Getting the description right and making it count: Ethical practice in mathematics education research

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Introduction

All over the world there is a tendency towards reform in mathematics teaching and learning which takes for granted the four following features:

- Rich mathematical tasks
- Relating mathematics to real life experiences and practices
- Learner-centred practice (valuing and working with learners' mathematical meanings)
- Inquiry-based classrooms.

These reform initiatives are being researched and developed, and while emerging from practices in the developed world, they are nevertheless the object of desire in the developing world, despite substantive contextual differences. The underlying assumptions in the reform, and in much of its related research, is that these four features of mathematical classroom practice will lead to appropriate, meaningful and more successful mathematical learning.

Imagine a situation where the dominant forms of schooling are over-determined by selection rather than education. In poor countries there are enormous constraints on wide provision of public services (like health care) and public goods (like education). As Mwakapenda (2000) so vividly describes of Malawi, when only 10% of primary school leavers gain access to public secondary schooling, teaching and learning practices are inevitably driven by the forces of selection. Processes of democratisation and development – increasing equitable access to improved social and economic goods – in such a context are significantly different from those in the

developed and dominant world. It goes without saying that mathematics education reforms will be shaped by such divergent conditions.

Imagine a mathematics education researcher from a developing context as described above, at the level of, say, PhD. As is often the case, this person gains entry into PhD study in an institution in the developed world, and is sponsored by the State Department of Education in his country. He enters a world where what counts as problems in mathematics education are framed by the reform movement described above. He decides, after considerable exploration of the field, to study the implementation of inquiry-based mathematics teaching. He believes, as a result of his reading, discussion, and reflection on the educational situation at home, that inquiry-based approaches offer potential for improving mathematics teaching and learning in his country. He communicates with relevant parties at home, teachers are reported to be interested. He develops a programme and set of materials that he believes are appropriate to his home context and he returns to set up the project, including at this stage, a series of workshops with a selection of Grade 7 mathematics teachers (the final year of primary school). During this time, he obtains their agreement and support for the project. Indeed, the teachers appear to enjoy the workshops where inquiry-based mathematics learning is modelled and issues discussed. The teachers share with him how they have been challenged mathematically and pedagogically. They express positive views of the potential for such practice in their own classrooms and a willingness to implement these ideas. He then spends a short period of time with one of the teachers in her class and together they try out activities in her classroom. On the basis of this piloting, he modifies and then leaves a set of materials for all the teachers to try out and develop and reflect on in their respective Grade 7 classes and returns to his academic institution.

Armed now with what has been agreed by his institution as sufficient ground-work and piloting, he proceeds with the designing the next and critical phase of the research, the collection of data related to teachers' implementation, and so interpretation, of inquiry-based mathematics learning. Three months later, as planned, he returns home, this time with a range of research tools (instruments) and a carefully formulated participant observation design process for data collection and analysis. To his dismay and frustration, he finds, across all the teachers, that the materials have

barely been touched – an occasional activity had been tried. Moreover, term dates have been unexpectedly changed. Instead of a process being underway where he could now work with teachers to interrogate their interpretations of inquiry-based mathematics teaching, the teachers are focussed on preparing their learners for the kinds of assessments they will face at the end of their primary schooling. Teaching is restricted to providing practise with algorithms for the operations on common and decimal fractions. And the extended time he had thought would be available for participant observation has been curtailed by changed examination times. He now faces considerable practical, methodological and ethical challenges.

He could continue with a modified exploration of inquiry-based mathematics. He could, for example, organise additional time with learners and teachers from one or two schools, after school hours, where he himself teaches mathematics in an inquiry-based way. Through this research strategy he might be able to identify and describe the kinds of activities learners' engaged with, how and with what effects. His overall description and explanation is, nevertheless, likely to proceed from a starting point of 'failure' in relation to mathematics education reform by the educational system in his country and include a description of how and why the teachers were unable to implement inquiry-based mathematical learning.

By contrast, he could abandon his orientation to inquiry-based mathematical learning and reorient the study so as to understand why and how testing has come to over-determine considerations of epistemology and pedagogy, and how and why the time-table changed, so 'disrupting the data' (Valero & Vithal, 1998). This would be a difficult decision to take. Given time constraints for the study, he would need to proceed with a rolling plan for interviews, observations, where time for developing and piloting instruments was curtailed. If he travels this road he is likely to elicit data related to the selective function of mathematical performance, and to a range of socio-cultural and political conditions that shape the forms of school mathematics practice in Grade 7 in his country. His description and explanation of what happened through his research activity is more likely to focus on wider educational issues than strictly mathematical ones. He is also likely to be able to explain resistances in the system (as opposed to in the individual teachers) to the intended 'reforms'. In other words, to explore and understand what happened would require redesigning the study, and most

critically, zooming out of inquiry-based mathematics and into the wider educational practices in which the teachers are positioned.

How should he proceed? Which route should he follow? Depending on where he shares his quandary, he is likely to experience quite diverse and unsettling responses, particularly if he presents a preference for the latter approach. In the wider educational arena he could be challenged as to his competence to take this more sociological and systemic approach to the research. He is likely to share this concern. At the same time, in the community of mathematics education research, he is likely to experience reactions like: "Well, this is no longer mathematics education research".

From an ethical point of view, as he confronts the multiplicity of goals, responsibilities and ownership that infuse this research endeavour, some of the questions he must confront are:

How does he continue with confidence and competence?

How does he not do harm to the teachers?

How does he establish respect, reciprocity and mutual benefit?

What does it mean for him to be 'culturally and contextually sensitive'?

Where does his responsibility lie? with the teachers? with the school system? the academy? with himself as a developing researcher?

How does he advance knowledge in and for mathematics education?

As a 'newcomer' to mathematics education research, he could feel pressured to maintain a 'mathematical' focus to the study i.e. continue with the first option described above. This focus is more likely to gain acceptance in the community of mathematics education research. However, as intimated above, in either case he is likely to produce a description of failure as located somewhere between himself as researcher, the teachers and the learners. In short, the description would keep intact a decontextualised sense of the potential benefits of inquiry-based mathematics teaching, and lead to recommendations for how school mathematics needs to change in his country, and what is needed to support this change.

Is this description 'right'? For some, the pivotal question here is whether the design, instrumentation, data collection, interpretations and claims made are

systematic, rigorous and valid. The above approach might well satisfy these methodological requirements, and lead to a successful PhD thesis i.e. it would count in the wider mathematics education research community. But our view is that, however unintentionally, it is likely to do damage to the teachers, and so too the context in which they work. What we are raising here is that getting the description right and making it count across diverse interests are ethical issues that need to inform the practices of the mathematics education research community.

Let's assume that because of this ethical standpoint, and within his financial and time constraints, the researcher proceeds along the more challenging path. He makes this choice despite not being an apprenticed sociologist and aware that it might well undermine goals for his own development and entry into the community of mathematics education research. He sets out to explore and explain teachers' practices in their mathematics classrooms with tools from the interpretative turn, and so to chart a less clear methodological path. As intimated above, he finds his description of teaching practices are framed by an analysis of the educational system in his country, fiscal constraint, and its overall examination and selection processes. The knowledge produced becomes more about how the teachers interpret and explain their mathematical practice within such systemic enablements and constraints, rather than about teachers' understandings of, and approaches to, inquiry-based mathematics. He goes on to include recommendations for a serious localisation of the notion of "inquiry-based" mathematics, and a speculation that a description of its forms and functions is likely to be substantively different from that which permeates dominant mathematics education discussion.

From our concerns with ethics in this chapter, this emergent description is 'right'. But our experience is that it does not easily count in the dominant field of mathematics education research. From an ethical point of view we can unpack our position by asking three questions. First, is the research route he took important? Second, is this good research? All mathematics education researchers and readers of such research, implicitly or explicitly, engage these two questions, and based on criteria available through existing research methods, would probably agree that the research route taken is important, and potentially 'good'. But lurking in our midst as mathematics educators, is always the additional question: Is this research *mathematics*

education research? From a research perspective this can be re-interpreted as: Can and will it add to the knowledge-base in mathematics education?

For some, the answer here would be No! In their view, the research ultimately tells us little about *mathematics* education, and more about educational systems, and broader constraints in the developing world. From this perspective, the insights from this approach to the study offer no advances to understanding more effective mathematics teaching and learning, despite suggestions from the study as to what these might mean in this different context. In short, that kind of study might be worthwhile in general, but it backgrounds what has come to be valued in school mathematical practice, and in so doing offers little of value to the wider and dominant community of mathematics education.

