# Languaging in mathematics classrooms

## Space for students' varied language repertoires in the Language introduction program in Sweden

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The aim for this article is to investigate how languaging in mathematics classrooms for recently arrived students may or may not support students' development of mathematics language and thinking. The study builds on classroom observations with four teachers in upper secondary school in Sweden, and the analysis is based on languaging as a source of meaning. Generally, students did not ask many questions and it was only in two classrooms that students were required to talk mathematics and to move between different representations. A space open for students' use of their varied linguistic repertoires appeared. However, whether teachers themselves took part in the ongoing translanguaging practices or not influenced what value these practices were attributed. The article highlights the need for teachers to be educated in the role of languaging in mathematics and in conditions for learning among recently arrived students and students who study school subjects through a second language that they are in the beginning of learning.

This article investigates how space is opened or closed for the use of varied linguistic repertoires that second language learners have in mathematics classrooms. The context here is *Språkintroduktionsprogrammet*, the *Language introduction program* (LIP) in Swedish upper secondary school for students who have recently arrived in the country and who are second language learners of the language that is used as medium of instruction, Swedish. In this program, students receive education in Swedish and in school subjects that they need to fulfil the entry requirements for national programs.

Schleppegrell and Colombi (2002) highlight that knowledge construction of the types typical for secondary schooling includes particular ways of meaning-making and participation in social contexts where

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knowledge is shared and learned. In mathematics, as in other subjects, students' learning includes meaning-making and taking part in social practices through the negotiation of meaning. This includes both challenging current practices and developing new ways of using language in the advanced ways necessary for knowledge construction.

The diversity regarding backgrounds and experiences that students bring to the classroom makes the pedagogy of all classrooms, and in this case the mathematics classroom, a complex and challenging endeavor. Mathematics may be perceived as a social semiotic, a form of social action that includes meaning-making where language and context coparticipate (Schleppegrell & Colombi, 2002). As Lemke (1989) states, language is integrated with other semiotic resources in the advanced forms of meaning-making that take place. Teachers cannot assume homogeneous groups of students, but rather students who speak different languages, who have been socialized in varied ways, and who had their earlier schooling in various settings and contexts. There is also diversity in language, also when only on language is in use, something that is very much related to challenges that both students and teachers face and manifests itself in different ways. This is very much the case in the LIP, where students face demands to develop Swedish language proficiency at the advanced levels required for upper secondary school studies, while simultaneously complementing previous studies.

To create understanding of languaging in these classrooms in relation to space for students' use of their varied linguistic repertoires, Barwell's *sources of meaning* (2018, 2019) will be used as the analytic tool, with the aim to investigate how languaging in mathematics classrooms may open or close space for students' use of their varied linguistic repertoires.

## The Language introduction program

In Sweden, almost all students continue to upper secondary school after having completed compulsory school grade 9. Recently arrived students who have not qualified for mainstream programs in upper secondary school at the age of 16 are admitted to LIP. Both research on an international level, such as Cummins (2000) and García (2009), and research on a national level (such as Axelsson, 2013) have showed the challenges that developing the new language to high levels means and also that this takes several years. In Sweden, an extra challenge is the age limit at 19 years of age before which these requirements should be met. After the age of 19, the students are not allowed in upper secondary school. Thus, LIP is a transitional program and students are under pressure to move on as quickly as possible.

In LIP, education should be planned individually for each student, following careful mapping procedures. Students have, according to the Swedish education law (SFS 2010:800), the right to what is called *Mother tongue tuition* and *Study guidance through the mother tongue* (SGMT). Through SGMT, students who need it should receive support through a language other than Swedish that they master. In this situation, which is challenging both for schools and students, there is a demand not only for qualified teachers but also for SGMT assistants with relevant qualifications and with a mastery of a large number of languages.

