' needs in mathematics.

We argue that the development of knowledge and awareness regarding inclusion in mathematics for all learners must be included in what are commonly called 21st century skills, the new professional skills that the social and technological changes in modern society pave the way for. There are broad suggestions as to what these skills should include (e.g., [2]). The official Norwegian report, The School of the Future: Renewal of subjects and competences, highlights the following as key competences for current and future learners: "creativity, innovation, critical thinking and problem-solving" [3] (p. 10). Often, 21st century skills are connected to the skills that students need in order "to enter the era of globalization, anticipate the fast advancement of science and technology, and utilize information technology in various activities" [4] (p. 61). There is no doubt that teacher

education must educate teachers who can prepare learners for the demands of the 21st century. Because it is impossible to ignore the social changes in our society, we consider the teachers' competence in and strategies for promoting inclusion in mathematics for all students, regardless of social background, as 21st century skills for teaching. We regard this as an important topic that new mathematics teachers should be introduced to and prepared for during their education.

As mathematics teacher educators and researchers working within the framing of the research project "Mathematics Education in Indigenous and Migrational contexts: Storylines, Cultures and Strength-based Pedagogies" (MIM project) and focusing on minoritized learners in mathematics education contexts, we are interested in understanding how mathematics teacher education in Norway prepares becoming teachers to teach mathematics in an inclusive way that meets the needs of the diverse learners, including the minoritized learners in particular, in the classrooms in Norway. We interviewed students who were becoming mathematics teachers (in this paper we use *becoming teachers* for the master's students who attended mathematics teacher education classes) and were in the very last semester of their education about how they experienced their time as teacher students; the focus was on inclusive teaching for all. We believe that their voices are important to include in the debate about how teacher education programs in mathematics prepare becoming teachers for the work of teaching in the schools and classrooms of today. Not only are the becoming teachers experienced students in the last years of their education, they also have rich experiences from teacher placement. Hence, these students' voices are a unique means of gaining insight into the current situation of teacher education in mathematics and the relations between the institution's focus and the present situation in schools.

We found that these becoming teachers expressed frustration about the differences in perspectives on teaching between their university courses and what they experience in practicums. Our interest in how mathematics teacher education prepares future teachers for their daily work aligns with the work by Raaen and Thorsen [5] who say that "the legitimacy of teacher education depends on its ability to offer professional learning that will enable student teachers to meet formal requirements as well as taking good care of the actual academic and social needs they are to face in school" (p. 1). This legitimacy is addressed through an analysis of what becoming teachers are expressing about the discourses in schools as compared to those they encountered at university or in societal conversations. The following research questions guide our analysis:

1. What storylines emerged in interviews with becoming mathematics teachers in their last semester of teacher education when they talked about teaching in diverse classrooms?
2. What implications might these storylines have on mathematics teacher education?

1.1. The Socio-Political Context for Teacher Education in Norway

We will start by describing the socio-political context for mathematics teaching in Norway before we explore the already-known tensions in teacher education. As they are in the transition from becoming teachers to full-fledged teachers, the students in our study have been actors in two connecting worlds, in school placements and in teacher education institutions, and they have experienced tensions and frustrations in both settings. Hence, these two contexts work as a backdrop for our conversations with the becoming teachers.

The Norwegian Grunnskole (age 6–16) is one of the core elements of the Norwegian welfare state for the promotion of social mobility. In fact, a goal of schooling in Norway is to iron out social differences and give all students equal opportunities [6]. However, there have been concerns raised about whether the Grunnskole manages to fulfil the goal of promoting social mobility. Social differences are rather exaggerated during the years students spend as learners in Grunnskole [7–9]. Reisel et al. [10] state:

The Norwegian unitary school system is not particularly well equipped to handle student diversity, and that this can make it difficult for students with minority back-grounds to fit in. The tradition seems to identify a contested institutional field, where teachers attempt to handle a diverse student body, without adequate curricular tools to do so.

So, even though the Norwegian society is well known for its high level of equity and social mobility, there are extra challenges for minoritized students in the educational system.

To recognize all students for who they are and to adjust for what they need as learners is an ideal for every teacher. This has had a prominent position within the Norwegian curriculum over the years and has received the label "tilpasset opplæring" (TPO, "differentiated instruction"). It is a strong guideline which emphasizes that every student must be given opportunities for learning and growth regardless of their unique situation. Like TPO, inclusion has a strong position in the curriculum: "It is important to recognize and value the diversity of students, and to see diversity as a contribution and resource" (Translated from: "Det er viktig for å anerkjenne og verdsette mangfoldet av elever, og for å se på mangfoldet som en berikelse og ressurs.") [11] (p. 3).

In addition, mathematics as a school subject is important in developing learners' competence in critical thinking and for democratic citizenship. Also, mathematics has important connections to learners' future opportunities in their social lives. Within the research field of mathematics teaching and learning, these connections are well known; for instance, Williams [12] argues that mathematics has major exchange value in our society: the high status of mathematics qualifications positions mathematics as a ticket to a future or to a good life [13]. Hence, it is of huge importance that all learners get the opportunity to develop mathematics skills and knowledge in the spirit of TPO and inclusion, regardless of their background or language skills.

The becoming mathematics teachers need to be prepared for meeting diversity in all aspects, with consciousness and care for all students (in this paper we use the word *learners* for pupils in schools). In this sense, teacher education plays an important role. In particular, the becoming teachers need to know about the importance of diversity and inclusion in mathematics [14] and to arrange for every student to have the space to build on their own thinking [15]. Furthermore, they need to know about how the dynamics of exclusion may play out. To not be aware of such issues may have serious consequences; exclusion may be hidden in plain sight. To be excluded as a mathematics learner could exclude young people from further education and life in general [16,17].

