Neither a borrower nor a lender be? Code-switching of first and second languages in mathematical discourse

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The study seeks to investigate when and why primary school teachers (Grades 1 to 7) and their pupils code-switch between English and chiShona during mathematics lessons. It also focuses on the effects of such code-switching on learning outcomes. Ten primary school teachers in Masvingo city former group B schools were videotaped while teaching mathematics. The 10 teachers and 40 of their pupils were later interviewed. It was found that the teachers switch to the mother tongue to clarify concepts in their own minds and for the pupils. Pupils revert to the mother tongue whenever they cannot express themselves in the language of instruction. Such code-switching appears to be driven by the abrupt shift from first language (L1) to second language (L2) as medium of instruction in Grade 4. Code-switching appears to be caused and maintained by weak facility in the L2 and the unrealistic expectation that pupils will learn mathematical content through the L2 while at the same time learning that L2. The result has generally been an impoverished quality of communication which is counterproductive to the goal of accessing mathematical curricular content.

Introduction

For many children from poor and disadvantaged backgrounds, the chance to break the cycle of inter-generational poverty is supposed to come when they enter school and are introduced to mathematics which is the basis of economics, science and technology. Such a chance may be obscured in multilingual Zimbabwe where the choice of which language to use in teaching this important subject generally gives rise to emotional debates in the public domain. According to Ogutu (2006) some indigenous languages have not been codified and standardised. One view is that English, as an international language, is the most practical language for teaching and learning (Ogutu, 2006). The opposing view (Gondo et al., 2005) is that children are better taught in a language in which they are fluent as they learn better in their own indigenous language such as chiShona. This debate rages in a Zimbabwean academic environment where Chimhundu (1993 in Gondo et al., 2005) observes that there is widespread code-switching as many chiShona speakers cannot complete a chiShona sentence without using some English or an English sentence without using some chiShona. Government policy as enunciated in the Education Act (Zimbabwe, 1987) made it clear that in the first three grades an indigenous language (L1) be used as medium of instruction while in higher grades English should be used. The current legislation (Zimbabwe, 2006) allows for the teaching of all subjects in an indigenous language up to Grade 7. Kembo-Sure (2006) argues that the strongest defence for such a policy is that it is a perfect compromise between denying children the use of their culture completely and also denying them sufficient access to an international language. Using mother tongue as a language of instruction is believed to enhance cognition, as concepts are more easily learned and stored in the mother tongue.

It was at one time the stated policy and accepted practice of the colonial government in Zimbabwe (then Rhodesia) to have a curriculum that peddled European values in order to develop what colonisers perceived as docile and obedient African citizens in an environment where indigenous languages were looked down upon with preference given to English and other European languages. Zvobgo (1997, 2000) observes that education was meant to provide skills that made Africans efficient servants of the European master. Siyakwazi (1996:27) explains that African education was purposefully designed to turn African children into ‘hewers of wood and drawers of water’ for the colonial masters. Mavhunga (2008) says it was the vision of Cecil John Rhodes, the father figure of European settlement in Rhodesia (now Zimbabwe) to allow Africans to ‘benefit’ from Western civilisation brought to them by the ‘finest’ race on earth. Mavhunga (2008:5) also cites Atkinson (1972) who claims that Rhodes once said:

I contend that we are the finest race in the world, and that the more of the world we inhabit the better it is for the human race. Just fancy those parts that are at present inhabited by the most despicable specimens of human beings, what an alteration there would be in them if they were brought under Anglo-Saxon influence.
This could be misconstrued as negative perceptions of the African race and their culture and language.

When the post-independence Zimbabwean government assumed responsibility for education in 1980, they were naturally uncomfortable with this racist legacy (Zvobgo, 1997) as education could no longer be allowed to be part of an oppressive social system through which the majority of citizens were excluded from participation in society. However, it was not feasible to completely discard the imported European language, as many stakeholders saw it as already standardised. In addition, most teaching materials already existed in English therefore making it more economical to continue using it. Ogutu (2006) further says that some people argue quite narrowly that, because indigenous languages have not been codified and standardised, they are not rich in expression and are therefore unsuitable for modern needs. Kembo-Sure (2006) argues that another reason for the continued use of English was that it provided access to existing knowledge in science and technology, which Africa needs badly if it is to develop economically and industrially. The Zimbabwean government instituted a language policy enshrined in its Education Act similar to what was in place in most parts of post-colonial Africa.

