Exploring Mathematics Classroom Practices in South African Multilingual Settings

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Abstract

The study reported in this article explored mathematical classroom pratices in four South African multilingual classroom settings. This paper sought to unpack both the use of language as well as the implementation of discussion as a technique in the teaching and learning of mathematics during and after the intervention The study followed an ethnographic design using four mathematics multilingual classrooms as individual cases, and the four mathematics teachers who participated in the study from each school were part of a larger case. Thus, the goal of this ethnographic research was to understand and describe the phenomenon surrounding the use of languages in the teaching and learning of mathematics from the perspectives of the four cases. Data collection strategies included a classroom observation schedule that took place over a period of six months at a research site. The findings revealed that teachers used both the language of learning and teaching and learners' home languages when explaining mathematical concepts being taught in the classrooms. It was further observed that the quality of discussions in small groups was high amongst group members, whereas the whole-classroom discussions were very low in quantity, particularly discussions between the teacher and the learners during the lesson. Although learners were afforded opportunities to use the language they preferred for discussion and problem-solving in their small groups, the use of English by their teachers suggested the teachers as a figure of a powerful authority, which had an effect on the language used by the learners in the classrooms.

Keywords: *language; problem-solving; multilingual classrooms; sense-making; discussion technique*

1. Introduction

A review of South African research in mathematics education during the past decade (see Setati, Chitera & Essien, 2009) provides seemingly contradictory messages, such as that learner proficiency in English translates to gaining epistemological access and conversely, that teachers should be encouraged to draw on the learners' home language as a resource. Although there are suggested teaching strategies and/or techniques (such as code-switching, translation, re-voice, etc.) that draw on and promote the use of the learners' home language(s) as a resource in South African multilingual classrooms, reports (e.g., Adler, 2001; Akindele & Letsoela, 2001; Setati, 2005b) indicate that teachers make gross errors in their attempts to code-switch and translate from LoLT to the home language of learners. Chitera (2009) argues that translation in a multilingual mathematics classroom is inevitable as most of the classrooms follow prescribed textbooks and other learner support materials that are written in English. Nevertheless, in so doing, mathematics classrooms are faced with challenges of implementing these proposed techniques without diluting or filtering the mathematics content that is taught – something to be considered in the light of the fact that learning mathematics in a language that is not the learners' first, main or home language (Setati et al., 2009) has been criticised as being both a vehicle of acculturation and an easily recognisable trait for maintaining privilege (Barwell, Barton & Setati, 2007).

2. Literature review

This section looks at discussion and dialogue as a teaching technique in mathematics classrooms, , a framework for categorizing the types of instruments used to assess learning style, as well as prior researches on learning style.

2.1 Discussion and dialogue in mathematics classrooms

There is now a prominent body of empirical and theoretical grounds that demonstrates the good outcomes of

participating in mathematical dialogue in the classroom (e.g., Mercer, 2000; Moschkovich, 2002). What these researchers have demonstrated is that effective and quality instructional practices demand students' mathematical talk. Unfortunately, little authentic discussion has been seen in South African classrooms (Moschkovich, 2000; Webb, 2010).
Wood (2002) found variation in students' ways of seeing and reasoning, and these were assigned in the first place to the particular differences established in classrooms early in the year pertaining to *when* and *how to contribute* to mathematical discussions and *what to do as a listener*, consistent with findings reported by a number of other researchers (e.g., Gillies & Boyle, 2006; Webb, Nemer & Ing, 2006). Moreover, participation obligations put boundaries around the opportunities for students to share their ideas and to engage in mathematical practices (Webb et al., 2006).
Webb, Williams and Meiring (2008) suggested the value of introducing concept cartoons and argumentation writing frames in South African schools within the current curriculum to promote classroom discussion and argumentation. In usual textbook word problems the students are required to make meaning out of symbolically described situations whereas, through cartoons, researchers (Lesh & Doerr, 2003) want learners to make symbolic descriptions out of meaningful situations. The concept cartoons, which are cartoon-style drawings showing different characters arguing about everyday situations, are not meant to be humorous but are designed to provoke discussion and stimulate thinking (Webb et al., 2008).
In South Africa, as in many previously colonised countries in Africa and Asia, there is an added level of complexity in terms of learner achievement in mathematics (Alidou & Brock-Utne, 2005). This added level of complexity hinges on the fact that mathematics is both taught and learned in a second language (English) in a majority of schools in both rural and urban areas (Taylor & Vinjevold, 1999; Fleisch, 2008).