## Languaging in mathematics classrooms

The linguistic challenges in mathematics have been researched in various ways, commonly with a focus on mathematical language, on the role of linguistic repertoires, and on how teachers and students use material, linguistic and social resources in the construction of mathematical thinking (see for example Halliday, 1978; Pimm, 1987; Lemke, 2003; Schleppegrell, 2007). The focus lies here instead on *languaging* in mathematics classrooms, and thus on how teachers and students *language* in the negotiation of meaning in multilingual mathematics classrooms. Using *language* as a verb directs our focus towards how negotiation is carried out and how meaning-making takes place (Barwell, 2018; Wedin, accepted). Although mathematical vocabulary is important in the construction of knowledge in mathematics, other linguistic resources are also important for the development of mathematical thinking, such as verbal language in oral and written forms, mathematical semiotic systems such as symbols and diagrams, and body language and gestures of varied types. In this article, verbal language is thus understood as mediated by and embedded in a diversity of semiotic resources and as such as "situated in expanded social, material, historical and geographical scales" (Canagarajah, 2018, p. 7).

For students in the LIP mathematics classroom, the task is thus to learn the Swedish language of mathematics, while also developing mathematical thinking. Some students may have earlier qualifications that cover current knowledge required in upper secondary school, and thus their task is mainly to learn Swedish through the mathematics lessons, while others need to develop both mathematics language and new knowledge.

The linguistic challenges for all students in mathematics are many, including developing what Halliday (1975) calls the *mathematics register*. This may be understood as a linguistic development from everyday ways of talking about mathematical phenomena, to the more technical and precise ways of expressing mathematical knowledge on an academic level.

Researchers such as Cummins (2000), Lemke (1989, 2003) and Schleppegrell (2004) have highlighted the importance of developing the more explicit and precise ways of languaging in academic language, but Schleppegrell (2007) stresses the particular use of language in mathematics, with its precision lying not in language itself but in how it is used. For L2 students, however, Cummins (2000) among others stresses that learning also includes building on previous education where other linguistic resources were used. This motivates a focus on the languaging of mathematics and on the negotiation of meaning in mathematics. Pimm (1987) showed that, through the multi-semiotic systems that mathematics draws on to construe knowledge, a range of features are used, such as order, orientation, position and relative size, which includes symbols, verbal language in oral and written forms, as well as graphs and diagrams. This means that through mathematical language, meaning may be expressed that goes beyond what can be expressed through ordinary, verbal language (Schleppegrell, 2007). Thus, in mathematics teaching, language and visual representations are central parts of meaning-making.

Gibbons (2003) showed that teachers and students in a science lesson moved along a mode continuum, from visual contextualization, through everyday language, to scientific language. For mathematics, Wedin (accepted) showed how one mathematics teacher in a Swedish school anchored mathematics thinking and language in everyday ways of thinking and languaging, returning to more formal mathematics ways of expressing knowledge. Teachers' spoken language is important but Hansson (2012) shows in her research that Swedish mathematics lessons are characterized by a low level of teacher instruction, and even more so in classrooms with a high proportion of students born abroad and in classrooms with students from homes with a low socio-economic status.

Students in LIP in Sweden should have been involved in mapping procedures, but Norén and Svensson-Källberg (2018) show that these were often done with the Swedish curriculum as the norm, and thus some of the students' knowledge was made invisible or not valued. Svensson et al. (2014) found that teachers failed to recognize the complexity of students' knowledge, and thus the main responsibility for learning was placed on their homes.

The importance of including students' varied linguistic resources has been stressed by researchers such as Cummins (2000), Gibbons (2006) and García (2009). Li Wei (2011) highlights the importance of creating what he calls *translanguaging space* in classrooms, where students are invited and stimulated to use all their linguistic resources. Gwee and Sarvanan (2018) studied code-switching in mathematics education among teachers in Singapore classrooms and found positive results. Also, Dahm

and Angelis (2019) found positive results from including students' literacies in varied languages in grade 9 in France. In a study from mathematics education in grade 8 in Los Angeles, Abedi and Lord (2001) found that linguistic modification had positive effects on students' test results, and that students who were English language learners, students with low socio-economic levels and students from low level and average mathematics classes benefited particularly. However, research on science by Swanson et al. (2014) and Ünsal et al. (2018) warn against relying too much on students' own translation between languages, as there is a risk for misinterpretation.

