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► **To cite this version:**

Toril Eskeland Rangnes, Andrea Synnøve Blomsø Eikset. Preservice teachers' reflections on language diversity. Eleventh Congress of the European Society for Research in Mathematics Education, Utrecht University, Feb 2019, Utrecht, Netherlands. hal-02435368

HAL Id: hal-02435368

<https://hal.science/hal-02435368>

Submitted on 10 Jan 2020

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Preservice teachers' reflections on language diversity

Toril Eskeland Rangnes and Andrea Synnøve Blomsø Eikset

Western Norway University of Applied Sciences, Faculty of Education, Arts and Sports,
Norway; tera@hvl.no and anei@hvl.no

In this paper, we investigate how preservice teachers (PTs) express their awareness about language diversity in mathematics classrooms. We use “language as resource” and “language as a problem” as theoretical constructs. The data is taken from PTs' group assignments, including transcriptions of dialogues between the PTs and multilingual students, and from PTs' written reflections about teaching in multilingual classrooms. We found that in the dialogues, PTs and multilingual students produced meanings together through negotiating a shared repertoire from out-of-school and in-school mathematics context. Nevertheless, the students' home languages were not evident as resources in PT's dialogues and reflections. A deficit perspective was present in their reflections. These findings lead us to rethink our teacher education courses so that language as a resource becomes more prominent.

Keywords: Language as resource, language as problem, preservice teachers.

Background

In this paper, we explore preservice teachers (PTs) understandings of how to teach mathematics in multilingual classrooms. In particular, we consider if, and how, they used the construct of “language as a resource” in their interactions with multilingual students and in their written reflections about teaching in multilingual classrooms.

The construct of “language as resource” has been developed as a framework to understand how languages are used and perceived in multilingual mathematics classrooms (Planas, 2018; Planas & Setati-Phakeng, 2014). Planas and her co-authors build on Ruiz's (1984) policy planning concepts of language as a right, as a problem, and as a resource. Ruiz focused on the resource perspective. This inspired Planas (2018) to develop a theoretical framework for exploring and theorizing how language can be seen as a resource in mathematics education. The focus on “language as a resource” has the potential to contribute to a shift away from seeing home languages, which differ from the instruction language, from a deficit perspective. This shift is also identified in CERME'S 20-year history (Planas, Morgan, & Schütte, 2018).

Nevertheless, how to understand and operationalize “language as resource” in multilingual classrooms can be challenging in teacher education, schools and in research. One attempt to do this is to use ideas about *translanguaging* in mathematics lessons. Planas (2018) described the focus of translanguaging as being on what learners do to convey meaning, on how they use all their languages, and not on the normative performance of the language of instruction. This includes “situations in which multiple mathematical sign systems, iconic representations of mathematical objects, and narratives of mathematical ideas co-exist” (p. 218). According to Planas, the concept of translanguaging supports a move from a focus on correct language to a more deliberate use of language resources in the participants' meaning making so that they develop mathematical ideas together. This is seen as deeply connected to equality in the

classroom, as multilingual students often find themselves being viewed as lacking because their home languages are suppressed (Barwell, 2018).

Teacher education context in Norway and in former research

The “ordinary” mathematics classroom in Norway has changed in the last 20 years from being monolingual to multilingual. In Norway, there are three official languages, Norwegian, Sami and sign language. Norwegian dominates as the language of instruction in most municipalities. In some classrooms with language diversity, there can be many different languages, spoken by refugees and immigrants. Often there will be students who will not have any classmates or teachers who can understand their home language. The discourse around classrooms with language diversity seems to be dominated by a “Norwegian only” attitude (Naustdal, 2017), similar to what has been identified in neighbouring Sweden, where the described discourse is “Swedish only” (Norén, 2016).

In teacher education in Norway, there has been little focus on language diversity in mathematics education. For example, in the former *National Guidelines for Teacher Education*, language diversity is mentioned once in the chapter about mathematics and then only as something the PTs should learn to take into consideration. In the new *National Guidelines* (Universities Norway, 2016), the resource aspect is added: “the students’ different needs, where cultural, linguistic and social backgrounds must both be taken into consideration and seen as a resource in the teaching” (p. 23). Our study is situated in this change, as we re-focus our teacher education to incorporate the view that all students’ languages can be a resource in the learning and teaching of mathematics. Through a four years long research project *Learning about teaching Argumentation for Critical mathematics Education in Multilingual classrooms [LATACME]*, our research group aims to develop both tools for teaching and theories about this development through an educational design research program. The aim in this paper is to identify our starting point, namely, how preservice teachers are currently aware of, and interpret, multilingual diversity in mathematics teaching and learning as resource, which will be the basis for subsequent interventions.

