

EXPLORING ISSUES OF THE USE OF LANGUAGE AS A PEDAGOGICAL TOOL IN THE LEARNING OF MATHEMATICS

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Abstract

There is a continuing debate in South African education regarding language use for teaching and learning in multilingual classrooms. This debate centres on the language that should be used for teaching, learning, and assessment. In a study reported in this article, I explored teachers' and learners' perceptions of the use of language as a tool to enhance academic achievement in mathematics. The results presented here are part of a research project that followed a mixed-methods design with the qualitative results informing the quantitative data. However, only qualitative data are presented in this article. Data collection strategies included classroom observations and semi-structured interviews at both teacher and learner levels. 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. In fact, learners' use of English seemed to be aligned to these ideals, rather than as a resource to learn mathematics in the classroom.

Keywords: resource, language of learning and teaching, home language, problem solving,

INTRODUCTION

There is a continuing debate in South African (SA) education regarding language use for teaching and learning in multilingual classrooms (e.g., Howie, 2003, 2004). 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 & 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) points 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 SA government promotes multilingualism through its Language-in-Education Policy (LiEP), which allows schools to use more than one LoLT (Setati, Adler, Reed, & Bapoo, 2002). However, the LiEP has encountered implementation constraints and has been censured by language experts (Granville, Janks, Mphahlele, Reed, Watson, Joseph, & Ramani, 1998), who suggest that it may not succeed in altering the prestige and power of English. Reports (see for example, Taylor & Vinjevold, 1999; Setati, 2008; Mayaba, 2009) have shown 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 SA classrooms.

LANGUAGE AND ACHIEVEMENT IN MATHEMATICS

The mathematics achievement gap between English Second Language (ESL) learners and English First Language (EFL) speakers has been well documented (Secada, 1992; Tate, 1995). Internationally and in SA, 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 Boaler, 2009; Burton, 2003). Such research originates outside the realm of 'traditional' mathematics education research and theory and supports Weissglass's (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.

IMPLICATIONS OF LANGUAGE IN EDUCATION POLICY (LIEP) ON THE TEACHING AND LEARNING OF MATHEMATICS

It is also widely acknowledged that education policies and language-in-education policies are determined by economic interests and political ideologies (Taylor & Vinjevold, 1999). The LiEP

in SA implies that mathematics teachers and learners have to negotiate, agree, and decide which language to use, how and when to use it, in the teaching and learning of mathematics in multilingual classrooms. In previously marginalised schools of SA, mathematics teachers may prefer to use English, which is the learners' second language, but which they believe provides learners access to power, social goods and prepares them for tertiary education (Setati, 2005a).

Adler (2001) points out that the learners whose language of learning and teaching is not their home language tend to communicate in their home language when solving group mathematics tasks in multilingual classrooms. In these classroom settings, teachers have to make a decision whether to promote code-switching between the two languages with the purpose of developing meaning or just to disregard the LiEP, and continue to use English only as LoLT. Setati's (2005b) study in multilingual classrooms of SA reveals that teachers are more concerned with providing the best instruction possible that will give learners access to social class, power, higher education and employment. She argues that mathematics teachers feel guilty to code-switch as a teaching strategy because it may deprive their learners of an opportunity to acquire proficiency in English.

THEORETICAL FRAMEWORK

This study is framed by a socio-cultural perspective (Cooper, 1998) which proposes that collective and individual processes are directly related, and students' unrealistic responses to real world problems reflect the students' socio-cultural relationship to school mathematics and their willingness to employ the approaches emphasised in school. From a socio-cultural perspective, modelling and/or problem-solving implies engaging in inter-semiotic work. In other words, one has to decide about the appropriate and useful manners of coordinating linguistic categories and mathematical expressions and operations in order to come to a solution problem (Säljö, Riesbeck, & Wyndham, 2009). In inter-semiotic meaning-making, the truth value of statements and arguments are established on the basis of analytical considerations of how a particular usage of concepts fits into the universe of meaning that is mathematical discourse.

METHOD

In this study I used interviews as a strategy to collect data. The interviews provided an understanding of the learners' uses of both language of instruction and the one spoken at home.

