Cultural Conflicts in Mathematics Education: Developing a Research Agenda

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Research on ethnomathematics within the last ten years has opened up some new possibilities for developments in mathematics education, particularly in situations where cultural conflicts potentially exist. In this paper I shall explore the "culture conflict" construct with a view to developing a possible research agenda.

Up to ten years ago, mathematics was generally assumed to be culture-free and value-free knowledge; explanations of "failure" and "difficulty" in relation to school mathematics were sought *either* in terms of the learners' cognitive attributes or in terms of the quality of the teaching they received; there were several attempts to make mathematics teaching more affectively satisfactory to the learners, with few long term benefits; and "social" and "cultural" issues in mathematics education research were rarely considered.

Within the last ten years, there has been an increasing move to make *mathematics* accessible to *all* learners; there has been an increasing questioning of the relevance of ex-colonial models of education in developing countries, and in countries with indigenous "minorities"; the social dimension has come into greater prominence in research in mathematics education; and the cultural nature of mathematical knowledge has become clearer to many mathematics educators [see Keitel *et al.*, 1989].

Three important research approaches are shaping the recent work on ethnomathematics, with the following foci:

a) Mathematical knowledge in traditional cultures, e.g. Ascher [1991], Zaslavsky [1973], Gerdes [1985], Harris [1991], Pinxten [1987]. This research is informed by an *anthropological* approach, emphasising the uniqueness of particular knowledge and practices in relation to different cultures. Languages are also of significance in these studies, together with the values and customs of the cultural groups concerned.

b) Mathematical knowledge in non-Western societies, e.g. Ronan & Needham [1981], Joseph [1991], Gerdes [1991]. This research has a *historical* flavour, relying as it does on past documents, rather than on present practice.

c) Mathematical knowledge of different groups in society, e.g. Lave [1984], Saxe [1990], de Abreu [1988] Carraher [1985]. This research has a *socio-psychological* emphasis, where the focus is on actual practice. The particular mathematical knowledge is socially constructed by the groups who are engaging in the specific practices.

Underlying all this research is the fundamental epistemological question: Is there one mathematics appearing in different manifestations and symbolisations, or are there different mathematics being practised which have certain similarities? From an educational perspective, however, the concerns are generally focussed by the implications of the differences between the mathematical knowledge of different cultural groups.

For example, within current educational practices we can recognise that efforts to develop multi-cultural mathematics education have produced violent hostility in several education quarters. Many schools, and teachers claim "we don't have that problem in our school", and "real" mathematics is still felt to have "powerful" connotations within many educational systems, mitigating against efforts to broaden the mathematics curriculum.

Cultural conflicts

The area I want to address in this paper concerns the research issues deriving from the different interpretations and responses to cultural conflicts in mathematics education. In my book *Mathematical enculturation: a cultural perspective on mathematics education,* [Bishop, 1988] cultural conflicts were not specifically addressed. The ideas of cultural difference and similarity did play a large role in the first part of the book, where different kinds of mathematical knowledge and cultural values were analysed. However, after demonstrating what I called the "pan-cultural" nature of mathematical *activity*, the educational analysis followed the enculturation path, in which the principal assumption made was of cultural consonance. Thus, the focus in the second half of the book was on the mathematical education of young people born into, *and assumed to be experiencing no conflict with,* a Westernised, mathematico-technological, society and its associated culture (MT).

This assumption of cultural consonance has generally been for many years tacit, accepted, and unproblematic. Despite continual concerns about the difficulties children have learning mathematics and about the feelings of anxiety provoked by much mathematics teaching, explanations have been sought elsewhere. Societal explanations have been raised about the pressure on everyone to learn mathematics, psychological explanations have been developed about the ability of everyone to learn mathematics, and pedagogical explanations have been sought about the ability of teachers and materials to make mathematics accessible to all. Cultural consonance has also been assumed because of a general lack of understanding of mathematics

as cultural knowledge, and a lack of awareness of any values underlying mathematical knowledge. For many people still, mathematics is culture-free and value-free knowledge. As was made clear in *Mathematical enculturation,* one of the reasons for writing that book was precisely to explode the "culture-free" myth.