During the first three years of education (Grades 1 to 3) English was to be taught as a subject. Other subjects in the curriculum were to be taught using the indigenous languages (chiShona and isiNdebele) as medium of instruction. In the fourth year, English was to become the language of instruction for all subjects, except the indigenous language which would then be taught just as a subject.

This study aims to determine the effects of the widespread borrowing and lending (code-switching) between English and chiShona languages in the teaching and learning of mathematics in ordinary primary schools and to explore the reasons for this code-switching.

The purpose of code-switching

It is important to identify the broad functions that language plays in society in order to illuminate the functions that the use of English and chiShona would play in teaching and learning mathematics in a primary school classroom. In multilingual societies like Zimbabwe, language users code-switch in order to attain the five basic language functions (Gondo et al., 2005) namely transactional, expressive, directive, aesthetic and interpersonal. Leech (1981, in Durojaiye, 1993) also identifies these five different functions of language. The most important is the informational function in which language is used to convey information from one person to another. Halliday (1985, in Durojaiye, 1993) calls it the ideational or transactional function. Secondly, language has an expressive function in which it is used to convey feelings and attitudes. Thirdly, there is a directive function in which language is used to influence the behaviour or attitude of other people through commands and requests. At the fourth level, language has an aesthetic function whereby one makes language choices and arranges them in a beautiful or fascinating way which is interesting. The final function of language involves establishing social relations, sharing feelings and generally keeping communication channels with others open. Leech (1981, in Durojaiye, 1993) calls this the phatic function, while Halliday (1985, in Durojaiye, 1993) calls it the interpersonal function of language.

Each of the afore-mentioned functions may be performed by a specific language. To do this, language users would have to code-switch. Poplack (1988:581) says code-switching is the alternation of two languages within a single discourse unit, sentence or constituent. Similarly Valdes-Fallis (1978, in Durojaiye, 1993) says it is the alternate use of two languages at the word, phrase, and clause or sentence level. Likewise, Bakamba (2002) says it is embedding or mixing words, phrases and sentences from two codes within the same speech event and across sentence boundaries. Code-switching may be observed in the adoption of and phonological adaptation of English terms into chiShona, for example sikweya for 'square' and mirimita for 'millimetre'. Code-switching in pragmatic translation can also be seen in the creation of completely new chiShona words to replace English ones. The researchers observed that teachers employ a mixture of chiShona grammatical morphemes (e.g. ku- ‘to’) with English words, for example kumultplaya for ‘to multiply’. Such words, which are neither English nor chiShona, are unstable but this is quite a common practice with teachers in their mathematics classes.

The belief that mathematics transcends discourse factors has been pervasive and has even affected bilingual educational policies. Mathematics is often identified as one of the first subjects that can be taught in the student’s weaker language (English), while other subjects continue to be taught in the student’s native language. However, the complex relationship between language and mathematics has long been recognised by researchers such as Pirie (1998) and Setati (2009). These studies have found that mathematics is like a language and learning it is much more abstract. Setati et al. (2002) found that the teaching of mathematics in multilingual classrooms has the dual task of teaching both mathematics and English at the same time. While these studies by Setati et al. (2002) and Setati (2009) have been positive about code-switching and its use in the teaching and learning of mathematics, not much has been done to explore which functions chiShona and English play when they are used interchangeably in the teaching and learning of mathematics.

Focus of the study

The study investigates the functions of chiShona and English when they are used interchangeably in the teaching and learning of mathematics. It seeks to discover why the two languages are perceived by the language users as fulfilling those particular functions as well as what effect such code-switching has on the learning of mathematics. To this end, the study sought to address the argument through these specific research questions:

• Why and when do primary school teachers and their pupils code-switch during mathematics lessons?
• What is the resulting quality of mathematics learning when teachers and learners code-switch to the learners’ first language in lessons?
Methodology

Sample
The study employed a descriptive survey design. Systematic random sampling was used to select five primary schools from the 10 public primary schools in Masvingo city. Convenience sampling was then used to select two teachers who were teaching mathematics at the time of the visit to each school, to get a total of 10 teachers. The team of researchers observed primary school teachers' mathematics lessons with the intention of trying to capture instances when either the teachers or the pupils code-switched in mathematics lessons. The lessons were video-taped, as Welman et al. (2005:12) put it, ‘... enable participants to relive the situation afterwards and to observe salient related issues that occurred concurrently’. Direct observation was preferred because the behaviour that was to be studied could be recorded first hand. Post-lesson in-depth reflective interviews were conducted to find out the teachers’ reactions to instances when either their or their pupils code-switched from English to the mother tongue. The researchers sought to find out from the teachers and pupils why and when they code-switch in the first place and what effect they thought this had on pupils’ understanding of concepts.

