Chapter 6
Language Diversity in Mathematics Teacher Education: Challenges Across Three Countries

Anthony A. Essien, Nancy Chitera, and Núria Planas

6.1 Different Countries, Similar Challenges

Do mathematics student teachers and mathematics teacher educators across countries face similar challenges when integrating language, didactical and pedagogical issues in the construction of professional knowledge? To unravel this question, we look at mathematics teacher educators' awareness of the context of their practice, the practices they use, and how they position themselves with regard to the linguistically diverse classrooms of the mathematics student teachers that they teach. Little work has been undertaken on teaching and learning in linguistically diverse mathematics teacher education settings, though there is evidence that the two dimensions are connected (Chitera, 2011; Civil, 2012). Most of the work accomplished has been carried out using classroom data and interviews with participants experiencing the same language policies and involved in programs from the same institution. As far as we know, no systematic research has examined data across countries with distinctive linguistically defined groups of mathematics student teachers and mathematics teacher educators in teacher education institutions. In this chapter we explore mathematics teacher education in linguistically diverse classrooms across three countries, South Africa, Malawi, and Catalonia-Spain, as a

A.A. Essien (✉)
University of the Witwatersrand, Johannesburg, South Africa
e-mail: Anthony.essien@wits.ac.za

N. Chitera
University of Malawi, Blantyre, Malawi
e-mail: nchitera@yahoo.com

N. Planas
Universitat Autònoma de Barcelona, Barcelona, Catalonia-Spain

University of South Africa, Pretoria, South Africa
e-mail: Nuria.Planas@uab.cat

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way of opening a new line of important research. Despite the existence of similar challenges, the authors' experiences of working in teacher education classrooms in these countries show that they are different in many ways.

The following two questions that are the foci of this chapter:

– What do we know about mathematics teacher educators' awareness of the multilingual context of their practice?
– What practices are mathematics student teachers introduced to in the preservice classroom?

Unlike teaching mathematics to mathematics major students, teaching mathematics to mathematics student teachers is more multifarious because of the different facets involved in teacher education. In addition to being knowledgeable about the content they will teach, mathematics teacher educators also need to know how to teach it (content) in context, and have knowledge about instructional practices. A number of authors have argued for the integration of mathematics and language development in multilingual classrooms (Adler, 1995; Barwell, Barton, & Setati, 2007; Smit & van Eerde, 2011). These authors have argued against the avoidance of linguistic aspects in the teaching and learning of mathematics and for attention to be paid to the language needs of students in multilingual classrooms. This is why as part of the layers involved in teaching and learning mathematics in linguistically diverse teacher education classrooms, it is critical to examine how each of these classrooms pays attention to language issues. Our approach, therefore, allows provision for the analysis of evidence present in different classrooms (across the three countries) in support of the multiple and interacting layers in teacher education of: *becoming teachers of mathematics*, *becoming teachers of mathematics in multilingual classrooms, becoming learners of mathematics content, becoming learners of mathematical practices, and becoming proficient language users* for the purpose of teaching and learning mathematics (see Essien, 2014, for an elaboration of these multiple facets). This notion of multiple layers involved in teacher education provides the lens for examining practices into which mathematics student teachers are enculturated. The contexts of schooling regarding language and learning provide the background for the discussions on linguistically diverse teacher education classrooms across the three countries in focus. In particular, it sets the scene for examining the practices used in teacher education classrooms in order to delineate what challenges are similar or different and what lessons are to be learned across the three contexts.

6.2 The Three Contexts: South Africa, Malawi, and Catalonia-Spain

The choice of the contexts in this chapter is the result of, on the one hand, common interests of the authors on issues of mathematics teacher education and multilingualism and, on the other, the intention to show the presence of similar challenges

in spite of different geographical and political conditions, particularly between Catalonia-Spain and the two African countries. The teacher education institutions in the three contexts are universities where both content and pedagogy are not separately taught by different departments/faculties, but within the schools of education where prospective teachers are educated. In what follows, we engage with the multilingual contexts around teacher education in the three countries.