2.2 Mathematics Achievement

Factors associated with achievement in general include motivation (Skuy, Schutte, Fridghon & O'Carrol, 1996); personality characteristics (Van Eeden, De Beer, & Coetzee, 2001); gender (Van Rooyen, 2001); race (Walker & Plata, 2000); and home-language (Lerman, 2001; Setati, 2008; Van Rooyen, 2001); student intelligence (Flynn, 1991), self-esteem and self-efficacy (Leung, 2002; Wilkins, 2004); academic expectations and effort (Johnson, 1996); family education values, expectations, and support (Crystal & Stevenson, 1991); as well as language clarity, word structure, and patterns (Han & Ginsburg, 2001; Li & Nuttall, 2001) have been shown to have an effect on mathematics achievement. As this study focuses on issues of language and mathematics when learners in previously disadvantaged 'Black' schools solve word problems, the possible relationships between school, teacher, race and language are discussed below.

2.2.1 Language and achievement in mathematics

Internationally and in South Africa, there is no long history of research into the specific mathematics schooling experiences of English second language learners. However, in the past few decades a growing number of scholars in the (mathematics) education community have suggested expanding the sphere of mathematics education research into the socio-cultural arena in order to understand the schooling and mathematics outcomes of these learners more fully (e.g., see Atweh, Forgasz, & Nebres, 2001; Secada, Fennema, & Adajian, 1995; Walshaw, 2004). Such research originates outside the realm of 'traditional' mathematics education research and theory and supports Weissglass' (2002) assertion that the historical contexts and the socio-cultural structures in which mathematics and mathematics teaching and learning are embedded have a significant effect on students' mathematics learning and performance, especially on those students who have been historically marginalised.

2.2.2 School level factors related to achievement in mathematics

Previous research has identified a number of school level factors that influence achievement. A review by Greenwald, Hedges and Laine (1996) reveals that class size has a minor effect on achievement. Leadership, organisation and management have been identified as important factors by school effectiveness researchers, whilst school improvement researchers (Gray, Hopkins, Reynolds, Wilcox, Farrell & Jesson, 1999) have concentrated on decision-making, within-school hierarchy and communication. However, other findings in school effectiveness studies (e.g., Teddlie & Reynolds, 2000) show that school-level factors influence achievement far less than do factors at the class-level. Rather, textbooks,

teacher quality and time have been identified as key factors emerging from school instructional effectiveness research (Darling-Hammonds & Sykes, 2003; Johnson & Kritsonis, 2007).

2.2.3 Teacher level factors related to achievement in mathematics

The instructional practices of teachers who are highly qualified and who have strong pedagogical and mathematical knowledge are of a higher quality than those who do not (Darling-Hammonds & Sykes, 2003). Students in schools in the United States (US) with large numbers of Black students and low-income populations have fewer qualified teachers than schools that have largely White populations (Darling-Hammonds & Sykes, 2003). These findings suggest that minority students in the US are less likely to be taught by teachers with strong pedagogical and mathematical knowledge, which could be a contributing factor to the mathematics achievement gap in other countries like the US (Johnson & Kritsonis, 2007).

2.2.4 Race and achievement in mathematics

A number of researchers suggest that lower achievement by Black students may be a result of the curriculum and instruction that these students receive (Johnson & Kritsonis, 2007). Lubienski (2001) found that the gaps between Black and White students were more attributable to race than socio-economic differences. Ferguson (1998) believes that teachers' expectations, perceptions and behaviours sustain and even expand the Black-White achievement gap, and that these effects accumulate from kindergarten through high school.

