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Examining opportunities for the development of interacting identities within pre-service teacher education mathematics classrooms

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In any pre-service mathematics teacher education classroom, multiple identities are co-constructed simultaneously through the practices in which such classrooms engage. These multiple identities, which are interrelated and in constant interaction, include becoming a teacher of mathematics, becoming learners of mathematics, becoming learners of mathematical practices and becoming proficient English users for the purpose of teaching/learning mathematics and, finally, in multilingual contexts, becoming teachers of mathematics in multilingual classrooms. In this paper, I explore how classroom engagement supports the development of these interacting identities within pre-service teacher education classrooms. I use a developing framework, which I describe in this paper, to delineate each of these identities in four pre-service teacher education classrooms in two universities in South Africa. A notable finding was that, even though the teacher educators in the study were aware of their context of teaching, the identities that were projected through their classroom practices were mostly those that inducted the pre-service teachers (PSTs) into becoming learners of mathematics content. There were very limited practices aimed at inducting pre-service teachers into becoming teachers of mathematics and even more limited opportunities for the development of the identity of becoming teachers of mathematics in multilingual classrooms. Recommendations are made for the design of pre-service teacher education programmes.

Keywords: pre-service teachers, identity in practice, teacher education, mathematics classrooms

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Introduction

In recent years, researchers and educationists have paid increased attention to multilingualism as a phenomenon which relates positively to cognitive development, flexibility and the promotion of academic achievement in learners (Adler, 2001; Agnihotri, 1995; Conteh, 2000; Cummins, 1979; Gorgorio & Planas, 2001; Halai, 2004; Moschkovich, 1999; Setati, 2002, 2005; Setati & Adler, 2000). In South Africa, where most of the classes are multilingual, one of the greatest challenges facing teacher education institutions and teacher educators is how to prepare pre-service teachers to deal with the complexity of teaching effectively in multilingual mathematics classrooms (Young, 1995). In this regard, research in multilingual mathematics classrooms in general, and in South Africa in particular, has focused mainly on the language practices, the dilemmas and the complexity which in-service teachers deal with while teaching in mathematics multilingual classrooms (see Adler, 2001; Du Plessis & Elsie, 2003; Setati, 2002, 2005; Setati & Adler, 2000). There is a dearth of research into how pre-service teachers are prepared at universities to deal with the complexity of teaching multilingual mathematics learners (especially at secondary level) whose first language is not the language of learning and teaching (LoLT). In general, teacher education research on mathematics education, thus far, has rarely focused on multilingual mathematics education, and research on multilingual mathematics education has hardly focused on teacher education. Most teachers teach in multilingual classrooms in South Africa, and research in South Africa (Adler, 2001; Setati, 2002, 2005; Setati & Adler, 2000) has shown that learning and teaching mathematics to multilingual learners is complex and that teachers grapple with dealing with this complexity. Adler (1995:265) expresses this complexity in these words:

> *... the dynamics of teaching and learning mathematics in multilingual classrooms is not simply about proficiency in the language of learning; nor is it only about access to the (English) mathematics register; nor should it be reduced to social diversity and social relations in the classrooms. These three, while analytically separable, are in constant interplay in the cultural processes that constitute school mathematics learning.*

Hence, teaching mathematics in multilingual classrooms involves the teacher's being confronted by situations constituted by the above triple interplay. Chekaraou (2009), who investigated teachers' appropriation of a bilingual educational reform policy in two schools in Niger, found that pre-service teachers who were enculturated into the intricacies of using different languages to teach during their pre-service training found it easier to accommodate different languages in multilingual classrooms. On the other hand, pre-service teachers who were not trained for bilingual classrooms and were not exposed to ways in which to accommodate the different languages in a multilingual classroom found it difficult to accommodate different languages when they began to teach in schools. Therefore, it is not given that pre-service teachers would develop competence in teaching in multilingual contexts by the mere fact that they sit in multilingual classes during their training programme. This evokes a need to

explore how teacher training institutions attend to the needs of pre-service teachers who are being trained for teaching in multilingual classrooms.

