

Making Mathematics Accessible for Multilingual Learners

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Why do we need a special issue of *Pythagoras* on teaching and learning mathematics in multilingual classrooms? While there is a reasonable amount of research done in this area of study in Southern Africa (e.g. Adler, 2001; Kazima, 2007; Setati, 2005), much of this work is not published locally. In the past ten years *Pythagoras* has not published a single article on learning and teaching mathematics in multilingual classrooms¹. Furthermore the work that is already published in this area of study is not easily accessible to practicing school mathematics teachers.

The majority of learners in South Africa learn mathematics in a language that they are not fluent in. This area of research is therefore important for equity and ensuring that all learners have access to mathematics. Until these learners can have equal access to mathematical knowledge it will be impossible to produce the number of engineers, technologists and scientists that South Africa so desperately needs. There is therefore a clear need for a collection that is of relevance to the South African context focused on teaching and learning mathematics in multilingual classrooms. A recent analysis of research on multilingualism in mathematics education in South Africa for the period 2000 – 2007, shows that there is a paucity of published research in this area of study (Setati, Chitera, & Essien, in press). As editors of this special issue, we believe that it is crucial that *Pythagoras*, the only accredited South African mathematics education journal, focus on teaching and learning mathematics in multilingual classrooms now.

An analysis in which Kahn (2005) uses language as a proxy, shows that it is mainly learners who

¹ Tobias (2003) focuses generally on the relationship between language and mathematics rather than multilingual issues.

learn in a language that is not their home language who do not succeed in Grade 12 mathematics. This finding is consistent with what Howie (2003, 2004) found in her analysis of the performance of South African learners in the Third International Mathematics and Science Study (TIMSS). It is thus crucial that more research is undertaken to explore why it is that learners who learn mathematics in a language that is not their home language do not perform at the expected levels. That said, we hold the view that poor performance by multilingual learners cannot be solely attributed to their limited proficiency in English. We agree with Setati et al. (in press) that learner performance (and by implication, mathematical achievement) is determined by a complex set of interrelated factors. Poor performance by multilingual learners thus cannot be solely attributed to the learners' limited proficiency in English (suggesting that fluency in the language of learning and teaching will solve all problems) in isolation from the pedagogic issues specific to mathematics as well as the wider social, cultural and political factors that infuse schooling. There is a need for research that can identify other factors that interact with the fact that these learners have limited proficiency in the language of learning and teaching to contribute to their poor performance. There is also a need for research that can point to initiatives that can be implemented to ensure success in multilingual mathematics classrooms.

In this issue we publish six papers by authors all of who work in multilingual mathematics classrooms in Southern Africa. While these authors work in different countries, they all regard language as a resource. They critically engage with policy, past research and the demands of teaching and learning mathematics in multilingual classrooms to explore ways in which mathematics can be made more accessible to learners in these classrooms. Rather

than fall prey to creating dichotomies, the authors present ways in which the different home languages of the learners can be drawn on to support their mathematics learning. In so doing the authors point to the fact that teaching and learning mathematics in multilingual classrooms is a complex cognitive and socio-political phenomenon, not to be simplistically analysed.

In his paper, Dlamini discusses the relationship between examination results in mathematics and in English language in Swaziland. In that country, students are not admitted to university to study mathematics or sciences without a pass in English language – even if they have high scores in all other subjects. Dlamini argues that this language policy is based on a false assumption – that proficiency in English is necessary for success in mathematics. He bases this argument on analysis of examination data for the country as a whole, as well as for students in one school. These analyses demonstrate that there is no connection whatsoever between students' performance in mathematics and their performance in English. Hence, denying university places in mathematics to students because they do not have a pass in English language is to deny places to potentially talented mathematicians. This policy affects a large number of students. Dlamini argues that a country such as Swaziland can ill afford to turn away such a large pool of potential mathematical talent. His article forcefully makes the point that in multilingual societies, mathematics educators cannot afford to ignore broader language policies.

Setati, Molefe and Langa report on their innovative study in which they explore a new approach to teaching mathematics in Gauteng's multilingual classrooms. This approach involves the teacher giving his Grade 11 learners mathematics problems in both English and in the main African languages used by learners in his class. The research team then investigated the effects of this strategy. They found that access to multiple languages was beneficial for learners. Of particular interest is the way the learners made use of the different language versions – they tended to regularly switch between them, sometimes referring to English, sometimes referring to the African language version they had in front of them. The different language versions were therefore mutually supportive. Their analysis demonstrates that common assumptions about, for example, needing to choose between teaching and learning in English or teaching and learning in an African language are

simplistic. What seemed to be effective in this study was using several languages at once! This paper therefore represents a significant challenge to received wisdom about teaching and learning mathematics in South Africa's multilingual context.

Webb and Webb explored some similar issues to Setati et al., but with a particular focus on the nature of classroom discourse. In their study, which was conducted in the Eastern Cape, they worked with teachers in an in-service program to develop the use of 'exploratory talk' in their mathematics lessons. Exploratory talk is talk that involves careful reasoning, characterised, for example, by the sharing of different ideas and the use of words like 'because'. Research in the UK and Mexico has shown that working with teachers to develop exploratory talk is effective in improving learners' mathematical attainment. An interesting feature of Webb and Webb's study is that exploratory talk intersects with code-switching. They present evidence that at least some of the teachers in the program did start to see more exploratory talk in their mathematics lessons and that this entailed use of both isiXhosa and English.

Like the two preceding papers, Vorster's study also examines the issue of how multiple languages may be used in teaching mathematics. In the study, which focused on a geometry topic in Grade 8, two teachers were provided with notes, a glossary of relevant mathematical terms and an end of topic test in both Setswana and English. The teachers used these materials as well as active code-switching during their teaching. As in Setati et al.'s study, Vorster reports that learners had a positive attitude to this planned use of their main language alongside English. Interestingly, while the teachers in the study were also enthusiastic, they were concerned about the use of Setswana mathematical terminology. These concerns can be traced to the context of the study, in which mathematical terminology is usually only in English. Hence the learners were not necessarily used to using Setswana terminology. It may be that with more systematic use of terminology in learners' main languages in addition to English, this issue would not arise.

Bohlmann and Pretorius work in the field of reading research. As part of a recent study of Grade 7 reading in two township schools, they also collected data on students' attainment in mathematics. This attainment was indicated by their performance on examinations prepared by

their teachers. Bohlmann and Pretorius's analysis produces an interesting and, for some, perhaps a surprising result: students' mathematical attainment is closely linked to their reading proficiency. This finding should not, however, be so surprising. Success in mathematics depends in part on reading and interpreting mathematical texts, particularly in the context of Curriculum 2005. Mathematics educators have not often considered broader factors in learning mathematics in multilingual contexts. This study alerts us to an important non-mathematical aspect of learners' education that potentially has a big impact on mathematical attainment.

Finally, this special issue ends with Kazima's discussion of some of the different policy options available for teaching mathematics in multilingual classrooms. She considers three countries – Tanzania, Nigeria and Malawi – who have adopted different approaches, including, in some cases, the development of mathematical terminology in African languages or, in other cases, the adoption of English terminology. Kazima highlights some of the complexity involved in developing a language policy for mathematics. This complexity relates to many of the issues apparent in the other papers of this collection. A particular tension seems to arise around the issue of whether to follow current practice and hence stay with what teachers and learners are used to, or whether to attempt to change current practice, with the hope of leading to more successful learning. It is apparent from all the papers that these kinds of tensions are ever present.

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