It has been found that, generally, teachers form different expectations of students as a function of race, gender and social class, and these expectations seem to be established in different ways (Secada, 1992). Jussim, Eccles, and Madon (1996) reported that teacher expectations and perceptions had a significant effect on sixth grade students' grades and performance on a standardized mathematics assessment. They found that teacher expectations were almost three times greater for Whites than for African-American students, and that the effects were larger for girls and low-income students. In his study on teacher expectations and the achievement gap, Ferguson (1998) concluded that effects of teacher expectations could be substantial if the effects accumulate from kindergarten to high school. Similarly Berry (2003, 2004) reported that African American male middle school students experienced lowered expectations from their mathematics teachers. He contended that these lowered expectations affected their achievement in mathematics and their opportunities to gain access to high-level mathematics courses.

3. Research methodology

3.1 Participants

107 Grade 9 learners from four schools participated in the study over a period of six months. The average age was 15.4 years ranging from 15 to 17 years old. The four schools attract learners from low-income house-holds. The four teachers who formed a convenience sample of the study were mathematics qualified teachers with a minimum qualification of a 4 year Bachelor degree.

3.2 Instrument

The instrument used in this study was the classroom observation schedule. The observation schedule assisted the researcher in attempt to understand (holistically) the worlds of the participants and that of the observer. Such a data collection technique enabled the researcher to be both involved and detached from the topic of study (Eisenhart, 1988), as well as faithfully representing participants views and meanings. The four participating schools were viewed as institutions in societies that organize meanings and social relations in a particular ways to support the social order of all the groups within the societies. Thus, what is taught and learnerned is expected to vary by classrooms within these schools. Data collected through participant observation attempted to respond to the following objectives of the study:

3.2.1 To identify the use of language by both the teacher and learners, when teaching and learning in multilingual mathematics classrooms (Components 1-3); and

3.2.2 To check whether the introduction of discussion and argumentation into classroom practice has an influence on learners' sense-making and problem-solving abilities (Components 4-7).

Data collection and analysis in this study proceeded together throughout the period of study (six months). The ultimate goal of this procedure was to provide a theoretical explanation that comprised all the data and thus, provided a comprehensive picture of the complex and meanngs and social activity.

3.3 Procedure

Materials gathered in a form of data were organized into major categories of meaning in which identified elements were treated as if they were quivalent. All the known elements in selected domains were listed, and the meaning of elements within and between domains was matched in order to classify components that distinguished one domain from the other. The sorting procedure in this study were sufficiently done by both the researcher (participant observer) and participants with the aim of maintaining participants' meanings and thus, filled in possible gaps in the researcher's material. The final step of the study's procedure, done by the researcher, was to organize meaningful components into plausible themes that made it possible for him to make meaning of the participants' world in almost the same way they do. All the themes were considered in light of existing sociocultural theories and are discussed in the next session.

3.4 Interventional strategy

The intervention strategy took a form of introducing participating teachers to use of discussion as a technique in the teaching and learning of mathematics in multilingual classrooms. The intervention took place over a period of six weeks. The aim of the strategy was to encourage the teaching of mathematics through mathematical discussion and allowing learners to talk about concepts that are learned during a mathematics lesson in the classroom. Thus, the strategy would create space for a learner centred approach in the teaching and learning of mathematics.

4. Findings and discussion

4.1 Component 1: Use of language by the teacher when asking questions, teaching, giving feedback, explaining mathematical terms and concepts

The first component of the observation during the implementation of the intervention strategy was to understand and reveal the use of language(s) by the four teachers, when teaching word problems and problem-solving in mathematics classrooms. The issues of language use included, amongst others, teachers' questioning techniques, giving feedback to the learners, explanation of mathematical terms and clarification of concepts being taught. The results obtained from this component also assisted on how learners reacted to the language that is used by their teachers and implications for their own learning.