While the actual story here is fictitious, as PhD supervisors and external examiners, we have constructed it as a generalised case of similar struggles by PhD students and other researchers in mathematics education. Moreover, one of us was witness to precisely this negative reaction when a similar situation was raised for discussion at an international mathematics education research forum. The researcher, on the basis of her experience, suggested that research designs need to be flexible, culturally sensitive, and cautious about importation of ideas from elsewhere. The first response drawn was: "This situation (of disruption of the data) suggests you cannot do research". Other responses were less narrow. They did not bracket out research, but posited instead that this was no longer *mathematics* education research i.e. bracketing out mathematics.

Some, including ourselves, would answer "Yes! Despite limitations that are inevitable given time and financial constraints, this research could and should inform the knowledge base in mathematics education". The position here is that insights into the challenges of reforming the teaching and learning of mathematics in school lie precisely in an understanding of how mathematics takes shape in teaching and learning situations across school contexts. Such insights entail more than a grasp of the mathematics of the reforms intended, and their interpretation. Critically, getting the description 'right', and making it count for its participants, entails coming to grips not only with didactical transposition (Brousseau, 1989) but with recontextualisation

processes inevitable in schooling. Curriculum change involves changes in how knowledge is classified and framed, and so too in relations of power and social control (Bernstein, 1996). Curriculum change will inevitably be contested terrain. It thus requires an in-depth understanding of school mathematics, and schooling itself, across diverse contexts.

This story and the questions it provokes are about the worth of the research reported, its quality, its boundaries and its methods, its financial constraints, and ultimately about ethics and values. We have told it in some detail as we are of the view that there is insufficient debate in the mathematics education research community of the kinds of *ethical* issues we are highlighting. There is insufficient critical reflection on what it means to get the description right and make it count for participants (i.e. locally), as well as the mathematics education research community (i.e. globally).

In their earlier work, and their related chapter in this handbook, Valero and Vithal have problematised some of the elements of the story above as a North-South issue. Their position has provoked interesting, critical methodological debate in a context of wider power relations (Valero & Vithal, 1999; Ruthven, 1999). Our goal is to interrogate the story from the perspective of the ethics of educational research. We are aware, nevertheless, that 'getting the description right' and 'making it count' slide over into questions about validity and relations of power (i.e. the methodological and the political). There is always ideology in what is "right".

In our interrogation of mathematics education research activity from the perspective of ethics, we are pointing to what we believe are omissions in recent publications of ethics and research in mathematics education. We need to state up front that we are not trained in moral philosophy, that field typically concerned with questions of ethics. Nor do we intend to delve deeply into moral philosophy in this chapter. We have been motivated by our own experiences of the important ethical questions we open up in this chapter. Our purpose is to engage such questions as *mathematics education research practitioners, i.e. as members of the community of mathematics education researchers*.

We believe, furthermore, that the current context of globalisation raises new ethical questions. A changing world economic order is producing increasing differentiation (inequality) as well as increasing demands for accountability in public spending within and across socio-economic contexts. The story we have told is, in its own way, also about the effects of globalisation. It is about the tension between global trends and pressures for development so as to remain/become 'competitive' in a global world on the one hand, and democracy, the more equitable distribution of social and economic goods on the other. How do countries in the developing world embark on educational innovation and development? Do they attempt to keep abreast of developments elsewhere? Perhaps an exploration of inquiry-based mathematics would have been possible in the story above if the study could have been restricted to a careful selection of adequately resourced and developed schools. What then of concerns for deepening democracy in the country? Embedded in that kind of choice would be a commitment to "trickle down" notions of development. But does development trickle down? It is beyond the scope of this paper to delve into development theory. It is, however, important to understand that development might well be more effective (in the sense of increasing access and democracy) if research and development activity is grounded in (i.e. takes as its starting point) contextual realities. As has been described elsewhere, in a country like South Africa, development and democracy are in constant tension in general and so too in mathematics education (Adler, 1997). This tension produces new ethical challenges for research.

In the next section we develop an analysis of what we consider to be an ethical framework for mathematics education, building on some of the literature in the field. Following this, we will return to the scenario we have presented, and then present aspects of three research areas: qualitative studies in teacher education, comparative international studies and studies of teaching and learning mathematics with new technologies. Together these will illustrate our position in terms of reading/doing research ethically (Brown & Dowling, 1998). Each area, in recent years, has generated numerous projects, texts, and "truths" about the teaching and learning of mathematics. While these by no means exhaust the field, they enable us to prod and probe research practice in terms of whether the description provided is 'right' and for whom it has come to count. In so doing we come up against challenging ethical

questions both in the conducting of research (its processes), and the place such processes and findings come to hold in the mathematics education research community (its products and their dissemination). We conclude the chapter by offering a theoretical framework that locates and illuminates further, the position of the 'ethical' in our complex research practice.

Ethics and Educational Research

Our rehearsal of key issues in the ethics of educational research draws on two chapters in recent collections: Sowder's "Ethics in Mathematics Education Research" from 1998 and Howe and Moses' "Ethics in Educational Research" from 1999. The authors have surveyed the literature thoroughly and written well-constructed chapters that provide clear overviews and insights into the field. We feel privileged by their work, both in their quality and in that they enable us to focus on aspects of ethics that are not covered in those chapters. Nevertheless, no chapter on this area would be complete without summarising the issues they raise and we will therefore proceed to that task. This rehearsal will be a synthesis and as it would be tedious to the reader to refer to the specific author on every point we hope it will be acceptable to acknowledge the authors in general and invite readers to consult the individual chapters for further details.

We began this chapter with a scenario to frame the arguments we will be making. We were drawn to start this way through reading the Sowder chapter, in which she introduced her review with three scenarios. The first scenario concerns the issue of confidentiality, promised to interviewees, when a funding agency asks the researcher to share the interviews at a meeting. The second raises the problem of the public and private, of wanting to report critical things about teachers who, through the research, had become friends of the researcher when it is clear that the teachers would not be happy with the report. The third scenario concerns anonymity, when problematic aspects of the mathematics teaching in a group of schools are to be reported, but the schools are such a special group that they will be recognised. Sowder then goes on to review the history and development of ethics literature in the field of educational research, as does the chapter by Howe and Moses.

Serious considerations of the ethical issues in research owe their origins to the Nuremberg Code, following World War II. This and subsequent guides drew, in the main, on the needs of ethical considerations in bio-medical research. A number of well-known studies, such as the Milgram and the Tearoom Trade studies, resulted in the recognition that specific criteria were required in social science research. Education was often seen as unproblematic since its orientation was to the improvement of the educational experience for school students. Nevertheless, educational research needed its own considerations, leading to the American Educational Research Association ethical standards of 1992, and today probably all Universities have codes of ethics and ethical procedures for research in the social sciences. The shift towards interpretative research, drawing more on qualitative approaches than quantitative, has led to substantial developments in ideas and a wider range of potential problems.

The traditional or pre-interpretative approach made a distinction between moral-political issues in research and its scientific-methodological merits, the former concerned with the treatment of participants and the latter with misconduct in research practices not directly affecting participants. Moral theories contrast *teleological*, utilitarian principles and *deontological*, Kantian principles. Teleological principles are goal or outcome-orientated, where weighing up the value of a piece of research is, in the main, governed by the significance of the outcomes. Now this process can be a case-by-case procedure, a kind of cost-benefit analysis, usually called *act-utilitarianism*, or the analysis can be guided by a set of principles, *rule-utilitarianism*. The Kantian, or deontological approach, emphasises the duties of the researcher and guiding principles insist that the research subjects be seen as ends, not means. Problems with this universal theory (May, 1980) include: there is no room for exceptions; it is too individualistic; and it offers a focus on general obligations only. Rawls (1971) outlined a form of the Kantian, deontological position that focused on the rights of the subjects of research, their dignity, liberty, equality, and autonomy, as criteria for action.

Regarding research misconduct, issues of concern include intentional deceit; falsification of research; plagiarism; misrepresentation or misinterpretation of results; inappropriate collaboration; inappropriate faculty-student relations; denying

knowledge of dishonest research practices; and conflicts of interests with funding agencies.