### *Sources of meaning*

The shift in sociolinguistics from analyzing and describing languages, varieties, dialects and registers as discrete entities, to viewing language as fluid, changing and complex (see, for example, Blackledge & Creese, 2010; Blommaert, 2010) has been used as a starting point for Barwell's framework of *sources of meaning* (2018, 2019). *Sources of meaning* is framed by a Bakhtinian perspective on language, and examined in terms of discourses, voices and languages. Barwell starts with the view of students as *languaging* mathematics, drawing on a repertoire of language practices from their diverse experiences from communication in multiple, varied contexts in their meaning-making in mathematics. His use of *repertoire* is derived from linguistic ethnography, referring to various linguistic features that individuals use in their meaning-making. In this view, repertoires are understood as relatively stable but not fixed, and are used in ways that may be referred to as *translanguaging*, what Lindahl (2015) calls a seamless shuttling between varied linguistic resources. Barwell (2019) understands learning mathematics as an "expansion of students' repertoires of sources of meaning" (p. 137). He stresses that "Meaning arises from the relations within and between each aspect of language as it is used" (2019, p. 137), and that agentivity in mathematics lies in language as it "carries the voices, ideas and intentions of previous speakers" (2019, p. 137, see also 2018), while linguistic diversity in mathematics lies in multiple discourses.

Multiple voices have been put in focus by Moschkovich (2008) in a study of students' use of multiple mathematical meanings, while Barwell (2005) has shown the importance of multiple discourses and multiple voices in classrooms. By focusing on discourse, Barwell studies text genres, world problem scenarios and oral and written definitions. In the term *voice*, he includes students' voices, teachers' voices and the voices of the text, while concerning languages he deals with the language of

instruction, what he calls "the student's home language" (Barwell, 2019, p. 149), and varied features of the language of instruction. Here, language will include all linguistic repertoires that are used in the classroom, also including the repertoires participants create when they share with each other. This means that what Barwell describes as "students' repertoires [...] seen as highly complex networks of interrelated sources of meaning" (2019, p. 149) are here combined with what from a sociolinguistic perspective is called the *multilingual turn* (Conteh & Meier, 2014; May, 2014). Thus, the notion *translanguaging* (García, 2009; Paulsrud, et al. 2017) becomes relevant, questioning a notion of languages as autonomous and separate entities, and instead treating language as a mobile resource (Blommaert, 2010) and as something we *do* rather than as a structure (Pennycook, 2010). The prefix *trans-* in *translanguaging* has a transformative nature and a transdisciplinary function which "open for the construction of new educational structures, and [...] enable a focus on questions of empowerment, social justice and linguistic human rights [...] in order to capture the complex processes of language and learning embedded in and transformative of social structures" (Paulsrud, et al., 2017, p. 14).

Thus, the sources of meaning framework will be used for analysis, with attention paid to *multiple languages*, *multiple discourses* and *multiple voices*, to create an understanding of how spaces for students' varied linguistic repertoires are opened and closed.

## Method and analysis

The four teachers and their classrooms were included in a larger research project on recently arrived students in upper secondary school in Sweden.[1] The methodological frame for the project is linguistic ethnography (Creese, 2008; Copland & Creese, 2015; Martin-Jones & Martin, 2017), which, according to Copland and Creese, links "the micro to the macro, the small to the large, the varied to the routine, the individual to the social, the creative to the constraining, and the historical to the present and to the future" (2015, p. 26), and is particularly relevant when creating an understanding of complex phenomena, such as linguistic repertoires in education for recently arrived students. In this case, linguistic ethnography was used to create the material, while Barwell's sources of meaning are used for the analysis.

To create an understanding of language use in the classrooms, observations were made through a combination of sitting at the back of the classroom, walking around observing individual students' work and interaction, and occasionally sitting down with one or two students asking about their work and helping them when asked. During the observations,

attention was paid to showing respect towards the teacher and students, and not disturbing their work. Field-notes were transcribed shortly after the observation.

