

Learners' Voices on the Issues of Language Use in Learning Mathematics

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ABSTRACT Despite the fact that South Africa is a democratic, multilingual, and multicultural country with eleven official languages, the majority of its learners learn mathematics in English, which is a second or foreign language. The study reported in this article sought to explore the learners' perceptions of use of language (both language spoken at home and language of learning and teaching) in the teaching and learning of mathematics. Data collection strategies included classroom observation schedule and semi-structured interviews. The sample consisted of grade 9 learners from four schools. The data gathered via interviews revealed that learners used isiXhosa to solve word problems in their groups. They primarily used their home language and then translated their solution statements into verbal and written English when they presented their solutions to the entire classroom, and in their notebooks respectively. Analysis of lessons observed in the sampled schools showed that English emerged as the language of teaching, and thus the language of mathematics and of assessment.

INTRODUCTION

A review of South African research in mathematics education during the past decade (see Setati et al. 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 (Akindele and 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 et al. 2007).

Language Use in South African Schools

There is a continuing debate in South African education regarding language use for teaching and learning in multilingual classrooms (Howie 2003, 2004; Güles 2005). This debate centres on the language that should be used for teaching, learning, and assessment. In this country an overwhelming majority of township and rural schools officially use English as a language of teaching and learning and for assessment purposes, despite the fact that the learners in these schools often have little contact with and access to English (Taylor and Vinjevold 1999). The learners often have low reading, speaking and writing abilities and struggle to comprehend texts that are written in English (Mayaba 2009).

Barkhuizen (2002) pointed out that English has often been stated as the language of progress, power and economic success and suggests that the African languages, despite large numbers of speakers, simply cannot compete with the status of English, a situation which challenges the aim of setting up a truly multilingual society in Africa. Constitutionally, the South African government promotes multilingualism through its Language-in-Education Policy (LiEP), which allows schools to use more than one LoLT (Setati et al. 2002). However, the LiEP has encountered implementation constraints and

has been censured by language experts (Granville et al. 1998), who suggested that it may not succeed in altering the prestige and power of English. Reports (Taylor and Vinjevold 1999; Setati 2008) showed that most schools are not opting for their learners' home languages as their LoLT. Consequently, there is an increase in English language instruction and a decrease in primary language instruction in South African classrooms.

Language and Achievement in Mathematics

The mathematics achievement gap between English Second Language learners and English First Language speakers has been well documented (Secada 1992). 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 (Secada et al. 1995; Burton 2003). 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.

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 and 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 and Vinjevold 1999; Fleisch 2008). For this reason issues of second language learning of mathematics are an integral part of this study and are discussed below.

METHODOLOGY

The study reported here followed a qualitative approach with data collection strategies

including observation of lessons and semi-structured interviews. Qualitative researchers tend to collect data in the field at the site where participants experience the issue or problem under study (Creswell 2009). In the study discussed here, I have attempted to gather up-close information by actually engaging or interacting with, talking directly to people, and seeing them behave and act within their context, which Creswell (2009) refers to as a major characteristic of qualitative research. In the natural setting, the researcher had face-to-face interaction with the participants over time.

Sampling

107 Grade 9 learners were chosen as they had already switched over from mother tongue to English as their formal language of learning and teaching (LoLT) for four years at the beginning of this study, a period in which they should have developed the necessary skills in English to solve the word problems used in the research. This language pattern in schools is a result of an educational model that is commonly used, namely one where learners are moved out of their main (home or mother tongue) language into an official LoLT after a period of mother-tongue instruction. Four mathematics teachers were purposely selected to participate in the study and were observed when teaching mathematical word problems.

Data Collection Instruments

Learners' Interviews

Issues of language of learning and teaching, language spoken at home, language in mathematics and word problem-solving, addressed in this study reported here, formed the basis of the primary research questions (Creswell and Plano Clark 2007). The open-ended interview questions were also used to measure the extent at which the language policy in their schools influences their current practice regarding the use of languages in their multilingual mathematics classrooms. The interviews (n=6) took place immediately after baseline testing and were done with learners from each participating schools. The questions for learners' interviews were as follows:

Which language do you use to communicate in your classroom? Why?

Which language (s) do you prefer to use when you solve word problems? Why?

What problems do you usually have when understanding and solving word problems?

Which language do you prefer to be taught mathematics with? Why?

What difficulties did you experience when solving word problems in isiXhosa test? What about English test? Why?

Which language will you choose for your assessments (for example, tests and examinations)? Why?

The interview responses were sorted into themes that are discussed in the results section of this article. The reasons that were provided by learners on their personal language preferences and/or choices were analysed qualitatively. A classroom observation schedule was also used to validate the qualitative data gathered from interviews.