This paper uses data from a wider study (Essien, 2013) to explore one of such needs (in four PST education classrooms at two universities in South Africa), namely the opportunities which pre-service teachers are afforded for the development of identities pertinent to the teaching of mathematics in multilingual contexts. Hence, the research questions that this paper seeks to explore is: What facets of mathematics teacher training do teacher educators pay attention to or are developed in pre-service teacher education mathematics classrooms and how can these facets inform pre-service teacher education in South Africa?

The study is grounded in Wenger's (1998) notion of identity in practice. A thread that runs through this paper, based on this notion, is the assumption that the pattern of language used by teachers and students within and about a particular content area (mathematics in this case) would determine the nature of enculturation into the discipline and would, invariably, lead to the internalisation of the ability to engage in discursive mathematical practices in particular kinds of ways (Brilliant-Mills, 1994).

Wenger's notion of identity in practice

Wenger (1998:5) defines the notion of identity as a way of talking about how learning changes who we are and of creating personal histories of becoming in the context of our communities. Wenger describes identity as a "constant becoming", as trajectories which are not necessarily linear and which have no fixed destination. For Wenger (1998:215), identity is acquired and shaped in the engagement in practices of the community, and learning transforms "who we are and what we can do … It is not just an accumulation of skills and information, but a process of becoming a certain person". This line of thinking resonates with the later work of Mayer (1999:5) on the importance of teacher identity development:

> *Learning to teach for the preservice teachers involve[s] [the] interplay of teaching role and teaching identity … Learning to teach can be learning the skills and knowledge to perform the functions of a teacher or it can be developing a sense of self as teacher. In the former, one is "being the teacher", whereas in the latter, one is "becoming a teacher".*

Wenger (1998) notes that identity is in part a trajectory of where members of a community (as a collective and as individuals) have been, where they currently are, and where they are going. Examining this three-tiered trajectory of identity would entail following pre-service teachers as students, as student teachers and then as novice teachers. It was not the aim of this study to do all these and so the methodological approach does not focus directly on this three-tiered trajectory. And given that data were collected only during the time interval in which a mathematics topic/concept was addressed in class, the study focused only on the second part of

Wenger's identity trajectory – where members are currently, while bearing in mind where they are going.

An approach for characterising identities within pre-service teacher education classrooms

In exploring identity within Wenger's framework, several aspects of identity could become a focal point. In the present paper, I restrict my investigation of identity to how classroom engagement in practices provides a window for what the pre-service mathematics teacher pays attention to and reifies as importance indices in pre-service teacher preparation. Since it is not the aim of this study to explore how the label "mathematics teacher" is given form in classroom setting in schools (by the pre-service teacher), the study does not investigate whether pre-service teachers have formed an identity, but explores the opportunities that exist for the formation of what I have referred to here as interacting identities.

Unlike teaching mathematics to mathematics majors students, teaching mathematics to pre-service teachers is much more complex because of the different facets involved in teacher education. In addition to being knowledgeable about the content they will teach, they also need to know how to teach it 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 avoiding linguistic aspects of teaching and learning mathematics and for paying attention to the language needs of learners/students in multilingual classrooms. This is why, as part of the identities involved in teaching and learning mathematics in multilingual pre-service classrooms, it was critical for this study to also examine how each teacher education classroom community pays attention to the language needed for mathematical learning. To this effect, the present methodological approach allows for the analysis of evidence present in the different classrooms in support of the interacting identities of *becoming teachers of mathematics (BTM)*, *becoming teachers of mathematics in multilingual classrooms (BTMMC), becoming learners of mathematics content (BLMC), becoming learners of mathematical practices (BLMP) and becoming proficient English Users (BPEU)* for the purpose of teaching/learning mathematics. This notion of interacting identities was the pivot upon which the construction of identities was analysed in this study. The table below provides more detail about the codes that were used and examples from teacher education classroom observation transcripts. The codes were developed both a priori (from Wenger's theory and from literature) and a posteriori (from data). The emphasis on "becoming" rather than "being" must be noted. This is in line with Wenger's notion of identity as a constant becoming as discussed earlier.

