USING MULTIPLE LANGUAGES TO SUPPORT MATHEMATICS PROFICIENCY IN A GRADE 11 MULTILINGUAL CLASSROOM OF SECOND LANGUAGE LEARNERS: AN ACTION RESEARCH

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This paper provides an overview of my Master’s Research report. The study explores the deliberate use of multiple languages to support the development of grade 11 learners’ mathematics proficiency in a multilingual classroom. The study is an action research aimed at transforming my teaching. A well-selected mathematical task set in multiple languages was used for teaching and multiple languages were used in a planned and proactive manner.

INTRODUCTION

I teach mathematics to grades 10 and 11 learners, who are multilingual learners and have limited fluency in English, which is the language of learning and teaching in the school. The participation of these learners is usually very limited during classroom discussions, especially when they have to interact with me. When the discussions are between learners during group activities, they usually use their home language(s) in addition to English, and most of them do take part in such discussions. Sometimes they ask questions or make inputs in the public domain in their home language(s), and when I insist that they use English, most of them refrain from asking questions or making inputs. This makes learning and teaching difficult.

From my conversations with other teachers I have come to realize that what my learners are doing is not unique. Most mathematics teachers are faced with these challenges in their multilingual classrooms. Learners on the other hand, are faced with a challenge of understanding mathematical terminology, concepts and meanings explained in the language that they are still learning. According to Pretorius (2002), the use of more than one language has become a strategy that teachers in multilingual classrooms rely on to explain concepts.

The South African language-in-education policy encourages multilingualism. Schools have the right to choose their LoLT, and this right must be exercised with the aim of promoting multilingualism (Education Labour Relations Council, 1996). One way of promoting multilingualism in mathematics classrooms is by using multiple languages during teaching. The debates around language and learning in South Africa tend to create a dichotomy between learning in English and learning in the home language(s). These debates create an impression that the use of the learners’ home languages for teaching and learning must necessarily exclude English, and the use of English must necessarily exclude the learners’ home languages. The aim of the study reported here
was to challenge this dichotomy between the use of home languages and the use of English for teaching and learning of mathematics.

The study explored the deliberate use of multiple languages to support the development of Grade 11 learners’ mathematical proficiency in a multilingual classroom. The study was guided by the following research questions:

- How can the learners’ home language(s) be used to support the development of learners’ proficiency in mathematics?
- To what extent can tasks set in multiple languages support the development of learners’ proficiency in mathematics?
- To what extent can learners’ interactions with the tasks in multiple languages support the development of learners’ proficiency in mathematics?

This was an action research aimed at transforming my teaching. I refer to this as transformation because I taught in a way that was different from my usual way of teaching.

**What Was Transformed?**

While I sometimes used learners’ home languages in my teaching, I used them in an unplanned manner. The tasks that I previously used in my class, which were mostly from textbooks, were not set in multiple languages, but in English only. Due to learners’ limited proficiency in English, the tasks I selected were comparatively easy and the mathematics thereof was generally of a lower cognitive demand. I used them generally for assessment purposes with the aim of assessing learners’ understanding of mathematical procedures, algorithms and rules. While these kinds of tasks are in general worth doing with learners, in the study, I gave a mathematics task of a higher cognitive demand set in multiple languages and used it for learning and teaching. However, the mathematics of the task was not compromised. The cognitive-level demands of the tasks, as suggested by Stein, Smith, Henningsen and Silver (2000), were taken into consideration. Furthermore, multiple languages were deliberately used for teaching and learning. This implies that learners’ home languages were used in a planned and proactive manner.