Internationally we find few studies on how teacher education can develop understandings of language diversity in mathematics classrooms. For instance, McLeman, Fernandes and McNulty’s (2012) study from the USA revealed that issues about mathematics education of English learners needed to have more prominence and to be integrated into teacher education to hinder the development of a deficit perspective among PTs. They explicitly suggested that PTs would need to be provided with experiences within the context of mathematics to help them better understand the interconnection between language and mathematics.

Based on three different contexts (South Africa, Malawi, and Spain/Catalonia), Essien, Chitera and Planas (2016) found that even though the mathematics teacher educators are aware of the linguistically diverse contexts, the “teacher education institutions rarely attend to the complexity of teaching mathematics to linguistically diverse mathematics student teachers in a structured way in their programs” (p. 107). Yet even when there is such awareness, it is challenging to change discourses (Eikset & Meaney, 2018). In their analysis of their conversations about preparing PTs for teaching in multilingual classrooms, Eikset and

Meaney found that other competing discourses, such as the PTs' expressed needs for learning more mathematics, gained priority.

The data for this paper is collected from a mandatory group assignment in the first compulsory mathematics course for those who will become teachers in Grades 1-7. The PTs were asked to write 8-10 pages about number sense connected to children's language and to link this to theory and experiences from their practicum. As part of the process, they had supervision with the second author. The PTs had to include a research question and transcriptions of dialogues between themselves and students. These PTs were in language diverse classrooms, and their interpretation of teaching in the multilingual classroom became an important part of their text. The PTs were encouraged to use their own home language as resource in their problem solving during their teacher education program and were aware of the concept of language as resource. Consequently, our research question is: *How do PT express their awareness and understanding of the construct "language as resource" through written dialogues and reflections?*

Theoretical framework

Planas (2018) described "language as a resource" in mathematics education research as being used more as a metaphor than as a defined concept in the last decade. She demonstrated that "language as resource is not about the unproblematic functioning of language as producer of meaning taken as mathematical and shared" (p. 226). From her perspective, language contributes to the realization of normative meaning in the culture of schooling and school mathematics and does so by reproducing discourses connected to these cultures. In addition, knowledge of language enables learners to influence the process of gaining meaning through interaction. Therefore, language can be a resource both for meaning making and for the relocation of culture in learning situations in mathematics classrooms. From this perspective, mathematical language cannot be separated from the learning gained from other languages or be given priority. Instead, there is a need for language from different contexts, both in and out of school, to be combined in meaning production. In Bakhtin's dialogism, learning can occur in the tension between different forces (Bakhtin, 1981). Tension can occur between voices where different opinions, understanding and linguistics settings are expressed. For example, demands to use the correct language can be one force, while focus on solving a mathematical problem can be another. Tensions might occur in the mathematics classroom between the stratified and formal mathematical language and the language of instruction on one side and the more informal and diverse multivoicedness on the other side (see for example Barwell, 2018; Planas, 2018). However, tensions provide opportunities to negotiate meaning and in multilingual classrooms to learn both language and mathematics.

In their investigations of what happens in classrooms, both Barwell and Planas have focused on translanguaging. Barwell (2018) emphasized the view of students and teachers as languaging, where they use "a repertoire of language practices that draws on students' varied experiences of communication in multiple contexts to make meaning in mathematics" (p. 161), whereas Planas (2018) stated, "translanguaging refers to what people actually do with language to convey meaning" (p. 218). This is a change of focus, from the language systems

and the mix between them, to what students and teachers do with language. This includes the use of different representations and mathematical signs to make sense and convey meaning.

Methodology

The data was collected during the autumn of 2017 when groups of PTs completed a written assignment about mathematics, in particular number sense, connected to children's language, conceptual knowledge and representations in mathematics. The PTs were in their second year of a course to become teachers of Grades 1-7 and were in their first of two semesters of mathematics education. During this semester, teaching mathematics in a multilingual classroom was one of several topics. In their assignment, they were asked to take into consideration how they could adapt their teaching. Two groups chose to include language diversity as an issue in their assignment, and one of these will be analysed in this paper. It was mandatory for the PTs to obtain data that included oral responses from students, where the PTs' role was not to evaluate or judge their students. They were asked not to collect any personal data about the students. The assessment was completed before the PTs received a written request about whether this material could be analysed for research purposes. The dialogues presented in the group's assignment were between a PT and a student in grade 6 in a classroom setting (18 students). The PTs had given the students some tasks, provided them with individual help and in some cases asked the students to explain their thinking.