Table 1: Descriptors of interacting identities in pre-service teacher education classrooms

Guiding question	*Identification questions*	*Code and descriptors*	*Example from transcript (indicators)*
How does classroom engagement support interacting identities?	*What evidence exists in support of interacting identities of:*		
	Becoming teachers of mathematics?	[BTM] [Allusion is made to the teaching of mathematics]	TE: And this word "probable" *[writes: "probable"]* you know if a child had to hear this word for the first time, how could you *as a teacher explain* what probable [in relation to probability] means?
	Becoming teachers of mathematics in multilingual classrooms?	BTMMC [When attention is paid to teaching and learning in multilingual contexts]	TE: I want you to discuss this concept [probability] in your home languages in your group. After that, one member of the group will tell us what it means in a language of your choice and the direct translation.
	Becoming learners of mathematics content?	BLMC [When the mathematics concept is the main focus of attention]	TE: An activity that is taking place or will take place is called an Event.
	Becoming learners of mathematical practices?	BLMP [When pre-service teachers are taught, for example, the formal definition of a maths concept, this is BLMC, but when they are "taught" the importance of defining in the teaching and learning of math, this is BLMP]	TE: I am telling you now, you need to know how to define fractions correctly. Definitions are important in mathematics. I repeat, correct definitions are an important part of mathematics.
	Becoming proficient English users?	BPEU [General English usage]	TE: And when we speak in English instead of we say … instead of using the word "probability" what can I say? S: Chance TE: What are the chances of getting a …

There are subtle differences between these interacting identities. In what follows, I describe these differences which were evident in the study with the hope that it would help anyone desirous of using this framework to analyse classroom data from pre-service (multilingual) classrooms.

Elaborating on the coding schedule

Becoming teachers of mathematics (BTM) is about teaching, and the teacher educator sees herself as developing this identity in the pre-service teachers, while the pre-service teachers see themselves as imbibing this identity. By the same token, in *becoming learners of mathematics content* (BLMC), the teacher educator sees herself as responsible for teaching the pre-service teachers the mathematics content, and the pre-service teachers see themselves as learners of this content. Hence, while the one is about teaching, for the other, the attention is more towards learning. Instances in which the teacher educator asked pre-service teachers to think about what other students were thinking when they solved a problem on the board were also coded as BTM.

Becoming learners of mathematical practices (BLMP) relates to becoming knowledgeable about mathematical processes such as the processes of coming to define/exemplify. For example, if pre-service teachers were taught the formal definition of a mathematics concept, this was coded as BLMC. A situation where the teacher educators entrenched the importance of defining in the teaching and learning of mathematics was coded as BLMP. Hence, while BLMC pertains more to becoming knowledgeable about content, BLMP pertains to becoming knowledgeable about mathematical processes. In the former, the content is the object of attention; in the latter, the practice becomes the object of attention.

In *becoming teachers of mathematics in multilingual classrooms* (BTMMC), there is something specific about teaching in multilingual contexts, so attention is not only paid to the fact that the pre-service teachers would become teachers, but that they would become teachers in multilingual contexts. *Becoming proficient English users* (BPEU) was used to code instances where attention was paid to how ordinary English was used – where there was teaching for developing proficiency in the LoLT.

The study

Research design

In order to address the questions which this research sought to explore, a qualitative study approach was adopted. My choice of a qualitative study was motivated by its ability as a research method to bring new variables or understanding to the fore.

Sample

The wider study for this research consisted of a sample of four universities in a province in South Africa. All four universities have well-established pre-service teacher education programmes. For the study reported in this paper, four teacher educators teaching in four different classrooms were selected from two of these universities. Two of the teachers were from University A (TEIA) and the other two

were from University B (TEIB). The two universities were chosen because they present contrasting contexts of pre-service teacher education. TEIA is frequented by pre-service teachers and teacher educators for whom English (LoLT) is an additional language. TEIB is frequented by pre-service teachers of different linguistic backgrounds, taught by a good number of teacher educators whose first language is the LoLT. I have called the two teachers educators from University A TEIA-M and TEIA-S respectively, and those from University B TEIB-E and TEIB-L respectively. The teacher educators were video-recorded while teaching a mathematics concept from start to finish. The voices of both the teacher educators and pre-service teachers were part of the classroom observation because both teaching and learning were in focus in the study.

Ethical considerations

Access to the universities was negotiated with the heads of the school (faculty) of education of each university and the teacher educators were asked for written consent to participate in the research. The researcher informed the teacher educators (and the universities) that their anonymity would be protected.