**THEORETICAL FRAMEWORK AND LITERATURE REVIEW**

This study was broadly informed by Vygotsky’s theory of socio-cultural development. According to this theory, the child’s cognitive development depends on external factors, i.e. language, cultural and social processes. This development, from the Vygotskian perspective, occurs in and through socially mediated activity, and language plays a key role in mediation (Vygotsky, 1978). This theory is helpful because it provides a framework within which one can describe the role that the learners’ home languages as
used by the teacher, the learners and in the tasks can play in a multilingual classroom. Central to Vygotsky’s theory is the fact that the higher mental functions are formed through social interaction (Vygotsky, 1978). This resonates with Hatano’s work who argues that humans construct their own knowledge, and the process of knowledge reconstruction “is not a purely individual enterprise but is constrained socioculturally” (Hatano, 1996: 199). In other words, learners do not construct mathematical knowledge on their own but they do so in interaction with resources around them, both human and non-human. Hence this study highlights the importance of well thought-out tasks and an environment where learners can interact with each other and with the teacher. According to Vygotsky’s general genetic law of cultural development,

Any function in the child’s cultural development appears twice, or on two planes. First it appears on the social plane and then on the psychological plane. First it appears between people as an interpsychological category, and then within the child as an intrapsychological category (Wertsch, 1979; Vygotsky, 1978 in Tharp and Gallimore, 1991; Vygotsky, 1966, 1978).

This law suggests that in order to explain the psychological, we must look at the external world or the social plane in which the child’s life develops and not only at the child (Tharp and Gallimore, 1991). The interpsychological or the social plane is the classroom in which learning and teaching occurs through the use of English and the learners’ home language(s), and through tasks set in multiple languages. On the interpsychological plane there are learner-learner and teacher-learner interactions whereby the learners and the teacher communicate mathematical ideas and concepts through language.

**The Role of Language**

Language is used by teachers to lead the discussions, give direction and guide learners’ constructions (Jaworski, 1997; Wertsch, 1984). Berger (1998) indicates that language serves as a cognitive re-organiser that aims at changing the quality of teaching and therefore helps in developing thinking. This suggests that when a learner exchanges mathematical ideas with his/her peers through language, he/she moves from one state of knowing to another state of knowing, since learning is an additive process (adding to what is already there). Through language, the teacher’s assistance and effects of peers (Ginsberg, 1985:9), and the use of mathematical tasks, learners become active participants in the process of knowledge construction. In my view, the use of multiple languages may play a vital role in this regard. The learners’ language background should also be considered when tasks are selected or created because if a task is in the language which learners have limited fluency in, they may have difficulty in understanding and interpreting it. Even if the task matches learning goals, such goals may not be realised.
Mathematical Tasks

One of the important aspects of learning mathematics is developing mathematical understanding and the learners’ ability to think mathematically. However, developing mathematical thinking is not easy. Learning mathematics is not only about application of rules and procedures. According to Ball and Bass (2003), knowing procedures and mathematical ideas as just routine or mere fact without mathematical reasoning is not enough. Through tasks, learners can learn how to reason mathematically.

Well-selected tasks can provide learners with an opportunity to gain mathematical power, that is, to be mathematically competent, which Kilpatrick, Swafford and Findell (2001) refer to as mathematical proficiency. Kilpatrick et al. (2001) suggest five interwoven and interdependent components/strands that are significant in developing learners’ proficiency in mathematics. These strands are conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition. The use of tasks, which are classified into lower-level and higher-level demands tasks, during the learning and teaching of mathematics is important in developing learners’ abilities in the five strands of mathematical proficiency because they (tasks) form the basis of learners’ opportunities to learn mathematics (Stein et al., 2000). Therefore, cognitive demands of the tasks, must be taken into consideration because “it is the level and kind of thinking in which students engage that determines what they will learn” (p.11). In other words, what the learners will learn is dependent on the opportunities that the tasks they are working on provide.

Lower-level demand tasks are classified into ‘memorization’ tasks and ‘procedures without connections’ tasks. Since memorization tasks and procedures without connection tasks do not have the capability to engage learners in complex forms of thinking, they can be used to develop learners’ procedural fluency, which “refers to knowledge of procedures, knowledge of when and how to use them appropriately, and skill in performing them flexibly, accurately, and efficiently” (Stein et al., 2000:121).