Table 1 illustrates a summary of teachers' use of language while implementing the intervention strategy used in this study, and provides a numeric rating per teacher against component 1.

Table 1. Teachers' use of language while implementing the interventional strategy

Strategy	Teachers			
	A	B	C	D
Uses home language only				√
Discourage use of home language				
Use English and switch to home language			√	
Uses English only	√	√		

Table 1 shows that both teachers A and B used English only, whereas the other two teachers, C and D, switched between English and learners' home language. Teacher A used English to ask questions and elucidate concepts that were taught during the implementation of the intervention strategy. Although her lesson was learner centred and the instruction given in English, most learners on all observations did not engage successfully with the teacher, but with the context in content used during the lesson. Teacher A explained the problem-solving task, which was presented in the form of a concept cartoon, in English. Learners interpreted and solved the task amongst them using their home language, and the teacher also used learners' home language to clarify issues emerging from the task. Most of the learners seemed to be more actively engaged with both the content and mathematics discourse in their home language than when communication occurred in English. Only few learners in this classroom managed to engage the teacher in English without fear of embarrassment before their own peers.

Teacher B, just like in Teacher A, used English only to teach, ask questions and give guidelines on the concepts that were taught in his classroom. Teacher B intentionally used, on several instances, re-voicing as a strategy to explain concepts that were learned in the classroom in learners' home language. In this classroom, isiXhosa was used as an invisible resource to interpret and solve problems in groups. Learners responded to teacher's questions in their preferred language, switching between the LoLT and their home language when necessary.

In all the observed lessons conducted by Teacher C during the implementation of the intervention strategy, a structured use of learners' home language and LoLT in different phases of the lesson was employed. Teacher C predominantly used English during the introduction and work phase. In other words, English was used to introduce new concepts to be taught and explain the application of these concepts when solving mathematical problems during the lesson. In so doing, it became very difficult for the learners to interact confidently with the teacher using the LoLT. Learners preferred to communicate in their home language, amongst themselves, during one-to-one and group discussions.

Teacher D approached her lessons differently compared to the other three observed teachers above. All the observations into her classroom revealed that she is a confident isiXhosa speaker and had higher vocabulary levels of mathematics terms compared to her peers. She used isiXhosa as a resource to improve and encourage maximum interactions and participation in the classroom. Her classroom talk was high in both quality and quantity. She used learners' home language to teach, ask questions, clarifying concepts were necessary and when solving problems. The use of learners' language resulted in dialogical interactions and utterances that made it possible for a complicit agreement between the teacher and learners to participate in classroom discourse.

4.2 Component 2: Uses of Language by the learners

The second component focused on learners' use of language to seek clarification, elaborate and solve mathematical problems, pose questions and build upon previous responses during the lessons. Some of the discussion on this category is given in the first component above. Table 2 depicts how learners used language during the observed lessons.

Table 2. Learners' use of language during implementation of the Intervention strategy

Strategy	Teachers classes of learners			
	A	B	C	D
Use home language to solve problems	√	√	√	√
Seldom use English				√
Use English but switch to home language	√	√	√	
Uses English only				

The choice of language uses by Teachers A, B and C, did not have any effect and/or influence whatsoever, in learners' use of language when solving problems during the lesson. Learners from the two classrooms switched from English to isiXhosa in order to understand what was required of them within a problem-solving activity. Although they used code-switching as a resource to interpret and solve problems, learners of Teachers A, B and C classrooms communicated

mostly in their home languages. However, they were able to use English to present their written solutions to both the teacher and entire groups.

Although Teacher D and her learners used mostly home language in her classroom, learners' infrequent use of English was noticed. In this classroom, English was used by the learners to translate and re-voice activities to be solved. They used English sentence starters when presenting answers to the teacher and reading instructions given to them.

4.3 Component 3: Language use by learners in groups

This component revealed the use of language by the learners when working in groups to solve problems, discuss and share ideas, talk, argue and engage in dialogue during classroom interactions.