South Africa presents a complex picture of multilingualism, due not only to its political history of Apartheid, but also to its distinct nature of multilingualism. Of the 11 official languages, 9 are indigenous African languages which can be grouped into 2 major families based on linguistic characteristics: the Sotho and the Nguni. The Sotho languages are comprised of South Sesotho, Sepedi, Setswana, while the Nguni languages are isiZulu, isiXhosa, siSwati, and isiNdebele. There is mutual intelligibility between the languages in these groups (this is not the case with the remaining two African languages, Tshivenda and Tsonga), so that it becomes relatively easy to learn other indigenous languages. Hence, it is not uncommon for students to discuss their mathematics task in their home languages during group work even though other members of the group may have different home languages. This picture is different from most African countries where the indigenous languages share little, if any vocabulary so that if the teacher used her/his language to teach, many students would not understand (Essien, 2010a).

To qualify as a teacher in South Africa, the *Minimum Requirements for Teacher Education Qualification* (DHET, 2011) stipulates that all teachers should

> be proficient in the use of *at least one* official language as a language of learning and teaching (LoLT), and partially proficient [that is, have conversational proficiency] in *at least one* other official language (including South African Sign Language). (pp. 15–16, italics in original)

But even though the South African Constitution and the Language-in-Education Policy (LiEP) make provision for learners to learn in any official language of their choice, research has shown that due to economic, political, and ideological factors, most learners prefer to learn mathematics in English, a language which for most is not their first or home language (Setati, 2008).

In Malawi, like in South Africa, English plays a significant role both in society and in the teacher education context. Malawi is divided into three regions (the Northern, Southern, and Central), each with its own main language. English is the official language and Chichewa, which is spoken by about half of the population (Baldauf & Kaplan, 2004), is the national language. There are 16 other indigenous languages. Hence, just like in South Africa, Malawi is a highly multilingual society where what is seen as an international language is more valued than the local languages in teacher education. In 1996, the Malawi LiEP required learners in the first 4 years of schooling to be taught in their home language (Secretary for Education's Letter 1996, No. IN/2/14). The LiEP for lower primary education supports multilingualism and allows primary teachers to be flexible and use home language(s) in their teaching. However, English remains the LoLT for upper primary classes and in secondary and tertiary education.

The present primary teacher education program, set up in 2005, runs for 2 years. The first year is residential training when mathematics student teachers stay in college and attend lectures and complete projects and assignments. The second year is the school-based education year which is carried out in the form of teaching practice in various primary schools. Mathematics student teachers are expected to become conversant with content related to pedagogical knowledge such as the technical skills of lesson planning, and teaching methods, as well as the specific learning areas that are offered in primary education: Numeracy and Mathematics, and Literacy and Languages (Chichewa and English), among others. Numeracy and Mathematics consists of subject content and methodology. It is organized in such a way that mathematics teacher educators first teach a particular topic followed by the pedagogy related to it.

The Catalonian context plays out differently from the South African and Malawian contexts in different ways, notably given the fact that a local language (Catalan) is the official LoLT. In Catalonia, an autonomous region in north-eastern Spain, the choice of Catalan as the LoLT was made after 1983 as a way to integrate the population that had arrived from other parts of Spain in successive immigration waves. At present, there was a sort of de facto bilingualism between the two major languages in the region (Catalan and Spanish), though in reality the society is now becoming more and more multilingual with the arrival of people from North Africa, Central Asia, and Latin America. So far, successive LiEPs have alternatively served the interests of the Spanish and the Catalan dominant groups, while other language groups, mostly represented by immigrant families, have not been considered to the same extent (Planas & Civil, 2009). This results in the invisibility of certain languages in the teacher education system, particularly in the preparation courses for mathematics student teachers to teach mathematics in primary and secondary schools.

In response to the above situation, at some institutions, the training for preservice teachers has recently included innovative courses on teaching and learning mathematics in multilingual classrooms. Despite the current LiEP and the Catalan Law of Universities ("Catalan is defined as the natural language of the universities in Catalonia", Official Diary of the Government of Catalonia, 2003, p. 3327), it has been possible to design and develop pilot courses in which mathematics student teachers' languages are planned to be flexibly used. A learning environment has been fostered to challenge mathematics student teachers to think about issues of language diversity and mathematics education, as well as to become designers of activities with an integrated focus on mathematics and language. While reflecting on the implementation of such courses (they are very few, the approach is not widespread, and the curriculum is experimental), some changes have been incorporated to facilitate greater insight into linguistically responsive practices within the groups of mathematics student teachers. To develop understandings of language as a crucial resource in the learning and teaching of mathematics, it is thought that mathematics student teachers need intentional and explicit learning environments.