Strategic competence, which is “the ability to formulate mathematical problems, represent them, and solve them” (Kilpatrick et al., 2001:124), can be developed through the use of ‘procedures with connections’ tasks and ‘doing mathematics’ tasks, which are tasks of higher-level demand. Such tasks assist in the development of meaning as they can be represented in various ways, and a certain amount of cognitive effort is needed when working on them. Therefore, the procedures used cannot be followed without understanding. Since ‘doing mathematics’ tasks “demand self-monitoring or self-regulation of one’s own cognitive processes” (Stein et al., 2000:16), they may require learners to explain and justify how the solution can be obtained, developing the proficiency in adaptive reasoning. As learners’ reasoning skills improve and are able to justify and explain mathematical ideas, their conceptual understanding also improves. Conceptual understanding, which refers to “comprehension of mathematical concepts, operations, and relations” (p.116), enables learners to know the importance of certain mathematical ideas and the contexts in which they are relevant. As Kilpatrick et al. (2001) suggests, learners must “see sense in mathematics, perceive it as both useful and
worthwhile, believe that steady effort in learning mathematics pays off, and see oneself as an effective learner and doer of mathematics” (p.131), which is a competence referred to as productive disposition. The development of this strand, which occurs over time, depends on the development of the other strands and also helps the other strands to develop.

The instructional task used in the study was selected from the Malati Draft Materials (30-04-2005). It consists of 10 questions. As Stein et al. (2000) suggest, the task features determine its level of cognitive demand. The task I selected had the following features: a ‘real world’ context is used, it is a problem situation, some questions require an explanation, some questions may require the use of a calculator, learners must use prior knowledge and experiences when working on the task, and an approach to follow is not suggested. The task was used to teach ‘Linear Functions’ because it is one of the topics included in the Grade 11 syllabus. Since the aim of this study was to use a mathematical task to support the development of learners’ proficiency in mathematics, the type of task selected had to provide learners with such opportunities. The English version of the task used in the study is shown below.

THE MATHEMATICS TASK

COST OF ELECTRICITY:

*The Brahm Park electricity department charges R40 – 00 monthly service fee then an additional 20c per kilowatt-hour (kwh). A kilowatt-hour is the amount of electricity used in one hour at a constant power of one kilowatt.*

1. The estimated monthly electricity consumption of a family home is 560 kwh. Predict what the monthly account would be for electricity.

2. Three people live in a townhouse. Their monthly electricity account is approximately R180 – 00. How many kilowatt-hours per month do they usually use?

3. In winter the average electricity consumption increases by 20%, what would the monthly bills be for the family home in (1) above and for the townhouse?

4. In your opinion, what may be the reason for the increase in the average electricity consumption in (3) above?

5. Determine a formula to assist the electricity department to calculate the monthly electricity bill for any household. State clearly what your variables represent and the units used.
6. a). Complete the following table showing the cost of electricity in Rand for differing amounts of electricity used:

<table>
<thead>
<tr>
<th>Consumption (kwh)</th>
<th>0</th>
<th>100</th>
<th>200</th>
<th>300</th>
<th>400</th>
<th>500</th>
<th>600</th>
<th>700</th>
<th>800</th>
<th>900</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost (in Rand)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b). Draw a graph on the set of axes below to illustrate the cost of different units of electricity at the rate charged by the Brahm Park electricity department.

![ELECTRICITY COSTS Graph]

After careful consideration, the electricity department decide to alter their costing structure. They decide that there will no longer be a monthly service fee of R40 – 00 but now each kilowatt-hour will cost 25c.

7. What would be the new monthly electricity accounts for the family home and the townhouse?

8. a). Complete the following table showing the cost of electricity in Rand for differing amounts of electricity used using the new costing structure:

<table>
<thead>
<tr>
<th>Consumption (kwh)</th>
<th>0</th>
<th>100</th>
<th>200</th>
<th>300</th>
<th>400</th>
<th>500</th>
<th>600</th>
<th>700</th>
<th>800</th>
<th>900</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost (in Rand)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b). Draw a graph on the same set of axes in question 6.b. to illustrate the cost of electricity for different units of electricity using the new costing structure.
9. Do both the family home and the townhouse benefit from this new costing structure? Explain.

