

Teachers' perceptions of catering to the mathematical needs of immigrant students

Kavita Baluja

This paper reports on the teaching approaches and strategies adopted by primary-school teachers in their endeavour to cater to the mathematical needs of immigrant students in New Zealand. It focuses on the needs of immigrant students alongside the philosophy of the New Zealand mathematics curriculum. It identifies strategies employed by teachers to strike an optimum balance between providing an equitable learning environment that caters to the needs of immigrant students and implementing the New Zealand mathematics curriculum. The outcomes have implications for all primary-school teachers in New Zealand who have immigrant students in their classrooms.

Introduction

New Zealand schools are becoming increasingly more multicultural with a variety of ethnic groups present in classrooms due to the growth in the diversity of immigrants. This places a significant responsibility on teachers to make the teaching of mathematics a culturally-bound subject (Thomas, 1997) and to provide equal opportunities to engage all students, irrespective of their ethnic groups, in developing reasoning and analytical skills and higher level mathematical concepts (Croom, 1997). At the same time as diverse ethnic groups are changing mathematics classrooms more problem solving, hands-on activities and the use of a variety of technological tools are changing the nature of mathematics education (Trentacosta & Kenney, 1997). This change reflects the New Zealand mathematics curriculum (Ministry of Education, 1992) which, based on a constructivist epistemology (Begg, 1999), lays down guidelines for meeting learning outcomes through an emphasis on problem solving. Immigrant children come into the country with their own attitudes and learning styles that may not be similar to the ones encouraged by the New Zealand mathematics curriculum. The rationale for this study was to find out what teaching approaches and strategies teachers employ to cater to the

needs of immigrant students while implementing the New Zealand mathematics curriculum. With this intention, it examines the needs of immigrant students, discusses the principles of the current New Zealand mathematics curriculum and explores the strategies adopted by teachers while teaching mathematics to immigrant students in their classrooms.

Equity in mathematics education

Mathematics is vital for educational development today. This belief is reflected by Secada (1990, cited in Moyer, Cai & Grampp, 1997) who writes "Mathematics is considered fundamental for literacy in the twenty-first century". The future demands a workforce competent in the skills of problem solving and logical reasoning through teamwork. Therefore there needs to be a focus on providing all students with equal opportunities to learn mathematics. This places responsibility on teachers to provide equitable learning environments for student populations that differ in culture, race, gender and socioeconomic background. According to Croom (1997: 4) "An equitable learning background is one that affirms the richness of cultural diversity and creates an opportunity to engage all students in an interactive learning process." Croom further emphasizes that all students irrespective of their diverse ethnic groups must be given the same opportunity to learn higher-level mathematical concepts and develop reasoning and analytical skills. The implication for the question under investigation is that the teacher is expected to ensure a non-threatening and supportive classroom environment that provides students with appropriate learning activities to encourage pupils to explore, reason and make decisions.

Although this investigation is about mathematics teaching, "any theory about teaching would be based on one about learning" (Begg, 1999: 2). Hence it is important to consider the learning theories on teaching that influence mathematics education in New Zealand. According to Begg the latest curriculum document of New Zealand leans towards constructivism. Thus it is appropriate to briefly discuss the constructivist approach to education. Zevenbergen (1996) discusses how constructivism represents a distinct break

from the passive reception of knowledge to a more active process of meaning-making. This implies that pupils will construct ideas and find their own answers rather than follow the 'direct instruction' of the teacher. Lane (1999: 2) supports this view stating "Knowledge is built up within the mind as a process of building on what a person already knows." Therefore the constructivist perspective of learning mathematics knowledge expects that the teacher's role is to provide appropriate guidance and classroom environments and learning activities such that students are given opportunity to construct their own knowledge (Cobb, 1994 cited in Moyer, Cai & Grampp, 1997).

Some needs of immigrant students

New Zealand, and especially Auckland, classrooms are multicultural and this has implications for the teaching and learning of mathematics. Barton (1995) states that the number of Asian immigrants in some schools in Auckland increased from 5% to 30% in a five-year period from 1988. Immigration has culturally influenced mathematics education in New Zealand. Barton adds that these immigrant students have their own cultural values, like giving top priority to education, and unquestioning respect for elders and teachers. As a result, these students exhibit a preference for the more traditional 'direct instruction' mode of teaching. Barton further points out that this transmission mode of teaching is also preferred by Pacific Island students who sometimes experience difficulty in classrooms where the more European values of questioning, doubting, and justifying one's thinking are integral to mathematics learning. Many immigrant students come from a background of teacher-led, direct transmission approach to teaching and learning, thus favouring a more rule-bound, formal mathematics. Therefore it follows that immigrant children might need a lot of encouragement and guidance, perhaps much more than the non-immigrant children, when it comes to problem solving, questioning and critical thinking.