1.2. Tensions in Teacher Education in Norway in the 21st Century

How universities and schools are in touch with the changing needs in society has been a debated topic in different research contexts over the years. In the North American context, where diversity has been a considerable force for educational reforms and challenges for over a century, Bascia and Jacka [18] show how the way that educational institutions respond to societal change is problematic. While educational systems should play a leading role in promoting the emerging and changing needs of youth, there are challenges based on how institutions respond to changes in the social society. We believe that these challenges apply in the Scandinavian context too. While societal changes are rapid, change in educational institutions is slow-moving, piecemeal, and fragmented. Hence, there seems to be a time lag or reaction difference between societal changes, responses in schools, and mathematics teacher preparation.

The discipline of educating teachers goes back several centuries. There has been ongoing discussion about what kind of knowledge teachers need; this discussion goes back to the beginning of the 20th century and Dewey's [19] work. He identified two forms of knowledge that are important for teachers' work: "the skill and proficiency in the work of teaching" and the use of "practice work as an instrument in making real and vital theoretical instruction; the knowledge of subject-matter and of principles of education" [19] (p. 9). He considered possible ways to bridge the gap between these forms of knowledge. Since then,

the discussion on how to bridge the gap has continued both in the research literature and in public debates [20]. Questions like "What counts as legitimate knowledge in education?" and "How can such knowledge be obtained?" have been of interest to several scholars [21]. This is also the case in Norway [5]. A national report, the NOKUT report [22], shows that teacher education is fragmented by a divide between theory and practice, without a clear line of communication between the two. A future discussion on how to bridge the gap seems to be important. A more recent report, from 2016, about strategies for teacher education in the future, emphasizes that the "gap between campus and the world of work generally remains too wide" [23]. As we show, this gap appeared implicitly and explicitly in the interviews. The becoming teachers expressed frustrations. Hence, the discussion of the gap in teacher education is not just a discussion among researchers. It is an important part of everyday life for the becoming teachers.

Another tension that becoming teachers meet relates to the move they have to make between research-based learning (what they learn at university) and practice (what they learn in schools). Jenset and Blikstad-Balas [24] underline the fact that, in general, becoming teachers in Norway emphasize that what they learn in practice, in teacher placement, is for them the most valuable aspect of their studies. Prior research has used a number of metaphors for this move, such as bridging a gap (e.g., [20]), border crossing (e.g., [25]), or medical metaphors like those in the political discourses about "evidence-based approaches" in education [25]. The border crossing metaphor suggests a currency exchange between the theory (valued in research) and the practical applications that are highly valued in educational practices. "As progress continues in efforts to promote border crossing, those who dwell on each side should seek to respect the world across the border" [25] (p. 183). An alternative approach is presented by Bjerke and Nolan [26]. They draw on Pereira [27] and argue for the need for a post-field third space focusing on the practice–theory transition, which includes the voices of teacher educators, teacher mentors, and teacher students. They show how disruptive pedagogies in teacher education can "invite awareness and action toward disrupting and challenging dominant discourses in mathematics classrooms" [26] (p. 11). We argue that becoming teachers are primarily the ones who actively cross this border a number of times during their five years in teacher education. Hence, their voices are important.

However, an interview study conducted at four Swedish universities showed that becoming teachers do not feel properly prepared for teaching in linguistically diverse classrooms, indicating a deficiency in teacher education programs [28]. (We believe that the same feelings are present in Norwegian universities.) Teacher educators in turn express an awareness of the need to address multilingualism, but they also express uncertainty and a lack of consensus about where measures should be included in teacher education. Usually, the responsibility falls on teacher educators in the language subjects, especially becoming teachers in the "Swedish as a second language" subject [28,29]. In Sweden, "a Swedish linguistic norm is taken for granted" in teacher education [30] (p. 46) and the case is similar in Norway [31]. However, Lundberg [32] maintains that teachers' attitudes and beliefs are rather positive towards multilingualism and multilingual pupils, although "sceptical views, often based on monolingual ideologies, are present and are likely to pose challenges for the implementation of pluralistic policies" (p. 266) in schools. According to Dewilde [33], Norwegian classrooms are also subjected to a language ideology that promotes Norwegian language as the only language of instruction.

As we can see, there are several tensions in teacher education, and the becoming teachers in our study were exposed to and were a part of these tensions during their education. Thus, their stories have huge importance in the endeavor to understand the dynamics between what the teacher students learn and what they develop knowledge of during their education and to understand what will be important knowledge and skills for becoming teachers.

2. Theoretical Framework; Storylines

We chose storylines as our conceptual lens for investigating the becoming teachers' accounts of their experiences from their time in teacher education. This choice enables us to discuss mathematics teacher education from a critical and socio-political perspective. Positioning theory puts communication acts, positioning, and storyline in a triad: any communication or interpretation of communication needs to envision a known storyline and to position the current interlocutors within the storyline [34]. Storylines, as conceptualized in position theory, can be described as peoples' worldview or the big stories influencing how people are positioned in interaction [35]. By worldview, we do not mean something static; storylines are dynamic and full of potentiality. This means that (1) storylines influence peoples' interactions; (2) interlocutors influence each other; and (3) the actual interactions influence the coming interactions. Hence, storylines are influenced by the actual interactions and the interlocutors' histories from previous interactions, and they will also have an impact on future interactions. Davies [36] explained this complexity by saying that "we are imbricated in our relations with each other, in our workplaces, in our writing and our thinking. We are the thick tangles of our relationality and the assemblages of power/knowledge that make up our lives" (p. 474). When we chose storylines as a theoretical construct to frame our discussion of the becoming teachers' stories, we were motivated to focus on the complexity described by Davies.

Herbel-Eisenmann et al. [37] describe how "a storyline tends to be a broad, culturally shared narrative that acts as the backdrop of the enacted positionings. The storyline that is invoked or called forth by the participants shapes and constrains the kinds of positions that can be enacted" (p. 104). Importantly, it is naïve to claim that there is one single answer as to which storylines are at play in any human interaction. As Herbel-Eisenmann et al. [37] note: "Because there are multiple storylines and positionings at play in any interaction, the same communication actions can be interpreted in more than one way" (p. 104).

Moreover, storylines are contestable and contingent [34]—contestable because people may either accept or resist a storyline and act within it or within a competing storyline, even when they are involved in the same interactions. The contingency of storylines means that when people are connected in an interaction, they may not be acting or talking within the exact same storyline. In other words, our interpretation of storylines will be colored by who we are and our experiences. Any situation can be interpreted with different storylines, and there is no correct storyline or positioning in any given situation [34].