The material used here consists of classroom observations with field notes from 23 lessons, about 60 minutes each. Observations were made in one school that was part of the bigger project over two semesters. The four teachers were those that taught mathematics at the school during these semesters. Teachers and students were asked for consent and due to the vulnerable situation for many of the students no video-recording was possible. For the same reason, only two of the lessons were audio-recorded, and photographs were taken in six of the lessons. The four teachers were all acting mathematics teachers during these lessons. In some of the lessons, there were also SGMT assistants present, who worked with Somali, Kurdish, Arabic and Farsi/Dari. The two dominant languages among the students were Somali and Dari. Other languages used by students were Kurdish, Tigrinya, Arabic, Thai, Swahili and English. Information will here be presented in ways that avoid recognition, and names are pseudonyms.

Only two of the teachers were trained mathematics teachers, Maria and Khaled, and none had particular training in teaching students with Swedish as a second language. Maria had a Swedish teachers' degree for upper secondary school in mathematics and natural science. Apart from Swedish and English, she did not share any language with the students. Khaled had a teachers' degree from Iran and was now in the final stages of finishing a Swedish teachers' degree in mathematics. Apart from Swedish and English, he also spoke Farsi, a language that is very close to Dari. The two other teachers had both been employed as SGMT assistants because of their linguistic knowledge. For one period each during the observation period, however, they were appointed as teachers for some of the most recently arrived students. Barzan was a former engineer who, apart from Swedish and English, spoke Kurdish (Sorani and some Kurmanji), Arabic and Farsi. He was appointed as mathematics teacher for a group of students during their first semester at the school. Xoriyo had completed upper secondary school in Sweden, and spoke Somali, Swedish and English. She was appointed mathematics teacher for a group of Somali-speaking students who were new to the school. These two groups of students had not been placed following mapping procedures but formed groups of students who had arrived in Sweden and had started at the school most recently. The number of observed lessons with each teacher was with Maria 12, Khaled 7, Barzan 1 and Xoriyo 3. Only Maria was permanently employed as a mathematics teacher at the school, and the variation in numbers of observations between teachers is due to changes

on a school level. During the time for observations, the number of students in the program at this school was cut down by half, which affected plans for individual teachers. The number of students in each group was 12–15, but, due to harsh life conditions, absence was high and between five and ten students attended each of the observed lessons. In all groups, students had textbooks in mathematics which were special editions for adults with special needs, with simplified text and fewer exercises than ordinary textbooks.

Material from observations, mainly field-notes and for some lessons audio-recordings and photographs, were analysed to identify *multiple languages*, *multiple voices* and *multiple discourses*. As a first step, the material is analyzed to identify the use of multiple languages in each classroom. In the next step, the focus lies on identifying multiple voices and then multiple discourses in the classrooms. These steps will then be used to discuss how spaces for students' use of their varied linguistic repertoires are opened or closed in these classrooms. As the material from different lessons varied, mainly due to ethical reasons, all material from each lesson was first analysed, and then all lessons of each teacher were combined with each other.

## Space for students varied linguistic repertoires

Languaging and space for students to use their varied linguistic repertoires varied between the four teachers' classrooms. Classroom practices in Maria's and Khaled's two groups respectively resembled each other so they will be analysed together as one classroom each. Thus, observations from each classroom will first be analysed regarding multiple languages, and then regarding use of multiple voices and multiple discourses. This will then be used as a base for the analysis of space for students' repertoires.

### *Multiple languages in the four classrooms*

In this first step, each classroom will first be presented to create a picture of practices and language use in each classroom and then analysed regarding the use of multiple languages.