Another major issue for teachers who have immigrant students in their classrooms is that of language. Thomas (1997) says that there is this notion among some people that students do not need English to study mathematics as mathematics is really about

symbols. This is questioned by Barton (1995: 155) who asks "How do you teach mathematics to a student who cannot understand English?" Thomas points out that the immigrant children who come from non-English speaking backgrounds will probably need more time to learn mathematics than those from English speaking backgrounds. Therefore the school curriculum needs to be so structured that the issue of time for language development is taken into consideration with appropriate provision of ESOL staff to provide language-support.

A strategy promoted to raise self-esteem, motivation and achievement in students is co-operative learning as it helps students explore mathematical concepts in an interactive problem solving setting (Croom, 1997). Co-operative learning experiences can prove to be very beneficial in a multicultural classroom as some immigrant students who come from lower socio-economic or non-English speaking backgrounds (NESB) need good models and specific instruction. It can be helpful for them to learn through their peers where they could improve and how their work can meet the expected standards (Thomas, 1997).

Other strategies that meet the needs of immigrant students is the use of concrete materials and diagrams, encouraging them to talk about ideas in their own language first through allowing children of the same language background to work together (Thomas, 1997), and acknowledging the ways of thinking that immigrant children can bring to the classroom. These different thought processes are embedded in the cultures of immigrant children and can impact on the mathematics culture of a multicultural classroom. It is important for the teacher to implement diverse ways of providing a mathematics learning environment that is inclusive of the immigrant children in the classroom.

Both Peressini (1997) and Croom (1997) propose that schools and teachers should devise strategies that encourage family involvement of all students in mathematics education as well as general school matters. Parents certainly want the best for their children and such partnerships will strengthen mathematics education and make it more meaningful.

Family involvement is particularly useful in a multicultural school because the cultural and background needs of the immigrant children can be discussed with their families, making it easier for teachers to understand differences and enrich the mathematical experiences for these students.

The New Zealand mathematics curriculum

As mentioned earlier, constructivism underpins the New Zealand mathematics curriculum. This is suggested by the recommendations within the document (Ministry of Education, 1992: 11):

(Concept learning) should be taught in such a way that students develop the ability to think mathematically. Students learn mathematical thinking most effectively through applying concepts and skills in interesting and realistic contexts, which are personally meaningful to them.... Rather than remembering the single correct method, problem solving requires students to search the information for clues and to make connections to the various pieces of mathematics.

Further, the New Zealand mathematics curriculum espouses "... that mathematics is for all students, regardless of ability, background, gender or ethnicity" (p.12) and that opportunity is to be provided to all students to achieve to their maximum potential. This suggests that immigrant students are entitled to receive mathematics education such that they too are enabled to achieve high standards. The document recommends flexibility in teaching time and style to permit pupils to develop at their own rate. This is of particular importance to immigrant students because, as suggested earlier, some immigrant students need more time to learn mathematics than other students due to language barriers. Constructivism implies that the learning objectives *will* allow the curriculum to be flexible and also assumes that students *would* look for their own answers rather than be led totally by the teacher.

The curriculum stresses the need to apply mathematics to the real world and to make it meaningful for the student. Therefore it is important that the teacher encourages students to make links with real life situations and these will vary for different cultures, languages and socio-economic situations. The curriculum also strongly emphasizes a problem-solving approach and liberal use of activities to cater for a range of interests of pupils (Begg, 1999; Knight & Meyer, 1996). Assessment in constructivism focuses on informal assessment and involves greater participation of the learners. This is in contrast to traditional assessment tasks that are behavioural in nature. Thus assessment should reflect the constructivist premise of process being as important as product (Haynes, 1996) and particularly aimed at valuing the participation of immigrant students.

Gathering the data

The study was conducted in an urban primary school in New Zealand. This particular school has a large number of immigrant children and thus suited the purposes of this investigation. Consent for the study was obtained from the principal and classroom teachers of the school. Twenty teachers, teaching new entrants to year six students participated in the study. The teachers represented a variety in age and teaching experience ranging from beginning teachers to teachers with thirty-five years of teaching experience. The data was collected through official documents and questionnaires.