6.3 What Do We Know About Mathematics Teacher Educators' Awareness of the Multilingual Context of their Practice?

We now address ways in which mathematics teacher educators think of language diversity in the teaching and learning of mathematics. Three teacher education scenarios, with slightly different pedagogical orientations in the construction of professional knowledge, are used to gain an understanding into mathematics teacher educators' awareness of the complexity of teaching mathematics to linguistically diverse mathematics student teachers who will, in turn, teach mathematics to linguistically diverse students. Our broad interpretation of awareness includes (1) the recognition of multilingualism as (potential) resource, rather than hindrance; (2) the attention to the linguistic structures in mathematical and everyday languages as compared to the structures in the home language(s) of the learners; (3) the attention to how learners use language as they engage with activities like making conjectures, examining constraints, making inferences, abstracting, inventing, explaining, justifying, and challenging; and (4) the use of appropriate mathematical language to respond to learners. This idea of awareness plays a key role in the practices that are privileged. In the discussion that follows, we highlight two common facts in the three contexts: first, the mathematics teacher educators are aware of the linguistically diverse contexts in which they teach; and second, 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.

6.3.1 Mathematics Teacher Educators' Awareness in South Africa

In a study involving 4 teacher education institutions in South Africa and 12 teacher educators (Essien, 2010b), 3 categories emerged regarding mathematics teacher educators' awareness of the context of their practice. The first category consisted of mathematics teacher educators for whom awareness is about experience and gained through teaching second-language English learners and reflection on how mathematics student teachers use language during their teaching. The second category consisted of mathematics teacher educators for whom awareness came through as being about disciplinary knowledge and knowledge of language issues in the teaching and learning of mathematics. For the third category, awareness came through as something gained through research and experience of teaching in linguistically diverse classrooms. What is important to note is that the mathematics teacher educators were all aware of the challenges embedded in their context of practice even though they talk differently about awareness.

Even though the mathematics teacher educators were mostly aware of the general context of their practice, that they were teaching mathematics to preservice

teachers who will, at the end of their training, teach mathematics to students, they admitted that at the institutional level, they did not receive enough support by way of courses aimed at introducing preservice teachers into the dynamics of teaching and learning in linguistically diverse classrooms. Rachel talked about how she prepared mathematics student teachers to teach mathematics in multilingual contexts:

> Rachel: We don't prepare them in any structured way, we prepare them by taking up suggestions that may arise during practical teaching and talk about those during the methods class. And we take it up by making them more explicitly aware during their methods class to be aware that people don't necessarily understand their English, but nothing structured.

Rachel echoes the sentiment of other mathematics teacher educators who also indicated that courses were not aimed at creating awareness of what it entails to teach mathematics in multilingual contexts, despite the fact that most preservice teachers will teach mathematics to learners who are not English dominant. As argued in Essien (2010b), this concern is not new to preservice education in South Africa; neither is it new that in preservice education the importance of language in the teaching of mathematics is not well-attended to. In the early 1990s, a report by the National Education Policy Investigation (NEPI, 1993, p. 181) observed that the role of language in (mathematics) knowledge acquisition is not a focus area in primary and secondary teacher education. The conclusion was that, notwithstanding whether the language of instruction was the home language or the second language, these gaps in teacher education affect the professional ability to use the language of instruction in the best interest of the learners. Two decades after this finding, sadly this recommendation remains valid for teacher education institutions in South Africa.