There is both a methodological and epistemological shift with the move to the interpretivist approach; indeed the distinction between teleological and deontological principles is brought into question. According to this approach educational research does not have a neutral scientific language on which to draw, social life is dialogical (Howe & Moses, 1999, p. 32) and so the methodology of social science must also be dialogical. As a consequence, a range of other positions on moral and ethical considerations become available to educational researchers: communitarianism or cultural relativism; relational ethics; ecological ethics; critical theory; postmodernism; and contemporary liberal theory. These theories raise a variety of problems for researchers.

- Communitarianism or cultural relativism: what is perceived as ethical varies across communities and can only be understood from the inside of those communities. This position would call for the engagement of participants in the planning, conduct, analysis and dissemination of the research.

- Relational ethics: the researcher must actively care about and care for the researched, over and above a concern with the rights of the researched. This position is at the basis of feminist research, and differs from communitarianism in that these values transcend the specificity of cultures. The research questions chosen should have the potential to contribute to the future well-being of the subjects, and in our case to teaching and learning and the school community.

- Ecological ethics: research must recognise the interdependence of researcher and researched and the whole environment of the classroom. Focusing on avoiding harm to the individual must therefore be set within the avoidance of harm to the whole system.

- Critical theory: research must be historical, that is aware of the emergence of the situation to be researched. It must be emancipatory in that its focus is on not just the improvement of the teaching and learning environment for the subjects, but must also enable the subjects to gain a perspective on their own lives and oppression and enable them to change their own lives for the better. The separation of means from ends is not possible, since means are always relative to

ends, means are themselves subject to constraints according to values, and a dialogical, democratic approach requires that ends are continually available for renegotiation. Research from a critical perspective is always advocacy research.

- Postmodernism: people always act in discursive practices which carry their own regimes of truth, normalising individual selves. Researchers are therefore "accomplices in social domination" (Howe & Moses, 1999, p. 35). This position calls, at least, for a recognition of the asymmetric relationships in research and the potential for oppression, leading to the notion that participants must take active roles in the research. Researchers should be aware that the notion 'progressive' is always local, not universal, and a statement of a particular position. The findings of any research must be self-conscious of how it deals with relations of power.

- Contemporary liberal theory: whilst liberal theory has been under threat for some years, particularly from the five positions preceding this one, contemporary liberal theorists have modified the perspective to insist that participants must be treated as equals in the research and should not be defined in terms outside of their choice, a common failing with earlier utilitarian or Rawlsian liberalism. Justice is to be sought in the distribution of predetermined goods but also in the status and voice of research participants (Howe & Moses, 1999, p. 37).

In terms of operationalising these ethical values in educational research, one has to recognise that interpretative research is more ethically problematic than positivist research precisely because it is always ethically uncharted. It calls, therefore, for: care and reflexivity; for refined notions of consent including participation of research subjects and continual reaffirmation of consent; and a refined notion of autonomy and privacy, including the principle that oppression, especially of children, must be seen as a greater wrong than that done by deceiving oppressors.

Finally, the authors have some comments about the honesty of reporting, including the recognition that there is a tension to be continually negotiated between thick description and privacy, between whose version emerges, or who owns the data interpretation, and between responsibilities to outside agencies and to research sites.

In summary, together with these authors we wish to recognise that educational research is always advocacy research inasmuch as it unavoidably advances some moral-political (and so ideological) perspective; that educational researchers must be able to defend what their research is for (respect for truth); that the research must have points of contact with insiders' perspectives (voice, respect for persons); and that it militates against race, gender, class and other biases (respect for democracy) (Bassey, 1999, p.37).

The duty of the researcher, in taking all these perspectives into account, is to engage continually in the struggle to get descriptions right and make them count.

The ethics of mathematics education research

We consider it uncontroversial to claim that studying aspects of the teaching and learning of mathematics is to be doing social science. As such, we cannot divorce the mathematics from the learners/teachers/texts/classroom/school/society, depending on the chosen focus of the zoom lens (Lerman, 1998), the object of research, as created by the researcher. The field inevitably overlaps with other research fields and, like those fields draws on a number of intellectual resources.

> Educational research is located in a knowledge-producing community... Of course, communities will display a great deal of variation in their cohesiveness, the strength of their 'disciplinary matrix', and the flexibility of the procedures by which they validate knowledge claims. Education as a field of research and theorizing is not firmly rooted in any single disciplinary matrix and therefore probably lies at the weak end of the spectrum, although I think this need not in itself be seen as a weakness. (Usher, 1996, p. 34)

Recognising and accepting the fuzzy boundaries, we define mathematics education research as the researcher's gaze on the teaching and learning of mathematics, however oblique that gaze might be, and down whichever paths such a gaze leads the researcher. But since 'Educational research is located in a knowledge-producing community' such a definition must be tempered by where the researcher locates her or his own field, and her or his own community. Mathematics education research is not defined by the intellectual resource, sociology or psychology for example, but by the community to which the research is addressed. Now the

mathematics education research community is quite cohesive and active, as evidenced for instance by the fact that the mathematics education group is now the largest division in the American Educational Research Association. The procedures for validating knowledge claims that have emerged in recent decades, including peer review of journal articles, conference papers, research grant applications, and doctoral thesis examinations, are becoming more flexible and the criteria more varied. The numbers of journals and conferences are increasing, and one can expect that the development of on-line journals, and perhaps video-conferencing too, will accelerate the increasing flexibility. All judgements of what is acceptable at any time as mathematics education research by the various gate-keepers are value judgements. What matters ethically is that those values are made explicit and are constantly under challenge and review by the community. This places great responsibility on journal editors, PME Presidents and the like but also all of us as reviewers, PhD examiners and so on.

Having located mathematics education research within the community, eight key questions, arising from our overview, frame an ethical approach and must be taken into account if the description is to be right:

1. On whose behalf is the research advocating? Is it against racism, sexism, classism etc.?
2. What is the research for? Can the researcher defend the research? On what grounds?
3. Does the research incorporate the insider's perspective?
4. Is the research reflexive?
5. Does the research take care of those being researched, especially avoiding their oppression?
6. Does the research draw on a refined notion of consent?
7. Does the research draw on a refined notion of autonomy?
8. Does the research draw on a refined notion of privacy?

How these questions are answered in research practice will inevitably vary, produce conflicts and contradictions, and involve self-conscious decision-making. Sowder's discussion of ethics in mathematics education research deals illustratively

and theoretically with respect for democracy, truth and for persons and the tensions between them. What we are foregrounding, is that all research is also advocacy research. A set of values, and hence a moral and ideological position of some kind, informs all research. Typically, in a great deal of mathematics education research, what we would call the dominant literature, these positions are rarely discussed or made explicit.

Turning back to our opening story, we would argue that the research path chosen by the researcher attempts to address questions 1, 2, 4 and 5. He could also ensure the remaining questions should he choose to do so and depending on the time and resources he has available. His choice is to advocate against naïve importation of ideas, and on behalf of the mathematics teaching and learning community in his country, located as it is within its wider educational system. The research path actively seeks to understand what others might interpret as a deficiency or failure, and so its intention is (ethically) reflexive and against oppression (of the developing by the developed world). There are personal and political issues in this, each with their own potentialities and costs. The researcher is likely to struggle with the development-democracy tension. As he chooses away from prominent values in the mathematics education research community, he will still need to confront development issues – how these are to be identified and addressed. More immediate will be the struggle to get the description right by grounding it in its local context, and also make it count in the wider mathematics education research community.

What then of other current research in mathematics education? How does respect for research practice, democracy, truth and persons play out as descriptions are produced? Are they right? For whom and how do they come to count?

Researching formalised in-service

Sowder drew on qualitative teacher education research as an arena where the ethical issues of confidentiality, privacy and anonymity loom large. We too start with a discussion of a mathematics teacher education research project in South Africa so as to illuminate further the ethical questions we have raised.

In 1996, the University of the Witwatersrand introduced an in-service teacher development programme: the Further Diploma in Education (FDE) in Mathematics, Science and English Language Teaching. The FDE is a formalised in-service programme for teachers who have a three year post secondary school teaching diploma (what in South Africa is abbreviated as an "M+3") and who wish to upgrade to an M+4 qualification in one of three subject areas: Mathematics Teaching, Science Teaching or English Language Teaching. Under apartheid rule, most black teachers in South Africa qualified with an M+3 through studies in segregated Colleges of Education. Most white teachers, particularly secondary teachers, completed a three-year degree followed by a one-year post-graduate diploma, and thus have an M+4 qualification. Underscored here is the strong redress motivation in the FDE programme and its broader goals of quality and equity. More specifically, the goals of the programme are:

- to broaden and deepen teachers' subject knowledge, pedagogic subject knowledge and educational knowledge;
- to extend teachers' reflective capabilities;
- to facilitate professional growth (increasing participation and membership in professional activities, networking, associations, workshops, curriculum discussions);
- to enable access to further education.