Table 3. Language strategies used by learners in the classroom

Strategy	Teachers			
	A	B	C	D
Uses home language for group work	√	√	√	√
Seldom use English		√		√
Use English but switch to home language	√		√	
Uses English only				

Table 3 illustrates that in all the four classrooms, isiXhosa was used as a preferred language for group work and group discussions. The quality of discussions in small groups was high amongst group members, whereas the whole-classroom discussions were very low in quantity, particularly discussions between the teacher and the learners during the lesson. In both Teacher A and B's classrooms, learners used English infrequently, compared to the other two classrooms, where learners used English first, and then immediately moved to their home language in order to have common and mutual understanding of concepts being learned.

Learners used home language to engage their peers in exploratory talk during group problem-solving of tasks. They participated fully in discussing and formulating arguments about different solution strategies. They used their home language, isiXhosa, to negotiate rules of engagement in their individual groups and during classroom interactions in general.

4.4 Component 4: Learners' use of writing

Component four focused on the general use of writing as a strategy to learn and solve real-world problems in mathematics. The ways in which some of the classrooms were structured seemed to support the development of learners' written explanations. These explanations were in most instances modelled by the teacher and developed gradually in a relatively consistent progression that reflected the use of sentence starters and/or writing frames in the learning of mathematical concepts, using the LoLT.

Table 4. Learners' use of writing to learn mathematics

Strategy	Teachers			
	A	B	C	D
Learners do not write at all				
Learners write ineffectively	√			
Learners write to record findings, but text quality	√		√	

does not enhance their problem-solving skills				
Learners write effectively to record findings and enhance their problem-solving skills	√	√	√	

During implementation of the intervention strategy, observations on the management of students' writing revealed that three-quarters of the four teachers managed to use writing in mathematics as a learning and/or assessment tool for their learners, but struggled to analyse learners' writing for insight into student learning. Table 4 shows that learners of the two classrooms (teachers B and D) wrote effectively to record their findings. As such, most of the group tasks were solved successfully, which revealed that their problem-solving skills gradually improved over time. Although learners did not write arguably good mathematical explanations, they learned problem-solving within classrooms, in which writing about mathematics was an integral activity. Teacher A's classroom pedagogy showed the fact that writing about mathematics can be used does not in itself justify its implementation as an important part of classroom instruction.

4.5 Component 5: Teacher promoting discussion

One of the key elements in the intervention strategy was the use of discussion and argumentation in the teaching and learning of mathematics. This component focused in the introduction of discussion by the teacher during the lesson. Table 4.14 below shows teachers' ratings against this component.

Table 5. Teacher promoting discussion during implementation of the intervention strategy

Strategy	Teachers			
	A	B	C	D
No discussion, talk is irrelevant				√
Unclear expectations set about behaviour in group tasks, no exploratory talk	√			√
Prompts given to support talk and argumentation	√	√	√	√
Clear expectations set about behaviour in group tasks, and the purpose of their talk		√	√	

Teachers B and C illustrated what the intervention strategy can do in whole classroom situations. These teachers prioritised opportunities for discursive talk and avoided posing closed questions during classroom instruction. They successfully used sentence starters to support and promote cognitively orientated talk and argumentation. Learners of the two classrooms were free to engage in interactive discussions, contribute ideas and share their experiences. Teacher A, like Teacher B, could not use discussion effectively in the classroom. As such, learners from these classrooms were not given the opportunity to brainstorm ideas, discuss opinions, and debate controversial issues emerging from concepts that are being taught or learned. The two classrooms were places where teacher could not create a truly safe environment in which learners were willing to share and plan a good deal of structured conversation. The arrangement of furniture in these classrooms did not allow learners to freely engage in discussion and dialogue during the lessons.

4.6 Component 6: Learners' responses

This component focused on how learners responded to different interactions in the classroom. Learners' responses occurred between the teacher and learners, and among learners themselves. Table 6 below shows types of learner responses during classroom interactions.