6.3.2 Mathematics Teacher Educators' Awareness in Malawi

As with the contexts of South Africa described above and Catalonia (see next section), responses to interview questions and classroom observations in research conducted by Chitera (2009) involving four mathematics teacher educators who had different home languages (but could all speak Chichewa and English) indicated that mathematics teacher educators were aware of the multilingual context of their practice. Their responses indicated that even though they were aware of the multilingualism in their classrooms, they regarded multilingualism as a problem and the use of languages other than the LoLT in the preservice classroom as problematic. The mathematics teacher educators described their classrooms as multilingual, not because participants spoke different home languages, but because the mathematics student teachers were allowed to use their home languages when they were unable to express themselves adequately in English. For example, Otani explained that their classes were multilingual because there were mathematics student teachers who failed to communicate in English and were then allowed to use Chichewa. Hence their classes were deemed to be multilingual, not because student teachers spoke different home languages, but because they were allowed to speak Chichewa if they failed to speak English:

Otani: Yeah, that one is multilingual because there are some who cannot express themselves in English so we accept Chichewa.

Otani explained that a way of helping his students was to allow the use of home language(s). The overriding notion was that mathematics student teachers who were not able to express themselves in English could switch to their home languages and hence compensate for the deficiency. Skiba (2007) suggests that in circumstances where code-switching is used due to a presumed inability of the person to competently express, it serves for continuity in speech instead of presenting interference in language. In this respect, the use of home languages in a preservice classroom stands to be a supporting element in communication and interaction. Hence, the use of home languages occurs when mathematics student teachers are given the opportunity to use them by their mathematics teacher educators. It is not a spontaneous practice but rather a controlled practice. In Malawian classrooms, the use of local languages cannot be avoided, and therefore, student teachers need to graduate from the teacher education colleges better prepared to function productively when they begin to teach. Even though the mathematics teacher educators were aware of the benefits of using home languages, the exploration of how to use them in a mathematics classroom is not practised freely in the public domain, because every student teacher is supposed to speak English. Moreover, there are no structured courses aimed at inducting mathematics student teachers into the intricacies of teaching and learning in linguistically diverse classrooms.

6.3.3 Mathematics Teacher Educators' Awareness in Catalonia

In Catalonia, in 2010 and 2011 interviews were undertaken with five Catalan and Spanish bilingual mathematics teacher educators working in an institution in which a few lessons on multilingualism and mathematics education had been planned as part of a pilot and singular design research. The mathematics teacher educators were free to implement these lessons or not as they choose, and three of them declined. In conversation with those who declined, several reasons were provided like "working priorities" and "more interest in new technologies." All the mathematics teacher educators were also asked to talk about what a multilingual mathematics school classroom looks like, and what are some of its needs. In their responses, though they recognized multilingualism as a potential resource in the teaching and learning of mathematics, awareness appeared as rather weak. Most mathematics teacher educators referred to the need to create classroom conditions in which non-dominant Catalan mathematics student teachers did not experience their language "difference" as an obstacle, but none of them referred to the case of mathematics.

Unlike in the South African context, the mathematics teacher educators did not express the need to develop professional knowledge to use multiple languages in the teaching and learning of mathematics. For them, being bilingual was significant, but the experience of bilingualism was not problematized at a professional level. Their recitation of non-problematic bilingual stories framed their conceptualization of language diversity as pedagogically neutral. This is consistent with what was found

in the work with a group of in-service mathematics teachers who did not initially see language issues as crucial for their teaching in multilingual classrooms. The professional development initiative, however, succeeded in creating optimal conditions for those teachers to work on awareness. After one academic year they became more attentive to how their students switch their languages depending on the complexity of the mathematics (Planas & Civil, 2009).

Teacher education programs in Catalonia have a field orientation in that mathematics student teachers spend long periods in schools to observe teaching practices. This organization opens a space in terms of visiting mathematics classrooms with immigrant learners who are in the early process of learning Catalan, and also with in-service teachers who are at different levels of awareness. When such classrooms were mentioned in the interviews, the impact of language issues was minimized by the mathematics teacher educators, even by the two mathematics teacher educators who had volunteered to teach the innovative lessons:

Judit: Language diversity is more present now than ever in the past. But it's not so much about math education. It's much more about creating the sensitivity to language and cultural differences in the class with the student teachers.

Magda: Many mathematics teachers have never seriously reflected on issues of multilingualism, nor have they ever had experience with language diverse backgrounds in their classrooms. But they still are fantastic teachers.