Using storylines as our theoretical lens means that we recognize that culturally shared repertoires are important in all storylines; they are perhaps especially important in storylines pictured from mathematics education perspectives in indigenous and migrational contexts. Indeed, mathematics education itself has a cultural repertoire. Andersson et al. [38] found three storylines about culturally shared repertoires in public news media about mathematics education and minoritized groups: (1) the majority language and culture are keys to learning and knowing mathematics; (2) mathematics is language- and culture-neutral; and (3) minoritized students' mathematics achievements are linked to culture and gender. Undoubtedly, these storylines of the general public would also be known to becoming teachers.

Previous research on storylines from work by mathematics education researchers [37] and in the public news media [38] are powerful voices that can (re)produce 231 "common sense" about mathematics education [39]. However, because storylines are reciprocal—human interaction goes both ways [34]—the "consumer" voices of mathematics education are also important in understanding mathematics teacher education.

Importantly for this study, becoming teachers meet storylines in university, in practicums, and in society, and these storylines are contestable and contingent. Hence, a way to rephrase our research questions could be to analyze what happens when these becoming teachers meet conflicting storylines and how they handle these tensions or frustrations that they talk about.

3. Methods

This research is part of the Norwegian Research Council's FINNUT-granted project MIM: Mathematics Education in Indigenous and Migrational contexts: Storylines, Cultures and Strength-Based Pedagogies (see https://www.usn.no/mim (accessed on 8 July 2023)); it is a collaboration between Canadian, American, and Norwegian researchers, drawing on participatory approaches to investigate educational possibilities and desires in times of societal changes and movements. Although we focus here on the Norwegian context, we recognize that these kinds of societal changes and movements impact many countries throughout the world. With these changes, language diversity may be the most obvious challenge in mathematics classrooms, but this reality also connects to cultural differences and the conventional characteristics of the mathematics subject and discipline [40]. Indigenous communities have experienced linguistic and other challenges for decades as a result of colonization.

The data for the research reported here come from in-depth, semi-structured interviews with nine teacher students who completed their five-year mathematics teacher education while writing master's theses that were connected to the MIM project. The nine students, from two universities, all had experience of working in schools as teachers in addition to their five-year university education. Some of them drew on teaching incidents when reflecting on their teacher education experiences. Three of the students had experiences from working in indigenous school contexts in northern Norway, and all of them had experiences from multilingual or multicultural primary school classrooms in urban schools. One student had experience from introductory classrooms where newly arrived students aged 16–21 years old were introduced to the Norwegian school system while learning Norwegian. Mathematics teacher students were informed about the MIM project during their first years in teacher education. They were students at institutions where MIM participants give lectures in mathematics classes. After learning about the MIM project, some of the master's students expressed interest in migrational and indigenous aspects of mathematics classrooms. Some of the students chose this as the topic for their master's degree studies. The interviewees were recruited from this last pool of students.

All the interviews except one took place in the student's last semester while they were writing up their master's theses. Each interview used Zoom and involved two people from our research team and one student. The interviews were recorded, anonymized, and transcribed in Norwegian. In the semi-structured interviews, the students were invited to share their experiences and reflections freely. Examples of the interview questions include: Can you briefly say why you chose teacher education and not least why you chose to become a mathematics teacher? Can you describe one successful lesson where you organized mathematical learning opportunities? What have you learnt from teacher education about mathematics instruction for minoritized and indigenous students? Our ethical protocol was an important part of ensuring open communication from the students. The participants were informed in advance about the study, through a written informed consent process before entering into the research. Participation was voluntarily and the participants were informed that they could withdraw from the research without giving a reason and without negative consequences.

The analysis process was iterative. We started out by independently reading each interview multiple times, trying to understand the student's stories. We took notes of what the becoming teachers talked about regarding their teacher education experiences; what they said they learnt (or not) during teacher education; and what struck us as important in their interviews. When we met as a group, we critically reflected on and discussed the different themes and topics as potential storylines. The first selection process involved asking whether the themes or topics were relevant for teacher education. The next process involved discussing how the remaining potential storylines were connected to the storylines that were already known (by us) from the relevant literature in mathematics teaching and learning. This made us realize how some topics were interconnected, and the list of storylines was once again reduced. We considered whether the storylines we had identified

in the becoming teacher interviews were overlapping or contrasting, whether some of them were overarching, or whether some of them were less prominent than others. This made us reflect on our findings and on this article, and we decided upon the following three storylines: (1) storylines about the importance of language in mathematics education; (2) storylines about the importance of accepting diverse methods when doing mathematics; and (3) storylines about issues of invisibility at play in mathematics classrooms.

The participants in this study were master's students in mathematics teaching and learning in their very last semester; the students wrote their master's theses as part of the MIM research project. This means that they had a special interest in equity and social justice questions and wanted to develop strength-based pedagogies in diverse mathematics classrooms. The becoming teachers in our study were involved in the MIM project, even if their theses explored different topics. Also, we as researchers are involved in the MIM project. We are aware that the becoming teachers' interpretations and reflections of experiences from their educational pathways are colored by who they are, as the analysis is colored by who we are. Moreover, we are aware that to name storylines through a research process and to present them to a reader may reduce their complexity. This resonates with what Gerbrandt and Foyn [41] noticed in their discussion on how to hunt storylines; to name a storyline and present it to an outsider could be compared to freezing a picture of a movie. The frozen picture would in this case include us as researchers, the transcripts, and the relationships between them. As Gerbrandt and Foyn [41] state, "It is like three threads coming together, and it is within these threads and in the spaces between, that we are trying to capture the surrounding narratives" (p. 329). We are aware that other researchers and other becoming teachers could have enabled other storylines to emerge. However, this does not mean that we regard our findings as unimportant. Rather, our interpretations are possible meanings that are important to highlight—they promote a discussion on teacher education in changing times from the perspective of the MIM context.

