

Book Review...Mathematics Education Research: Past, Present and Future: Reflections on an Analysis

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M.A. (“Ken”) Clements and Nerida Ellerton (1996) have written a most compelling and provocative book called “Mathematics Education Research: Past, Present and Future” that raises some crucial questions for anyone engaged in research in our field. The authors are two highly experienced and committed researchers who are seeking a paradigm shift in the way we think about research in our field. Neither of the authors is new to controversy and its consequences, and there are bound to be some strong reactions to their controversial ideas and expressions. I hope however that the book will be read and critiqued in the way the authors intended: namely, as a challenge to existing paradigms and mind-sets, and as a stimulus to finding new and more appropriate research stances and approaches.

Ostensibly, the main context of the book is the Asia-Pacific region, but there are plenty of other contexts where I believe the authors would argue that research has lost sight of its crucial role. The book is certainly not a bland survey of research, such as might be found in Chapter 2 of a cautious thesis. Nor does it present a balanced, impartial, or representative view of research. It is a focussed, highly partial, and idiosyncratic view, and is all the more interesting for that. We have so few ‘straight-from-the-shoulder’ research reviews that this makes welcome and refreshing reading. I often wish that more writers would make their assumptions and values clear when discussing research issues. With Clements and Ellerton you won’t die wondering!

It is therefore a book to be read, which is perhaps a strange thing to say—except that I wonder how many people reading this paper have actually read from cover to cover the two handbooks of research on mathematics education, Grouws (1992) and Bishop et al. (1996), which **were** intended to be reference books? This book gives the initial impression of being a review of research, and in some sense it does do that job. But it is not a good reference book, and as the authors admit, it is not intended to just do that job. It is not laid out in a standard, subject focussed way, and the chapters often have what seem to be rather surprising sub-sections. The headings of Chapter 2 for example will give a good flavor of the whole book. The chapter is titled “What are the Basics in Mathematics Education?” and it has four main sections, with the following sub-sections:

- The Politics of Mathematics Education

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- > Round pegs in square holes (about working with students in Papua New Guinea in 1980)
- > Sacrificial lambs (the imposition of ‘foreign’ basics on indigenous groups)
- > Who should make curriculum decisions?
- > Language and Garma (an aboriginal belief system in Australia)
- > Cultural imperialism
- > Mathematics for the minority
- The Last Bastions of Academic Standards
 - > Changing circumstances for tertiary departments of mathematics
 - > Accusations of elitism
- Newman Error Analysis Research, and Implications for the Issue of “What is Basic?”
 - > The Newman procedure
 - > Example of a Newman interview
 - > Summary of findings of early Newman studies
 - > Some recent Newman data
- The Death of Proof in School Mathematics?
 - > Throwing out the baby with the bath water.
 - > Curriculum considerations: should all students be introduced to the notion of proof?

These are not the main ideas one would expect to find in a chapter on the ‘basics.’ But the authors’ choices of entries are argued and justified, and the chapter is both provocative and challenging. The aim of the chapter is conveyed also by the running head “Redefining the basics.”

Having said that it is not primarily a reference work, I should point out that there are many references that will be new to some readers, as well as familiar ones, many from the authors themselves. There are 28 pages of references, a subject index and an author index. They have done a splendid job in bringing to a wider audience research findings that hitherto have not been seen in the mainstream literature, but of course these references are all in English! As I pointed out in my chapter for the Grouws Handbook (Bishop, 1992) what is published in English is likely to be a very tiny fraction of the research that is actually carried out.

Clements and Ellerton are no strangers to research in the Asia-Pacific region, nor are they researchers who are happy to rely on a few easy-to-find references. They are dogged in their search for fresh research papers and readers can trust that the research referred to in the book does include the most relevant and up-to-date references from the region. As they proudly say in their first sentence in the Preface: “The entry for ‘Asia-Pacific region’ in the Subject Index to this book is longer than the entry for the ‘United States of America’” (p. 1). This does not mean that the book is parochial in its concerns—far from it. For a start, the authors take as their geographical context, “nations within East Asia, South-east Asia, Micronesia, Oceania, Polynesia, Australia, New Zealand, Papua New Guinea,

and certain Southern Asian nations within the ‘Indian sub-continent’ (p. 1). This, one can see, is not an unproblematic definition. Nevertheless, having defined the region this way, they go on to point out that it contains about half of the world’s population, and is not just a large but also a very diverse region. Moreover, using school examples from those countries, they make the crucial point that

Education researchers who investigate mathematics education issues in the Asia-Pacific region are dealing with very different circumstances and must therefore expect to have different priorities from those researchers who collect data and analyse data from schools in relatively affluent Western nations. (p. 4)

The first chapter, “Towards a balanced perspective on contemporary mathematics education research,” sets the tone of the book: The dynamic towards balance primarily comes from recognizing and critiquing the essential imbalance, the values of imperialism, and the prejudicial views emanating from research done in the ‘affluent West.’ This is not to say that no criticism is given of research in the region. In the section called “Can mathematics education research be justified?” the authors say:

We are concerned that a continuation of much of what has gone on under the general umbrella of ‘mathematics education research’ in Asia-Pacific nations during the last quarter of the twentieth century has been narrow, almost sterile, and unlikely to throw much light on difficult and important mathematics education issues. (p. 14)

They argue for a greater use of a wide range of methodologies, including both quantitative and qualitative, as well as encouraging a much greater attention to cultural contexts.