The team responsible for the development of the programme was determined from the outset to develop the programme through research. In 1996, a research project was launched with the aim of investigating the FDE programme effects. An underlying assumption in the programme and the research is an understanding of what we have called "the teacher in context". This is an assumption that teachers' changing knowledgeability (their participation in and take-up from the programme) needed to be located in a conception of knowing as tied to becoming in context (Lave & Wenger, 1991).

The aims of the overall research project were three-fold: (i) to investigate teachers≪ take-up from the FDE programme in Mathematics, Science and English Language Teaching and to what extent and how this shaped the quality of their

classroom practices; (ii) to contribute to knowledge about formal in-service professional development (INSET); and, (iii) to feed back into the FDE programme≪s curriculum development through research. The research team set out to describe and analyse continuities and changes in classroom practices within and across some participating FDE teachers over time, in relation to conditions in which teachers work and their pupils learn. These multiple goals, and related values, reflected multiple responsibilities (to the teachers and schools, the programme and its funders, the academy) and multiple levels of ownership of the research agenda, in turn producing an ongoing balancing act of competing interests.

Data were collected in ten rural and urban, primary and secondary schools in which a selection of teachers from the 1996 cohort of FDE teachers were working. Each of the teachers in the sample was visited for one week in each of three successive years (25 teachers in 1996, 23 in 1997 and 18 in 1998, with the numbers changing as a few teachers were transferred or dropped out of the programme or were working in contexts where schooling was disrupted. Nine of these were mathematics teachers). The 1996 data served as the base-line data. Most of the teachers graduated from the programme at the end of 1997 i.e. before the 1998 data collection. The data include transcribed interviews with each teacher for each of the three years, teacher narratives and responses to questionnaires, observation schedules and notes from the lessons observed, videotapes of some of the lessons, examples of learners' work and selected testing of learners. Methodologically, while the research project has 'project evaluation' elements to it, it is more appropriately described as a practice-based (Lampert & Ball, 1998), case study of cases (Bassey, 1999). The FDE is the overall case, with the teachers constituting a collection of particular cases. The research aimed to learn from teachers' classroom practices (knowing-in-practice) about their practice, with the focus on the relationship between this practice and the practices in the FDE programme (Adler & Reed, 2000; Adler, Lelliott & Slonimsky et al 1997; Adler, Lelliott & Reed et al, 1998).

Throughout the three years of the study the research team confronted and made decisions on a range of complex methodological and ethical issues all of which involved concerns with respect for democracy, truth and persons within an overall set

of values related to inequality in education in South Africa. These are described in Adler & Reed (2000), and resonate with those raised by Sowder.

Briefly, multiple goals, responsibilities and ownership of the project pulled at it in challenging ways. Firstly, we were constrained by a limited research grant and hence by research time. We were not able to employ full-time research assistants, and so carried the research alongside the development of the programme. We were constantly concerned with the limits on the time we were able to spend in schools. More time was needed to come to understand teaching practices in all their complexity. We also needed more time than we had to generate in depth insider perspectives on specific teaching practices as well as the research endeavour as a whole. Within these constraints, we nevertheless strove to produce rich accounts of each teacher's complex practice.

And there were tensions in producing rich accounts. We were simultaneously pulled by multiple responsibilities: to the teachers themselves, to the project, in our construction of the descriptions of their practice. Descriptions of 'gaps' in what we saw relative to project goals were important for the project, but coldly, produced the teacher as relatively deficient. We were advocating teacher professional development opportunities, in the interests of teaching and learning. We had a responsibility to "tell it like it is" but within the ethical bounds of confidentiality, privacy and anonymity, and with care for the teachers themselves. Our pragmatic solution was to develop a detailed portrait of each individual teacher, but these were not made public. They were used, however, as the first step in analysis across teachers, and for reaching "fuzzy generalisations" (Bassey, 1999) across teachers. We were thus able to provide for anonymity, privacy and confidentiality, and at the same time, we were able to describe and illustrate both effective and problematic teaching practices as we interpreted them.

We were continually challenged by ownership of the research, both in terms of a large research team where different members participated in different ways (some feeling more ownership than others) and in terms of the teachers themselves. They were not directly involved in setting the agenda. The ethics of our working with them was at the level of informed consent. Vithal's (2000) notion of "democratic

participatory validity", where teachers themselves are part of the data collection processes, could perhaps have increased ownership and enabled more grounded questions and insights, and perhaps too a more grounded approach to teacher development. This would have meant more time with the teachers, and as we were working across two distant provinces, more money.

Added to the challenge of ownership and voice, and thus whose perspectives came to bear on the research, was that of working in the multilingual South African context. We were constantly aware of how language practices both in the classrooms and in the research context were productive of particular accounts. Some of the research team shared a main language with a particular teacher and were able to have conversations in both that language and English. We were aware of the difficulties teachers had in reflecting on their purposes and actions in English, but also of how this skill improved over time and with increasing levels of trust. We were aware too that since the programme was delivered in English, the educational discourses produced through their participation in the programme tended to be in English. Discussion about the programme needed to be, at least partly, in English.

In addition, like others in teacher education research (Wilson & Berne, 1999) we struggled with our responsibility to the academy, with how to evidence take up of practices when these were distributed over reams of qualitative data in video-text, interview recordings and field notes.

In short, all the way through the project, from design to data collection and analysis, as well as to the production of descriptions and their dissemination, the research team worked to meet and resolve competing goals, responsibilities and levels of ownership, as reflected in questions 1 – 8 raised above. In certain moments we self-consciously decided to act in ways that detracted from what we felt was optimum ethical practice. The overarching ethical question remains whether or not we were getting our descriptions right and making them count in the struggle for educational change in South Africa, and in the development of teacher education more generally. Were we actually able to describe what came to count for the teachers as they worked on their practice; what this meant for the FDE programme; and what it meant for the wider field of in-service teacher education?

Various aspects of the research have been, and are still in the process of being, published in the mathematics education research community and beyond. This dissemination of the research includes mathematics education journals (e.g. Adler, 2000; Setati & Adler, forthcoming), refereed conference proceedings (e.g. Setati, 1998; Brodie, 1999), and book chapters (e.g. Adler, in press). It extends outwards towards general education research journals (e.g. Adler & Reed, 2000; Brodie, 2000), and language and education journals (e.g. Setati, Adler, Reed & Bapoo, in press). In addition, a summary report of the research was produced, offered first to the teachers and schools for comment, and then widely disseminated in South Africa. The point of this elaboration on publication is to demonstrate that in terms of the demands of the academy, the project descriptions count.

But new ethical issues emerged as the research entered the academy and the public domain. An overarching observation through the research was that teachers took up the forms of learner centred practice, but not its substance (Adler et al, 1999). Learner-centred practice is not a neutral goal in education. We were conscious that even with rich accounts of how teachers interpreted learner centredness and why, our descriptions inevitably pointed to some inadequacy in relation to a teacher's pedagogic mathematical knowledge. In the current South African context where turning around apartheid education is a mammoth task, and one not easily reached, the profession has come under considerable political attack. Any description of inadequacy could feed a political agenda of "blame the teacher". In much of the teacher education research literature in the USA (as reported in Wilson & Berne, 1999), inadequate learner-centred practice is typically attributed to teachers' lack of depth of mathematical knowledge for teaching. The data in the FDE research project, in general, supports that this could have been the case. However, conditions in schools together with the influence of the wider educational transformation agenda in the country, went a long way to explain why teachers attended to form over substance in their interpretations of learner centred classroom practice.

From a development perspective we were concerned that dominant interpretations of learner centred practice might well be oppressive in the different conditions in which we were working. For example, in contexts of limited English language

infrastructure, revoicing of mathematical English is a critical teaching function, and could and often is interpreted as teacher centred practice, and hence undermined (Setati, Adler, Reed & Bapoo, forthcoming; Adler, forthcoming). Contrary then to an interpretation of inadequate learner centred practice, the research team learned of the need to work instead to reinterpret learner centred practice so that it enables description and interrogation of practices across diverse contexts. Influencing the dominant literature, however, making a new perspective count in an unequal world, is likely to be a considerable challenge.