4. Results

Even though the becoming teachers in our study gave an account of their own reflections, thoughts, and experiences from their specific and unique contexts, our analysis show how they talk about similar topics that cross-cut the data. This enabled us to become aware of the storylines about mathematics teaching and learning which surround the becoming teachers in their educational pathway towards becoming full-fledged mathematics teachers. The structure of our findings is presented as follows: for each storyline, we first introduce how the given storyline is presented in the research literature; then, we turn to how the storyline was expressed in the becoming students' narrative.

4.1. Storylines about the Importance of Language in Mathematics Education

4.1.1. Storylines of Mathematics Education and Language in Research Literature

At university, becoming teachers usually learn that languages are to be seen as a resource in diverse multilingual classrooms; this is in line with what the research has shown in, for example, Canada [42], India [43], New Zealand [44], Sweden [45], and other countries. They may learn that code switching—the practice of switching among languages within a conversation—supports multilingual students when learning mathematics [46]. In a South African context, Chikiwa and Schäfer [47] conclude "that consensual understanding of best practices for code switching is required to promote code switching that is precise, consistent, transparent and thus supportive of teaching for conceptual understanding of mathematics" (p. 244). Becoming teachers may also learn that translanguaging may support mathematics learning, as was shown in a Hong Kong context [48] and in Spain [49]. The theory of translanguaging challenges simplistic divisions between languages and describes "translanguaging" practices that are more nuanced than code switching, including non-standard languages and words and complex and shifting linguistic identity.

However, in Norwegian schools there seems to be a *Norwegian language only* storyline, a storyline about monolingual ideologies [33]. We decided to write about it as a storyline

as we, and others, cannot find evidence that "Norwegian only is best practice" is required in steering documents. There seems to be an established truth that says that you learn Norwegian better or faster if the language of instruction, Norwegian, is the only language allowed in the school classrooms (as, we note, is the case for English in a number of other countries) [44,50]. Nortvedt and Wiese [51] interviewed Norwegian mathematics teachers about "their classroom practices and on how they adapt teaching and assessment situations to migrant students" (p. 527). These teachers addressed language issues, explaining how a common language is considered crucial for mathematics communication and student-centered teaching. The importance of language is also addressed in Norwegian policy documents. These documents argue that knowing the majority language is crucial in processes of inclusion [52].

Choosing the language of instruction in mathematics classrooms is not simple. There are, among other aspects, the language(s) spoken by the teacher; the language(s) spoken by a particular learner; and the language spoken by the other learners. Moreover, there is the language advocated by policy documents, which tends to be the majority language [53]. On the one hand, it is helpful for the learning opportunities if there is a common language in the classroom. On the other hand, it is helpful for the particular learner if the language of instruction is adapted to a language familiar to the learner. Hilt [52] explains part of this complexity: "Both inclusion and exclusion processes are necessary in order to draw distinctions between a system and its environment, in the case of politics and education as well as other systems. After all, it is not the minority language in itself that is the problem, but how the lack of a common language challenges the extensiveness of educational communication" (p. 108). This explanation intersects with the Norwegian teachers' view of language as both a key and an obstacle to learning [51].

The becoming mathematics teachers might have first-hand experiences with language-related tensions when moving between the theory–practice transitions and the practice–theory transitions [26]. While acknowledging the language-related challenges, we suggest that it is important that mathematics teacher educators facilitate the becoming teachers' opportunities to critically reflect on these kinds of experiences. Teacher educators need to help becoming teachers enact critical emotional praxis so that they can disrupt the taken-for-granted language-related storylines in mathematics education. This can provide becoming teachers with the opportunities to understand and challenge how they "address questions of otherness, difference, and power" [54] (p. 307).

4.1.2. The Expressed Storyline about Language as Important in Mathematics Education

All the becoming teachers express and underline the importance of the connections between the language of instruction, the languages allowed in the classroom, and mathematics education, and they wish they had learnt more at university. We start by sharing one of Vilde's practicum experiences after meeting a 10-year-old immigrant boy in school:

> *I met a boy who had come to Norway two years ago. And he was a real resource in maths [. . .] because here he contributed to the classroom environment, knowing that somehow "here you are allowed to answer incorrectly". He helped to ask a lot of questions, i.e., "stupid" questions and, as it were, big questions and everything he wondered about, he asked about. And it also contributed to the fact that the others "here we can. Here it is allowed to . . . ask what we wonder about". And he was good at explaining to the others and putting into words how [. . .] he was very good at explaining things in a very simple way to other students who found the things we worked on difficult. He was a supporter for me in my very first maths lessons, he was a supporter because he understood what the others didn't understand and helped me explain them [. . .] I experienced this as a real resource in the classroom [. . .] but of course he lacks many terms which we cannot uncover in such a conversation.* (A:1) (A is short for "Appendix A" in the Supplementary Material, and 1 is the ordinality of the utterance within the Supplementary Material)

In alignment with the university scholarship, Vilde considered him as mathematically knowledgeable, and as a resource in the classroom because he explained and because he supported the other learners in his translanguaging way. Vilde experienced the way in which his questions opened the mathematical conversations because his questions and explanations enabled him and her to explain things for the other learners; but also by making it appropriate to ask questions in any language or a mixture of languages. However, the ordinary class teacher considered this boy as low achieving in mathematics because he did not understand the questions during test situations:

> *But then his teacher asked me about what I thought of him, like what grade I would think he got, I said he must have a 5 or 6 [6 is the top mark in the Norwegian grading system] because he has a lot of competence in maths. And then the teacher says no, he is between 2 and 3 because he does not understand the questions in the test situations.* (A:2)

Contrary to Vilde's view of the boy's mathematical competencies, the teacher was more oriented towards the boy's test results. Vilde reflected further on how test situations could be adapted to the learners' language:

> *And then there is a test, then he [the same boy] asks: "What does increase mean?" Then there is that word that sort of... then of course I helped with that, but I had actually been told that I shouldn't help with questions, but then it was in a way the language that was a challenge for his performance, because it was quite clear that he had a high level of competence in maths.* (A:3)