#### Maria's classroom

Maria was observed in 12 lessons with two separate groups, where students had a simplified textbook for grade seven. In six of the lessons, an SGMT assistant speaking Kurdish, Farsi and Arabic was present; in one lesson, an assistant using Farsi, and in one, an assistant using Somali. The main student activity was individual work in textbooks. In eight of the

twelve lessons, Maria used the first five minutes to present some knowledge on the whiteboard. The topics for these presentations were: order of operations (between addition, subtraction, multiplication and division), division through long division, rounding and length units, the area of basic geometric shapes (triangle and square), and switching between different length units. In one lesson, she organized the students in groups with the written instruction to think of a number and to make calculations such as "subtract 1" [2] and "multiply by 4". When they finally arrived at a number, they were to sit in groups and discuss their results. One lesson started with a diagnostic test.

During the presentations, students were not required to talk mathematics, apart from occasionally suggesting an answer to a question. When students answered, Maria did not follow up by asking for example how they had arrived at that answer, and when she found the answer incorrect, she gave the intended answer herself. During some of the presentations, she wrote basic mathematical terms on the whiteboard such as "ruler", "protractor" and "triangle". After that, students worked individually in their books, and thus what they worked on generally had little direct relation to the presentations. During their work, there was some small talk among students, about tasks and private matters.

The dominant language during Maria's lessons was Swedish through textbooks and her own presentations and explanations. While students worked individually in their textbooks, they used the linguistic resources that were at hand in small talk between themselves and with the SGMT assistants related to tasks and private matters. One example was when two students with a Somali background and one with Kurdish discussed a task using Arabic together. Another was when four boys were involved in a discussion about a task and used Sorani, Kurmanji, Arabic and Dari in their interaction. One of the boys knew Kurmanji and Arabic, and by combining them with the little knowledge he had of Sorani, he could make himself understood by the two Dari speakers, who in their turn knew enough Arabic to include the fourth, mainly Arabic-speaking student. When the researcher asked one of them how they could communicate when they did not share one common language apart from Swedish, he explained: "We explain to each other and use the words we know in different languages".

Thus, in Maria's classroom, there was space for students to use their multilingual resources, which they also did in small-talk between themselves and with the SGMT assistants. Students exercised mathematics mainly on their own, and Maria was not much involved in interaction with students during this work. The support observed for the development of mathematics language observed consisted of basic concepts that

were not directly related to students' work, and they were not required to talk mathematics.

**Khaled's classroom**

Khaled, the other trained mathematics teacher, used the introduction and termination of the lesson to attend to students' welfare. He started by welcoming students, asking about how they were, and making sure that they were at ease. Also at the end of the lesson, he addressed issues of being a student such as encouraging them to study at home and not to fear future tests.

During the observed seven lessons, he taught two groups. While students in group A worked with basic mathematics, with a textbook for grade four, students in group B were close to sitting for the final exam at grade nine. After the welcoming part, he begun by presenting a chosen topic, and after that handed out exercises on that topic, or told students on what page they should work in the textbook. In one of the seven lessons, he gave individual work to two of the students while he worked on the decimal system with the others. In the other six lessons, the presentation and the exercises focused on one and the same topic for the whole class. Topics for group A during the observed lessons were the four rules in arithmetic, the number line negative numbers, fractions, magnitude, the relation between multiplication and division, and the decimal system. In group B, the topics were mathematical patterns and tables, the coordinate system, and the equation of a line.

In two of the lessons in each group, a Somali SGMT assistant was present for part of the lesson. Khaled himself used Swedish with all students, and occasionally some English or Arabic. He often used Farsi with those who knew Dari, and in presentations he made sure that all students had understood by checking with the SGMT assistant or asking students to check with each other using their varied languages. He also made ample use of varied extra-linguistic resources for his explanations, such as mathematics material, drawing on the blackboard, body language and gestures. The Somali-speaking assistant also spoke some Arabic which he shared with a Tigrinya-speaking student. One Kormanji-speaking student only shared Swedish with the others, and Khaled made particularly sure that she had understood by using diverse linguistic resources, such as his own body and mathematics material.

Thus, in presentations and work, varied linguistic resources were used, including students' various languages, body language and related mathematics material, as well as graphs and equations on the whiteboard and on exercise-sheets. The use of multiple linguistic resources included both the teacher, students and SGMT assistants.