10. If people using the electricity had the option of choosing either of the two costing structures, which would you recommend? Clearly explain your answer using tables you have completed and graphs drawn in questions (6a) and (6b) and (8a) and (8b) above.

RESEARCH DESIGN AND METHODOLOGY

The Research Context
The study was undertaken at a school where I teach. It is a multilingual high school located in Soweto, a township southwest of Johannesburg. It caters for learners from Grade 8 to Grade 12. I selected to do the study in a Grade 11 class I teach because I also taught the same group of learners in 2004 while they were in grade 10. It was convenient for me to do the study in that class, as I did not have to interfere with the daily school timetable or arrange visits to another school. There were 36 learners of varying abilities, ethnic groups and gender in the class. The class was multilingual, and the home languages of learners were SeTswana, XiTsonga, IsiZulu and TshiVenda. All the learners learnt English and their respective home language(s) as subjects. As indicated before, learners’ fluency in English was limited. As the teacher who was teaching the class I was a critical participant in the study. I am multilingual and able to communicate in the following languages, Setswana, Sesotho, Sepedi, Xitsonga, IsiZulu, Tshivenda, English and Afrikaans. My home language is Setswana. I have been teaching mathematics at secondary school level for 15 years.

Methodological Approach
I have chosen an action research approach because I was researching my own practice so as to transform and improve it. I referred to this as transformation because as explained earlier, I did things differently from how I usually used to do them. Unlike other research approaches like Case Study, Survey, Experiments and many others, action research was an approach that gave me an opportunity to research my own teaching so as to change or transform it. As Davidoff and van den Berg (1990) argue,

Action Research is a way of taking a systematic, close, critical look at the way in which we teach, with a view to changing it so that the classroom experience becomes a more meaningful one for all those involved in it (p.28).
The quotation suggest that through action research, an opportunity was created where I systematically reflected on my classroom activities so that effective and efficient changes that were beneficial to both learners and I during learning and teaching could be made. Reflecting critically on what takes place in ones classroom is key to the beginning of a process of classroom transformation. Action research allowed for modifications of the intended intervention after analysing, evaluating and reflecting upon the first cycle of data collected (Opie, 2004).

Data Collection
During data collection, four lessons were presented over a period of four successive days. Since the action research process is cyclic, each lesson was taken as a cycle. Each cycle included planning, implementation, observation, reflection, and planning a revised action (Davidoff and van den Berg, 1990). Each lesson was 80 minutes long. In all lessons, the main instrument, a mathematics task set in multiple languages was used for teaching and learning. Learners were divided into home language groups and given both the English version and the home language version of the mathematics task. Since the task consisted of ten questions, the questions were divided across the four lessons. Two observers were present during lessons, one taking notes and the other one video-recording lessons. At the end of the fourth lesson, four learners, one from a different home language group, were selected for individual learner interviews which were conducted by a fellow researcher, who was once a senior teacher of mathematics in the same school. The interviewer was not present during lessons. Figure 1 below shows the cyclic process of the planned action research:
How Data Was Analysed

When analyzing data, research questions were not dealt with separately but holistically. Kilpatrick et al’s (2001) five interwoven and interconnected strands of mathematical proficiency were used as a framework to analyse data. Video recordings of data collected during the four lessons in this study were transcribed and then utterances in English and the learners’ home languages were counted to investigate which languages were used. Using Kilpatrick’s et al’s (2001) strands of mathematical proficiency, the transcripts were then categorized to explore if and how the deliberate, proactive and planned use of multiple languages contributed to the development of learners’ proficiency in mathematics. The main categories were then categorised further into sub-categories which I refer to as the ‘action’ that either the teacher or learners displayed in each strand. The five strands used for the categorisation of the transcript were procedural fluency (PF), strategic competence (SC), adaptive reasoning (AR), conceptual understanding (CU), and productive disposition (PD). Below is the description of sub-categories:
• **Displaying procedural fluency (DPF):** Evidence of knowledge of procedures to be used, when and how to use them suitably, and evidence of skills to perform them flexibly, accurately and efficiently.