As soon as mathematics is understood as culturally-based knowledge, largely through an awareness of cultural forms of mathematics which are different from that of MT culture, then a general educational assumption of cultural consonance becomes invalid. One is made starkly aware of the fact that many young people in the world are experiencing a dissonance between the cultural tradition represented outside school (for example in their home or their community) and that represented inside the school. Moreover one can argue that although this is very likely to be the case for children in rural societies in Africa and Asia, for example, it is also a plausible scenario for young people in many other societies as well, such as those where "Westernisation" has happened rapidly, or where the Islamic religion defines the cultural norm.

For focussing on research ideas, however, I believe it is important to make a more radical assumption, namely that all formal mathematics education is a process of cultural interaction, and that every child experiences some degree of cultural conflict in that process. This I believe is a plausible assumption to make, on the bases that schools are different social institutions from others such as homes, that they have been established to do what homes and other institutions cannot do, and, furthermore, that a great deal of research has already documented such conflict.

The UNESCO publication *Mathematics, education, and society* [Keitel, 1989] which is a report of the Special Day's proceedings in ICME 6, demonstrates that among the groups for whom conflict with, and alienation from, school mathematics exists are:

— ethnic minority children in Westernised societies
— second language learners
— indigenous "minorities" in Westernised societies
— girls in many societies
— Western "colonial" students
— fundamental religious groups, often of a non-Christian nature
— children from lower-class and lower-caste families
— physically disadvantaged learners
— rural learners, particularly in Third World communities

The conflicts appear to vary and concern some or all of the following:

— language
— geometrical concepts
— calculation procedures
— symbolic representations
— logical reasoning
— attitudes, goals, and cognitive preferences
— values and beliefs

In such a situation, educational decision-making in mathematics takes on a new order of complexity. The assumption of cultural consonance implied a conceptually unproblematic educational future—a future of cultural continuity, albeit with a critique encouraged from within, and in terms of the existing cultural norms. In a sense, mathematical *enculturation* seemed a natural, educational evolutionary process, well interpretable within the already established frames of mathematics education.

By contrast, in situations of dissonance between out-of-school and in-school cultural norms, it is very unclear what the educational task should be. Cultural continuity becomes a meaningless term, or should at least be treated problematically. The established theoretical constructs of mathematics education, developed through a research history which has failed to recognise cultural conflicts, are at best misleading, and at worst irrelevant and obstructive. The task of exploring the teaching and curricular implications of cultural dissonance seem to be of a totally different order.

One way to make a start on this task is to analyse the similarities between situations of conflict, and between the experiences of different alienated groups. Hitherto mathematics educators have been reluctant to do that, with their research focussing on, and remaining within, the problem-space of any one group (for example, ethnic minority students, girls, or second language learners). Not only have mathematics educators not looked across different groups *within* their field, they have failed to look across at similar conflict situations experienced in history education, TESOL education, or religious education, to name but three areas. Therefore, it is helpful, I believe, to begin to recognise and analyse similarities between the responses of educators to those different situations of conflict. The table (see next page) represents a first attempt to do this, based on the existing research in mathematics education, which is limited but helpful nevertheless.

As was indicated earlier the predominant traditional view of mathematics education was a "culture-blind" view, and this view still prevails in the vast majority of mathematics classrooms around the world, in my estimation. The view is essentially a corollary of understanding the "universality" value of Western mathematics as implying a culture-free knowledge domain. The reality is that Western mathematics developed the value of the universal applicability and validity of its statements. That however does *not* suggest that this knowledge domain is in any way culture-free, nor value-free.

Assimilation approaches are demonstrated by the many attempts to introduce mathematical ideas and practices from different cultures. Zaslavsky's article [1991] illustrates this multi-cultural approach.

In accommodation approaches, the argument is taken further and rather than just adding interesting examples to the normal curriculum, attempts are made to restructure that curriculum. This is perhaps one of the differences between a multi-cultural approach and *critical mathematics education,* which also argues for such a restructuring [Skovsmose, 1985]. Ethnomathematical research such as Pompeu's [1992] also tries to tackle this problem area.