Classroom Observation Schedule

Qualitative observations are those in which the researcher takes field notes on the behaviour and activities of individuals at the research site (Creswell 2009). Gibson and Brown (2009) argue that observational research can be conducted for many reasons, but it is very often a part of a general interest in understanding, for one reason or another, what people do and why. In the study reported here, the structured observation schedule was administered in four classrooms within a period of five consecutive days. The external and independent isiXhosa expert observer provided the study with broader insights into the interpretation of all observed behaviour and activities in the classroom, particularly where the communication took place in the learners' home language (isiXhosa).

The classroom observation schedule focused on the following:

Use of language by the teacher (asking questions, teaching, giving feedback, explanation of mathematical terms and concepts);

Uses of language by learners (seek clarification, elaborate and solve problems, pose questions, build upon a previous response);

Learners' use of language with individual and/or group peers (problem-solving, talk, argue, dialogue);

Learner writing (use of Writing Frames, writing comprehension); and

Teacher promoting discussion (collaborative tasks – paired activities, group presentation, arguments);

Learner responses (individual, group, paired, hands-up, at the board, verbal, in writing, negotiation of meaning, etc.);

Learner work in groups.

The researcher used a four point scale in the design of the instrument (observation schedule), with spaces made available for the observer to record the name of the school, name of the teacher, grade level, topic to be taught, number of learners in the class, the date of observation and comments on key issues observed.

RESULTS

Observation Schedule

The classroom observation schedule data, supported by field notes, produced both qualitative and quantitative results. The baseline observations were done with the object of understanding the nature of instruction in the multilingual classrooms. The observations done revealed the following:

Kgabo Senior Secondary School

Teachers' Use of Language in the Classroom

The teacher used English, the official language of learning and teaching (LoLT) for both teaching and assessment of concepts being taught during a lesson. The LoLT was broadly used for explanation of mathematical terms, clarification of mathematical language, to ask questions and provide feedback to the learners;

Learners' Use of Language in the Classroom

Learners used their home language (isiXhosa) when they solved problems or tasks given in pairs or individually. Learners found it difficult to pose questions and build upon previous responses using the language that is not their home language. They were not given the opportunity to write in their books.

Classroom Interactions

The teaching approaches and strategies did not promote discussion and argumentation in the classroom. The classroom atmosphere did not provide opportunities for learners to engage

in dialogue, where they could agree to disagree in order to reach a common understanding. Forms of interactions in this classroom followed a narration and one-way question and answer approach.

Teaching Methods and Learning Styles

Textbook and narration methods formed a fundamental approach to the teaching and learning of mathematics in this classroom. The teacher employed the chalk-and-talk method, with learners receiving top-down information. The lessons were dominated by teacher's talk and learners' roles were that of spectators in the learning process.

Kolobe Senior Secondary School

Teachers' Use of Language in the Classroom

The teacher is not an isiXhosa speaker, but tried to use language as an invisible resource in her lessons. She used certain learners as participatory resources to their peers by allowing code-switching and translations between LoLT and their home language. The teacher's instruction was in English and she always encourages learners to use the LoLT supported by their home language.

Learners' Use of Language in the Classroom

Most of the learners showed their preference for LoLT and not their mother tongue. They used English in the classroom for problem-solving of tasks in groups, and outside the classroom when they play. Learners switched between the two languages in their group discussions. The lesson on shapes and space experienced talk that was high in quantity but low in quality. Linguistic competence of these learners was a complex technical ability, because of the structure of power positions that was present, yet invisible, in the exchange between the teacher and learners.

Classroom Interactions

Interactions in this classroom took the form of teacher initiated discussions, typified by teachers' frequent use of inauthentic initiating question turns. The follow-up turns by either

the teacher or learners did not happen during classroom discourse. The teacher asked questions and learners responded mostly in chorus. The interactions that took place within this classroom were found to have highly ritualised components that are not explicitly taught, but are embedded within the classroom culture.

Teaching Methods and Learning Styles

The teaching and learning was centred and planned within a question-and-answer approach. The teacher provided limited opportunities for observing learners and listening carefully to their ideas and alternative conceptions. More emphasis was put on procedural understanding, with low levels of comprehension of mathematical concepts and relations that were taught. The teacher did not show the ability to teach learners on how to reflect, explain, and justify own claims.

Tlou Senior Secondary School

Teachers' Use of Language in the Classroom

The teacher was confident and competent in using dual-medium instruction in his lesson. He used both English and isiXhosa as a resource to explain mathematical terms used within the concepts being taught. The teacher's instructional practice suffered from a balance of linguistic and cognitive demands when assessing concepts being taught. He struggled to provide feedback that was adapted to the learner's level of language proficiency, lacking strong home-school connections.