• **Displaying strategic competence (DSC):** Learners indicating the knowledge of number of strategies and also know which strategy might be useful to find a solution for a particular mathematical problem. This simply means evidence of mathematical problem formulation, representation and solving skills by learners.

• **Displaying adaptive reasoning (DAR):** Learners showing the ability to explain and justify mathematical ideas and how the solution to a specific mathematical problem was obtained. This is displaying a skill of explaining, justifying, and thinking logically about and reflecting upon the relationships among concepts and situations.

• **Displaying conceptual understanding (DCU):** Learners showing the ability to comprehend mathematical concepts, ideas, operations and relations, and knowing the importance of certain mathematical ideas and the contexts in which they are relevant.

• **Displaying productive disposition (DPD):** Evidence of some indication by learner(s) of seeing sense in mathematics, regarding it as both useful and practicable, believing that constant effort in learning mathematics pays off, and seeing oneself as a capable learner and doer of mathematics.

**RESULTS AND FINDINGS**

Due to limited space in this paper, I only present a summary of results and findings. Table 1 below shows the prevalence and the frequency of the use of the learners’ home language(s) and English during each cycle.

<table>
<thead>
<tr>
<th></th>
<th>CYCLE 1</th>
<th>CYCLE 2</th>
<th>CYCLE 3</th>
<th>CYCLE 4</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lang.</strong></td>
<td><strong>Teacher</strong></td>
<td><strong>Learner</strong></td>
<td><strong>Teacher</strong></td>
<td><strong>Learner</strong></td>
<td><strong>Teacher</strong></td>
</tr>
<tr>
<td>HL</td>
<td>70</td>
<td>52</td>
<td>88</td>
<td>39</td>
<td>66</td>
</tr>
<tr>
<td>ENG</td>
<td>98</td>
<td>98</td>
<td>149</td>
<td>69</td>
<td>138</td>
</tr>
</tbody>
</table>

Table 1. Frequency of the use of multiple languages by learners and the teacher in each cycle.

Even though the learners’ home languages were encouraged and used deliberately in each cycle, Table 1 shows the dominance of the use of English by both the teacher and learners across the four cycles. This is not surprising because English is the official LoLT of the school and the aim was not to exclude its use during teaching and learning.
but to create a platform for learners to use their home language(s) as a resource. Furthermore, the dominance of English does not in and of itself necessarily imply lack of understanding by learners. What is not visible in Table 1 is whether and how using multiple languages contributed to the development of the learners’ proficiency in mathematics. This is reflected in Table 2 below.

<table>
<thead>
<tr>
<th>SUB-CAT</th>
<th>LANG.</th>
<th>CYCLE 1</th>
<th>CYCLE 2</th>
<th>CYCLE 3</th>
<th>CYCLE 4</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>DCU</td>
<td>HL</td>
<td>14</td>
<td>10</td>
<td>04</td>
<td>05</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>ENG</td>
<td>27</td>
<td>19</td>
<td>37</td>
<td>17</td>
<td>100</td>
</tr>
<tr>
<td>DPF</td>
<td>HL</td>
<td>05</td>
<td>05</td>
<td>00</td>
<td>01</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>ENG</td>
<td>10</td>
<td>10</td>
<td>02</td>
<td>02</td>
<td>24</td>
</tr>
<tr>
<td>DSC</td>
<td>HL</td>
<td>04</td>
<td>03</td>
<td>00</td>
<td>01</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>ENG</td>
<td>07</td>
<td>04</td>
<td>06</td>
<td>07</td>
<td>24</td>
</tr>
<tr>
<td>DAR</td>
<td>HL</td>
<td>02</td>
<td>06</td>
<td>00</td>
<td>03</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>ENG</td>
<td>03</td>
<td>02</td>
<td>03</td>
<td>09</td>
<td>17</td>
</tr>
<tr>
<td>DPD</td>
<td>HL</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>ENG</td>
<td>00</td>
<td>00</td>
<td>00</td>
<td>01</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 4. Prevalence of strands of mathematical proficiency.