Reading Chapter 1 will either put you off the book entirely or encourage you to read on! I suspect that those who will want to read on are predominantly those who already feel in sympathy with the essential goals of the book, and who recognize that the basic assumptions of much current mathematics education research need to be critiqued. This is not just because of the post-modern trends in scholarship, but because most of the sympathizers will probably recognize that mathematics education is essentially a practical and situated matter, and that research which does not recognize and take into account that fact needs seriously critiquing about its importance and worth.

Chapters 3 and 4 are very strategic review chapters with the former looking at research prior to 1980 and the latter reviewing trends post-1980. The choice of that year is interesting. It was the year of ICME 4 in Berkeley, California and, as well as being the first ICME to be held outside Europe, it was also the first ICME to have a significant representation from the Americas and from the Asia-Pacific region. It was then almost no accident that the next ICME was held in Australia, with the myth-shattering plenary session of Ubi D’Ambrosio taking center stage. The progression demonstrates that mathematics educators prior to 1980 looked to Europe

and USA for their inspirations, and that after 1980 there became much greater awareness of a wider range of traditions and practices.

While Clements and Ellerton pick some of the obvious trends in these two chapters, they don’t—to my mind—achieve the coverage that one would expect in a review book, nor in a book which intends to do a highly critical analysis. For example, prior to 1980 there was a great deal of work on concrete apparatus, on developing testing and assessment, on developing new teaching methods, on investigating individual differences, on developing new types of books and materials, on developing teacher education approaches, and on investigating the teaching of more applied mathematics topics. Much of this work had a strong influence on practice in many countries, and laid the foundation for many of today’s practices in primary and secondary schools. This early research is hardly recognized.

Post-1980, their most significant omission is the increasing role of technology. Whilst I can see that a technologically driven research agenda may well seem irrelevant to mathematics education in developing countries, governments’ obsessions with keeping a competitive edge in technology has nevertheless driven research funding in many of these Asia-Pacific region countries. Technology in general is also part of the context of mathematics education and has played a strong role in shaping views of politicians and educators about the goals of mathematics teaching. The authors would have been able to develop a further argument had they considered technology as a broad concept and pursued its relationship with mathematics education, particularly through science education.

This leads to another general criticism that could be made about these two chapters, in that they do not refer to the teaching of other subjects, yet their teaching was not static during these periods either. Science educators had their own battles and the role of mathematics as a service subject was often on their agenda also. Statistics was on the rise, partly because of demands from developments in the teaching of geography, social studies, business, and economics. Hence probability was being experimented with and taught, first in secondary schools, and now in primary schools as well.

The authors’ difficulty has clearly been one of where to draw the limits of their discussions, particularly when one is trying to separate out trends in mathematics education practice from trends in mathematics education research. Furthermore, if one is also seeking to make a point about the irrelevance of much research, then clearly one chooses one’s examples and one’s definitions appropriately. To my mind, however, a broader notion of research that included experimentation and development would probably have enabled a more balanced picture to be painted of the contribution of research to practice. In the final chapter they do refer to a research contribution of their own which does not correspond with what they think the dominant modes of research dictate. They perhaps could have been a bit more persuasive if they had quoted some of the many other experimental investigations which do not always go under the name of ‘research’ but which have undoubtedly influenced the practices of mathematics education.

The most challenging chapter is probably the final one called “Reconstructing the international mathematics education research agenda.” Surprising to this reader was the emphasis on the word ‘international’. I had assumed that the climax of the book would have been an emphasis on developing research and collaboration in the Asia-Pacific region. Whilst not disagreeing with many of their ideas in this last chapter, I feel it would have had slightly more ‘bite’ had it been more narrowly focussed on the region. In trying to address the sense of the label ‘international’ I feel that they have rather undercut their own message. Indeed, many of the comments in Chapter 1 (titled “Should mathematics education research be more localised?”) which address the problems of developing research in the region, would in my view have fit more appropriately in the final chapter. As it is, one is left wondering about the wisdom of trying to take on the world in the way that they do.

Fortunately, the challenge to the international community of researchers is written in the form of 10 issues which they call rather curiously ‘problematiques’ (I say curiously because earlier they gave the French researchers short shrift over their dependence on, and promotion of, theory-driven research!). The issues are well documented already, and attendees at the ICME in Seville might have heard about them there, but nevertheless I feel they are sufficiently important to be described again, so here they are in the form of the subsection headings, with some comments on their discussion.

1. *Identifying the bases of current practices in school mathematics.*

I agree that this is important but I also wonder why the word school is there? So many developments are taking place in Vocational Education and Training, and in Non-formal Education, that to omit them seems remiss. If the authors mean, by school, “formal” mathematics education then they should have used that format in my opinion, and in a UNESCO publication it would surely have been very appropriate to refer to Non-formal Education.