Vilde's story is not a solitary voice about an awareness of language challenges and how to meet them. This situation was challenging for the becoming teachers. They expressed a wish to adapt the tests so the language would become familiar to the learners, but they were not allowed to make these kinds of adaptions. Marja said, when commenting on the Norwegian language only storyline, that:

> *[...] then you can see that a storyline like this is more real with language being the key to everything, language and culture being the key to everything.* (A:4)

Beth described a similar experience:

> *I've been in practice and, as I said, I've met students who have Norwegian as a second language and I've come across problems, but I haven't thought about how to fix those problems until we've had those subjects [at the university], that how do you manage to get into them, how will they manage to understand us?* (A:5)

Kim raised a similar concern related to the context of superdiverse classrooms (see, e.g., [55,56]):

> *Yes, a few have been able to discuss in other languages. But the problem here in Oslo is that there are so many groups that meet in the same classroom. So, it is quite rare that you have two students who speak the same language. Then that opportunity [to use another language than Norwegian] doesn't really exist. Even if someone who is a little better in Norwegian can tell you that we say it this way and that way, in Arabic. But then it stops a bit there. Quite simply. Also, because many have only learned the concept we use in Norwegian, since they have attended children's and youth schools in Norway. So often they can't do it in their mother tongue either.* (A:6)

Part of the becoming teachers' expressed frustration relates to the need for a common language and language rigidity within the mathematics classroom—the sense that everyone should be using the same language. Another part of their experiences is related to the learners' wishes and reflections. The becoming teachers' experience was that the learners really wanted to learn mathematics in Norwegian, as Henning says:

> *They point out that they would like to just learn it in Norwegian in one way, with Norwegian language and terms, and that it becomes almost confusing to mix their own mother tongue into it. The way that they don't mix up the terms is special. Like the boy*

> *who then speaks both Italian and Tigrinya, he in a way very much wants to learn it in Norwegian and speak Norwegian and to use the Norwegian language in a way. So that he can join the class. [. . .] He is afraid of misunderstanding terms, so he would very much like to memorize it. Learn it in Norwegian.* (A:7)

This storyline focused on the becoming teachers' reflections on how to communicate about mathematics with learners that have language and culture backgrounds that differ from those of the dominant context. They were frustrated and explained how they experienced struggles in the "Norwegian language only" classrooms. As the last utterance illustrates, however, we should not forget the learners' wishes and concerns about learning mathematics in diverse classrooms.

4.2. Storylines about the Importance of Accepting Diverse Methods when Doing Mathematics

4.2.1. Storylines of Mathematics Education and Method Rigidity in Research Literature

The pace of the world is rapidly changing, and we (the society) can only imagine or predict the skills needed for the 21st century. This increased pace and uncertainty has implications for schools and higher education. Schleicher [57], Director for the Directorate of Education and Skills—OECD, explained that:

> *Education today is much more about ways of thinking which involve creative and critical approaches to problem-solving and decision-making. It is also about ways of working, including communication and collaboration, as well as the tools they require, such as the capacity to recognize and exploit the potential of new technologies, or indeed, to avert their risks. And last but not least, education is about the capacity to live in a multi-faceted world as an active and engaged citizen. These citizens influence what they want to learn and how they want to learn it, and it is this that shapes the role of educators.*

These changes have implications for teacher education, and one of the current method debates is about what should be considered as mathematics knowledge. Using the words of Skemp [58], this debate is about tensions between instrumental and relational knowledge. Others have addressed what was almost the same debate by using the words procedural and conceptual knowledge [59]. More recently, remnants from this debate were given topicality and were discussed at a culturally oriented level in discussions about culturally responsive pedagogy (CRP) and mathematics teacher education. Nolan and Keazer [60] describe CRP "as a critical component of teaching in ways that value and incorporate children's diverse cultural and community knowledge resources" (p. 151). This approach can be considered a response to the beliefs about mathematics as non-complex, value-free and culturally neutral [61]. When mathematics classrooms are framed within these beliefs, the learning situations tend to be oriented around direct instructions that promote method rigidity [62]. These debates can be pictured using the border crossing metaphor [25]. The non-complex and rigidity approaches are on one side of the border, and the complex, relational, and diversity approaches are on the other side.

Returning to the method debates, we recognize teacher education as being crucial for teachers' knowledge about the importance of allowing and encouraging all learners to use diverse methods. One concern raised in the method debates is whether diverse and multiple methods are beneficial for all learners. Lynch and Star [63] explained some of this complexity: "Despite apparent professional consensus, debate continues about whether instruction with multiple strategies is beneficial to all students or only to high-achieving students" (p. 7). Another part of the complexity within this debate is that the changing times are influencing what is considered useful to learn and whether it is appropriate to learn it. Cultivating learning in the 21st century can be demanding for teachers, and the challenges and fears might be more visible than the opportunities and insights [64]. This is part of the backdrop for our wish to learn more about how becoming teachers reflect on the methods available for learners in mathematics classrooms.

4.2.2. The Expressed Storyline about the Importance of Accepting Diverse Mathematical Methods

The importance of accepting diverse mathematical methods is a storyline at play in the tensions between the freedom to use multiple methods and the expectations related to method rigidity. This storyline can be considered a response to the storyline about method rigidity (e.g., [63]). This storyline was visible in the interviews when the becoming teachers shared reflections and experiences related to methods that differed from the ones addressed by a particular teacher. One example is from a student's perspective when the becoming teacher, Vilde, described a situation where a foreign student explained her experiences related to a method from her home country:

> *The student said: 'in my country, I have learnt to calculate a percentage like this.' She showed me an algorithm which was brilliant! She then told me that she was not allowed to use this method on tests. She explained 'because here I am supposed to do mathematics as we do it here.'* (A:8)

This utterance exemplifies that migrant learners might experience that they are not allowed to use methods in Norwegian classrooms that they learnt and used before moving to Norway. One consequence of method rigidity might be that students are not given agency and authority to think mathematically. Instead, they are positioned as non-competent, with the duty to follow the rules and procedures given by the teacher. The becoming teachers explained how this positioning might influence how students are experiencing mathematical opportunities, or the lack of these opportunities. As Vilde explained:

> *it is related to students not considering themselves as successful in mathematics. They are afraid of trying (. . .) they are not trusting themselves, like: 'No, I don't think I am right'.* (A:9)

However, if learners are not allowed to use the methods that are familiar to them, it becomes challenging for the learners who must relearn and also understand why. Understanding is another method-related aspect that came up in the interviews. Jørn described:

> *the ideal teacher as a person that gives students the opportunity to understand.* (A:10)

He had many experiences during placement periods with teachers that emphasized drill over understanding:

> *you have to practise, practise, practice* (A:11)

Jørn continued to explain that he saw understanding as more helpful for mathematical learning opportunities than practicing algorithms without understanding. The becoming teachers shared experiences related to method rigidity:

> *So, among the mathematics teachers working at that school, there are expectations about which methods and strategies to use.* (Vilde, A:12)

> *They [migrant learners] might have other methods that are incorrect, or they are not incorrect, but they can be interpreted by the teacher as incorrect (. . .) for example, if they [learners] are from South-Africa and their father who is an engineering teaches them equations, their teacher might reject it because the method is not familiar to the teacher.* (Emma, A:13)

The becoming teachers expressed frustration related to method rigidity. On the one hand, they experienced situations in which teachers were limiting the available and allowed methods in mathematics. On the other hand, they experienced multiple and diverse methods as a great source. In the words of Vilde:

> *So, then among these teachers who worked at this school and have mathematics, they have an idea about which method of procedure should be followed. Then there was a group in the classroom with many different ways of solving percentage calculations, which was absolutely brilliant for me. Which gave such a huge bang for the buck in other ways of doing it. I came back to university and just "okay, look here now! In this country they do*

> *it like that and in this country they do it like that!" And this is a great resource! Sitting in a classroom, you suddenly have ten ways to do it instead of one way to do things.* (A:14)

The way this storyline was at play in the interviews illustrates that the becoming teachers move in the intersection between method rigidity and the freedom to use multiple methods. On the one hand, they shared experiences with students and teachers operating within the frames of method rigidity. On the other hand, they advocated the freedom to use multiple methods. Henning explains how the master's courses in teacher education changed his understanding of the importance of accepting diverse mathematical methods and led him to challenge experienced mathematics teachers:

> *I have noticed that I as a becoming teacher educated at a master level, am challenging some of those around me. It relates to how things are done in the way of thinking I have with me from the university. It challenges them.* (Henning, A:15)

The becoming teachers described another way that they handled the frustrations related to method rigidity vs. method freedom; this was to go behind the teachers' backs:

> *So, we went behind the backs of these teachers and did things the way they [learners] did things because then you could transfer it to the way these teachers wanted it then [. . .] I thought it was strange.* (Vilde, A:16)

This storyline focuses on the becoming teachers' frustrations related to method rigidity. They described a tendency towards method rigidity in schools, where the methods familiar to the learners were not necessarily accepted as valid in the classroom. The becoming teachers recognized the teachers to be the source of the method rigidity; for example, the becoming teachers were not allowed to translate words to help learners during test situations. In other situations, it was the learner that explained that their methods were not considered valid or allowed in the classroom. The frustration originated from the experiences with method rigidity and the becoming teachers' expectations about mathematics as a way of thinking rather than a count of test scores.

4.3. Storylines about Issues of Invisibility at Play in Mathematics Classrooms

4.3.1. Storylines of Mathematics Education and Issues of Invisibility in Research Literature

To be aware of students' social background and how that affects how they are positioned as mathematics learners has been explored over the years by several researchers [65–68]. Their work explores how a white, male, middleclass background position students in a privileged position as mathematics learners. These students are easily noticed and given attention by the teachers while other groups of students and their needs are more invisible. Stepping outside of the mathematics classroom, the occurrence of visibility and invisibility for students that are different from the majority groups continues. Wing [69] focuses on race and discusses how Asian students expressed feelings of invisibility and insignificance and notes how this group of students was rendered invisible by widespread acceptance of the "Model Minority Myth", that Asian students are different from other racial minorities within the American context. Moreover, language issues are also part of the dynamics of invisibility, such as in the way that minority languages become invisible because of the dominance of majority languages. Major [44] notes, from a study conducted in New Zealand, how the use of English in schools is taken for granted as the norm and is used as the dominant language. This resonates with studies within the Norwegian setting. Schipor [70] and Krulatz et al. [71] claim that minority languages in Norwegian schools tend to be regarded as less valuable than Norwegian and English.

From studies within the field of gender and mathematics, we know that invisibility is a mechanism to hide being different and exposed. Walls [72] explores girls' invisibility and argues how female students in mathematics "are required to don a cloak of invisibility that affords them temporary status as honorary males in a male domain" (p. 47). However, invisibility is not just about the students' wish to not be seen, it is also a question of being noticed by others. The combination of students' invisibility and teachers' failure to see is discussed by Foyn and Solomon [73]. They explore these dynamics in the case of

Sarah, a female high-achieving student who was overlooked and not recognized for her mathematical competence. They argue that there was a double bind; Sarah was caught between the others' 'failure to see' and her invisibility in that she was unable or unwilling to perform smartness.

Even though teacher education has a focus on TPO and inclusion for all students and learners in diverse classrooms as an interdisciplinary topic, the dynamics of seeing, noticing, and recognizing all students for their uniqueness as mathematics learners, regardless of their social background, are debated and will be a challenge that newly educated teachers will face when they start their professional work.

4.3.2. The Expressed Storyline about Invisibility in Diverse Classrooms

The storyline about issues of invisibility at play in mathematics classrooms relates to learners having a mother tongue that differs from the dominant language (in our study the dominant language is Norwegian).

> *And I see nothing! I see nothing at all! I don't think it is any of them who talk about it. So, it is totally invisible.* (A:17)

These are Vilde's words describing some of her experiences with teaching in diverse classrooms and with students that have a mother tongue other than Norwegian, and we noticed a sense of frustration in her words. Vilde's teaching experience was in a school that had a small proportion of students that did not have Norwegian as their first language, and she explained that it was hard to know or notice whether the learners met the challenges of having Norwegian as the instruction language in schools or which strategies the teacher used to help the learners.