In Table 2 the prevalence and the frequency thereof, of the strands of mathematical proficiency and the language associated with each strand in each cycle, as mentioned earlier on, are shown. Though the prevalence of each strand is shown separately in the table below, this does not mean that each strand was developed independently from others, since the strands of mathematical proficiency are interdependent and interwoven (Kilpatrick et al., 2001). The above table present an overview of the extent at which each strand of mathematical proficiency was developed in each cycle. Table 2 shows that all the five strands of mathematical proficiency were displayed, but generally conceptual understanding was dominant across all cycles as compared to other strands and was most frequently displayed (DCU) in English. This suggests that most of the interactions were conceptual, unlike in the primary multilingual classrooms that Setati (2005) observed, where procedural discourse dominated. In this study, procedural discourse was second in terms of dominance and was displayed (DPF) mostly during cycle 1 and cycle 2. Since procedures to solve Questions 1, 2, and 3 were not suggested in the task, it was also significant that learners knew, as Kilpatrick et al. (2001) suggest, a number of strategies and identify a strategy (DSC) which might be of use to each problem. The understanding of mathematical concepts and their relationships between them, enabled learners to identify a useful strategy and to remember the appropriate
procedures to solve problems in the mathematics task (Kilpatrick et al., 2001). Table 2 further shows that adaptive reasoning was most frequently displayed (DAR) during the second and fourth cycles. This was due to working on question 4 and questions 8 and 9 from the task sheet, which were done during the second cycle and the fourth cycle respectively. These type of questions may “demand self-monitoring or self-regulation of one’s own cognitive processes” (Stein et al., 2000:16) as they required some explanations and justifications, and therefore supported the development of learners’ proficiency in adaptive reasoning. What is interesting is that even though the use of English dominated the interactions, Table 2 shows that during Cycle 2 the display of adaptive reasoning was mostly in the learners’ home language(s), suggesting that learners’ used their home language(s) as a resource to give an ‘opinion’, that is responding to Question 4.

As table 2 shows, productive disposition, a strand that develops when the other four strands have developed, was only displayed in the fourth cycle. It was not surprising that productive disposition was the least frequent because, according to Kilpatrick et al (2001:131), “seeing sense in mathematics, regarding it as both useful and practicable, believing that constant effort in learning mathematics pays off, and seeing oneself as a capable learner and doer of mathematics”, is not a once-off thing, but is developed over time. Below is an extract showing the display of conceptual understanding (DCU), procedural fluency (DPF) and adaptive reasoning (DAR) by a learner.

In the extract, Given uses Tshivenda as a resource to display conceptual understanding, procedural fluency and adaptive reasoning as she explains how the solution to a mathematical problem was obtained.

Given: Hei, nayo … ar … (Giggles) … So forty rhanda hi monthly cost ne, then ba yieda nga twenty cents kha kilowatt for one hour. Then after that, angado shumisa …, baibidza mini? Heyi … ndoshumisa one kilowatt nga twenty cents kha one hour [...So forty rand is the monthly cost, then they add twenty cents per kilowatt-hour. ..., they use..., what do they call it? Heyi ... they use one kilowatt-hour for twenty cents].

Sipho: Eya [Yes].

Given: Boyieda, maybe boshumisa twenty cents nga one hour [They add it, maybe they use twenty cents per hour].

Sipho: Eya, yantha [Yes, one hour].

Given: Iba …[It becomes…].