Table 6. Learners' responses during implementation of the intervention strategy

Strategy	Teachers			
	A	B	C	D
Learners do not respond at all				
Learners struggled to initiate talk	√		√	
Teacher builds on responses, exploring ideas		√	√	√
Learners initiate talk and contribute to discussions		√		√

The lessons that were observed in classrooms of both Teacher A and C had very low participation in classroom discourse. Learners in these classrooms struggled to initiate talk, and the teachers could not understand the importance of an individual's negotiation of participation opportunities within classroom practice. Most of these teachers valued and acknowledged learners' responses and managed to build on these responses when exploring shared ideas. Teachers B and D had good open questioning techniques that probed learners' utterances which resulted in high discursive talk. Learners were encouraged to initiate talk, contribute to, and engage in authentic discussions. The teachers' talks were less discursive than that of learners.

4.7 Component 7: Learners work in groups

Different cooperative learning techniques and theories of learning were employed in the four classrooms during the implementation of the intervention strategy. This component will only present group dynamics and the type of interactions that emerged during group work in these classrooms.

Table 7. Group work interactions during implementation of the intervention strategy

Strategy	Teachers			
	A	B	C	D
Learners sit in groups but work individually				
Only 2 or 3 learners in a large group interact	√	√		√
Groups of learners with limited interactions	√		√	
Groups of learners discuss problems by themselves		√		√

Table 7 depicts that although all the observed teachers practised group work techniques in order to promote and encourage learner participation, and allow learners to construct their own knowledge, only few instances of authentic discussion took place within groups. For example, three classrooms (Teachers A, B and D) experienced few learners in large groups dominating discussions and interacting amongst themselves in the process. Teacher D frequently engaged learners in whole-class conversations where he asked a question and then called on learners to participate and how they would participate. While she maintained rules for participation within certain groups, she would frequently allow the rules of discourse to disintegrate when the learners got excited about a topic and the learners were allowed to interrupt and speak over one another.

The data generated via the classroom observation schedule presents possible explanations to teachers' classroom practices and learners' behaviour during and after the intervention and are presented in the following sections.

4.8 Use of language in the classroom

Lerman (2001) reiterates the importance of accounting for alignment and power in analysing language in mathematics classroom, suggesting that the official language of the classroom can position certain groups with power and privilege. Although learners were afforded opportunities to use the language they preferred for discussion and problem-solving in their small groups, the use of English by their teachers suggested the teachers as a figure of a powerful authority, which had an effect on the language used by the learners in the classrooms. Reports by researchers (Adler, 2001; Moschkovich, 2002; Setati, 2005a) indicate that teaching and learning mathematics in neither a language that is not the learners nor teachers' home language is complex and can create dilemmas for teachers. As Setati and Adler (2001) argue, the movement from informal spoken language to formal written language is complicated by the fact that the learners' informal spoken language is typically not the LoLT. Mathematics teachers in multilingual classrooms are faced with yet another dilemma of encouraging learners to participate actively in mathematical discourse, and classroom talk in general. Baseline observations revealed that only a few learners participated in the discourse because they are not confident and competent in linguistic exchanges (Zevenbergen, 2000). The baseline observations suggest that most of the classroom talk was teacher dominated and in the process, learners' roles were relegated to that of a spectator in the teaching and learning of mathematics (Alexander, 2004). In so doing, teaching mathematics through problem-solving and understanding was not attempted and/or achieved in these classrooms.

In an analysis of lessons observed in the four classrooms, English emerged as the language of teaching, and thus the language of mathematics and of assessment (Setati, 2002). Data generated from observations revealed that, although most of the teachers were found to be largely using English as the language of mathematics, authority and assessment (Setati, 2005), there were very few instances, contrary to findings by Setati, where the learners' home language, isiXhosa, functioned mainly as the language of consolidation. In fact, learners' home languages functioned mainly as the language to connect classroom mathematics activities with learners' everyday-life knowledge during small group discussions. As such, it appeared that the majority of the learners preferred to use their home languages when discussing and solving problems in small groups. In rare cases where a teacher would use English throughout the lesson, communication and utterances were the domain of the teacher only. Only few learners responded to the teacher's questions in English, which possibly signalled their linguistic incompetence in this regard (Mayaba, 2009).