We analyse two excerpts containing dialogues between a PT and a multilingual, primary-school student and the PTs' reflections on the dialogues and their comments about language and multilingual students. We use a two-layered analysis. First, we sought to identify what PTs and students did to convey meaning, how they used languages, and which repertoire they used, in order to identify instances of translanguaging. Second, we sought to identify language as a resource or as a problem in PTs reflections. To do this, we searched for tensions between voices and the potential for learning that they can create (Planas, 2018; Barwell, 2018).

The original dialogues were in Norwegian and have been translated into English as faithful as we could to retain the original sense. Where the PTs have transcribed incorrect words that the student used, we place the word [incorrect Norwegian] in brackets.

Result and discussions

The PTs' aim in the activity was for the students to discover the connection between multiplication and division. Although this was the headline on the student work sheet, the PTs claimed that the student, Laban, whose home language is not Norwegian, did not read it. The task was $98/7=$

PT: Can you explain for us how you were thinking here?

Laban: Here I took 7, but the 9 is bigger. We minus [minuse] only with the nine, nine minus 7 is 2. Then we take the eight and wait... 14... so we took only 1 here (points to the second digit for tens) with 2 which is 28, then we take 7 up to 28 so that is 4, so that is 28 minus 28, which is zero. You should all the time, when it's 7 just you should just insert 1 up here, then it becomes 7

and if you take up till 9. Then it's 14, it can't be that, so we just take 7 times 9 then minusing [minuse] the 9. I can do it all in my headed [hoden].

PT: Oh yeah! That is so cool, have you worked a lot with the timetable [gangetabell] before?

Laban: No, division.

PT: That is sort of times, multiplication. It's kind of, the twin of division.

Together with his written solution, Laban managed to explain to the PT how he was thinking. Laban demonstrated that he saw the connection between multiplication and division when, for instance, he said "which is 28 then we take 7 up to 28 so that is 4 so that is 28 minus 28 which is zero". He was switching constantly between multiplying up (7 up to 28) and reversing by subtracting so he could check if there would have been zero left to divide.

In the PT's response to Laban's explanation, s/he amplified Laban's explanation by exclaiming "Oh yeah! That is so cool". The PT also asked Laban if he had worked a lot with times tables (gangetabell) which is an informal word for the multiplication table in Norwegian. Laban denied this by saying, "No, division". His "No, division" is an interesting change as division is a more formal expression, even if the PT uses an informal expression "times" (gange) instead of multiplication. The PT then followed up with "that is sort of times" before s/he changed the wording to "multiplication", "It's kind of, the twin of division". The introduction of "multiplication" as "the twin of division" seems to be a new language construction, perhaps to support Laban to be more aware of the connection between multiplication and division, even though he already demonstrated this in his explanation. As the student and PT used resources from their informal and formal language to make meaning together, they were languaging (Barwell, 2018). The student's idiosyncratic language of "minuse" (subtract), and his conjugation of a noun into a verb as in "headed" (hoden) was in the transcription in the group assignment. However, the PTs did not highlight these examples. In this case the tension in language use was apparent in the juggling between formal and informal mathematical language, rather than between a home language and the language of instruction.

When Laban explained and requested time to think, indicated by his "wait", he used informal words and sentence construction. While he was answering the PT's question, he began to use formal mathematical words, such as division, which belong to the school mathematical vocabulary. The dialogue between PT and Laban is characterized as a mutual willingness to make sense together. It seems that the student affected the language choices of the PT.

The group of PTs reflected on the dialog in their assignment:

He explained his way of thinking and led us through his calculations. This gave us the impression that it was not his number sense that was the challenge for Laban. He is a student we can clearly see has gained much practice in mathematics.

By mentioning that Laban explained his thinking and led them through his calculation, they recognized his skills to communicate and his number sense. However, they indicated that there was still something which was a challenge for Laban, without specifying what this was.

By including his language errors, one interpretation is that the PTs saw language as a problem even as they recognized his communication skills. In the summary, the PTs repeated their belief in Laban's and another multilingual student's number sense and their explanation skills:

The students could also explain their way of thinking, the different types of calculations and how they could use this in their daily lives without much difficulty. ... Thus, we will say that it is not the numerical understanding or the number concept that hinders the students from dealing with mathematics, but rather that it is insufficient understanding of the concepts.