A second area of interest that emerged through the research was our observation of the importance of relating resource availability to its use. We have produced accounts of how 'more' resources do not necessarily equate with better practice (Adler, 1998a; 1999). These have been challenged in the wider academy for not including sufficient insider perspectives into the issue of resources. In South Africa, critique has been about feeding a discourse of fiscal discipline that lets the government off the hook from more equitable distribution of educational resources. It gives rope, however unintentionally, to an increasing political claim that "good teachers can be successful even with limited resources", a claim not made in celebration of the teachers, but in defence of poor delivery on policy and as a result, enduring inequality. Both challenges to our descriptions are ethical and, in our view, "right". They reflect the limited "insider perspective" of which we were always conscious. Each challenge, however, is quite different. The first is an ethical stance that emphasises the significance on insider perspective, where advocacy is for the researched and hence their voice. The second challenge is that the research does not take sufficient care of those being researched. In its description, it cannot avoid their potential oppression. In short, the research report could feed an oppressive agenda.

The point we are making here is that judgements on whether and how to report research findings are inevitably ideological. We understood that our discussion of resources in particular was controversial, and potentially damaging for teachers. Our decision to produce the description was in the interests of the research, and the interests of a critical academy in a politically charged context of change. This can be defended, though some would disagree with the decision.

The most complex question to answer for the research project as a whole is: On whose behalf is the research advocating? In all its complexity, the research ultimately advocated improved mathematical opportunities for learners, through improved teaching. Yet this advocacy for more and equal access to quality mathematical learning opportunities cannot be separated from the strong and particular conception of "mathematics" and "good" teaching that permeated the FDE programme and so too the research. Defending the research thus includes a need to defend a specific approach to mathematics and its learning and teaching, approaches ultimately informed by a particular ideological perspective.

This detailed discussion of a particular teacher education research project illuminates just how complex are the ethical demands on our practices in mathematics teacher education in particular, and in mathematics education more generally. None of the eight questions we posed at the end of the previous section present clear, straightforward answers. Ethical decision-making means working within and across diverse goals, ownership and responsibilities, across diverse participant interests. Ethical research practice includes, in our view, more explicit accounts of the kinds of decision-making that informs any research agenda, and how and why these have come to shape the description produced.

The detailed discussion of the FDE research project also reveals how ethical issues do not remain bounded by research processes and resultant products. These products will not travel in some benign way into the academic and public arenas. There are ethical issues in how descriptions might be read, and who takes responsibility for such readings and their effects: In short, how they come to count and for whom. Getting a description right and making it count thus include ideological dimensions. It is this moral advocacy that we feel is insufficiently problematised in the mathematics education research community.

TIMSS

In a globalising world, international comparative assessments make sense. They provide benchmarks for both internal and external comparisons. Such arguments have been made both by the key organisational hub for TIMSS (Plomp, 1998) as well

as wider afield (Nebres, 1999). As it re-entered the world in 1994, participating in TIMSS in 1995 was an attractive option for South Africa. Here was a possibility for setting up a benchmark against which progress by the post-apartheid Government could be mapped and judged (Howie, 1998). The results of TIMSS are now well known, and need no rehearsal here. The question we pose is the broader ethical one that drives this whole chapter. Did TIMSS get the description right?

Keitel and Kilpatrick (1999) provide an extensive critique of TIMSS. In their discussion of the 'promises and perils' of international comparisons in mathematics education, they open up numerous ethical issues for the research endeavour. Firstly, they highlight how the direction of the study has been over-determined by psychometric expertise. In handling the data once collected, and 'treating' possible problems, they argue,

> … problems of methodological validity, reliability and quality have been resolved purely from a formal point of view. Questions of content – in all its aspects – have usually been seen as secondary. p. 245.

The second issue they raise is that financial support for the study influences the goals, and the extent to which they are "politically determined" or "research oriented", not to mention which countries are able to participate. South Africa was one of the few 'developing' country contexts to participate. An interesting, and disturbing question, is why countries were ranked as in a league table. Whose interests are served by this, and what kind of description is this?

This points to the third issue they raise: control over the framing and dissemination of results. The power of TIMSS publicly is the sense that "numbers do not lie" and that the results obtained through the careful data collection and analysis processes were somehow "objective". We only need to pause and reflect for a moment on Cooper and Dunne's (2000) extensive research on performance on 'realistic' test items in the United Kingdom. They show convincingly how more complex forms of assessment, like contextualised questions, or questions requiring extended elaborated responses can produce false negatives, and tend to do so in ways that disadvantage working class learners. When they interviewed learners who presented or selected wrong answers to such items they found, on probing, that the

answers selected masked learners' mathematical competence. And there were significant differences here between working and service class learners. Their research raises important questions about test validity and we would add the ethics of using such results for determining the position of individual learners, let alone countries on a ladder of achievement. A number of the TIMSS items were embedded in realistic contexts. From this perspective TIMSS could not get the description right. While revealing important information about how learners across countries performed on a particular construction of the mathematics curriculum, and how countries performed in relation to each other, the data and analysis could not go far enough to reveal false negatives, or for that matter, false positives.

For South African learners, the test format was not only in a second or third language for the majority who wrote it, but the dominant multiple choice format was unfamiliar (Howie, 1998). Although these issues were recognised, they were treated as methodological problems. They were described together with sampling and data collection difficulties that were experienced in a country where many schools are in remote areas, difficult to communicate with and to access. Yet, the 'result' of South Africa being last in 42 is the enduring one, and a political tool in all kinds of national education debates.

The final and most significant point made by Keitel and Kilpatrick is the implications of an assumption that curricula across widely diverse contexts can be compared through learner performance presented as an average. What does this mean, ultimately? And moreover, what do such 'numbers' mean when they cannot be located in the full complexity of the cultural contexts. The example Keitel & Kilpatrick provide is of the whole system of afternoon lessons in Japan where examination preparation is emphasised. This contextual information is hidden in a methodology that cannot get beyond surveys, textbook analysis, tests and classroom observations.

These criticisms of TIMSS are known. Why are we repeating them? Our point is that in the light of the above criticisms, TIMSS cannot get all of the description right, and in its omissions lie significant ethical issues.

Returning to the questions on p.00 that frame an ethical approach to mathematics education research, we need to ask: On whose behalf is TIMSS advocating? Governments and policy makers? Mathematics? The major arguments for TIMSS are the benefits of benchmarking, and thus a conception of progress and development that is facilitated by measurement and comparison. Within the TIMSS descriptions there is little that reflects on the possibilities for oppression arising out of the league table produced, not to mention the idealised curriculum against which the benchmarking and ranking took place.

TIMSS researchers have defended their research. The South African TIMSS researchers in particular have provided reflexive discussion of the considerable methodological challenges faced, like sampling, the language of the test and the format of the questions. There is an openness about, and hence some responsibility is taken for, methodological issues, such as the need to improve sampling, improve contextual descriptions and so too comparisons. Despite these issues and their detraction from getting the description 'right', it has come to count.

At a conference on TIMSS in South Africa in 1998 (Adler, 1998b), the Director of the IEA was asked whether TIMSS held itself responsible for the ways in which TIMSS results were reported across different national contexts. In particular, the South African results were feeding a conservative agenda and being used by minority interests to undermine those now in charge of education in the country. They were also being used by the new government to blame poor education provision on teachers. In the UK the poor performance of schools relative to the success of Pacific Rim countries in TIMSS was used to justify the incorporation of a style of teaching, called 'whole-class interactive teaching', into a compulsory numeracy strategy, initially for primary schools and now for secondary schools too. This style of teaching was identified as *the* reason for Pacific Rim schools' success by visiting UK professors of education to those countries. Again, TIMSS fuelled a conservative agenda.

The Director of the IEA defended the freedom of the research endeavour arguing that researchers were not responsible for how results are taken up politically, by the public or the academy. Many, if not most, of our community of mathematics

education researchers would agree that TIMSS researchers are not responsible beyond their reporting of the results. They would not hold the researchers accountable for how the results are used politically, arguing instead for the benefits of knowing where one stands, of how to plan for progress offered by the benchmarking and comparisons provided. We want to ask where does academic freedom begin and end in the research endeavour? Where does responsibility begin and end in mathematics education research? We ask this precisely because of the power mathematics has to include and exclude.