Judit and Magda shared awareness of the multilingual reality of many mathematics classrooms in the country and, like the mathematics teacher educators in Malawi, had the view that multilingualism was problematic when the students did not own the LoLT. Nevertheless, and differently to what happened with the mathematics teacher educators in South Africa and Malawi, they did not address the multilingualism and language practices that were present in the preservice classrooms, which were their more direct source of data. The mathematics student teachers coming from other parts of Spain tend to switch from Spanish (informally allowed) in small groups to Catalan (institutionally mandatory) in whole group. But practices of code-switching were not commented on by the mathematics teacher educators in the interviews, nor were they thought of as useful to model language practices for multilingual classrooms in schools.

6.4 What Practices Do Mathematics Student Teachers Get Exposed to in the Preservice Classroom?

To obtain an accurate picture of mathematics teacher education in our contexts, there is a need to examine the preservice classroom practices. We explore classroom practices that point to the (re)construction of meanings of language diversity and mathematics education with mathematics student teachers. More particularly, we report on practices that are oriented toward the multiple layers involved in teacher education. To reiterate, in a linguistically diverse teacher education classroom,

mathematics student teachers (who will most likely teach in linguistically diverse classrooms) are at once becoming teachers of mathematics, teachers of mathematics in multilingual classrooms, learners of mathematics content, learners of mathematical practices, and proficient language users.

6.4.1 Teacher Education Practices in South Africa

Research involving observations of teacher education classrooms in two teacher education institutions (Essien, 2013) revealed that one of the institutions predominantly enculturated mathematics student teachers into becoming learners of mathematical content. Hence, the overriding facet of teacher education that was privileged was the acquisition of mathematical knowledge. The mathematics teacher educators perceived their responsibility to be that of fulfilling this role in the class and the mathematics student teachers saw themselves as recipients of this knowledge. This was clear in how the mathematics teacher educators used practices such as defining, explaining, and exemplifying to develop the mathematical knowledge of the mathematics student teachers through an authoritative communicative approach (Mortimer & Scott, 2003). On the other hand, at the second institution, not only was the acquisition of mathematical knowledge an important enterprise, but also the enculturation of the mathematics student teachers into becoming teachers of mathematics. Induction into this layer of teacher education was clear in how the mathematics teacher educators insisted that mathematics student teachers explained the thinking (as teachers would) behind solutions proffered by fellow mathematics student teachers and also required of them to explain terms as they would to learners who were encountering the terms for the first time. Through practices such as predicting, conjecturing, justifying, and critiquing conjectures, the mathematics teacher educators were conscious of the fact of not teaching mathematics solely for the purpose of content knowledge, but teaching would-be teachers, as is evident in the excerpt below:

> Hendricks: Now before you do that and I'll repeat this, we're sitting here in a situation that is very different from what statisticians do. They go into the computer, they click trend line, it gives them the trend line they want … If I ask you to not start with the trend line but background that knowledge of yours, I want you to do it, get the valuable skill of a teacher, background the knowledge that you have and pretend that you know only what the learners in your class know […] How will you predict what the fuel consumption is for 2,000 kg and for 2,500 kg?

Throughout the lesson, Hendricks kept indicating to mathematics student teachers what statisticians do, and what they do not do, and more importantly, what they as mathematics student teachers need to become enculturated into. First, they must be able to think like learners who have never been introduced to the concept of a trend line and think of how they would be able to interpolate from a given set of data. Second, they must be able to draw the trend line accurately. A finding that

comes to the fore from the analysis of the various practices in the preservice classrooms of the South African context is that the practices-in-use in their classrooms were mostly those that inducted mathematics student teachers into becoming learners of mathematics content. There were very limited practices aimed at inducting mathematics student teachers into becoming teachers of mathematics and even more limited ones that inducted them into becoming teachers of mathematics in multilingual contexts. Hence it appears that mathematics student teachers are not being prepared adequately to understand and deal with the challenges involved in teaching mathematics in linguistically diverse settings. This has huge implications for teacher education in South Africa where most classes are multilingual and where most learners, despite their low English language proficiency, choose to do mathematics in English (Setati, 2008).