Official records were scrutinized to show ethnic breakdown of the school. The ethnicity by percentage shows that most of the students of this school are immigrants, of which more than half are Indians and Asians. The predominance of Indian and Asian students in the school sets the tone for certain cultural values, attitudes and needs associated with these immigrant students.

Teacher-responses were analyzed qualitatively. The use of open-ended questions helped gain insight into the practices followed in the school regarding the mathematics education of immigrant children. This showed the degree to which the teachers adopted particular strategies thus establishing a trend with respect to the learning and teaching of

mathematics in a multicultural environment. The patterns and trends that arose from the data were analyzed against a theoretical background of the literature reviewed.

Discussion of findings

Three major issues arose addressing the mathematics education of immigrant students: problem solving; parent expectations and attitude towards mathematics education; and language barriers.

- **Problem-solving in mathematics education**

Almost all the participants reported that their immigrant students favoured the 'teacher-led' style of mathematics education and many commented that these students, in particular, experienced difficulty in problem solving situations. This reflects Barton's (1995) findings that immigrant students exhibit a preference for the more traditional 'direct instruction' mode of teaching. This suggests that the transmission mode of knowledge-gain preferred by immigrant students is distinctly different from the constructivist approaches of *Mathematics in the New Zealand curriculum* (Ministry of Education, 1992).

- **Parent expectations and attitude towards mathematics education**

About half the participants stated that they did not involve families of immigrant students in the mathematics education of their children. The remaining participants who claimed to involve families did so through homework sheets and parent interviews. This suggests that there is a lack of meaningful involvement of families of immigrant students in the mathematics education of their children. Making contact with parents and involving them in the education of their children, especially in a multicultural school, will strengthen mathematics education and make it more meaningful (Croom, 1997; Peressini, 1997). Further studies have indicated that involvement of parents in the education of their children is one of the criteria for success, in particular Davidson and Kramer (1997) in their research with African-American students.

Most of the participants agreed that immigrant students place high value on mathematics. Expectations of parents of immigrant students most commonly reported by the teachers were related to formal mathematics education, with emphasis on basic facts and computation, bookwork, plenty of homework and a strong emphasis on marks and grades. This implies that the parents of immigrant students place very high value on summative success and achievement which could be a source of tension against the problem-solving nature of the current mathematics curriculum, with its process-based, non-traditional approach to mathematics learning. Schools have a role to play in increasing parents' awareness that the New Zealand mathematics curriculum emphasizes mathematical understanding rather than mathematical training. Clarification on assessment is required, explaining how constructivism advocates the formative aspect of the teaching/learning process, which does not focus on 'right answers' alone but on the ability to apply knowledge (Begg, 1999). This would help in bringing about a change in parent expectations and contribute towards making the teaching and learning of mathematics, according to the New Zealand mathematics curriculum, more effective for immigrant students.

• **Language barriers to mathematics education**

More than half of the participants agreed that their immigrant students often have problems understanding English. This is a significant factor that hinders quality mathematics education of immigrant children and poses a barrier when it comes to problem solving in mathematics. Croom (1997) has emphasized that all students irrespective of their diverse ethnic groups must be given the same opportunity to learn higher-level mathematics concepts and develop reasoning and analytical skills. Today this is a challenge that many teachers have to face: making available opportunities to develop higher-order skills in mathematics to students who may not understand English well.

More than half of the participants agreed that they often allow their immigrant students of the same language to work together during mathematics sessions. This indicates that they

believe this strategy to be useful in mathematics education when catering to the needs of immigrant students. Further, the results of this study show that immigrant students are given extra help through ESOL programmes. Though the ESOL programme is generic and not specifically aimed at supporting mathematics education, the help provided by this programme in improving the English language of immigrant students will be transferred to mathematics education. This definitely aids students in the learning of mathematics and also makes mathematics teaching easier for teachers. This has the support of Thomas (1997) who recommends the selection of ESOL staff to provide support across all curriculum areas.

Implications for teachers

This study has revealed some of the needs of immigrant students with respect to mathematics education and the strategies for making mathematics education in the New Zealand context more meaningful to them. The student population of the particular school used for the purposes of this study, though multicultural, is predominantly Asian and Indian. Hence a generalization cannot be made, as the findings of this study may not be applicable to all immigrant groups. This suggests a need for further research to ascertain whether the needs of immigrant groups other than Indians and Asians are similar to, or different from, the groups in this study and whether the strategies discussed are suitable to all ethnic groups.