By stating that the students can "explain their way of thinking" and that "numerical understanding or number concept" is not the problem, they recognized the skills the students had, and implicitly that the students were able to use language in Norwegian as a resource to make others understand their thinking. However, they also mentioned what hinders the students from "dealing with mathematics"; the multilingual students had "insufficient understanding of concepts". In this way they saw the student in a deficit perspective and the lack of concepts in Norwegian as a problem.

As an example of the problem that a multilingual child had with understanding mathematical concepts, they included this conversation with another multilingual student, Ahmed:

- Ahmed: What is "even" [jevent] I don't understand...
- PT: You play soccer Ahmed, don't you?
- Ahmed: Yes, Tuesday and Thursday
- P.T: Then you divide into two teams and play against each other, don't you?
- Ahmed: Yes!
- PT: When you divide into teams, what is important?
- Ahmed: That it's fair. That there are equally many on each team.
- PT: YES! That is another way of explaining "even".

The PT used an example from a familiar situation for Ahmed, soccer, to explain what "even" means in mathematics. By using language repertoires that they had in common from outside of school mathematics, they had made sense and gained a shared understanding of the mathematical concept. In their assignment, they explained how they used the example of soccer as a translational link to help the student understand the concept of "even". The PTs used the conversation as an example of where language can cause a problem, as they write "the student does not have an understanding of Norwegian term for the concept of even". At the same time, they demonstrated how they used language as a resource in the dialogue by drawing on the example from soccer as translation link. They used repertoires from different contexts, formal and informal school mathematics, and out of school activities as soccer, to make sense together.

A question arises about whether the students' and PTs' use of languages from different situations, can be considered translanguaging (Planas, 2018). In the Norwegian context, it was

repertoire from formal and informal Norwegian which were being transformed as meaning is being made. The PTs' understanding of language in multilingual classrooms also reflected a tension between how they made use of theirs and the students' language resources from different contexts, and seeing their student from a deficit perspective where language is a problem:

During the practicum, we learned that there is a connection between being able to master mathematics and to master the language. Minority-speaking students may have limited vocabulary and little understanding of Norwegian terms. This may be because the student speaks little Norwegian at home, in his immediate social environment, or never experiences situations where the terms are used.

The PTs recognized the connection between language and mathematics learning. It is clear from their perspective, that it could be a disadvantage for a student to not have Norwegian as their home language, which could cause limited understanding of Norwegian terms. The PTs only mentioned the Norwegian language. The home language and mathematical concepts that the students may have in this language were not discussed. There was no evidence that the PTs saw the students using their home languages in mathematics. This suggests that it may be difficult for PTs to know how to use the students' language and cultural background as resource and this pedagogical practice remains more an idea than an experienced reality in primary schools.

Concluding remarks

In this study, we identify tensions in more than one sense. There is a tension between "language as resource" captured in the transcribed dialogues and "language as problem" in the PTs' reflections. This tension could provide opportunities for learning if this tension become topics for discussion. In addition, we find a tension between students' and PTs' language use with informal and formal mathematical terms. Together they were languaging by using experiences of communication in multiple contexts to make meaning (Barwell, 2018, p. 161), as when they used soccer to explain even, and in the PTs' effort to connect concepts, when making the new language construction, multiplication as "twin to division".

Planas' (2018) conceptualisation of language as resource has given us the opportunity to see how PTs use a repertoire from different contexts in their meaning making. The opposite metaphor, language as problem, made us aware of where PTs see language diversity in the mathematics classroom as a problem and how the students' home languages are neglected.

If language as resource, which includes translanguaging, is going to be valuable in PTs' teaching in the future, they need to be exposed to broader understandings about multilingual teaching both in teacher education and in the practicum, as McLeman, et al. (2012) suggested. How can different languages be present in Norwegian schools where there can be so many different languages in one classroom and when the "Norwegian only" discourse is so strong? There is a need to develop a common understanding of what language as resource can be together with the teachers in the schools where students do their practicums. As the PTs' dialogues demonstrated, repertoires from different contexts, informal and formal, and the students' culture, such as soccer, can be resources in teachers' mathematical dialogues with

students. Identifying these potential resources in shared repertoires of experience can be developed further to include students' home language. Teacher educators need to engage in open discussions with PTs about which discourses dominate and which discourses should be developed to avoid language being viewed from a deficit perspective. Our next step is to develop an intervention in which practicum teachers, PTs and teacher educators explicitly discuss tensions between language as resource and language as problem. Working together to change our discourses may help us to explore how different languages can be present.

Acknowledgment

This research project is supported by the Research Council of Norway – program FINNUT.

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