The classes of the 10 teachers automatically participated in the study. Four pupils who the observers identified as switching codes most often in each lesson were purposively selected to answer interview questions. The pupils, who were aged from six to 14 years of age and were from Grades 1 to 7, were engaged in structured face-to-face individual interviews in the mother language for ease of communication. These 10 to 15 minute interviews initially established each pupil’s attitude towards mathematics, English and chiShona. The interview then turned clinical as it tried to elicit information about the procedures that the pupils had used to arrive at their answers in the written exercise for a particular lesson. Focus then turned to identifying instances in which they had switched codes during the lesson and asking them to explain why they had done this. The pupils’ written exercises for that particular mathematics lesson were also analysed for errors. A research journal was used to capture running field notes and to write reflective comments. The triangulation of observation, reflective interviews and research journal as well as data sources and researchers was obligatory to enhance the reliability and validity of research findings (Wiersma, 2000).

Data presentation and analysis
All post-lesson observation reflective interviews were audio-taped, fully transcribed and analysed for emerging themes that resulted from the representations of meaning that the teachers had made. The findings on when and why teachers and pupils switched codes in a lesson are presented below.

Findings
The data revealed four main reasons why teachers and pupils code-switched in their mathematics classes.

Facilitating understanding of concepts
It was found that teachers and all pupils from Grade 1 to 7 said that they switch to the mother tongue to facilitate understanding of complex mathematical concepts. Nearly all the teachers said that whenever they want to simplify material and enhance understanding for the learners they feel obliged to switch to the mother tongue. One teacher had this to say: ‘There is no point in proceeding with the lesson when I can see quite clearly that my pupils don’t seem to be following. I simply stop, rewind and go through the difficult idea again in Shona. This works for me most of the time’.

Another teacher said: ‘Difficult concepts and rather long procedures such as what you have just seen in long division require explanations in Shona rather than to continue in English. I find that my pupils remember better after such explanations’.

Another said: ‘I can anticipate which sections of my lesson presentation will be difficult to grasp in English and so will present these in Shona. I do this in order to prevent children from developing the idea that mathematics is difficult’.

The one teacher who did not find switching to chiShona useful for improving understanding of concepts had just been introducing fractions and explained: ‘Using Shona to try to explain the concept of fractions is not helpful because the Shona term for one half, a quarter, a third and so on remains the same: bandi or mapandi without a specific denominator and precision. This simply means a part of something but does not tell the learners what specific fraction it is’.

One pupil in Grade 4 said: ‘Ukabvunza nechirungu, unopindurwa nechirungu manje pamwe hauzonzwisisi zvakare. Ndosaka ndichivavhunza neShona.’ ‘If you ask the teacher in English he will answer you in English and you may still not understand. That is why I ask him in Shona’.

Another said: ‘Ndanga nisisa kunzwisisa kuti ticha vati, mune было. Kuti vanyatsotaurazve. ‘I had not understood what the teacher had said so I wanted him to explain again’.

Teachers sometimes switched code from English to chiShona by making an English word sound as if it was being said in chiShona. One teacher used the term sekoro instead of ‘circle’ but had to switch back to English and draw a circle roughly when it became evident that many in the class did not understand what he was talking about. Similarly the term indaresiti instead of ‘interest’ proved to be elusive for many in another class. When the switch to chiShona was actually an adaptation of the way the English word would have sounded in chiShona, there did not appear to be any improved understanding of the concept.

Pupils seemed to understand better when their teachers used chiShona words for equivalent English words. Some teachers switched whole sentences into chiShona in this way. In certain instances however, such a practice proved difficult for both the teacher and learners because of limited chiShona vocabulary. A Grade 7 teacher and a Grade 6 teacher, who were teaching ‘powers’ and ‘scales’ respectively, could not find appropriate chiShona equivalents and had to switch back to English. When such switching was done for whole sentences however, it turned out to be wordy and lessons took longer than usual.
When English mathematical terms were switched to chiShona by creating completely new chiShona words, the pupils were confused. In instructing his class to solve a set of problems, one teacher used the novel chiShona term *pwanyauruzvi* instead of the usual term 'problem' and no one in his class could tell what he wanted done until he said it in English.