Design type

Data collection strategies included classroom observations and semi-structured interviews at both teacher and learner levels. The semi-structured interviews were aimed at understanding their experiences and the meaning they make of those experiences. The interviews 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 structured observation schedule was administered in four classrooms within a period of five consecutive days over a period of six weeks. The classroom observations were done with the object of understanding the nature of instruction in the multilingual classrooms. 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).

Sample in this study

Four township junior secondary schools were selected as a convenience sample of a cluster of similar schools in a metropolitan city. The sample consisted of ninth grade learners (n=107) from four schools and four teachers participated in the study. The study reported here investigated what the situation was in terms of language use of Grade 9 English second language learners and teachers.

Data analysis

The process of data analysis in the study reported in this article involved making sense out of the data (Creswell, 2009). Qualitative data analysis followed Creswell's steps from the specific to the general, involving multiple levels of analysis. In other words, data were analysed and interpreted via a process which involved preparing the data for analysis using themes, conducting different analyses emerging from the themes, moving deeper and deeper into understanding the appropriate and relevant data, representing the data, and making interpretation of the larger meaning of the data within a framework of the study's theories. Qualitative data analysis involved gathering open-ended data, based on asking both learners and teachers general and specific questions. A qualitative analysis was developed from the information supplied by the participants.

RESULTS

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 two groups of learners in different schools.

Extract 1

Learners: English

R(earcher): 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 the reasons for their choice. The aim of this question was to understand mathematical discourses that occur when learners solve word problems in groups and/or pairs. Data gathered from their responses to this question 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 groups, with learners switching between (or moving from) their home language to English.

Skiba (1997) suggests 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, and allowing them to switch to their home languages is seen to compensate for such deficiency and perceived as a tool to make problem-solving a much easier process.

The data gathered from the learner interviews in this study shows 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

L2: Maybe someone wants to choose isiXhosa or English sometimes chooses to

use both of them.

R: 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 in Setati's (2005b) study, where it was indicated that both teachers and learners in multilingual classrooms code-switch freely between their utterances. In these classrooms, only learners switch freely between the languages and teachers use only LoLT for mathematics instructions.

DISCUSSION

Both qualitative and quantitative data analysis in this study indicate that although learners preferred both LoLT (English) and home language (isiXhosa) in mathematical word problem-solving, they performed better in English, which could be attributed to the fact that the everyday teaching of mathematics, and other subjects in general, were facilitated in English. However, learners' sense-making of word problems significantly improved in their home language. 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, which is consistent with reports by various scholars (see Baldauf & Kaplan, 2005; Setati, 2005a). In fact, learners' use of English seemed to be aligned to these ideals, rather than as a resource or a tool to learn mathematics in the classroom. Learners' choice of LoLT is further influenced by what Adler (1998) refers to as the language of assessment.

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 (e.g., Setati et al., 2008) 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.

Data obtained from the interviews in this study showed that learners preferred to use isiXhosa when they solve mathematical word problems in groups. This is supported by Setati and her colleagues (2008), who argue for the increased use of learners' home language, along with use of English, through dialogue and discussion in order for learners to acquire mathematical reasoning skills. It was also clear from learners' responses that learning through a medium of instruction other than the main (home) language is a challenge to both teachers and learners.

The results of the study echo a finding by Ellerton and Clements (1991) that a major source of difficulty with mathematical word problems can be attributed to the fact that the language of mathematics and the language of common English usage often differ in important ways. Although teachers have often assumed that poor performances in word problems have arisen from lack of understanding of mathematical concepts or a deficiency in computing skills (Hater, Kane & Byrne, 1974), the errors appeared to have been caused by an inadequate understanding of the language of the mathematics.

CONCLUSION

In this study the issues of language as a pedagogical tool when learning mathematics were investigated and reasonable conclusions drawn from quantitative data. The ideas generated should contribute to national and international academic debates on issues such as the realities of teaching and learning mathematics through both the language of learning and teaching, as well as learners' home languages in multilingual mathematics classroom settings. The findings of this

study should provide insights for individuals and groups who strive to empower mathematics teachers with innovative and effective pedagogies, particularly those who attempt to assist second language learners to use their everyday life knowledge, experiences, and common-sense understanding freely when solving mathematics word problems.

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