6.4.2 Teacher Education Practices in Malawi

In the Malawian context, the classroom practices show the major interest is to prepare mathematics student teachers to become teachers of mathematics rather than teachers of mathematics in multilingual contexts. Most discussions are on how to teach procedures for arriving at correct answers. Otani was one of the mathematics teacher educators who generally tried to instill in mathematics student teachers how to become teachers of mathematics by rephrasing their presentations. In the extract below, Otani asks one of the mathematics student teachers in his class to explain how to teach the addition of 0.7 and 0.2 using a number line. We begin with what the mathematics student teacher explained and then show how Otani rephrased the student's presentation.

Mark: Then you write small lines, can I … (writing on the board) then first of all we are going to tell our learner to stand at this point where we have a zero and we are going to tell that one to at least move seven steps to this side of the line that means start from here [zero] move one, two, three, four, five, six, seven it means at this place going to start here and stop here, so this means that this is still a fraction because we haven't reached the whole number and thereafter we are also going to ask that learner to move two more steps from this one, so it means start from here to here and here and then we are going to ask him to how many has he jumped.

The student focused on how he was going to teach and the steps that he would follow if he was teaching in a primary classroom. The first thing to be noted is the way in which he used grammar and pronouns. His language illustrates his recognition of how to involve the learners in a mathematics classroom through the emphasis on "telling" and "asking" in relation to solving the problem. The learner in this instance is positioned as a passive recipient answering questions, whereas the teacher is positioned as a professional expert who has power over the learners. The student's language also portrays a controlling (or possessing) belief that it is

expected teachers should have. This is the responsibility that teachers assume in a class: controlling the turns that students are given in to speak, and at what time. After the mathematics student teacher did most of the talking alone, Otani responded to the student's presentation as follows:

Otani: So instead of drawing a number line from here up to two here, you can just draw your number line unnhu then here you indicate that it is zero and here is what!
Chorus: One.
Otani: One, then between zero and one you mark how many points.
Chorus: Some say nine while some say ten.
Otani: Yah, nine points, so it's one, two, three, four, five, six, seven, eight, nine then this one simply means that each point is a, a fraction why because we are, we are in the range between zero and one which is a whole number so you let your pupil to stand on zero and ask him or her to move how many steps!
Chorus: Seven.
Otani: Seven steps, one, two, three up to …
Chorus: Seven.
Otani: Then ask him or her to add how many more steps?
Chorus: Two.
Otani: Then you ask him to say the number indicated on where he/she is standing. Seven, zero point, but first of all you should discuss this one (7 plus 2) eti, these are the things that they have done already, not so?

The steps followed by Otani were the same as those in the student's presentation. The mathematics teacher educator began by saying, "so instead of drawing a number line from here up to two here." This statement serves to correct the student's first step of drawing the number line from zero to two. He presented it as an alternative way to what the students did. Then he said to mark the nine equal points between the points zero and one. He pointed out that each mark represents a fraction because they are in the range between zero and one. Although not very explicit, Otani tried to give reasons for each of his teaching steps. Thus his language combined procedural and conceptual discourse, which was lacking in the student's language. Also just as the mathematics student teacher had done, Otani's language indicated how the students could involve their learners in solving this problem, and he explained how this could be done. This extract also reflects the students' involvement in the solving of the problem. Otani noted that "you let your pupil to stand on zero and ask him or her to move how many steps!" and then five lines further "then ask him or her to add how many more steps." He indicated to the mathematics student teachers that teaching mathematics extends beyond simply explaining some steps to the learners; he highlights what steps were necessary, and which were needed at each stage. Thus the emphasis is both on becoming learners of mathematics content and on becoming teachers of mathematics, while how to become teachers of mathematics in multilingual classrooms is left entirely to the mathematics student teachers to figure out (Chitera, 2012).

6.4.3 Teacher Education Practices in Catalonia

In the Catalonian context, it has been found that when mathematics teacher educators draw mathematics student teachers' attention to the fact that they are prepared to become teachers of mathematics in primary classrooms, most practices are oriented towards becoming learners of mathematics content. Discussions in preservice classrooms reflect some of the students' difficulties with the understanding of notions involving fractions, ratios, and proportions. When some of the Spanish-dominant mathematics student teachers try to use only Catalan in the discussion of these topics, they introduce questions about how to translate technical vocabulary from Spanish. In the extract below, Silvia, a mathematics student teacher, expresses a doubt about which is the appropriate Catalan translation and spelling for the Spanish words "extremos" and "medios" (the "extremes" and the "means" when equalling two ratios and getting a proportion, whose Catalan translation is "extrems" and "mitjos"). The intervention by Silvia appears as a reaction to an ongoing discussion on the distinction between ratio and proportion. The situation is that of having a second language being brought into the mathematical discussion:

Silvia: If you get *a* and *b*, you can only have a ratio, not a proportion, right? You need two ratios, and then the first ratio equals the second … I remember saying "extremos" and "medios" … But … how is it in Catalan? Extre … extrems? Do you spell it like that? And "medios" … Me … Medis … It sounds weird … What's the word?

Silvia is not sure about how to say the two words in Catalan. The mathematics teacher educator gives the literal translation and uses the appropriate Catalan words when referring to the inversion of the extremes and means in a proportion. In another lesson from the same preservice classroom, the interest on becoming proficient Catalan users in mathematical discussions also appears when a mathematics student teacher, Mónica, starts presenting her solution to a problem to the whole class. When she realizes that she is speaking Spanish, she switches to Catalan, repeats the same sentence that she has already said in Spanish (a language that all participants in the classroom are expected to know), and apologizes for not having used the LoLT:

Mónica: [Spanish] I have used a tree diagram to look for all possible combinations … [Catalan] Oh, sorry! [She repeats the same sentence now in Catalan, and keeps using Catalan] I have used a tree diagram to look for all possible combinations … and then I have made a multiplication.

Various extracts in this lesson, and others, point to the class talk as a place for revisiting the mathematics student teachers' mathematical knowledge and eventually dissuading the students from orienting the discussion toward language issues. In the extract below, Mónica and the mathematics teacher educator are talking about the mathematical problem that has been posed in the classroom. Although Mónica is Spanish-dominant and the mathematics teacher educator is Catalan and Spanish bilingual, the conversation takes place entirely in the LoLT (Catalan). When Mónica has completed her explanation (students need to find, in small groups, how many

possible menus can be obtained by combining three appetizers, four main plates, and three desserts), she raises a question in relation to 'the' language:

Mónica: We have thought only a few ways [of resolution] because … we've been doing at a low speed … we've realized that we were writing everything down in Spanish and we have spent time translating it to Catalan.

When Mónica raises a language issue, the mathematics teacher educator does not take that issue up, but carries on with the conversation about the different ways to solve the problem. She does not seem to realize the importance of the fact that the mathematics student teachers in that group have spent time translating their explanations from Spanish into Catalan, and that this time, as reported by Mónica, has been detrimental to the development of alternative solutions to the problem. The mathematics teacher educator is trying to push Mónica to share the second solution with the other mathematics student teachers in the class, and this is actually an expected practice in a problem-solving environment. What is surprising is that the mathematics teacher educator does not comment on the implications of having put the focus on the language. This is one of the several examples that points to the emphasis on becoming learners of mathematics, teachers of mathematics, and becoming proficient Catalan language users in the preservice classroom practices.

6.5 Joint Discussion

The discussion of this chapter focuses on two areas: the awareness and its implication as well as the practices and their implications in the training of mathematics student teachers in multilingual contexts. Because mathematics is abstract science, it is carried in semiotic form and therefore accessed through some form of language. Thus, the awareness of and attention to language use is critical in any classroom as far as classroom discourse is concerned. This awareness becomes even more critical in linguistically diverse contexts where students (and sometimes teachers) learn/teach mathematics in a language other than their first or home language. Moreover, it must be noted that one cannot assume a causal relationship between awareness and practice. Nevertheless, a practice such as introducing the students' languages requires gaining awareness of them as useful, not merely in terms of achieving rights but for epistemological purposes in relation to the learning of mathematics (Planas & Setati, 2014).