4.9 Classroom interactions

The baseline observations revealed that classroom interactions took the form of teacher initiated talk (Mercer, 2000), characterised by teachers' regular use of inauthentic initiation turns. In cases where the teacher asked questions, learners responded in chorus (Mayaba, 2009). Moreover, these classrooms were embedded with social discourses that reflected learners' socio-cultural backgrounds (Lemke, 1990). There were only few occasions that resulted in learners' engagement in dialogue, which occurred between the teacher and a few individual learners. As such, there were no understanding and agreement of rules of engagement between the teacher and learners in these classrooms to actively engage with mathematical discourse in order to contribute positively in problem-solving initiatives. The tendency by learners to be passive may be attributed to the classroom linguistic structures that were restricted to English, characterised by teachers' inability to attend to gestures, representations, and everyday descriptions that second language learners draw on to create and communicate meaning in mathematics classrooms (Nasir, Hand, & Taylor, 2008). In doing so, teachers inadvertently missed the multiple, rich resources that learners bring to the classroom. However, data obtained from observations during and after the intervention illustrate that teachers demonstrated the abilities to allow learners to actively engage in mathematical discourses that paved way for the learners to effectively interact with the mathematics contexts in content via classroom discussion.

4.10 Code-switch and re-voice as teaching strategies in multilingual classrooms

Classroom observations showed that teachers used English to pose questions, teach and explain concepts that were taught in the classrooms, whereas in other instances they moved between English and isiXhosa during the lessons. In most of the cases where English was predominantly used for teaching word problems, as mentioned before, learners would prefer to use their home language when solving word problems in small groups, but immediately switched back to English when giving feedback to both the teacher and entire classroom. This finding is consistent with the findings of a number of researchers such as Setati et al (2009); Rose & van Dulm, (2006); and Webb (2010), who reported that in

classrooms where English second language speakers are taught in English, code switching practices are likely to happen. These researchers showed that switching between learners' home language and the language of instruction by both teachers and learners enhances the quality of mathematical interactions in the classroom. In so doing, these learners would then use isiXhosa as an invisible resource (Adler, 1998, 2001; Moschkovich, 2002; Setati & Adler, 2001; Setati et al., 2009) for learning and solving word problems.

It was also noted that in classrooms where English was frequently used for instruction, on several instances the teacher intentionally used Adler's (1998) re-voicing, as a strategy to clarify concepts that were deemed complex during the lesson. As such, learners would cross-check amongst themselves whether they fully understood the concepts; if not, the learners who seemed to understand better were then used as a resource to explain the same concepts, using the language of their choice, to the learners who did not understand the concepts being taught.

5. Concluding remarks

In this study a use of discussion as a strategy to improve mathematics schievement and language use in mathematics classrooms were explored. The results of the analyses and discussions indicated that participating teachers made a good attempt of implementing the interventional strategy which appeared to improve learners' overall problem-solving skills and sense-making abilities over time throughout the study. The data generated in this study appeared to suggest that whole-class discussion and problem-based approaches to the teaching of mathematics can be applied appropriately and successfully (to certain degree) in second language teaching and learning settings, and can assist both mathematics teachers and learners improve their knowledge of mathematics real world problems.

The degree to which participating teachers demonstrated an acceptable level of content knowledge and pedagogical content knowledge seems to be directly connected to the content (topics) addressed during the intervention workshops. While this confirmed that the pedagogic- and content-based training aspect of the workshop strengthened and improved teachers' problem-solving abilities in general, it was evident that they still require additional and continuous support on the ways in which learners' dual use of both English and isiXhosa influence word problem-solving and meaning making. As such, it is suggested that strategies to promote the use of learners' home language, alongside LoLT, should be considered by curriculum planners and teacher development institutions and agencies.

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