Learners' Use of Language in the Classroom

Learners used their home language to communicate mathematical ideas among themselves and with the teacher, when they seek clarification and explanations of concepts that were taught. isiXhosa appeared to be the language of choice for learners when they solved mathematical tasks in groups and pairs. They were also allowed to share their ideas with the entire classroom using their home language. Consequently, learners grappled primarily with acquisition of technical vocabulary in the LoLT and language of mathematics, development of comprehension skills to read and understand mathematical re-

sources written in English, and the ability to solve mathematical problems in general.

Classroom Interactions

This classroom was embedded with mathematical and social discourses that reflected both the culture of the learners' backgrounds and that of their classroom. The teacher's actions in the classroom showed a domain of discourse closely associated with learners' cultures having the same assumptions, values, and linguistic domain. The teacher's perspective on bilingual mathematics learners encouraged acquisition of vocabulary, and did not reflect high levels of construction of knowledge and meaning.

Teaching Methods and Learning Styles

Lessons observed were learner-centred. The teacher's practice during the lesson reflected good organisational and communicational skills, but lacked substance in coordinating and managing mathematical discourses that took place. The teacher failed to employ necessary and relevant teaching strategies to coordinate the talk, which was good in quality, in the few identified groups during problem-solving.

Tholo Senior Secondary School

Teachers' Use of Language in the Classroom

The teacher introduced the lesson in learners' home language and went on to explain some of the mathematical terms in both LoLT and learners' home language. She allowed learners to choose their own preferred language when they discussed during the lesson. The teacher did not have clear teaching strategies in her approaches. She used learners' home language to clarify and explain some key concepts that were taught, and as an invisible resource throughout her lessons.

Learners' Use of Language in the Classroom

Learners' home languages took centre stage within the arguments that were attempted by the learners in their own groups. Over 95% of their utterances took place in their home language, but switched between the two languages when probed by their teacher during ques-

tion-and-answer sessions. Their mathematical discourse was very low in quality and reflected poor comprehension of mathematical language and low levels of vocabulary. Learners were not free to express themselves in the LoLT and they successfully used code-switching as a learning strategy to solve mathematical problems.

Classroom Interactions

Although the teacher occupied the largest percentage of talking time in her lesson, what she did was to enable the learners to engage in dialogue. This dialogue took place between the teacher and certain individual learners. Learners were not confident that they could argue a case and challenge the teachers. The teacher issued a lot of instructions about what the learners were to do and modelled what was to be done. She struggled to take firm comparison of the interactions during her lesson. The unsuccessful interactions in this classroom indicated scant understanding and agreement of the rules of engagement between the teacher and learners with a view to active and positive contributions to classroom discussions.

Teaching Methods and Learning Styles

The teaching and learning in this classroom is guided and largely influenced by the teacher's quest to complete the syllabus on time. As such, the teacher is under pressure to teach according to a stipulated mathematics schedule designed by the provincial Department of Education. The teacher practised behaviourism in her approach to the teaching of mathematics in this classroom, which boasted learners of different academic achievements and social class. She could not strike a balance between teaching for inclusion and designing mathematical tasks that encouraged problem-solving in real world contexts. Although dialogue was promoted by the teacher, her pattern of utterances dominated the discussion and the lesson followed a teacher-centred approach.

Learners' Interviews

The objectives of interviews include collecting concrete insight, understanding, meanings, constructions and perspective of the interviewee's own experiences or knowledge on var-

ious issues (Denzin and Lincoln 2005). In this study, pre-observation interviews were conducted at both teacher and learner levels respectively. The outcomes of these interviews are presented in the next sub-sections below.

The learner interviews were conducted to investigate which language they prefer to use during classroom interaction, to communicate, when they solve mathematical problems, and for assessment, and why? The results are presented below using a few selected extracts as examples from learners' responses. All questions were in English and asked in the same order for all the four schools, consisting of eight learners per group. Learners were free to respond in their home languages, but all the learners chose to respond in English.

Most of the learners indicated, from their responses, that English was a preferred language for classroom communication, when they individually talk to the teacher and present their group work to the entire classroom. This explanation was given in response to the question regarding the language that they use for communication in the classroom. Extract 1 below represents texts from the groups of learners in different schools.

Extract 1

Learners: English

R(eseacher): Why English?

L1: Because when you are educated you *must* know how to speak English, because maybe you will be hired in a job by a white person not Xhosa speaking person and you will be required to speak English.

R: OK

L2: You *must* use English because when you write in mathematics book you will not write isiXhosa because it is not a Xhosa period or Xhosa class, you also provide written answers in English, so it's better for you to answer in English, and become used in speaking and answering in English.

L3: And English is the most used language here in South Africa.

R: Any other reason?

L5: English helps you to communicate with people from other countries, for an example the visitors for 2010 soccer world cup, we will be able to communicate with them in English because they will not understand isiXhosa.

