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# TEACHING MATHEMATICS IN MULTILINGUAL CLASSROOMS

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*In this paper, arising from my doctoral research, I highlight issues that emerge for teaching and learning mathematics in multilingual mathematics classrooms. These are classrooms where the language of instruction is not the first, often not even the second language of the learners.*

Research about teaching and learning mathematics suggests that the dynamics of teaching and learning mathematics in multilingual contexts take on an added complexity, giving rise to a number of issues and dilemmas. There is need for acknowledging this added complexity and to understand the factors that lead to it. Some of the dilemmas are well recorded in Adler (2001) who highlights three:

- The dilemma of code switching, when learners and/or teachers switch from language of instruction to the first language
- The dilemma of mediation when teachers move towards the learners preferred language
- The dilemma of transparency when the teacher spends time explicitly teaching mathematical language (Adler, 2001, p. )

While Adler's context is multilingual South Africa, in today's increasingly connected world, multilingual classrooms are the norm. Hence, it is important to recognise the centrality of multilingual mathematics classrooms so that reform efforts may take them into account.

My doctoral research (Halai, 2001) involved a study of reform in learning and teaching mathematics. Of particular interest to me was the role of social interactions in students' learning of mathematics. The study was based in two classrooms (henceforth, classroom A and B) in Karachi, Pakistan. These were classrooms where the teachers were using reform-oriented teaching approaches i.e. students were typically set mathematics problems which were open ended in nature and were situated in everyday world contexts. A small group of students (10-12 yr.) doing mathematics was observed in each classroom. Both schools were English medium schools. This meant that the official medium of instruction including the textbooks used and the tasks set in the class were in the English language. In both classrooms, the instruction was almost entirely in English but during group work students spoke in a mixture of Urdu and English. The teachers also reverted to Urdu when they went to the various groups. In reporting the group work to the whole class the students spoke in English with a smattering of Urdu. At times students *took permission* from the teacher to report in Urdu. However, the mathematical terms used in this mixture were invariably in English because these terms came from the textbook, which was in the English language.

The data was qualitative in nature and came from classroom observations and interviews with students and teachers.

## **ISSUES IN TEACHING MATHEMATICS IN MULTILINGUAL CLASSROOMS**

A number of issues pertaining to the processes of teaching and learning arose because of the language of instruction being different from the first language of the learners. These included:

- Understanding the language to make sense of the mathematics;
- Use of everyday language and mathematics learning;
- Using own language to express mathematical thinking;
- Language of the textbook.

### **Understanding the language to make sense of the mathematics**

As students worked at mathematical problems it appeared that their understanding of the problem statement required interpretation at least at two levels. At one level the students appeared to make sense of the language in which the mathematics problem was coded. This involved making sense of the grammar and usage of words. And at another level they appeared to make sense of the mathematics involved. For example, in one problem task students were given the statement “*Sara will be 28 year old after 9 years. Find her present age*”. Their task was to form an equation for the given statement and to solve it.

Analysis of classroom interactions showed that understanding how the word “will” was used was crucial to the students’ successfully doing the task. Knowing that ‘will’ is future tense had major implications for how the problem statement is converted into a mathematical equation and then a solution is sought. There were other examples which showed that the understanding of the specific structures and usage of words in the English language was important for the students to make sense of the mathematics. For example, in her introductory lesson on ratios the teacher used the task of mixing water and orange juice concentrate to make drinks which were “stronger than”, the drink shown as a sample. However, students’ interaction showed that one student in the group translated and explained to the others that stronger means ‘ziada’ which is the Urdu word meaning “more”. The result was that the students categorised as stronger the juice that was ‘more in quantity’ and not as the one, which was more concentrated and hence stronger. This and other similar examples through the research provide vivid evidence of issues that students face in interpreting mathematical tasks that require an understanding of the grammar and usage of words in a second or third language. Questions arise for the teaching and learning processes in the multilingual mathematics classrooms. Was the teacher aware of these language issues arising in the classroom? What could the teacher have done to facilitate students’ learning? How else could the teacher have organized his/her classroom so that issues such as those above have been acknowledged and

addressed?

### **Use of everyday language and mathematics learning.**

In the classroom that I observed, teachers had prepared tasks that were set in everyday life contexts and made use of everyday usage words. There appeared to be an assumption that using everyday contents and language would facilitate learning. However, these words of everyday usage were in English language and therefore raised questions about assuming that students would be familiar and would be able to make a link with the mathematical concepts embedded in those words. My observation in the classroom showed that the teacher's use of everyday words for mathematical concepts led to difficulties for the students. For example, the teacher used "fair share" for proportional division but students appeared to think that the word "fair" meant "divided equally" or "divided easily". This had implications for how they worked on other related tasks.

A point that I am trying to make is that using discursive strategies to teach mathematics where students are expected to build on their knowledge of the everyday context and language takes on an added complexity in a multilingual context. This complexity arises because of possibly unquestioned assumptions regarding students' familiarity and understanding of the language of the language of instruction.

### **Students expressing mathematical thinking in their own language**

A pattern in the classroom interactions was that the students and the teacher moved back and forth in the use of language. While there is evidence that students change languages, understanding why they do so would be important to making a difference in the way teaching is organised in multilingual mathematics classrooms. Furthermore, changing from one language to the other raises the issue of translation from one language to the other. Now, translation is a nuanced and complex process. In mathematics classrooms translation of key words and phrases would require that the mathematical meaning is also kept intact. Examples quoted in this paper show that students did not always translate in a mathematically appropriate manner. Indeed, on occasions the issue was that there did not exist an appropriate equivalent translation of the key word or translation being used.

Issues pertaining to the status of language also arises (Haque, 1993). Why did the students need to take permission in order to report their work in Urdu? Issues of power and politics of language emerge. Why did students use a mixture of Urdu and English instead of resorting to Urdu only? Is it that they saw English as a more powerful and therefore wanted to belong to the community of English speakers?

### **Language of the textbook**

The teachers and the students in the classrooms where I did my research were all expected to follow prescribed textbooks. The textbook was used as a guide for the subject content to be taught and for providing exercises for practice. Each teacher emphasised to me that if the material provided in the textbook was not covered they

would be accountable to the head teacher. This emphasis on the textbook raised issues pertaining to the language being used by the students and that being used in the textbook. Language in the textbook used formal mathematical terminology coded in English. While teachers were using everyday words in English and the students translated these everyday words to Urdu. This rather complex scenario compounded the issue of transfer from the everyday language to mathematical language.

### **CONCLUDING REFLECTIONS**

To conclude, classroom data shared above shows that in the course of teaching and learning mathematics in multilingual classrooms, dilemmas and issues arise, similar to those discussed in Adler (2001). This is because students and teachers in these multilingual classes switch back and forth from one language to the other. This switching requires translation from one language to the other which is complex and not always possible. Furthermore, politics and power of the language of instruction and the students' language also gives rise to issues.

From the discussion so far certain questions arise for the academic and practitioner communities. I will end with some such questions:

- How can teachers organise their teaching to address the issues and dilemmas that arise in a multilingual mathematics classroom?
- In what ways can teacher education prepare teachers for multilingual mathematics classrooms?
- How can research inform practice in mathematics teacher education/ mathematics teaching in multilingual classrooms?