It is my contention that the community of teacher educators is different from the community of teachers. The former is much smaller, more academically and research inclined, and more conversant with one another's institutional and historical contexts. This makes research in teacher education an ethical mine-field. In this light, in all the publications resulting from this study, I have refrained from describing both the teacher educators involved in the study and the context of the institutions. Doing either or both of these would put the anonymity of the teacher educators or the universities in jeopardy. Furthermore, the pronoun, "she" is used for all the teacher educators in this study to protect their anonymity. Acronyms are also used for the institutions involved in the study.

Key findings and discussions

In discussing the findings, I first start with the individual universities before doing a cross-case analysis of both universities.

University A

In University A, the two teacher educators used a great deal of defining, exemplifying and explanatory practices in their classrooms. Using these practices as points of departure and how these practices shaped and were shaped by interaction in the class, the findings from the study indicate that, within the multiply layers of teacher education, the acquisition of mathematical content receives an overarching emphasis. In the excerpt below, I provide an example from TEIA-M's classroom:

Excerpt 1

> ***TE:*** *The next organisation of scores is by looking at the concept of expressing the scores in terms of a single score, the concept of central tendency (writes "central tendency" on the board). What do we mean by this central tendency? If you have a distribution, and then you want to identify a single score that would be representative of the whole population, then we would be speaking of a central tendency. Let me give you an overview: (writes on the board: "Central tendency is the statistical measure that singles out or identifies a single score as a representative of the entire distribution"; then repeats the definition verbally to students and continues)*
>
> ***TE:*** *Now, there are three main measures of central tendencies (writes while reading: "The main measures of central tendency are the mean, the median, and the mode"). We use the same distribution to look at the three measures of central tendencies. Let's start with the mean. How do we calculate the mean from the definition? You add all the scores and then divide by the number of the scores.*

Clearly, in both episodes of defining, TEIA-M gives the pre-service teachers the conventional or formal definition of the concepts without their input. The students are usually not given the opportunity to attempt or question a definition given by the teacher educator. The pre-service teachers seemed to be familiar with this particular practice and do not offer definitions or suggestions when the teacher educator asks for definitions (e.g., *"what do we mean by this central tendency?")* because they view it as a rhetorical question, knowing the teacher educator would provide the answer herself.

Even though defining as a mathematical practice was important for TEIA-M, the importance of defining as a mathematical process that is important for teaching and learning in mathematics classrooms was in the background. The practice of defining as used by TEIA-M was anchored in the development of the identity of BLMC. In other words, as far as defining was concerned for TEIA-M's classroom, the content was the overriding object of attention (and not the process of coming to define). It could be argued that, for TEIA-M, defining as a practice was focused on how the pre-service teachers could use the definition to solve mathematical problems rather than on how the classroom community could construct definitions of concepts through interanimation of ideas that the pre-service teachers bring to class. Defining as a practice, thus, served a utilitarian purpose of being the window towards mathematical calculations. This was also the case with exemplifying as a practice.

Bills, Dreyfus, Mason, Tsamir, Watson and Zaslavsky (2006) argue that, in mathematics, it is not so much the examples in themselves that are important, but what is done with those examples and how they are probed, generalised and perceived. TEIA-M used one or two examples for each statistical concept that she taught. In excerpt 2, I discuss how TEIA-M used exemplifying practices to achieve the

purpose of her lesson. These examples used by the teacher educator offer insight into what she perceives as mathematical knowledge and how it is learned:

Excerpt 2

1	TE	There are three ways of determining the median. *[talks while she writes: "Three ways of determining the median. Right. If you have … the number of the scores is odd you just choose the middle one, number. Right. If N is odd, the middle number is the median. The simple example will be if you take the numbers 1 2 3 4 and 5, the median is just 3."]*
2		*[next to* (1) *writes: "If N is odd, the middle number is the median. e.g. 1 2 3 4 5 the median is 3."]*
3	TE	So you could arrange the numbers either in descending order or in ascending order to identify the median. Right. What about if the number of the scores is even? If N is even, right, you take the two middle numbers, you add them and then you divide it by 2. So you take the average of the middle numbers. The average of the two middle numbers is the median.
4		*[writes: "(2) If N is even. The average of the two middle numbers is the median."]*
5	TE	Right, let's say we take this as the score *[writes: "e.g. 1 2 3 4 5 6"]* The number of the scores is even. N is even, right? How many scores do they have?
6	PSTs	6
7	TE	6. Is 6 an even number?
8	PSTs	Class: Yes.
9	TE	T: Alright. What are the middle numbers that we have there?
10	PSTs	Class: 3 and 4
11	TE	T: Huh?
12	PSTs	Class: 3 and 4
13	TE	T: So if we add 3 and 4 and divide by 2 …
14	PSTs	[Some students] 3.5
15	TE	T: We'll get 3 plus 4, divide by 2. This is the average of this, middle numbers, right? So that is 7 divided by 2, that is 3,5.
16		*[writes:*]
17	TE	You see the median may not necessarily be the number that is part of the distribution. So from this, this indicates that the median may not necessarily be part of the distribution.

Several arguments could be advanced with regard to the examples provided by the teacher educator in excerpt 2, which are typical of those that TEIA-M solved in the class, First, in general, in TEIA-M's class, there was a mix of what Bills et al. (2006:2) call "work(-out) examples" (the examples that the teacher educator performs in class) and "exercise examples" (where tasks are set for pre-service teachers to engage with on their own). The "work(-out) examples" were aimed at both concept development and the application of a mathematical procedure. Bills et al. (2006:2) identify three descriptive labels of examples based on the forms and functions of examples and based on how the teacher/learner perceives the mathematical object in question – generic examples, counter-examples and non-examples. A second

feature of exemplifying as a mathematical practice in TEIA-M's classroom community was that all the examples were generic examples aimed at serving as a template for pre-service teachers to have tools for solving similar problems involving the concept at hand. As Bills et al. (2006:3) note:

> *Unfortunately their [generic examples] use in lessons is often reduced to the mere practice of sequences of actions, in contrast to a more investigative approach … in which learners experience the mathematisation of situations as a practice, and with guidance abstract and re-construct general principles themselves.*

Exemplifying was used by TEIA-M to explain procedures for solving mathematical problems in the same way that definitions were used to explain procedures. The application of the definition or example given was foregrounded. Since the pre-service teachers' attention was not drawn to the importance of the choices of examples when working with their future learners, it could be argued that exemplifying as a practice in TEIA-M's class was anchored solely in making the pre-service teachers more knowledgeable in the content of statistics. In other words, the identities of BLMP of exemplifying and BTM were backgrounded in the exemplifying practices of the teacher educator.

University B

Perhaps one of the most significant findings from University B is that attention is paid to the development of the identities of BTM and BPEU alongside the identity of BLMC (see table 2). But, even though the teacher educators in University B were aware of their context of teaching, attention was not paid to enculturating the pre-service teachers into BLMP of, for example, exemplifying or justifying. And the teacher educators did not attend to the development of the identity of BTMMC. Excerpts 3 and 4 from classroom observations in TEIB-E class at University B indicate those aspects that received attention in her classroom. In the extracts in which there was a protracted discussion on finding the trend line, TEIB-E kept using the mathematics that they were doing in class to talk about the teaching of statistics:

Excerpt 3

> ***TEIB-E:*** *No statisticians do it but teachers do it today … 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?*
>
> ***PST1:*** *Our strategy was to join the point that is just before 2 000 with the next … and then draw a straight line [voice fades].*
>
> ***TEIB-E:*** *So, what are they saying? We don't have a point there where 2 is [writing on the chart] and there is a point that we could use, so let's work with the 2 points on either side of it. Okay, what's the meaning of this line you drew?*
>
> ***PST1:*** *It's almost like the difference between the two borders, like the difference in the way fuel consumption grows [voice fades out, not clear].*

> ***TEIB-E:*** *I am rephrasing what she's saying, I know they're saying slope, I know they're saying difference between 2 consumption rates, okay? As a teacher I am listening for those words because I know the background knowledge is functions and lines … Okay, so now how do you go about estimating?*
>
> ***PST2:*** *There we make 2 000, and drew a perfectly vertical line up to where it touches the green one, so that we know, and then we drew the horizontal across.*