A major barrier for mathematics education that arises is the lack of understanding of the English language among immigrant students. Teachers must recognize this fact while delivering mathematics education. A useful strategy that helps to overcome this to some extent is the formation of study groups comprising of pupils of the same language. This makes the learning and teaching of mathematics in a multicultural classroom less complex for the teacher and more effective for the learner.

The investigation has indicated that the English language barrier is a crucial contributing factor for immigrant students who experience difficulty problem solving. Problem

solving is an important aspect of the current New Zealand mathematics curriculum and thus it becomes imperative to help immigrant children feel comfortable with problem solving. Thus further investigation is needed to explore whether immigrant students have difficulty problem solving *per se* or is this difficulty experienced only due to language issues?

It is important for teachers to capitalize on the high value placed on mathematics education by immigrant students and their parents. One strategy is to increase the involvement of families of immigrant students, making them aware of the principles, processes and assessment in New Zealand mathematics education. Although the high expectation for mathematics education of these students and their parents is a positive factor, the students need support in transferring from a traditional teacher-directed mode of instruction towards approaches in line with the constructivist underpinning of the New Zealand mathematics curriculum.

This study is based on the perceptions of teachers and it shows that they make every effort to strike a balance between catering to the needs of immigrant students and providing mathematics education of the highest quality within the framework of the New Zealand mathematics curriculum.

References

- Barton, B.** (1995). Cultural issues in mathematics education. In J. Neyland (Ed.), *Mathematics education: A handbook for teachers, Vol 2* (pp. 150 – 164). Wellington: Wellington College of Education.
- Begg, A.** (1999, July). *Learning theories and mathematics: A, B, C, D and E*. Paper presented at the sixth biennial conference of the New Zealand Association of Mathematics Teachers, Dunedin, New Zealand.
- Croom, L.** (1997). Mathematics for all students: Access, excellence, and equity. In J. Trentacosta & M. Kenney (Eds.), *Multicultural and gender equity in the mathematics classroom: The gift of diversity* (pp. 1 - 9). Reston, VA: National Council of Teachers of Mathematics.
- Davidson, L., & Kramer, L.** (1997). Integrating with integrity: Curriculum, instruction, and culture in the mathematics classroom. In J. Trentacosta & M. Kenney (Eds.), *Multicultural and gender equity in the mathematics classroom: The gift of diversity* (pp. 131 – 141). Reston, VA: National Council of Teachers of Mathematics.
- Haynes, M.** (1996). *Influences on practice in the mathematics classroom: An investigation into the beliefs and practices of beginning teachers*. Unpublished master's thesis, Massey University.
- Knight, G., & Meyer, D.** (1996). *Critical factors in the implementation of the mathematics curriculum*. Auckland: Massey University.

- Lane, R.** (1996, July). *A model for teaching and learning mathematics*. Paper presented at the sixth biennial conference of the New Zealand Association of Mathematics Teachers, Dunedin, New Zealand.
- Ministry of Education.** (1992). *Mathematics in the New Zealand curriculum*. Wellington: Learning Media.
- Moyer, J., Cai, J., & Grampp, J.** (1997). The gift of diversity in learning through mathematical exploration. In J. Trentacosta & M. Kenney (Eds.), *Multicultural and gender equity in the mathematics classroom: The gift of diversity* (pp. 151 - 163). Reston, VA: National Council of Teachers of Mathematics.
- Peressini, D.** (1997). Building bridges between diverse families and the classroom: Involving parents in school mathematics. In J. Trentacosta & M. Kenney (Eds.), *Multicultural and gender equity in the mathematics classroom: The gift of diversity* (pp. 223 - 229). Reston, VA: National Council of Teachers of Mathematics.
- Thomas, J.** (1997). Teaching mathematics in a multicultural classroom: Lessons from Australia. In J. Trentacosta & M. Kenney (Eds.), *Multicultural and gender equity in the mathematics classroom: The gift of diversity* (pp. 34 - 45). Reston, VA: National Council of Teachers of Mathematics.
- Trentacosta, J., & Kenney, M.** (Eds.). (1997). *Multicultural and gender equity in the mathematics classroom: The gift of diversity* (pp. vii - viii). Reston, VA: National Council of Teachers of Mathematics.
- Zevenbergen, R.** (1996). Constructivism as a liberal bourgeois discourse. *Educational Studies in Mathematics*, 31, 95 - 113.

Kavita Baluja is a teacher at Manurewa Intermediate School. She taught in primary schools overseas for twelve years, before migrating to New Zealand two years ago
rajbaluja@xtra.co.nz