Given and Sipho: Forty rand twenty cents.

Sipho: Yes, vhoibadela monthly, ngangwedzi ya hona. Yo fhelela, yes. Sesiyaqubheka [..., the pay it monthly, each month. It is complete, yes. We continue].

The extract shows Given displaying conceptual understanding by explaining that “forty rands is the monthly cost” and that “they use one kilowatt-hour for twenty cents” which
is added to forty rands. This indicated that Given eventually understood the concepts involved, i.e. ‘the R40-00 service fee and the 20c per kilowatt-hour, and how the concepts relate to each other. By explaining, she was displaying adaptive reasoning as she was also justifying the obtained solution, R40-20c.

Learners’ Reflections and Views on the New Approach
The objective of analysing the learner interviews was to identify learners’ views, focusing mainly on two things, the nature of the mathematical task used in this study, and the deliberate use of multiple languages. All learners interviewed indicated that the four lessons conducted during this study were different from their normal (daily) mathematics lessons and they generally gave an indication that they liked the new approach.

The Nature of the Task
When responding to the interview question “What was different about the lesson?”, all but one learner began by referring to the nature of the mathematical task used and not the use of home language. While the two learners, Nhlanhla and Colbert pointed to the context used as a change in the way of teaching, Sindiswa pointed only to the mathematics of the task.

Interviewer: What … what was so special about the lesson?

Sindiswa: It does not include those maths … maths. It is not different, but those words used in maths didn’t occur, didn’t occur but we weren’t using them. Er … ‘simplifying’, ‘finding the formulas’, ‘similarities’, …

Colbert: Iya, basenzele [Yes, they did it] in order to … ukuthi ibe [so that it should be] simple and easy to us, because most of people, uyabona, aban-nderstendi like i … like i-card ne meter [you see, they do not understand like a… like a card and a meter]. Abanye bathi i-meter is … i-price yakhona i-much uyabona, i-card iless i-price yakhona, that’s why uyabona [Some say a meter is … costs more you see, the cost of a card is less, that’s why you see]. So, abantu abana-knowledge, uyabona, bakhuluma [So people do not have knowledge, you see, they talk…] just for the sake of it. So, I think for us, because we have learnt something, both are the same.

Nhlanhla: Okokuqala mem, ilokhuza, la sidila ngama-calculations awemali, manje ku-maths asisebenzi ngemali [Firstly mem, the.., here we work with calculations that involve money, now in maths we do not work with money].

One interesting point that Sindiswa makes about the task is the language of the task, which is different from the type of language used in mathematics textbooks they normally use. She mentions terms like ‘simplify’, finding the formula’, ‘similarities’, terminology that are usually found in mathematics textbooks. This suggests that even
with the English version of the task used, the language was made more accessible and the task enjoyable as it was less threatening for learners. Colbert goes beyond the lessons as he sees the nature of the task as having clarified the real-life situation since they now know how the two costing structures work. For Nhlanhla, what was different with the approach was that they dealt with calculation involving money, which is what they do not usually do in mathematics.

**Deliberate Use of Multiple Languages:**

While using either English or home languages did not make any difference for Sindiswa, the three learners, Sipho, Nhlanhla and Colbert liked the use of home language and saw both languages as a resource. These learners indicated that the use of home languages assisted in understanding of the task and made most learners to participate.

Interviewer: uMr Molefe ungitshele ukuthi kule vike beka fundisa completely different, ubona ukuthi izo … iyasebenza le ndlela ayisebenzisa manje [Mr Molefe told me that this week he was teaching completely different, do you think it will… does the approach he uses now work]?

Nhlanhla: Yes mem, I think iyasebenza, ngoba ama-learners amaningi, maybe like, uma ungasebenzise ama-home language wabo, abaphathisipheiti kakhulu. Mabanikezwa ama-home language abo, I think bazokhona ukuphathisipheita [Yes mem, I think it works , because most learners, maybe like, if you do not use their home languages, they do not participate that much. If they are given their home languages, I think they will be able to participate].