**Barzan's classroom**

Barzan, who was an engineer before and who apart from Swedish and English speak Sorani, Farsi and Arabic, was only observed during one lesson. The group consisted of recently arrived students, and there were both students with up to ten years of schooling in the group and students who had never been to school before. Three SGMT assistants were present, for Dari, Somali and Tigrinya, respectively. Barzan and the SGMT assistants all knew Swedish and English to a varied extent, and some students knew some English apart from their emergent Swedish; so multiple languages were used throughout the lessons among all participants.

After an initial diagnostic test, Barzan presented knowledge about money and numbers. He explained that he was aware that some of them knew a lot of mathematics but that they all still had to learn the Swedish mathematics language. The presentation included basic knowledge about numbers and the decimal system, the use of money, the importance of receipts, and a simple explanation of the VAT system in Sweden. Barzan first explained in Swedish, and then made sure that students had understood, both by switching to the languages he himself could speak and by making sure that the assistants explained. During the presentation, he gave room for the SGMT assistants to translate and for students to explain to each other. Although students did not say much, some of them asked a few questions for clarification. Students showed engagement such as when Barzan wrote "Tunes" on the whiteboard one student asked if it should not be spelled "Tunis". After a short discussion with the assistants, he changed the spelling to "Tunis". Then he arranged students in groups, and handed out fake money and written tasks in the form of mathematics letters. These tasks demanded that students exchange money and were prepared for this specific lesson. Students collaborated in the groups but did not talk much. He referred to the importance of learning mathematics language throughout the lesson, saying for example "vissa av er kan mycket matte men ni måste lära er mattespråket" [some of you know a lot of maths but you have to learn the mathematics language]. Thus, all participants in the lesson used varied linguistic resources in their meaning-making.

**Xoryiyo's classroom**

The group taught by Xoriyo also consisted of students that had recently arrived and were new to the school, all Somali speakers. During the three observed lessons, students worked most of the time individually in their textbooks, simplified editions for grade four, and talk was only in Somali. No use of Swedish was observed between Xoriyo and students, except for translations to Somali from the textbook. At the beginning of one lesson, Xoriyo handed out a test on multiplication tables 1–5. Another

lesson, she gave students a hand-out with basic division. In both cases, it became visible through observations of individual students' work that the task was very easy for some of the students, while some did not seem to understand the thinking behind multiplication and division. Students who already mastered the task finished it quickly and continued to work in their books.

While students worked, Xoriyo corrected what students did and answered questions, but was only observed to explain briefly when she had marked that the answer was wrong. No presentations were observed, and no mathematics material was used. Students worked quietly and rarely asked any questions.

Students in this group, as in Barzan's group above, had not been mapped as to their mathematical knowledge and all students worked in the same book, for grade four. As observed during the test, the content in the books also appeared to be above the mathematical knowledge level of some students, while below for others. Some students with many years of previous schooling showed low interest in the work, finishing some tasks and then occupying themselves with texting on their mobile phones, while others, who did not have much previous schooling, showed concentration on their task while making many mistakes. In some cases, illustrations and tasks in the book were of a type that made guessing possible, such as when a certain pattern was first shown and students could solve the following tasks using the same pattern without actually understanding the intended knowledge. One example was when students were required to add four digit numbers, such as 2314 and 3122 by adding units, tens, hundreds and thousands one after the other. Then some students were observed to calculate 4 + 2, 1 + 2, 3 + 1 and 2 + 3, and thus writing the intended answer 5436 without showing an understanding of the decimal system and the addition apart from the adding of the single figures. Some students were observed to add the sums starting from the left with the thousands.

Before the first lesson with Xoriyo, she approached the researcher and said that the problem for her students was, as she said, "the language", implicitly referring to (lacking) Swedish. She said that some of the students had good education, but that these did not "stand out in class because of the language". It may seem odd to find a nearly monolingual classroom in Somali in LIP Sweden where Swedish is the dominant language, and the main aim with LIP is that students learn enough Swedish to qualify for mainstream programs. However, it should be remembered that Xoriyo was originally appointed as an SGMT assistant, which means that she would support students who needed so through Somali. She did not have either teacher training or earlier teaching experience.