Mathematical thinking involves, as Stein, Grover and Henningsen (1996:456) put, "doing what makers and users of mathematics do". Throughout the lesson, TEIB-E kept indicating to the pre-service teachers what statisticians do and what they do not do and, more importantly, what they as mathematics pre-service teachers need to do to become enculturated into the teaching of mathematics. First, they must be able 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 data; secondly, they must be able to draw the trend line accurately. Here we see explicit attention being paid to BTM through practices such as predicting mathematically, conjecturing, and providing justification. TEIB-E is conscious of the fact that she is not teaching mathematics solely for the purpose of content knowledge, but that she is teaching would-be teachers. Nonetheless, the development of content knowledge is also vital in her classroom. Excerpt 4 focuses mainly on developing the content knowledge of the pre-service teachers by means of explanatory and justificatory practices in which the shared language "does it mean that" was used to get them back on track or to enable them to understand the concept at hand:

Excerpt 4

> ***TEIB-E:*** *Have I lost you?*
>
> *Chorus answer: Yes.*
>
> ***TEIB-E:*** *Okay then you have to tell me; if I have lost you then help me to find out where I have lost you. You have to tell me does it mean that, please can I have a few questions of 'does it mean that'.*
>
> ***PST1:*** *Does it mean that we are ignoring these points [points that show fuel decreases as load increases]?*
>
> ***TEIB-E:*** *Does it mean that we are ignoring these points? Yes it is. We ignore those points because we say they're unusual. We say it is unusual to get situations in which your fuel will decrease if your load increases … So it does mean that. Another 'does it mean that' question?*
>
> ***PST2:*** *Yes ma'am, I don't wanna say does it mean we ignore other points but say, does it mean that we ignore other factors.*

In excerpt 4, the teacher educator attempted to explain to the pre-service teacher that, in drawing a trend line, it makes sense to be guided by where the points are clustered than by points which appear to be outliers. A shared language does it mean that was a shared reference that participants used as they negotiated the mathematical knowledge around the concept of trend lines in statistics. The expression positions

the teacher educator as having more access to the mathematics knowledge than the pre-service teachers. It also positions the pre-service teachers as attempting to access this knowledge. In using the expression does it mean that as a specialised discourse in her class, it could be argued that the role of the teacher educator was clearly to enculturate the pre-service teachers into becoming knowledgeable about the content at hand (in this case, the concept of line of best fit).

Cross-case synthesis

The table below provides a general indication as to whether the practices were anchored in BTM, BTMMC, BLMC, BTMMC or BPEU. What is important about this table is not the number of times each identity occurred, but the pattern and what could be perceived as the privileged aspect(s) of teacher education in each of the teacher education classrooms:

Table 2: Cross-sectional view of interacting identities in the four teacher educator classrooms

Evidence in support of:	*Number of occurrence –TEIA-M*	*Number of occurrence– TEIB-S*	UNIVER-SITY A	*Number of occurrence – TEIB-L*	*Number of occurrence – TEIB-E*	UNIVER-SITY B	Total
Becoming teachers of mathematics	1	2	3	16	27	43	**46**
Becoming teachers of mathematics in multilingual classrooms	0	0	0	3	0	3	**3**
Becoming learners of mathematics content	80	75	155	111	108	219	**374**
Becoming learners of mathematical practices	0	0	0	1	7	8	**8**
Becoming proficient English users	0	1	1	23	5	28	**29**

A remarkable finding from table 2 is that, even though the teacher educators in the study were aware of their context of teaching – that they were teaching multilingual pre-service teachers who themselves would teach in multilingual contexts at the end of their qualification (see Essien, 2010) – this awareness was not reflected unequivocally in their practice. The practices-in-use in their classrooms were mostly those that inducted the pre-service teachers into becoming learners of mathematics content. There were very limited practices aimed at inducting pre-service teachers into BTM especially in University A and even more limited ones that inducted them into BTMMC. With regard to the multidimensional aspects of teacher education that are reflected in the interacting identities in both University A and University B, as discussed earlier, the development of the pre-service teachers as BTMMC and as proficient learners of mathematical process (of say, exemplifying, defining,) were less valued in the teacher education classrooms. This research, therefore, shows that mathematics pre-service teachers were, in fact, not being prepared adequately to understand and subsequently deal with the challenges involved in teaching mathematics in multilingual contexts, which is the context of teaching and learning in South Africa. This has significant implications for teacher training in South Africa where most of the classes are multilingual and where most learners, despite their low English language proficiency, choose to do mathematics in English (Setati, 2008).