> *And of course, it might be that things are done that I am not aware of. But I haven't seen anything other than a comment in the hallway: 'I do struggle a bit about the language and…' And that's that!* (A:18)

She elaborated on the reasons why the students' challenges with regard to language did not get attention:

> *I think it is a bit unfortunate for the students, because there are too few of them. That it's not such a big problem in a way. Then you rather go under the category that you have slightly greater challenges in the subjects.* (A:19)

It seems like it passed under the radar. The low proportion of students with a mother tongue other than Norwegian made it hard to notice them, or it made them invisible.

The becoming teacher Kim, on the other hand, describes the opposite case, when having a mother tongue other than Norwegian is normal and is the case for the majority of the learners. She elaborated on she experiences the support teachers have when they teach diverse groups of learners in mathematics. Kim said:

> *For the subject's concerns, it has been ok, but it is like the culture part is invisible. Here [at my school] everybody is different, that is how it is. So that's not much, I think the knowledge of this is scarce, at schools. Especially here. It has not been a topic. Quite simply.* (A:20)

To have a large group of students that have another mother tongue does not catch the attention or become a case discussed among the teachers, at least not to the knowledge of the becoming teacher Kim.

While Vilde and Kim talked about how the students' situation of having a mother tongue other than that of the instruction language was passing under the radar and not given attention, Beth raised the issue, based on her experiences, that some students were trying to hide being different. She said:

> *In that class there were some who had Norwegian as a second language. Then we had two girls in the class who hadn't been in Norway that long. So, they didn't speak Norwegian very well, […] the two girls were very quiet and there I noticed that I was having*

> *problems and felt that they didn't understand me. Then I asked if they understood the task, and they said yes. At least as I have experienced that they often say. Yes! It's going well. They also don't understand anything I say, but they do the math problems. They didn't really need any help. I didn't get into them. They didn't understand what I said.* (A:21)

Beth's words illustrate a frustration about not getting into a position to help the students with the math problems because something made them not talk about the problems they encountered. She described how the students were apparently not comfortable about having their problems exposed or seen.

In these three becoming teachers' stories, they shared how language issues in diverse classrooms become invisible, either because the students' problem is hard to see or because the students hide their problems. Going back to Vilde, she described an important consequence of this invisibility: the teachers talk about these learners as groups (they) and not as individual humans. She reflected on her way of describing the students:

> *I am now aware that I/we say "they". That is really uncomfortable, [. . .] that I distance myself from someone, and that is very uncomfortable.* (A:22)

This storyline focuses on the becoming teachers' frustration about the complexity of the issues connected to students' invisibility in diverse classrooms. They describe how they became aware of how language issues, which they were conscious of as a challenge from their time in teacher education, were hard to notice within the dynamics of the mathematics classrooms, despite the fact that they brought this awareness with them. Moreover, the becoming teachers expressed a frustration about how the learners' challenges connected to having a mother tongue other than Norwegian were reduced to more general challenges in learning and that there was little attention paid to these issues in the daily work in schools.

5. Discussion

Through our analysis, we found that the becoming teachers expressed frustration about mathematics education in diverse classrooms and that the knowledge they get in university does not always match what they experience in practicum. In most cases, the becoming teachers expressed their frustrations by sharing stories from their practicums and from their time in mathematics teacher education. We consider these storylines as interesting contributions to our first research question: What storylines emerged in interviews with becoming mathematics teachers in their last semester of teacher education, when they talked about teaching in diverse classrooms? Here we discuss the three storylines presented in our results: (1) storylines about the importance of language in mathematics education; (2) storylines about the importance of accepting diverse methods when doing mathematics; and (3) storylines about issues of invisibility at play in mathematics classrooms.

The storyline about the importance of language in mathematics education occurs frequently in our data from the interviews with the becoming teachers. We identified this storyline in two different arguments. First, a common language is important to facilitate communication in mathematics classrooms. Second, language is important to be positioned as knowable in mathematics. The first argument addresses the challenges of diverse classrooms in changing times [1]. It relates to the international storyline about language as a resource in diverse multilingual classrooms (e.g., [42,44,47]). The second argument addresses issues of mathematical competencies. The becoming teachers in our study described how learners who can express sophisticated mathematical knowledge when allowed to express this knowledge in familiar ways could be considered as low-achieving learners in mathematics when they were limited to using the majority language only. This storyline shares similarities and intersects with the storyline the majority language and culture are keys to learning and knowing mathematics from a media analysis conducted by Andersson et al. [38]. Interestingly, the becoming teachers also shared experiences from learners favoring the majority language over their home language. In a world of superdiversity, some learners have several languages, e.g., a home language, the previous

language of instruction, the current language of instruction, and the majority language. The becoming teachers' expressed frustrations about this storyline, which illustrates the importance of addressing language-related issues in mathematics teacher education in the 21st century.

The storyline about the importance of accepting diverse methods when doing mathematics is recognized in the field of mathematics education and overlaps with the skills needed in changing times. The importance of diverse methods is visible in mathematics education literature [59,63], as well as in official documents [74]. Nolan and Keazer [60] emphasize the importance of opening spaces where learners can build on their "diverse cultural and community knowledge resources" (p. 151). In our analysis within this storyline, we noted that the becoming teachers expressed frustrations about minoritsed learners not being allowed to use methods familiar to the learners from earlier classrooms. The becoming teachers described diverse multiple methods as a resource, and their frustration was directed at their experiences with teachers favoring method rigidity. We see this frustration in relation to the tensions that becoming teachers encounter when they move between practice (what they learn in schools) and theory (what they learn at university) [24,26]. We identified two different approaches in our analysis connected to how the becoming teachers navigate within these tensions: (1) challenging the taken-for-granted situation in schools and (2) going behind the teachers' backs. Interestingly, the becoming teachers could have ignored these issues within the tension of research-based learning and practice. Contrary to the findings of Jenset and Blikstad-Balas [24], our findings are not connected to what becoming teachers learn in teacher placement is most valued; the becoming students in this study drew heavily on issues that had been discussed at university. Both approaches are motivated by taking the learners' perspectives and cultivating spaces for the learners to learn from strength-based pedagogies anchored in the learner's experiences.