Sometimes teachers used terms that were a mixture of English and chiShona. One teacher used terms *ku-adder* and *ku-subtractor* to describe addition and subtraction respectively. Another used the term *ku-divider* in respect of the division operation. The mathematical concepts did not appear to be any clearer than if the English-only or chiShona-only term had been used.

**Facilitating self expression and communication**

One teacher said: 'Whenever I find myself struggling to explain a particular step to be followed in solving a mathematical problem, I change to Shona as it is easier for the children'. Another teacher corroborated this by saying: 'If the concepts are proving difficult for me to put across, I find it easier to say them in Shona so that the pupils will grasp them more easily'.

The pupils generally said that they switched to chiShona when they had problems expressing themselves in English. They said that in order to be better understood by their teachers, they would rather ask their questions in chiShona as it was easier for them. One pupil said: 'Paya ndazotaura nechivanhu nekuti ndanga ndichida kuti ticha vanzwisisi mubunzo wangu.' At that point I spoke in our language [chiShona] because I wanted the teacher to understand my question.'

Another pupil said: 'Handina kuziva mashoko acho echirungu saka ndanga ndichiedza kutsanangura nechivanhu.' I did not know the exact English words to use that is why I tried to explain my answer in chiShona'.

**Accommodating weak facility in English**

Many pupils said that they had problems understanding English. Most teachers reported that they could easily use English for teaching, but needed to switch to chiShona to ensure that their pupils understood the mathematical concepts that they were teaching. The teachers said that this was especially important in what they called 'the transitional grades' (referring to preschool to Grade 1 and Grade 3 to Grade 4) when pupils were changing from one language of instruction to another, which they had not fully mastered. Observation of oral mathematics lessons revealed that instances of code-switching did not appear to decline in the higher grades.

**Increasing pupil interest and participation**

Sometimes teachers suddenly switched to specific chiShona terms when addressing specific groups. A Grade 5 teacher referred to some girls in his class as *vana vamwene* ‘mothers-in-law’. When asked to explain this switch, the teacher said that he intended to express solidarity with the girls as they were usually perceived by society as a marginalised and endangered minority group in mathematics. The language change signals to the listener that the speaker is from a certain background and if the listener responds with a similar switch, a degree of rapport has been established.

Teachers sometimes switched code from English to chiShona in order to portray a particular effect. One teacher said ‘Isai misoro pamwe. Kukanya hurangana.’ (‘Put your heads together, messing up is a collaborative effort’) to a class that was beginning group work. Another teacher said ‘Ko, mukwasha mavakuiti!’ (‘Hey, brother-in-law what are you doing?’), in reprimanding a boy who was not behaving, and in this way the teacher maintained class control.

To find out what the resulting quality of mathematics learning was like in classes where teachers and pupils switched codes, pupils’ participation in class was observed and an analysis of their written exercises was done. Clinical interviews were also used to try to determine general language preferences and abilities while learning mathematics. The findings are presented below.

**The effects of code-switching in class**

Many of the pupils had problems understanding the vocabulary used in a mathematical sense. Pupils in the lower grades had difficulty with logical connectives such as ‘if’ and ‘because’. The manner in which language is used in mathematical problems, where it has very specific meaning, also seemed to create problems. They also had problems with specialist vocabulary used in mathematics such as ‘denominator’ or ‘isosceles’. Pupils also tended to ignore comparative linguistic forms in mathematics and the words ‘more’, ‘some’ and ‘together’ appeared to give problems.

Observation of the pupils’ mathematics exercise books showed that performance in the given exercises was generally weak, with most lesson objectives failing to be achieved. Performance tended to be especially weak where number stories in English were involved and better in exercises that involved mechanical operations.

Many of the pupils said that they had problems understanding ‘big’ English words and preferred either simple, everyday English or translations into chiShona. Their teachers generally corroborated that the pupils had difficulty with English and so communication in lessons could not be strictly either English or chiShona. The teachers noted that the biggest problem that they had in teaching mathematics was how to put across the concepts in a language that could be understood by the pupils.

Teachers said they were more proficient when teaching mathematics using English as there was insufficient chiShona vocabulary to cover many mathematical terms and concepts.