2. *Doing more than prepare students for the next highest level of mathematics.*

I agree strongly with this one. The issue is a real challenge in any democratic society where students are free to choose their options and their futures. The problem is partly one of prediction, because one certainly does not want to obstruct the progress of those who wish to do more mathematics.

3. *Making language factors a central concern.*

Again, this is a very important issue, and one which has widespread implications. Many students in the region will be taught in at least two languages. The authors use Papua New Guinea as an example, but there are plenty of less exotic examples which could have been chosen to illustrate that in some sense mother

tongue teaching is not the norm in countries of the region, or even perhaps in the world.

4. *Rejecting cultural imperialism in mathematics education policies and practices.*

It will not be a surprise to any reader that I agree strongly with this one. It has always seemed to me remarkable that one can go to schools in another country and see a different language curriculum, a different history curriculum, a different geography curriculum, etc., but almost the identical mathematics curriculum. We are far from understanding why that is so, and far from agreeing what we should do about it.

5. *Working out the implications of situated cognition research findings for mathematics education.*

Whilst agreeing that this is important, I wonder why many other research areas have been omitted here. For example just in relation to psychology, one could have included personality research, psychotherapy research, and the role of emotion in learning, all of which could have profound implications for mathematics education practice. There are also many developments in the sociology and philosophy of mathematics education whose implications should also be explored. Indeed, in such a culturally diverse region as the Asia-Pacific, one could easily make a case that these latter are more important to explore than the implications of psychological research.

6. *Reconceptualizing the role of theory in mathematics education research*

This is a very contentious one and, if anything, reflects more the cultural value of the researchers (and indeed the authors) than perhaps any other. This section of the book deals with theory in a reasonable but limited way. Totally missing from the discussion is any reference to the sociological reasons why some researchers have developed strongly theory-based research. One example will have to suffice here—that of the French researchers, whom I will refer to here as the mathematical *didacticians*. It was quite clear to them that they would get nowhere in the battle for research recognition (which also meant research funds) if they did not become more ‘scientific’ in their research. The French meaning of science is in some way more specific than in English but its methodology can be applied in broader fields. It is also entirely theory-based.

So the aim of the French didacticians was clearly to fight for recognition within their own country and within their own cultural norms; and they were successful. To suggest that their approach is in some way inappropriate is to fail to recognize the importance of the socio-cultural context of the researchers. Clements and Ellerton do a thorough job of emphasizing throughout the book the due recognition to be given to the cultural and social situation of the students. They do not however pay enough attention, in my opinion, to the cultural, economic and social situation of the researchers, particularly junior ones, and

those struggling to get their Ph.Ds. This is what I meant earlier when I expressed my misgivings about the last chapter referring to the international scene. One cannot do that without considering the position of both the researchers and those who wish to do research. We all work in specific social, political and economic 'situations' that constrain what we can do, and limit our 'cognitions' and our theories.

7. A new epistemological framework for mathematics education research

This, in some sense, follows on from the previous issue and, indeed, the authors present their own view of what this new framework should look like. Whilst it is always interesting to see others' frameworks, to me this looks rather like a primitive theoretical framework, albeit a broader one than that which they were criticizing earlier, but not capable of much further development. Perhaps they would have made more progress if issues 6 and 7 had been rolled together, and if my points about issue 6 had been taken into account.

8. Questioning the basis for assessing achievement in mathematics.

This issue follows on from a detailed discussion on the role of pencil-and-paper tests in Chapter 6, but here the authors go further, because they rightly point out that much research involves achievement measures. These therefore need to be kept broad; else, researchers themselves are inadvertently supporting societal and political pressures for simplistic measures.

9. Establishing research communities that value all participants, and

10. Making the international mathematics education research community truly international

These two issues are worth considering together because of their relationship. The authors argue, and I have no objection to it, that the need is clearly to recognize that we all grow by contrast, and using the contrasts that exist within the research communities in a positive way can only have benefits for research.

This message is perhaps one of the most important in the book. It is a message that is being echoed in other contexts also. At the Psychology of Mathematics Education conference in July 1998 in South Africa, there was considerable discussion of the relevance of

'northern' research methods for those researchers who work in the countries of the 'south' (see for example Valero and Vithal, 1998). This was also a theme of the Mathematics Education and Society (MEAS1) conference held in September 1998 at Nottingham, UK, and it was keenly debated.

The issue is not just about research methods of course, but is also about the role and generalizability of theory. Even if one is using qualitative methods because of a concern about the validity of quantitative approaches, whenever one uses theoretical constructs one must be aware that they are derived from, and based on, a certain sample of evidential reality, and set in a certain cultural and societal context. They therefore do not have unlimited generalizability or relevance. Theory is always **situated** theory. One can raise many interesting and important questions about the ethics of our research practices, and one can, for example, question the practice of over-generalizing from both an empirical as well as from an ethical perspective.

So these are some of my reflections stimulated by reading this most interesting book. It is a valuable addition to the literature base of our field, and it would certainly be a book to recommend to all Masters and Doctoral students in mathematics education. I am sure that the issues it raises will be hotly debated as we move towards the next millennium.

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