### *Multiple voices in the classrooms*

In all four classrooms, the voice of the teacher dominated, particularly during presentations. Also, the voice of tests, particularly the final test in grade nine, was strong in all classrooms. In Maria's and Xoriyo's case, the textbook was another dominant voice. In the three observed lessons in Xoriyo's classroom, the textbook can be said to be given a stronger voice than the teacher, as she did not give any presentations, but rather translated the voice of the textbook to Somali. Also, in Maria's classroom, the textbook was given a strong voice. As her students had access to answers, they could correct themselves and thus her voice was mainly restricted to instructions.

While Maria's whole class presentations were one-way with very few elements of students' voices, Khaled's and Barzan's presentations involved students' voices, and in some cases, also the SGMT assistants'. Not only did students in Khaled's and Barzan's classrooms answer questions, but they also initiated topics and suggested solutions. One example was when Khaled talked about the equation of a line, illustrating on the blackboard and mentioning how the line cuts the *y*-axis, in Swedish "linjen skär *y*-axeln", and a Dari-speaking student commented: "Sometimes in Dari that means donkey", whereby Khaled laughed and said that that was true because "خر" in Dari and Farsi is pronounced similar to the Swedish "skär" (which can be pronounced as *share* in English) and means "donkey". Also, the earlier mentioned example of the student in Barzan's lesson who commented on the spelling of "Tunis" is an example of a student initiative.

Students' voices were present in the form of small talk in all classrooms, but to a limited extent. Students with many years of schooling before their arrival in Sweden generally engaged more in small talk than students who had less experience of schooling. A topic brought up by some students was frustration about not being able to, or, as some students expressed it, not being allowed to, do tests and pass exams. They claimed to be able to perform on higher levels than what they could show on tests.

Hence, while teachers, tests and textbooks dominated, students' voices were not heard much in the four classrooms, particularly not those students who were more recently arrived, and students who had little or no earlier schooling and who studied on a basic level. There were a few student initiatives concerning teachers' presentations and their own mathematics knowledge. Furthermore, particularly students with many years of previous schooling expressed frustration concerning what they perceived as low level in the content and restricted opportunities to show their own knowledge.

### *Multiple discourses in the classrooms*

Varied discourses appeared in these classrooms with a mathematics discourse as dominant, as could be expected. While this discourse was close to monolingual in Xoriyo's classroom, with the textbook in Swedish as the only observed exception, the multilingual discourses varied from Maria's classroom where multilingualism was allowed but not encouraged, to Barzan's and Khaled's where multilingualism was used as an important source of meaning. A mathematics discourse with varied modalities and languages appeared in Barzan's and Khaled's classrooms when students were presented with topics that they did not yet master and were required to solve tasks and express their knowledge both orally, in written forms and with materials. In these two classes multiple languages and multiple discourses intersected with each other. Also, in Maria's teaching, multiple modalities were visible, but to a limited extent in her own short presentations. In Khaled's and Barzan's classrooms, students were required to move between varied ways of representations, such as in Khaled's to move between four-digit numbers and mathematics material, and to relate lines in the coordinate system to equations while saying what they were doing. Going between different representations may be perceived as important for the development of both mathematics thinking and language.

A discourse about being a student was visible in all classrooms: about being present during lessons, working hard, working at home, and doing tests. Talk between students appeared mainly in Maria's and Khaled's classrooms, and to some extent in Barzan's. This talk was student-initiated, asking each other for help, and included multiple languages. As students in Xoriyo's and Barzan's classrooms were more recently arrived, they generally did not talk much unless explicitly asked by the teacher. Particularly the teaching of Khaled and Xoriyo may be understood as adding an aspect of care in their student discourse, in Khaled's case by comforting and encouraging students, and in Xoriyo's through her use of Somali, the language her students knew best. Maybe also Barzan's highlighting of the need to learn mathematics language and thus perhaps having to study on too low a level may be understood as a caring discourse.