**Discussion**

The results show that primary school pupils code-switch from English to chiShona when they fail to express themselves or when they need clarification from the teacher. Teachers also code-switched to try to simplify the ideas so that their pupils could understand them better. The teachers’ switching of codes usually took one of four forms. Firstly, teachers switched code by giving the English term a chiShona pronunciation. Gondo et al. (2005) report that adaptation or adoption of the phonology of a source language such as English can be done with some success
into a target language such as chiShona. They argue that such English terms as ‘square’ and ‘millimetre’ can successfully be adapted phonologically into chiShona as sikweya and mirimita. In Zimbabwe, the present chiShona orthography does not accept using, for example, /thi/ as in Cos Ø. On this issue, Magwa (2004) and Chimhundu (1996, both in Gondo et al. 2005:8) suggest that a new chiShona orthography should accept the use of /th/ and others to enable the derivation of new chiShona terminologies in mathematics. Gondo et al. (2005) however observe that such a new chiShona orthography has not yet been adopted. Whereas Chimhundu (2005) has already produced a medical dictionary in chiShona, dealing a blow to the myth that science-related subjects cannot be translated into indigenous languages, mathematics as a science in chiShona is still lagging behind due to its limited register as observed by Gondo et al. (2005).

The second form of code-switching involved teachers using chiShona words for equivalent English words in a sentence. For example, what is the svomhu (‘sum’) of 5 and 10? Another example would be, how many mahekita (‘hectares’) is the piece of land? Word-for-word equivalence seems to capture main ideas of the original language. However Gondo et al. (2005) argue that, where linguistic equivalence strives to maintain the order of the key linguistic one-to-one equivalence, the switching may end up with several words all denoting that one word concept in the source language. Not only is this strategy difficult to use but it may also sacrifice core meaning for structure.

The third form of code-switching involved teachers creating completely new chiShona words to replace English ones, for example chitaimuzi for ‘multiplier’. This kind of code-switching is akin to what Halliday (1985, in Duroijaiye, 1993) calls ‘pragmatic translation’ in that it allows one to use whatever is workable and so facilitates creativity. The fourth form of code-switching involved teachers creating a mixture of English-with-chiShona words, for example provhiti for ‘profit’. Such words, which are neither English nor chiShona, resemble what Bochner and Albertini (1988) call pidgin or Creole words in that they are unstable and have a limited instrumental function. In this case, the pidgin or Creole words are likely to be restricted to teaching and learning situations.

Cook (1991) notes two constraints for successful code-switching. The first one is that a speaker may not switch languages word-internally, for example between the stem of a word and its endings or suffix(es), unless the speaker’s main language is the one which uses the particular ending(s). For example provhiti is switched between the stem of a word and its ending because the word’s ending is pronounced in the main language of the speaker. The second one is that the switch can come at a point in the sentence where it does not violate the grammar of either language. Both constraints appeared to be occasionally violated. As pointed out by Gondo et al. (2005) word coinage also has a problem of acceptability as the coined words might not be usable in other situations. In any case, code-switching of this nature does not appear to make the mathematical concept being learnt any simpler or clearer. The quality of communication may actually deteriorate rather than improve as a result of such code-switching.

Gondo et al. (2005) allude to this as loss of meaning in which the message yields less and weaker meaning than what was initially given. It would not be far-fetched to surmise that confusion might actually result from loss of meaning.

Conclusion and recommendations

It emerged that teachers and pupils switch codes to try to improve communication of mathematical concepts. They switch codes by creating novel words that are neither chiShona nor English, pronouncing the English term as if it were chiShona or creating novel chiShona words. In many such instances, these code-switching (borrowing and lending) strategies did not appear to attain the required level of mathematical correspondence between English and chiShona words. It became wordy and lengthy, thereby detracting from effective conveyance of the mathematical concept.

In light of these conclusions, it is recommended that government should come up with a bold policy that allows the teaching of science-related subjects, such as mathematics, through indigenous languages, not only to the end of primary school but up to university. The teaching of mathematics through one language that the pupils have already mastered is likely to enhance understanding and improve mathematics-learning outcomes. In order to make such a policy viable in practice, educational scholars should urgently develop an appropriate chiShona register for use in mathematics teaching and learning. This register could then be used by teachers’ colleges to enable pre-service and serving teachers to teach mathematics more effectively.

References