But, although an overarching emphasis is placed on developing the identity of BLMC, the four teacher education communities of practice in this study experienced this enterprise differently. Interestingly in this study, these four classrooms opened up different possibilities for the pre-service teachers as far as preparing for teaching mathematics (in multilingual classrooms) is concerned. In order to disaggregate these differences, I take another look at excerpts 2, 3 and 4, and argue that the way in which the teacher educators organised participation shaped the practices that were to be valued, and enculturated the pre-service teachers in particular kinds of ways.

For University A, both TEIA-M and TEIA-S privileged practices such as defining, exemplifying, explaining and proceduralising. The approach to the teaching and learning of mathematical concepts with limited interanimation of ideas around the mathematical concepts meant that the pre-service teachers had limited opportunity to develop how to make use of contributions in class in furthering the mathematical development of concepts. It also meant that the PSTs had limited opportunity in engaging in extended discussions regarding mathematical concepts. Since the practices of the teacher educators in University A focused largely on procedures for arriving at the correct answer, the acquisition of knowledge of concepts taught by TEIA-M and TEIA-S (during whole-class discussions) was mainly algorithmic knowledge; thus, there were limited opportunities for developing relational understanding and relational reasoning for the pre-service teachers. In requesting for clarifications or further elaboration, in extending invitations to other students for evaluation, and in reiterating the pre-service teachers' contributions, the teacher educators in University B developed mathematical knowledge in pre-service teachers

while, at the same time, providing them with opportunities for developing their (pre-service teachers) mathematics discourse.

What does this mean for pre-service teachers who would teach in multilingual mathematics classrooms at the end of their qualification? In a sense, it could be argued that the pre-service teachers in University B have had some experience of dialogic and interactive processes even though multilingualism was not foregrounded. In TEIB-E's classroom, because there was a high level of interanimation of ideas and extended dialogue regarding the concepts at hand, pre-service teachers had the opportunity of developing both spoken language and mathematical language while simultaneously developing mathematical meanings. The short procedural questions that required short procedural answers, which were used especially in TEIA-M's classroom, limited the pre-service teachers' opportunity to engage in extended interactions using both the LoLT and the mathematical language. It could, therefore, be argued that, unlike those in University A, the pre-service teachers in University B were more exposed to ways of dealing with the triple challenge of paying attention to mathematics, to the LoLT and to mathematical language discussed earlier.

Concluding thoughts

The foregoing discussions are an indication of which facets of teacher training are privileged in pre-service mathematics classrooms. In the early nineties, and based on a questionnaire sent out to teacher training institutions, the Report by the National Education Policy Investigation (NEPI, 1993:181) observed that all teachers needed to understand the role of language in the education of their pupils. It was revealed that there is no component in the training of primary and secondary school teachers that prepares them for the challenges of teaching through the medium of a language other than the pupils' home language. The NEPI (1993) recommended that, notwithstanding whether the LoLT is the home language or a second language, these gaps in teacher training seriously affect the ability of teachers to use the LoLT in the best interests of their pupils when they go to teach in schools at the end of their qualifications.

Two decades after this finding, this recommendation remains valid for teacher training institutions in South Africa. Increased attention (in teacher training) to teaching for teaching of mathematics, teaching for teaching of mathematics in multilingual contexts, teaching for learning of mathematical practices, and teaching for the development of proficiency in the LoLT would go a long way in bridging this gap and in producing teachers who are more prepared to deal with the challenges involved in teaching mathematics in a context such as that of South Africa. At the teacher training level, a course that attends to the complexities of teaching and learning in multilingual classrooms is essential. But a single course is not enough to enculturate pre-service teachers into the intricacies involved in teaching mathematics to multilingual learners. Hence, the enterprise of the development of teachers of

mathematics in multilingual contexts and what this entails should be a thread that runs through the entire teacher education (mathematics) curriculum.

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