Following the sketch we drew above of the ethical responsibilities in general of educational researchers, we want to argue that researchers *must* do their best to predict the uses that will be made of research findings in order to ensure that they take care of those being researched, that the rights of the insiders are maintained as long as possible, beyond publication. A similar situation exists in England where schools' results in national tests are used to rank schools on league tables, published in the press, a ranking that takes no account of what extra 'value' schools can provide for their students. Not surpisingly, well-funded schools in middle class neighbourhoods appear at the top of the lists. It is arguable that no good whatsoever has come out of this process of 'public accountability' for the disadvantaged, except to serve as fuel for conservative groups in society.

What this discussion reveals is that a TIMSS-like study precludes being able to take care of those being researched beyond individual anonymity, consent and privacy. At the level of the individual, insider perspectives are not possible within the design of the study. However, there is considerable scope for insider perspectives at the level of participating countries. Yet, participation levels in a study like TIMSS are determined by finances available, and are thus inevitably exclusionary. Developing countries have limited influence over the idealised curriculum that permeates the study, a conception that in the end judges, and so can oppress. The notion of development through progressive benchmarking is in tension with its simultaneous possibility for oppression.

The effect of the politicisation of TIMSS in South Africa is to produce and perpetuate an internal perception of 'failure' both at the level of individual learners,

and the whole population. Few would argue against the position that it is necessary in a globalising world to know and understand your competitive position and so be able to plan for improvement. From this perspective there is little critique as to whether the results of TIMSS count. The assumption is that the numbers can be trusted, that the description is right. Our analysis challenges this assumption, and our point, therefore, that there needs to be greater critical debate in the mathematics education research community on the ethics of ranging research projects, including those run on enormous budgets. A colleague, in response to calls for more and continuous assessment once noted that "You don't fatten a pig by continually weighing it". Is the money spent on studies like TIMSS worth it? For whom?

Researching technology in mathematics education.

Nowhere is the development-democracy tension more obvious than in technology in mathematics education. Whereas some schools and classrooms are "wired", and technological tools (computers and hand-held calculators) are part of the school's infrastructure and integrated into school mathematical practices, there are others where there is neither electricity nor telephone to support computers, educational software and internet access. Nor are there finances to invest in even one set of graphing calculators for shared use across the school. This dichotomy exists within and across countries. The technological divide is increasing the gap between those who have (access to material and economic goods) and those who don't. What is the worth of research that focuses on expensive, cutting edge technology, technology that could support an epistemological shift in mathematical learning when only a small minority of learners across the world is likely to benefit in the short to medium term from such a development?

The past two decades in particular have seen extensive research and development in technology in and for mathematics education. In the First International Handbook for Mathematics Education, Ruthven (1996) and Balacheff & Kaput (1996) provide reviews of mathematics education research and development in relation to hand held calculators, and computer-based learning environments respectively. We will not rehearse these in any detail here. Our intention in drawing from their reviews is to engage with the questions as to whether the various reports of

research on technology and mathematics education have got their descriptions right, and whether they count.

In his focus on hand held calculators, Ruthven argues that these are likely to become personal technologies. In contrast, computers are likely to be shared resources in the context of schools for some time to come. In opening his chapter, Ruthven comments that "… most recent contributions to the scholarly literature and international conferences originate in a rather narrow range of countries: Australia, UK, USA, Germany, Netherlands and Sweden". Hence, knowledge about technology in mathematics education has been informed only by European and American classroom practice. This is a limitation. There appears to be little change in the past four years. Ruthven discusses tensions between new technologies and equitable access to such tools in schools (but does not take this beyond the UK context). He also refers to gendered effects (girls benefiting more than boys) claimed in some research. In concluding his chapter, and summarising the research and developments in technology and its impact on mathematics education practice, Ruthven claims that despite their prevalence in some contexts, and despite research and development, hand-held calculators remain "… confined to the margins of classroom life". They are used "casually, instrumentally and often uncritically" (p. 464). He argued for "a renewed curiosity". That was four years ago. Yet research continues in much the same way, exploring the epistemological and/or pedagogical benefits of using technology in the mathematics classroom. Graham & Thomas (2000), for example, report on the potential of the graphing calculator for illuminating the concept of a variable.

For Balacheff & Kaput (1996), the source of power in technological tools is epistemological, rather than practical. Technological tools reify mathematical objects and relations enabling students to act more directly on those objects and relations. Their argument is that in this reification, "a new mathematical realism" is produced. Understanding and improving school learning thus requires moving beyond explorations of didactical transposition to include technological transposition. Like Ruthven they suggest that research in technology and the teaching and learning of mathematics is but at is very beginnings – more is needed.

In many ways, though more or less implicitly, both chapters suggest that the potential for technological tools to transform the nature of mathematical learning in school has not been realised. Through his review of research, Ruthven points to the conceptual limitations of quantitative studies. Their descriptions are suspect, and so too claims for or against the benefits of using technology to support mathematical learning. He is also cautionary about qualitative studies and uncritical generalisations from such research. Yet both chapters end with a call for more research.

We find this interesting, particularly in an educational climate where accountability for public spending is on the increase. In teacher education research, for example, there are increasing demands for demonstrating the impact of teacher education on student learning (Taylor & Vinjevold, 1999; Wilson & Berne, 1999). Teacher education needs to demonstrate its worth. Is the same true of technology in support of mathematics teaching and learning?

On whose behalf is technological research advocating? Is it against social discrimination? Is the advocacy for Mathematics? Or is advocacy locked into the tool itself? To be specific, on whose behalf was the extensive research on Logo advocating? Logo has come and almost gone. Who has come to benefit from the money spent on its development and dissemination?

Research into technology and the teaching and learning of mathematics, like the wider reform movement of which it is part, has come to count in the dominant mathematics education research community. The question that needs to be asked, from an ethical point of view, is: On what grounds do those researching technological tools in mathematics education defend their research. Presumably, the dominant defence will be from a development perspective, and particularly in relation to the epistemological potential of technological tools in mathematics teaching and learning. In fact, Balacheff & Kaput argue for the democratising potential of some of the software currently in use. Their argument is based on the new realism provided, and thus potential for greater access to otherwise abstract mathematical ideas and concepts. The problem, of course, is that they do not simultaneously question the costs of providing and sustaining such technological resources across schools. The serious difficulties in defending the research from a perspective of democracy were

evident at PME in Finland in 1997, where the panel discussion was on technology. Most contentious was Kaput's claim about "boxer" as a democratising tool. As was strongly argued, democratising in terms of mathematical mediation, maybe, but such opening up of mathematics would only be for a privileged minority. Arguing that a technology can democratise mathematics, making it more available and transparent for a particular learner, could not be defended from the perspective of mathematics for all.

At ICME9 in Japan, when the Technology Working Group reported on their working group deliberations during the conference, they too expressed the view that technology has not yet fulfilled its promise of educational transformation in mathematics. Yet investment continues, both in improving the tools and researching their educational use. The internet is now a new source of knowledge and work for the community of researchers in mathematics education.

We are not suggesting that technology-related research should be abandoned. Most people in the mathematics education community recognise the enormous potential of technology to transform the teaching and learning of mathematics. No doubt, most of us are excited by the possibilities, especially the epistemological shifts. The research on dynamic geometry is certainly a case in point, and the way that LOGO has been developed in floor turtles and various microworlds is another. Many of the software developments are themselves driven by people with the vision of those potential epistemological shifts: Papert, di Sessa, Laborde, Kaput, Confrey to name just a few. As we have indicated, it is of concern to our community that such potential has scarcely been fulfilled, even in technology-rich environments. However, many developments are driven not by people in the mathematics education community with vision, but by the market: incorporating Derive into graphical calculators is an example, the many forms of programmed learning is another. We acknowledge the vision of those of our colleagues who work to realise the potential of even these innovations for teaching and learning of mathematics and for greater equity in achievement. But it is here that we move into difficult ethical territory. Were funding for research to be available without preference to particular areas in mathematics education, would it be ethically appropriate to put resources into a field that is aimed at the few, across the world as well as across schools within technology-rich

countries, even in the medium to long term? Where more funding goes into technology disproportionately, additional questions need to be asked about who is providing the funding and why. On whose behalf is the research being done? Does it incorporate the insider's perspective, from an equity point of view?