Amalgamation approaches argue for an increased involvement of the particular community's adults in the education process. Bilingual and bicultural team-teaching experiments in Australia and New Zealand demonstrate the limitations of the two previous approaches. [Barton, 1990; Harris, 1988]

Approaches to culture conflict	Assumptions	Curriculum	Teaching	Language
Culture-blind Traditional view	No culture conflict	Traditional Canonical	No particular modification	Official
Assimilation	Child s culture should be useful as examples	Some child's cultural contexts included	Caring approach perhaps with some pupils in groups	Official, plus relevant contrasts and remediation for second language learners
Accommodation	Child s culture should influence education	Curriculum restructured due to child's culture	Teaching style modified as preferred by children	Child s home language accepted in class, plus official language support
Amalgamation	Culture's adults should share significantly in education	Curriculum jointly organised by teachers and community	Shared or team teaching	Bi-lingual. bi-cultural teaching
Appropriation	Culture's community should take over education	Curriculum organised wholly by community	Teaching entirely by community's adults	Teaching in home community s preferred language

At the appropriation level, the cultural conflicts caused by a Western schooling being imposed on, or adopted by, a non-Western community, are addressed by the take-over of that schooling by the community Gerdes [1985] discusses examples of this approach and Pinxten [1987] offers a theoretical rationale for developing this approach further

A possible research agenda

Various challenging questions are now raised by this kind of analysis, and here I will refer to just three aspects of research, which relate to the three levels of curriculum: intended, implemented, attained This structuring has been chosen to expose the three significant levels of cultural conflict recognition, and thus potential resolution.

1. **Regarding the mathematical knowledge as represented in the intended curriculum**
   Here we are becoming more aware of the need to consider three very different educational structures, and among the possible questions, the following seem the most promising:

a) *Formal mathematics education*
   What theories could influence the "culturalising" of the formal mathematics curriculum? How should, and could, a curriculum be restructured in relation to a local culture? The six-activity approach [Bishop, 1988] is one way—what are others?
   What values are developed within the current school mathematics curriculum? Values are rarely explicitly referred to in mathematics curricula, and research which reveals the hidden values is sorely needed. What other values can be emphasised?
   What criteria should be used to evaluate an appropriate intended mathematics curriculum in a culturally pluralistic society? There is no suggestion that a universal multi-cultural curriculum for mathematics education should be developed, but the determining of *criteria* for evaluating curricula would be a significant step forward

b) *Non-formal mathematics education*
   What roles are non-school alternatives fulfilling in relation to cultural conflicts? Are these alternatives on the increase? To what extent is the increase a measure of the communities' satisfaction with formal mathematics education? It is high time that more research looked at the relationships between formal and non-formal mathematics education, and this area of cultural conflicts offers a particularly important focus.

c) *Informal mathematics education*
   In what sense are informal societal and community influences on mathematics learners *educational*? How can we learn to document their influences, in order to point up cultural obstacles and barriers which they create for mathematics learners?

2. **Regarding implementing a mathematical knowledge environment in schools and classroom**
   Here there are three main research avenues which are worth exploring further:

a) *Implementing a "culture-blind" intended mathematics curriculum*
   To what extent can a "culture-blind" intended mathematics curriculum be made less of an obstacle to learning in the classroom? Given that changing the

intended curriculum has proved difficult, largely I believe because of the inadequate research base for many of the claims, what can be done at the classroom level? Research here can usefully be focussed on the cultural framing, and hidden assumptions involved, in classroom activities.

Can mathematical learning activities be usefully characterised as more-or-less "open" in relation to their cultural framing?

b) *The mathematics teacher as social anthropologist*

What outside-school mathematical knowledge do teachers recognise as legitimate inside the classroom? What knowledge about the learners' cultures can help mathematics teachers with their classroom decision-making? More fundamentally, how do teachers recognise cultural conflict in their classrooms?

c) *Multi-cultural mathematics classrooms*

What teaching strategies do mathematics teachers adopt if they recognise their classrooms as being multicultural? I describe some of my feelings about strategies as a result of my classroom experiences in [Bishop, 1991].

What values exist in the knowledge environment created by mathematics teachers in their classrooms?

3 **Regarding the mathematical knowledge attained by the learners**

What outside-school mathematical knowledge do learners recognise as legitimate inside the classroom? [e.g Bishop and Abreu, 1991]

What cultural conflicts are actually experienced by mathematics learners and how do they cope with them?

Is "cultural distance" of their home mathematical culture from the school mathematical culture a sensible construct? If so, how does it relate to the quality of their mathematical learning in classrooms?

In what sense does bi-cultural mathematical learning differ from bilingual mathematical learning?

What are the implications of all these questions for determining the appropriateness of any mathematical assessment procedures?

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