Of many things which the texts in Extract 1 may suggest, what comes to the forefront is the learners' reasons for the use and association of "English" with "hired in a job", "the most used language here in South Africa" and "communicate with people from other countries". All these learners, in exception of learner 2, provide reasons that are not necessarily related to their classroom interactions, but those that affect their everyday-life challenges. The frequent use of the word "*must*" emphasises the feeling of obligation that the learners expresses in using this language to "write in mathematics book" in order to "provide written answers in English", as stated in Extract 1 by learner 2.

Learners were also asked about the language(s) that they prefer to use when solving word problems, and why. The aim of this question was to understand mathematical discourses that occur when learners solve problems in groups and/or pairs. Data gathered from their responses to this question, and triangulated with the results of classroom observations, revealed that learners used isiXhosa to solve word problems in their groups. They primarily used their home language and then translated their solution statements into verbal and written English when they presented their solutions to the entire classroom, and in their notebooks respectively. For example, one of the learners stated that "We discuss in isiXhosa, but in the answer book we write English and we give presentation to the teacher in English". Although some of the few groups employed a parallel use of English and isiXhosa, the strategy of translating from learners' home language was consistently applied across all the classrooms, with learners switching or moving from their home language to English.

Skiba (1997) suggested that in the circumstances where code-switching is used due to an inability of expression, it serves for continuity in speech instead of presenting interference in language. In these multilingual classrooms, code-switching stands to be a supporting element in communication of information and in social interaction, and therefore serves for communicative purposes in the way that it is used. The notion prevails that English second language learners in these classrooms are not able to express themselves entirely in English (Sepeng 2010), and allowing them to switch to their home languages is seen to compensate for such deficiency.

The data gathered from the learner interviews in this study showed that there was an unconscious switch or movement between isiXhosa and English. This argument is supported by the following statements made by learners when responding to the question about the difficulties that they have experienced when solving word problems in isiXhosa and/or English test, accompanied by justifications in this regard:

Extract 2

L(earner) 2: Maybe someone wants to choose isiXhosa or English sometimes chooses to use both of them.

R(esearcher): Which one would you prefer?

L3: Both

R: Why?

L3: Because.... in English there will be words that I will not be familiar with, but understand them in isiXhosa, that's why I will use both.

R: Will you move between the two languages?

L2: I will also use them both, because isiXhosa it's difficult for me but then again there are certain difficult areas in English, so that is why I choose to use them both.

Extract 2 demonstrates that learners' were granted the opportunity by their teacher to move freely between the two languages in their groups when they solve word problems. However, the switching discussed here appears to differ from the switching presented earlier, where it was indicated that both teachers and learners in multilingual classrooms code-switch freely between their utterances (Setati 2005b). In these classrooms, only learners switch freely between the languages; teachers use only LoLT for mathematics instructions.

DISCUSSION

Lerman (2001) reiterated the importance of accounting for alignment and power in analysing language in mathematics classrooms, suggesting that the official language of the classroom can position certain groups with power and privilege. Although learners in the study 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 fig-

ure of a powerful authority, which had an effect on the language used by the learners in the classrooms. Reports by researchers (Adler 2001; Kaphesi 2003; Setati 2005a) indicated 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) argued, 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 in the sample 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 sampled schools, English emerged as the language of teaching, and thus the language of mathematics and of assessment (Setati 2002; Sepeng and Webb 2012). Data generated from observations revealed that, although most of the teachers in the schools 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 (Sepeng and Webb 2012). As such, it appeared that the majority of the learners in the schools 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).

Although all the learners seemed to be aware of the benefits of using English, some of the learners had a strong call for English to be used alongside and/or parallel to isiXhosa. This finding of the study is consistent with other reports (Setati et al. 2009) that called for pedagogical strategy that employs the use of learners' home languages deliberately and transparently (or invisibly) in order to solve real-world mathematics problems in South African classrooms. The learners who participated in this study claimed that problem-solving and connecting classroom mathematics activities to everyday-life situations is much easier to achieve, and stimulates their love for word problems when both languages are used. To some of these learners, as Hameso (2001) puts it, it seems that the use of foreign languages, such as English in education has partly made education irrelevant to the masses of their society.

CONCLUSION

The study reported in this article demonstrated that learners' reasons for choosing English to support communication in the classroom centred around viewing English as the language of authority, power, status, prestige, and access to social goods, including jobs and international recognition. In fact, learners' use of English seemed to be aligned to these ideals, rather than as a resource to learn mathematics in the classroom. Learners' choice of LoLT appeared to be further influenced by the language of assessment. It is therefore suggested that mathematics teachers should create an intelligible learning space for the learners to move between learners' home language(s) and the language used for teaching and learning.

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