This arena in mathematics education research, particularly because of its obvious position in the tension between development and democracy, requires a greater and more self-conscious ethical stance in its work.

Reflective comment

Our reflection on research in mathematics teacher education, large-scale international comparative assessments and technology has been to provide illustrations and illumination of the ethical questions that need to frame our practice in mathematics education research. Ethical challenges are not exclusive to qualitative research and an obviously conflictual area like teacher education, but also reside in quantitative studies where anonymity of individuals is secure but not so communities or countries. We have extended ethical questions beyond the production processes of research to include its dissemination, and argued that research reported can and has been used to feed a conservative agenda. This extended beyond comparative studies like TIMSS to aspects of teacher development research. Cooper and Dunne (2000) express a similar concern in the introduction to their book. They are aware that their extensive illumination of validity issues in more complex forms of assessment could well be turned to fuel a conservative pedagogical agenda currently in play in the UK. Their response to this ethical dilemma is to make it explicit, and to state their position quite clearly. They do not see the research as pointing to a return to basics, but rather as illuminating the work that needs to be done in teaching and learning of mathematics so that new forms of assessment are not discriminatory.

In addition, we have situated our exploration of ethical practice in the mathematics education community in a globalising and increasingly complex world from – a world where mutual respect for truth, persons and democracy in any research endeavour can pull in contradictory ways. We went further to suggest that the ethical
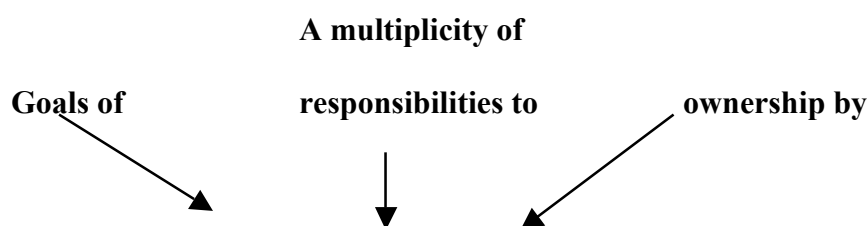
question of 'who benefits' includes a consideration of finances, particularly as the gap between haves and have nots continues to widen.

There has been a distinct Southern African focus in this paper. We are aware of the danger that some readers might marginalise the ethical issues we have raised because the history of the region, indeed the continent, is full of very dramatic inequalities, exploitation by the 'developed' world, and so on. We insist, though, that whilst inequalities might be more stark in Southern Africa than in many other places, inequalities and injustices are just as pervasive and ubiquitous in every part of the world and within every society, if sometimes less obvious. The cultural capital of success in school mathematics is common across the world: so too is the failure of so many students from working class and disadvantaged groups in mathematics. It is precisely the high levels of inequality that throw ethical issues into relief, issues that need to be confronted by all mathematics education researchers wherever they are.
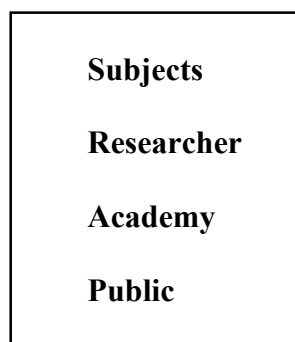
A Framework for an ethical approach to research in mathematics education

We turn now to drawing together and extending our analytic and theoretical framework for working in the mathematics education research community. We have suggested that one should consider educational research as located in a knowledge-producing community. In doing so, what comes to the fore is the engagement with others and with history in an enterprise that should meet, as well as perhaps challenge, sets of socially constituted standards and values. Research communities, like all communities, are fragmented, with sub-groups, established and new paradigms, tensions, disputes, and boundary conflicts. These are indications of a normal healthy research community: the modernist image of a unified scientific group achieving universally accepted answers to universally agreed research questions is no longer expected. The complexity of the research enterprise is thus captured in the notion that it is a social practice.

Research can then be seen as a map:

A multiplicity of

Goals of   **responsibilities to**   **ownership by**

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┌─────────────────────┐
│                     │
│   **Subjects**      │
│                     │
│   **Researcher**    │
│                     │
│   **Academy**       │
│                     │
│   **Public**        │
│                     │
└─────────────────────┘
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Research must take account of this multiplicity. Thus, in our first scenario, our researcher's dilemmas concern:

Goals: to modify his study of inquiry-based mathematical learning, or to examine why testing overcame other issues. He needs to be aware of the goals: of his subjects, the teachers, to be supported in their struggles, not undermined, and not to have their trust broken; of the academy, to do what informs *mathematics education* research in ways that uphold if not develop the ethical standards of the community; and of the public, who want the best for their children, whatever that may mean, and who want their privacy respected.

Responsibilities: to his subjects, the teachers, to advocate for them, not to hold them up for criticism when they joined him in his plans in good faith, as his understanding of their situation changed; to himself, in gaining a PhD within the community to which he belongs and at the same time to be true to what matters to him in his research; to the academy, to advance knowledge of the teaching and learning of mathematics in its widest sense whilst challenging the community to recognise and value the research issue; to the public, to do research that takes care of teachers and students whilst informing for future policy.

Ownership: by the subjects, who see themselves to some degree as participants in the research, to improve the learning of their students, but pulled also by many other, perhaps stronger, constraints; by the researcher, who demands that his community also claim ownership through him; by the academy, that this *matters* to

mathematics education research; by the public, that they should share in researching their schools.

One could carry out a similar analysis for any of the areas of research we have described in our chapter. This map, then, can act as a guide in identifying what and whom research is for and what part all the actors play in the research.

In addition, we have outlined above eight questions to frame an ethical approach, aimed at getting the description right. We repeat them here.

1. On whose behalf is the research advocating? Is it against racism, sexism, classism etc?
2. What is the research for? Can the researcher defend the research? On what grounds?
3. Does the research incorporate the insider's perspective?
4. Is the research reflexive?
5. Does the research take care of those being researched, especially avoiding their oppression?
6. Does the research draw on a refined notion of consent?
7. Does the research draw on a refined notion of autonomy?
8. Does the research draw on a refined notion of privacy?

Our proposal is that answers to these questions and responses to the map must form an integral part of research. But they are not answered once, nor are they answered in an uncontested way. Thus they need to be revisited as research proceeds, and the answers and responses must be addressed in interaction with the community.

In conclusion

To conclude this paper, we return to the issue that makes this chapter an extension to the existing work on ethics in educational research, namely, what makes something *mathematics education research*. In conjunction with the need for researchers to address the map and the questions we have set out, there is the need for the community to look into its assumptions regarding what makes a piece of research *mathematics education research*. The community is very successful in locating and

engaging with issues and challenges where the mathematics is prominent. A focus on the mathematics, however, requires that researchers are always aware of what is out of focus, the overlapping social practices that constitute the teaching and learning situations. We are convinced that the community also needs to be more open to seeking questions and answers where the mathematics recedes behind a myriad of intersecting social and political issues. Again, this is another focus of the lens in which the researcher creates the object of research through the process of foregrounding and, therefore, backgrounding.

When researching social and political forces in education, as in our first scenario, the mathematics is an essential feature in that it constitutes that setting quite differently from any other by virtue of the place that mathematics holds in society, in relation to education and to achievement. Let us be clear: social and political issues are not an irritation that gets in the way of research in mathematics education. We consider it our ethical responsibility to seek out these settings for research. Otherwise we collude in denying access to power and control over their lives for the majority of students.

References

Adler, J. (1997) A participatory-inquiry approach and the mediation of mathematical knowledge in a multilingual classroom. *Educational Studies in Mathematics*, 33, 235-258.

Adler, J. (1998) Resources as a verb: recontextualising resources in mathematics education. In Olivier, A. and Newstead, K. (Eds.) *Proceedings of the 22nd Annual Conference of the International Group for the Psychology of Mathematics Education. Vol 1*. University of Stellenbosch, Faculty of Education. Pp. 1-18.

Adler, J. (1998b) (Ed*.) Perspectives on the Third International Mathematics and Science Study*. Proceedings of a National Seminar. Mathematics Education Development Programme. University of the Witwatersrand. Johannesburg.

Adler, J. (1999) Redistribution of resources = equity? In Kuiper, J. (Ed.) *Proceedings of the 7th Annual Meeting of the Southern African Association for Research in Mathematics and Science Education. University of South Africa. Harare. Zimbabwe.* Rhodes University. Grahamstown. Pp. 23-32.

