CONCEPTUALISING CULTURAL AND SOCIAL CONTEXTS IN MATHEMATICS EDUCATION

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1. INTRODUCTION

As I write this paper I have been in Australia now for nine hectic months and I can assure you that I have absolutely no regrets about my move! I am delighted to be part of the vibrant mathematics education community in Australia and it is a great honour for me to be invited to give the opening plenary address to MERGA-16.

The theme of the conference is "Contexts in Mathematics Education" and is in my mind, a thoroughly appropriate theme for MERGA at this time. The economic and political context is shaping much of our thinking, and indeed our work, in mathematics education at present and it is highly appropriate for us to be thinking about how contexts should, and could, be considered in relation to research in mathematics education.

Those of you who know my work will know that I have a particular research interest in social and cultural contexts, although I have been known to engage in shaping the political context as well. I hope however that what I say today will help to inform your thinking about contexts in general - so even if most of my examples will be from the cultural and social fields, I shall be choosing them in order to address issues in other contexts - economic, environmental, and indeed conceptual.

2. CONSTRUCTIVE ALTERNATIVISM

I chose that word `conceptualising' for my title because I believe that conceptualising is the key problem which needs to be addressed in considering contexts. I am a constructivist from way back, but not from the von Glasersfeld `camp'. My thinking was critically influenced by George Kelly's writings. He published two volumes called "The psychology of personal constructs" in 1955; but more accessible is "Inquiring Man" by D. Bannister and F. Fransella (Penguin, 1971). Kelly believed that if psychology is concerned with describing human learning and behaviour then one surely ought to be able to recognise oneself somewhere in the descriptions. As Bannister says (p.16) "unless you are the very modest kind of man who can see himself as the stimulus jerked puppet of learning theory, the primitive infant of psychoanalytic theory, or the perambulating telephone exchange of information theory" then "the model man of personal construct theory will look recognisably like you".

Kelly's core idea was "constructive alternativism" and as one might expect from a psychotherapist he was often professionally concerned with the situation which he graphically described as "hardening of the constructs". As educators and teachers we are of course also concerned with influencing that condition, but we must attend to Kelly's self-reflexive admonition if we are going to develop our research. We need to be loosening our own constructs and our own conceptualisations through, and with, our research. Kelly's person is also an experimenting person, creating constructs to give meaning to experience and testing out the predictive validity of those constructs.

Changing and developing our constructs can be a more or less emotional experience depending on how deep or how superficial they are for us. If a new experience can be assimilated relatively easily into one's existing schema (to use some Piagetian terminology) then it may only be a matter of adjusting one's surface constructs. If however a new experience requires accommodating one's schema then it is likely to involve some re-shaping of some of one's core constructs. Accommodation is always more painful than assimilation.

3. SOCIAL AND CULTURAL DEVELOPMENTS IN RESEARCH

Social and cultural developments in mathematics education are forcing the same kinds of accommodation and core construct adjustment on us and on our research. 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.

I chose the `ten year' time scale because 1983 was a time when I was lobbying for far greater attention to be paid to social aspects of mathematics education within the ICME framework. In the 1984 ICME there was an important plenary address by Ubi d'Ambrosio "socio-cultural bases for mathematics education" and an equally important Theme Group concerned with the theme of "Mathematics for All" but it was not until the 1988 ICME that it was accepted as a sufficiently important area to warrant a whole day being given over to the theme of "Mathematics, Education, and Society". It was a highly successful day with some 90 contributors from over 40 countries, and many congress participants attended. Interestingly, though, many others took the opportunity of having another day's excursion. There were some strong views expressed about 'the day' and its contents, ranging from those which held that these ideas were not appropriate in a conference on mathematics education, through to others which held that the organisers didn't go far enough and that they merely scratched the surface of the real issues.

What that day and its surrounding publications did do was to force some serious core construct adjustment within the mathematics education community. As Kelly would have said - "the world never looked the same again".

However, research practice, in my view, is only slowly coming to terms with the changing conceptualisations. The recent "Handbook of Research on Mathematics Teaching and Learning" (D. A. Grouws, MacMillan 1992) demonstrates well both the progress which has been made, but also the limitations which remain. There are chapters by Terezinha Nunes on "Ethnomathematics and everyday cognition", by Marilyn Nickson on "The culture of the mathematics classroom", and by Walter Secada on "Race, ethnicity, social class, language, and achievement in mathematics". There are also references to social and cultural issues in some of the other chapters.

If we were to use a social dimension like the following, as a kind of category system for current research activity

Cultural
Societal
Institutional
Pedagogical
Individual

I believe we would find a genuine interest in the cultural and pedagogical levels, but only a limited interest in the others. I would conjecture that this is largely to do with the fact that research has not yet come to terms with either the practical complications of researching social aspects, or the value-laden, even moral, issues of researching educational phenomena from a social perspective.

Our field of research has, I believe, developed from three principle traditions, and their interactions. These traditions I call the Pedagogue, the Empirical Scientist, and the Scholastic-Philosopher. Each of these has a history and each is alive and well at present. They are all research traditions because they all relate to the three key components of any research activity in our field -enquiry, evidence, and theory - but they relate to them in different ways as illustrated in this table:

	Goal of Enquiry	Role of Evidence	Role of Theory
Pedagogue tradition	Direct improvement of teaching	Providing selective and exemplary children's behaviour	Accumulated and shareable wisdom of expert teachers
Empirical-scientist tradition	Explanation of educational reality	Objective data, offering facts to be explained	Explanatory, tested against the data
Scholastic-philosopher tradition	Establishment of rigorously argued theoretical position	Assumed to be known. Otherwise remains to be developed	Idealised situation to which educational reality should aim.