The storylines about issues of invisibility at play in mathematics classrooms draws attention to the becoming teachers' frustrations when they realized that they were categorizing minoritized learners rather than seeing them as individuals. We noted that this invisibility might be about language. The focus tended to be more on how to learn Norwegian and less on how to use the learner's home language to strengthen the mathematical learning opportunities. We also identified that the becoming teachers addressed issues of invisibility related to the learners' cultural background. The issue of invisibility in our data is mostly about becoming teachers not being able to see, even though they expressed awareness of the importance of language in the students' learning of mathematics. The becoming teachers in our study expressed frustration when they realized that they were being captured in the dynamics of how the learners' cultural background becomes invisible. Foyn and Solomon [73] have discussed how invisibility can be reciprocal. In other words, learners can be positioned as less competent by their surroundings (e.g., teachers) and in order to meet their duties following such positioning, they might conceal their learning potential. We recognize the becoming teachers' frustration as one of the first steps toward their awareness of learners' social backgrounds in diverse classrooms [65–68]. The fact that the becoming teachers were sharing stories about invisibility, describing frustration about how they could not see the different learners' languages and backgrounds, indicates that they were drawing on alternative storylines that may challenge the education system. They know the diversity is there, but they cannot see it because the existing storylines are powerful and define what is possible to see. In addition to this, during the analysis connected to storylines about language and method rigidity, we identified issues of invisibility related to how learners' mathematical knowledge can be invisible when schools do not have the resources to use diversity as a starting point for strength-based pedagogies.

The three storylines that emerged during the research process of this study are all connected to inclusion in mathematics, particularly for the students with minoritized backgrounds. Within the debate about how schools can arrange for TPO and inclusive practices for all students, recognizing the issues related to the tendency in Norway to consider minority languages as less valuable than Norwegian [70,71] will be of importance.

Also, to open up the use of diverse methods in mathematics classrooms, to meet the needs of a diverse group of mathematics students, to direct actions for inclusion, and to act with an awareness of how being different may be disguised with invisibility will be important in order to avoid that exclusion from mathematics happens without realizing it.

The second research question guiding this study is: *What implications might these storylines have on mathematics teacher education?*

The presented storylines focus on the becoming teachers' reflections on mathematics education in diverse classrooms. We have seen how the becoming teachers were frustrated and struggled in the "Norwegian only" classrooms. How can we in teacher education support becoming teachers to be more prepared to meet 21st century learners in regular teaching situations? How can becoming teachers facilitate learners' opportunities to express their actual mathematical understanding in classroom communications and test situations? The frustration we sense in the transcripts needs to be met by mathematics teacher educators, and the practice–theory transition [26] might be a catalyst for challenging the practices behind this frustration. We are aware that the educational institutions' way of change is slow-moving, but from our point of view, to raise discussions on the existing storylines that challenge inclusive practices in mathematics classrooms will be a strong entrance point for these changes.

We consider 21st century skills as an important backdrop when identifying implications for mathematics teacher education [4]. Some of the key competencies in 21st century skills are creativity, innovation, critical thinking, and problem solving. Preparing becoming teachers to be "change agents" [74] (p. 4) is crucial for them to be responsive to changing times and tomorrow's society. We therefore propose that teacher education should and must initiate disruptive and transformative practices. The becoming teachers said that critical mathematics education [75] in teacher education had changed their way of thinking. One consequence of this change, the becoming teachers explained, was that they challenged established mindsets in schools during practicums. We do not know how these challenges were met by the teachers. Inspired by Bjerke and Nolan [26], we suggest that teacher education is facilitating post-fields that invite critical conversations about tensions related to these kinds of challenges.

Our findings show that the becoming teachers expressed a strong awareness of the learners' mathematical knowledge rather than their test scores. According to the becoming teachers, this did not align with the teachers who followed storylines of rigidity for both language and methods. The becoming teachers did not always challenge the (mentor) teachers; sometimes, they went behind the back of the teacher and used methods familiar to the learner as a starting point. The intention was to use the familiar method as a gateway to the method(s) favored by the teacher. We wonder whether the lack of direct communication about different ways of understanding mathematical knowledge relates to issues of power. We suggest that teacher education invites becoming teachers to reflect on how they can contribute to dismantling structures of power in their communication with teachers. Darling-Hammond (2004), in Chubbuck and Zembylas [54], suggested something similar: "the profession would indeed be well served if preservice and in-service teachers were given opportunities in their teacher education classes to engage in intrapersonal reflection on their emotional understanding of justice related issues" (p. 307).

To summarize, the implications of the three storylines identified in the becoming teachers' stories of their time in teacher education are connected to the importance of creating space for discussions about issues that may challenge inclusive practices in mathematics classrooms. Even though the issues in this paper are discussed within the framing of the MIM context, we consider it to be important for all learners in mathematics classrooms in the 21st century, regardless of social background. Discussions of inclusive practices should take place so that participants in both worlds can share and connect their experiences from mathematics teaching from different perspectives. We suggest a need to add a post-field space where becoming teachers, teacher educators, and mentor teachers can meet.

Within the frames of mathematics teacher education, positioning theory, inclusive principles, and critical thinking, we identified three storylines and discussed the implications they have for mathematics teacher education. Looking back on the text in retrospect, we realize that the inclusive principles were about to become invisible in the last part of the text. This illustrates the importance of being aware of how the dynamics of exclusion may play out. In our case, we had the opportunity to go back and to try to give more attention to what hindered the attention to inclusive practices. For learners and teachers in mathematics classrooms, this opportunity may not be the same; awareness is crucial for navigating within the dynamics of invisibility. To not be aware of storylines that may hinder inclusive practices may pave the way for exclusion to happen in plain sight.

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