Adler, J. (2000) Conceptualising resources as a theme for mathematics teacher education. *Journal of Mathematics Teacher Education.* 3, 3. 205-224.

Adler, J. (in press) Re-sourcing practice and equity: A dual challenge for mathematics education. In Atweh, B., Forgasz, H. & Nebres, B (Eds.) *Sociocultural research on mathematics education: An international perspective*. Lawrence Erlbaum Associates.

Adler, J. (forthcoming) *Teaching dilemmas in multilingual classrooms*. Kluwer Academic Publishers. Dordrecht.

Adler, J., Lelliott, T., & Slonimsky, L. with Reed, Y., Bapoo, P., Brodie, K., Davis, H., De Wet, H., Dikgomo, P., Nyabanyaba, T., Setati, M. (1997) *A Baseline study: teaching/ learning practices of primary and secondary mathematics,science and English language teachers enrolled in the Wits Further Diplomas in Education programme*. Faculty of Education. University of the Witwatersrand. Johannesburg.

Adler, J., Lelliott, A., & Reed, Y., with Bapoo, P., Brodie, K., Davis, H., De Wet, H., Dikgomo, P., Nyabanyaba, T., Setati, M., & Slonimsky, L. (1998) *Mixed-mode FDEs and their effects. Interim Report June 1998*. University of the Witwatersrand. Faculty of Education. Johannesburg. June 1998

Adler, J., Bapoo, P., Brodie, K., Davis, H., Dikgomo, P., Lelliott, T., Nyabanyaba, T., Reed, Y., Setati, M., & Slonimsky, L. (1999) *Mixed-mode Further Diplomas in Education and their Effects: Summary Report on Major Findings of a Three-year Research Project.* Faculty of Education. Johannesburg. August 1999. Also published in *Open Learning Through Distance Education (OLTDE)*. 6, 1, 2000.

Adler, J. & Reed, Y. (2000) Researching teachers≪ take-up from a formal in-service professional development programme. *Journal of Education,* 25, 192-226.

Balacheff & Kaput (1996) Computer-based learning environments in mathematics. In Bishop, A.J., Clements, K., Keitel, K., Kilpatrick, J. & Laborde, C. (Eds*) International Handbook of Mathematics Education*. Kluwer. Dordrecht. Pp. 469-504.

Bassey, M (1999) Case study research in educational settings. Buckingham: Open University Press.

Bernstein, B (1996*) Pedagogy, symbolic control and identity: Theory, research and critique*. London: Taylor & Francis.

Brodie, (1999) Working with pupils' meanings: Changing practices among teachers enrolled on an in-service course in South Africa. In Zaslavsky, 0. (Ed.) *Proceedings of the 23ʳᵈ conference of the International Group for the Psychology of Mathematics Education*. Israel Institute of Technology. Haifa. . Vol 2, pp. 145-152.

Brodie, K. (2000) Mathematics teacher development in under-resourced contexts: A case study. In Matos, J. & Santos, M. (2000) (Eds.) *Proceedings of the Second International Mathematics Education and Society Conference (MES2).* Universidade de Lisboa. Portugal. Pp. 214-223.

Brown, A. & Dowling, P. (1998) *Doing research/ reading research: A mode of interrogation for education*. London. Falmer Press.

Brousseau, G. (1989) Le contrat didactique: Le milieu. *Reserches en Didactique des Mathemtiques*, 9, 3, 309-336.

Cooper, B. & Dunne, M. (2000) *Assessing children's mathematical knowledge: Social class, sex and problem-solving.* Open University Press. Buckingham.

Graham, A. T. and Thomas, M. (2000) Building a versatile understanding of algebraic variables with a graphic calculator. *Educational Studies in Mathematics.* 41, 3, 265-282.

Howe, K. R., & Moses, M. S. (1999) Ethics in Educational Research. In Iran-Nejad, A. & Pearson, P. D. (Eds.) Review of Research in Education. #24. Washington. American Educational Research Association. Pp. 21-59.

Howie, S. (1998) TIMSS in South Africa: the value of international comparative studies for a developing country. In Adler, J. (Ed*.) Perspectives on the Third International Mathematics and Science Study.* Proceedings of a National Seminar. Mathematics Education Development Programme. University of the Witwatersrand. Johannesburg. Pp. 22-40.

Keitel, C. & Kilpatrick, J. (1999) The rationality and irrationality of international comparative studies. In Kaiser, G., Eduardo, L. & Huntley, I. (Eds) *International comparisons in mathematics education.* London: The Falmer Press. Pp. 241-256.

Lampert, M. & Ball, D. (1998) *Teaching, multimedia and mathematics: investigations of real practice.* New York: Teachers   College Press.

Lave, J., & Wenger, E. (1991) *Situated learning: Legitimate peripheral participation.* Cambridge, England, Cambridge University Press

Lerman, S. (1998). A moment in the zoom of a lens: Towards a discursive psychology of mathematics teaching and learning. In A. Olivier & K. Newstead (Eds.), *Proceedings of the twenty-second annual meeting of the International Group for the Psychology of Mathematics Education* (Vol. 1, 66-81). Stellenbosch, South Africa: Faculty of Education, The University of Stellenbosch.

Mwakapenda, W. (2000). *Using everyday experiences in teaching secondary mathematics in Malawi: Possibilities and constraints for change.* Unpublished Ph.D Thesis. Deakin University. Melbourne, Australia.

Nebres, B. F. (1999) International benchmarking as a way to improve school mathematics achievement in the era of globalisation. In Kaiser, G., Eduardo, L. & Huntley, I. (Eds) *International comparisons in mathematics education.* London: The Falmer Press. Pp. 200-212.

Plomp, T. (1998) Purposes and challenges of international comparative assessments. In Adler, J. (Ed*.) Perspectives on the Third International Mathematics and Science Study.* Proceedings of a National Seminar. Mathematics Education Development Programme. University of the Witwatersrand. Johannesburg. Pp. 6 – 21.

Rawls, J. (1971) *A Theory of Justice*. Cambridge. Harvard University Press.

Ruthven, (1996). Calculators in the mathematics curriculum: the Scope of personal computational technology. In Bishop, A.J., Clements, K., Keitel, K., Kilpatrick, J. & Laborde, C. (Eds*) International Handbook of Mathematics Education*. Kluwer. Dordrecht.

Ruthven, K. (1999) The North writes back: North-South dialogue. *Perspectives in Education*. 18, 2, 13-18.

Setati, M. (1998) Chanting and chorusing in mathematics classrooms. In Olivier, a. & Newstead, K. (Eds.) *Proceedings of the 22rd conference of the International Group for the Psychology of Mathematics Education*. University of Stellenbosch. Stellenbosch. Vol.4, pp. 304.

Setati, M & Adler, J. (in press) Between languages and discourses: Code-switching practices in primary mathematics classrooms in South Africa. *Educational Studies in Mathematics*.

Setati, M., Adler, J., Reed, Y. & Bapoo, A. (in press) Incomplete journeys: Code-switching and other language practices in mathematics, science and English language classrooms in South Africa. *Language and Education*.

Sowder, J. T. (1998) Ethics in mathematics education research. In Sierpinska, A. & Kilpatrick, J. (Eds.) *Mathematics Education as a Research Domain: a search for identity*. In ICMI Study, Book 2. Dorcrecht. Kluwer. Pp. 427-442.

Taylor, N. & Vinjevold, P. (1999) *Getting Learning Right*. Johannesburg: JET/DoE.

Usher, R. (1996). Textuality and reflexivity in educational research. In D. Scott and R. Usher (Eds.) *Understanding Educational Research* (pp. 33-51). London: Routledge.

Valero, P. and Vithal, R. (1999) Research methods of the "North" revisited from the "South". *Perspectives in Education*. 18, 2, 5 – 12.

Vital, R. (2000). Re-searching mathematics education from a critical perspective. In J-F Matos & M. Santos (Eds.) *Proceedings of the second international mathematics education and society conference* (pp. 87-116). Lisbon: Centro de Investigação em Educação, Faculdade de Ciências da Universidade de Lisboa.

Wilson, S. & J. Berne (1999) Teacher learning and the acquisition of professional knowledge: An examination of research on contemporary professional development. In Iran-Nejad, A. & P. David Pearson. (Eds.) *Review of Research in Education # 24*, 1999. Washington: American Education Research Association. Pp. 173 - 209