It is clear that the constructs and conceptions which have come from our research traditions have helped develop the field of knowledge of mathematics education profoundly. Arguably our field is the most developed of any curriculum subject field.

But it is also clear to many mathematics educators that our research practices are no longer adequate to meet the challenges of today. In particular it is now clear that we have to begin to examine critically our research practices and our value-laden constructs if we are to make more progress in developing our social and cultural knowledge.

There is to be an ICMI study on "What is research in mathematics education, and what are its results?" and I hope that many of us here will play our part in shaping the debate and its outcomes. Already you can see what I mean about the need to question the constructs being used, when you reflect on the nature of the two questions used in that title!

Let me now indicate some ways in which we might address our constructs and our research practices, in relation to the theme of `context'.

4. RECONSTRUCTING CONTEXT (examples of research studies will be presented at the conference)

a) If we consider how context is constructed in research and theory writings, we can recognise ideas of `environment', of constraints, of imposed procedures, of applications, of sources of problems, of pressure groups, of boundaries, and others.

(b) We can recognise context as `external' in the sense of material environment, as well as `internal' in the sense of a learner's innate abilities.

(c) We can see a dimension of context such as the following:

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Imposed control	Constraining influence	A neutral `Milieu'	Modifiable in certain aspects	Completely under one's control

which extends from a `negative' to a `positive' image, from being `trapped' to being `free'.

(d) We can recognise a fundamental difference between `context as constructed' and `context as determined'. You can choose to construct your context as either controllable or not.

(e) With the example of the social dimension as described earlier:

cultural
societal
institutional
pedagogical

individual

we see an image of concentric circles of increasing contextual influence centring on the individual learner. We must also recognise that there are different people involved in the different `circles of influence', and therefore that one person's situation may well be another person's context. As Kelly pointed out, I am part of your context and you are part of mine.

5. RECONSTRUCTING RESEARCH PRACTICES (examples of research studies will be presented at the conference)

Context enters research practices in various ways:

- as a source of research problem
- as an environment from which one samples materials, examples, actions, situations
- as people from whom one seeks data
- as a situation to which respondents refer
- as a source of research control
- as a source of research funding
- as a source of explanatory data
- as a constraint on research practice

We can thus distinguish:

(a) a context of a research study

(b) context in a research study

As interest in the latter grows, there is a need to relate practical decisions concerning context to the constructions of the previous section. Conceptualisations of context are becoming just as important as conceptualisations of the principal variables in a research study. There are many significant consequences which flow from these reconstructions.

From my own work on cultural and social aspects of mathematics education, I have found it increasingly necessary to attend to contextual constructs. For example, in considering cultural conflicts in mathematics learning I find it necessary to distinguish the following educational situations:

Approaches to culture conflict	Assumptions	Curriculum	Teaching	Language
Culture-free 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 langauge 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 langauge.

This kind of analysis makes us aware of critical questions such as:

- what should the research process be focussed on?
- who should decide on the research problems?
- who should carry out the research?
- where should it be situated?
- what data will be relevant?
- what use could be made of my ideas?

A moral dimension enters into all of these questions in a way which it normally doesn't if context is not taken seriously. This can be felt to be a drawback to some researchers. Also however, such considerations can significantly enrich the development of research agendas.

6. EXAMPLE RESEARCH AGENDA

As an example of how a research agenda can develop from these ideas, I offer the following related to my own area of focus - cultural conflicts.

1. Regarding the mathematical knowledge as represented in the intended curricula

(a) Formal mathematics education

How should the mathematics curriculum be culturalised?
What values are developed within the current mathematics curriculum?
What is an appropriate intended mathematics curriculum for a pluralistic society?
Who determines this mathematics curriculum?

(b) Non-formal mathematics education

What role are non-school alternatives fulfilling in relation to cultural conflicts?
Why are they on the increase?
Is their increase a measure of communities' satisfaction, or their dissatisfaction, with formal education?

(c) Informal mathematics education

In what sense are societal and community influences on mathematics learners educational?

2. Regarding the mathematical knowledge environment in classrooms

(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?
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 curriculum decision-making?

(c) Multi-lingual and multi-cultural mathematics classrooms

What teaching strategies can mathematics teachers usefully adopt in multi-lingual and multicultural classrooms to stimulate all learners? What kind of knowledge environment can mathematics teachers create in multi-cultural classrooms?

What language strategies are most effective in multi-lingual mathematics classrooms?

3. Regarding the mathematical knowledge attained by the learners

What outside-school mathematical knowledge do learners recognise as legitimate inside the classroom?

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

How does the `cultural distance' of their home mathematical culture from the school mathematical culture relate to the quality of their mathematical learning in classrooms?

How does bi-cultural mathematical learning differ from bi-lingual mathematical learning?

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

7. IN CONCLUSION

An academic conference is an excellent situation in which to compare, and to extend, one's constructs. The area of `context' is one in which construct extension is crucial at the present time, as mathematics education develops into a global field, with implications at all age levels, and in all spheres of human activity. Research needs to recognise this, and needs therefore to be consciously and critically appraising the ways in which all contexts are addressed.