6.5.1 Awareness and Implications

The research summarized in the previous section, shows that there is a certain awareness of multilingualism and at least there is something being done toward the move to multilingualism in mathematics teacher education. There is awareness by

the mathematics teacher educators in all three countries that the students' (home) languages can be used as a resource for teaching and learning mathematics. However, even though the acknowledgement that languages other than the LoLT can serve as a resource, our studies show that South Africa, Malawi, and Catalonia do not have well-structured programs and courses for introducing mathematics student teachers into the complexity of teaching mathematics in linguistically diverse contexts. Ngu (2004) noted that mathematics teacher educators, especially in African countries, are being prepared to teach in languages that are not their own. Under such circumstances, teachers would be expected to find it challenging to cope with teaching in linguistically diverse classrooms, in which many learners are also coping with the use of a language that is not their own. In brief, what we have is that teacher education programs are inadequate in the training of mathematics student teachers for creating awareness regarding the needs of multilingual contexts and for developing their professional activity in them. Hence in-service teachers are not adequately prepared for facilitating the learning of mathematics of their students.

6.5.2 Practices and Implications

Research in the three countries under discussion reveals that mathematics teacher educators draw mathematics student teachers' attention to becoming mathematics teachers and to the acquisition of mathematical knowledge. The emphasis is mostly given to understanding of mathematical notions and constructing an identity as a mathematics teacher. This is crucial and critical for mathematics student teachers' development as mathematics teachers. However, we argue that preparation of mathematics student teachers needs to go beyond these focal points to include the challenges of teaching mathematics in linguistically diverse classrooms, the major challenge being to consider the students' languages as pedagogic resources. The studies in the three countries have shown that the mathematics teacher educators' practices do not focus on the practices that would induct mathematics student teachers into teaching mathematics in multilingual contexts. Further, these studies have shown that being aware of the multilingual context does not necessary imply the adoption of multilingual practices in the classrooms. For example, all the mathematics teacher educators are aware of the multilingual nature of their classrooms, but their practices do not include systematic responsive practices such as harnessing the diverse students' languages. Also, we feel that the absence of the well-structured programs and courses for introducing mathematics student teachers into the complexity of teaching in linguistically diverse classrooms has added to the lack of multilingual practices in the mathematics classrooms. Well-structured programs and courses might act as a bridge that would blend the awareness of multilingual context and the practices of the mathematics teacher educators.

6.6 Concluding Remarks

We have focused on the awareness and practices of mathematics teacher educators who are teaching in linguistically diverse classrooms across three countries. We have shown that the nature of multilingualism in these countries is distinct, yet the challenges faced by mathematics teacher educators are similar: those of preparing preservice teachers to deal with the complexity of teaching in linguistically diverse mathematics classrooms. In multilingual classrooms with learners whose home language is not the LoLT and who are not yet proficient in the language of instruction, teachers are faced with the triple challenge of striking a balance between attention to mathematics, to the LoLT and to mathematical language (Barwell, 2009; Planas, 2012). It is not a given that preservice teachers would acquire the knowledge required in dealing with this challenge by the mere experience of being in a multilingual environment, but rather through some form of teaching and enculturation. The reality from data across South Africa, Malawi and Catalonia-Spain is that, even though the mathematics teacher educators have an awareness of what it entails to teach multilingual mathematics student teachers who themselves will teach in multilingual contexts, this awareness is not reflected unequivocally in their practice. Their classroom practices are mostly those that induct mathematics student teachers into becoming learners of mathematics content and becoming teachers of mathematics. Hence we conclude that mathematics teacher educators need to have knowledge pertinent to the teaching of mathematics in multilingual contexts, as well as to the role of the students' languages in the mathematics learning. One way of equipping mathematics student teachers with this knowledge is creating awareness of the intertwinement between language and mathematics. These should never be separate issues taught in isolation. Creating awareness of the multilingual context of teaching and what it entails should be a thread that runs through the entire (mathematics) teacher education curriculum. But beyond creating such awareness, the teacher educator needs to actively draw on mathematics student teachers' multilingualism by tapping into and exploiting the different languages available in the multilingual classroom.

This chapter has been diagnostic and explorative in delineating the issues that are present in mathematics teacher education classrooms across three different countries in a bid to explain what *is* in mathematics teacher education. It is, first and foremost, a step towards delineating what *could/should* be in our preservice mathematics teacher education programs. An immediate future challenge of the three authors is precisely to develop research that informs linguistically responsive mathematics teacher education practices for the ultimate benefit of the learning of mathematics. At this stage, however, it is difficult to understand what *could/should* be without an international and practical understanding of what is.

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