Colbert: Iya yes, I think is a good idea, uyabona, ngoba iyenza ukuthi … iyenze izinto zibe simple, ngoba if singa-understendi ngeEnglish, sicheka ku … our languages, aba simple bese siyakhom phera [...you see, because what it does ... it makes things to be simple, because if we do not understand in English, we check in...our languages, they become simple and then we compare].

Sipho: Because kaofela digroup they were participating, wa utlwisisa mem. Le bane ba sa phathisipheiti ko klaseng, ne setse ba phathisipheita. Nna ke makets gore ‘he banna, mothaka o kajeko ke ena oe arabant so maths’ [Because all the groups were participating, do you understand mem. Even those who used not to participate in class, were now participating. I was surprised that ‘oh man, is this guy the one who responds so much in maths today’](Clicks fingers).

In Nhlanhla’s and Sipho’s views, using learners’ home language(s) encouraged learners to participate actively during lessons. While they both refer to learner participation as an indication that the new approach can be a success, how they say it is interesting. Nhlanhla says that “uma ungasebenzise ama-home language wabo, abaphathisipheiti kakhulu [if you do not use their home languages, they do not participate that much]”, whereas Sipho says “Le bane ba sa phathisipheiti ko klaseng, ne setse ba phathisipheita [Even those who used not to participate in class, were now participating]”. For
Nhlanhla, most learners do participate during mathematics lessons, but the absence of their home language(s) minimises active participation. On the other hand, for Sipho using home language(s) has encouraged all learners to participate. Nhlanhla refers to the ‘level of participation’ while Sipho refers to the number of learners who were participating. For Colbert, using learners’ home language(s) assists with comprehension of the task if the English version is incomprehensible for learners as they may simply switch to their home language version. These learners’ responses suggest that they view their home language(s) as both visible and invisible resources (Lave and Wenger, 1991, cited in Setati, Molefe, Duma, Nkambule, Mpalami and Langa, 2007) in the sense that they had an opportunity to draw from it and were neither a distracter nor an obstacle (switching to home language version of the task and having access to more clearer information).

IMPLICATIONS AND CONCLUSION

While research in mathematics and language shows that code-switching is used as one of the strategies by mathematics teachers to mediate learning in multilingual classrooms (Adler, 2001; Setati, 1998, 2002; Moschkovich, 1999), the findings from this study show that the deliberate use of learners’ home languages in addition to English can be resourceful in facilitating the development of learners’ proficiency in mathematics. As Zevenbergen (2000) argues, the learner’s home language and the way in which it is used can be a form of capital. In this paper, the findings from the study have indicated that learners had two languages to draw from in dealing with the task. Even though the results of the study show that the use of English dominated, learners interviewed mentioned that the advantages of using their home languages in the manner that the teacher used them were that it helped in understanding of the mathematical task, and encouraged learners to participate during lessons. Since literature suggests that well-selected tasks can provide learners with an opportunity to gain mathematical power, that is, to be mathematically competent (Stein et al., 2000), the analysis in this paper indicates that the nature of the mathematical task used plays an important role in supporting the development of learners’ proficiency in mathematics.

While this was a small-scale study done in one classroom, of which one may argue that its findings may not be generalised to other multilingual mathematical classrooms, it provides one with some ideas of transformation that one can make in ones’ classroom in order to assist learners to gain mathematical power. Other practitioners and researchers can learn from this study as it provides an important contribution for those who teach in multilingual classrooms and may encourage practitioners to research their own practice. However, teachers who would want to use the new teaching approach in their multilingual classroom as in this study are cautioned that using learners’ home languages in addition to the LoLT on its own is not enough. What is key in using the approach is that one has to be multilingual and mathematically strong to enable one to support the development of learners’ proficiency in mathematics in multilingual classrooms.
REFERENCES


The Sunday Times (29 February 2002). *English versus the rest in battle for the classroom*