## Discussion

The use of Barwell's (2018, 2019) sources of meaning in the analysis of spaces for students' linguistic repertoires in these classrooms made various aspects of multilingual practices visible. At the same time, an image appeared of an educational situation that is challenging both for teachers and students. In this case, two of the teachers had no teacher education and limited teaching experience, and students in their classes

had not been mapped for knowledge in mathematics. The two teachers with teacher education did not have education on conditions for recently arrived students or students studying through a second language. That students with very different prior knowledge are put together in the same classroom may be a challenge both for teachers and students. The frustration expressed by some of the students who had many years of schooling before coming to Sweden may be related to mapping problems (Norén & Svensson-Källberg, 2018; Svensson et al., 2014; Aho, 2018). A challenge on a school level was the fluctuation in number of students that make the organization of education and appointments unstable. That second language students face such a situation for education is unfortunately not unusual in Sweden.

The analysis of sources of meaning in the negotiation in classrooms revealed that the classrooms offered space for students' varied linguistic repertoires, and that multiple languages, voices and discourses were at play in the observed lessons, and intersected each other. Multiple languages were used in all classrooms, although restricted to Somali talk and Swedish text in the text-book in Xoriyo's classroom. She was also the only teacher who talked of language as a problem, or rather of students' perceived lack of language, implying Swedish skills. In the other three classrooms, multiple languages were welcomed and used, although Maria did not involve herself in the translanguaging practices that took place. While she left it to students and SGMT assistants to negotiate meaning through translanguaging, Barzan and Khaled took active part in these practices in their classrooms. When they did not directly share another language than Swedish, they used materials, body language, SGMT assistants and other students to make sure that the student in question had understood.

In all classrooms, the teacher and tests were strong voices while the textbook may be understood as having stronger voice than the teacher in both Xoriyo's and Maria's classroom, as they left students to work on their own to a great extent. The low level of teacher instruction that was observed in Maria's and Xoriyo's classrooms matches Hansson's study (2012). This highlights the risk found by Swansson et al. (2014) and Ünsal et al. (2018) regarding misinterpretation when students to a high extent rely on their own translations.

Multiple discourses were at play in all classrooms, but the mathematics discourse included more varied repertoires in Khaled's and Barzan's classrooms. Schleppegrell (2007) highlighted the importance for students to talk mathematics and to move between varied representations, something that was only observed in Khaled's and Barzan's classrooms. Barzan was the only teacher observed to explicitly talk about mathematics language, and about the need as a recently arrived student to

learn that in Swedish. He was also the only one that explicitly addressed the frustration that students may feel being faced with tasks that they perceive as being on too low a level.

Thus, space for students' varied linguistic repertoires, a translanguaging space (Li, 2011), was open in all four classrooms, but to a varying extent. Among the teachers, Khaled and Barzan were themselves active in the translanguaging practices that took place in their classrooms, while Xoriyo and Maria were observed to use only one language each, Somali and Swedish, respectively. What teachers do is of high significance in classrooms, and teachers represent high status. Thus, when teachers allow translanguaging, that is, students' use of their varied linguistic repertoires, but do not themselves engage in such practices, this signals low value. This actualizes the role of translanguaging for empowerment, social justice and linguistic human rights, as stressed among others by Paulsrud et al. (2017; see also Duarte, 2020). What teachers do and what repertoires they take part in is attributed to a high value symbolically. Hence, translanguaging was given higher value in the classrooms where the teachers themselves were involved in the negotiation of meaning through translanguaging.

The variation that appears here between these classrooms shows both the need for better educational conditions for recently arrived students and teachers' need for education in conditions for learning among recently arrived students and students who study school subjects through a second language that they are in the beginning of learning. It also supports earlier research on the importance of the role of languaging in mathematics.

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## *Notes*

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2 Quotes are translated from Swedish by the author.

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