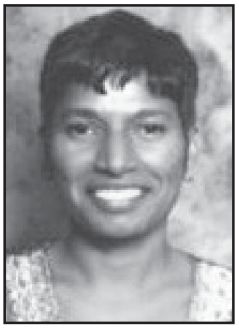
Perspectives in Education, Volume 23(3), September 2005

What mathematics learners say about the new South African curriculum reform

RENUKA VITHAL AND NIRMALA GOPAL

RENUKA VITHAL *is Dean of the new merged Faculty of Education at the University of KwaZulu-Natal. Her areas of research and teaching are mathematics education and educational research. In particular her interests are in the relation between mathematics teaching and learning and society including issues of democracy, equity and social justice within theory, policy, research and practice. She is presently the South African project leader for an international study on learners' perspectives of Grade 8 mathematics classrooms across ten countries.*



NIRMALA GOPAL *is currently employed in the Department of Social Work and Criminology at the University of Fort Hare. had been a classroom practitioner for 14 years and engaged curriculum reform at institutional and teacher union levels. She participated as a research assistant in the international study on learners' perspectives of Grade 8 mathematics classrooms. Her masters and doctoral degrees focused on curriculum issues at the level of the national department of education and at the classroom implementation level. Dr. Gopal continues to have an interest in curriculum reform issues as it affects learners at school and tertiary institutions.*

Abstract

In this article we report on what Grade 8 learners say about the new curriculum reforms in South Africa – Outcomes-based Education (OBE) and Curriculum 2005 (C2005) – that were introduced into their mathematics classrooms. The article begins by addressing what is argued to be a gap in reform research in mathematics education. It draws primarily on focus group interviews conducted with learners after having observed a series of consecutive lessons in three different previously racially segregated schools in the Durban region from the international study on mathematics learners' perspectives. The analysis is organised in five broad themes that emerged from the data, some of which resonate with the design features of the curriculum reforms: a strong focus on group work; the attempt to forge relations between mathematics and context; changes in the use of learning-teaching materials such as worksheets; issues of assessment; and learners' take-up of the discourse of the new curriculum approach. Learners' views seem to be linked to their teachers' explicit (non)engagement with the new curriculum, and they appear to be aware of the tensions and trade-offs for themselves in the enactment of the new curriculum.

Key words: mathematics curriculum reforms; mathematics learners' perspectives

Reform research in mathematics education

The analysis of learners' views and perspectives presented in this article are framed against an emerging field of research in mathematics education that may be referred to as reform research or policy studies. A number of mathematics educators (Amit & Fried, 2002; Bishop & Volmink, 2002; Lerman *et al.*, 2002, Vithal & Volmink 2005) point to a dearth of scholarship and studies that focus on relations between policy, practice, research and theory in mathematics education. However, a steady trickle of work published on mathematics education reforms in general education literature in the last decade such as Wilson *et al.*, (1996) and Knapp (1997) has become a growing wave in the last few years with several international volumes on mathematics education research, theory and practice devoting chapters, and entire sections to policy issues and reforms in mathematics education (see Kelly & Lesh, 2000; English, 2002; Bishop & Volmink 2003, Vithal & Volmink 2005) and an increasing focus on conferences such as the Southern African Association for Research in Mathematics, Science and Technology Education (for e.g. Brown 2003; Butler-Kahle, 2003) and the International Congress of Mathematics Education (see for e.g. the Programme for ICME 10, 2004, Denmark). One consequence of the emergent nature of this area of research is that theoretical and methodological tools for analysis are relatively underdeveloped.

Reform research is by definition concerned with change and as such the set of questions that reform research must engage is related to change of the "whole complex of students, teachers, researchers, parents, and politicians" (Amit & Fried, 2002, 355). A perusal of this limited literature that may be deemed reform-related research shows that the concern has been far more with some parts of this complex than with others. Arguably, the main focus in much of this work has been on teachers. This is also the case for South Africa. For example national curriculum policy reviews such as those interrogating the effectiveness of the introduction of first major post-Apartheid curriculum reforms of Outcomes-based Education and Curriculum 2005 (Department of Education, 2000) or research published on these reforms such as Jansen and Christie (1999) and also in mathematics education (Vithal, Adler & Keitel, 2005; Adler & Reed, 2003) do not in the main refer, as the primary unit of analysis, to what learners say, experience and learn within an OBE system. Yet, if education is, in the final analysis, about learners and what learners gain and take away from the curriculum, then one would assume that research and evaluation of outcomes-based education and C2005 would focus, as a priority, on all aspects of outcomes themselves for learners. This is surprisingly not the case. As Harley and Wedekind (2003, 3-4) state with respect to one key design feature of the new South African curriculum in which ironically learner-centredness is given considerable priority, "The learners' experience of classroom practice is the dimension of C2005 most poorly served by research", and identify as a gap in their review of research in this area that "learners in the learner-centred system have been displaced from the gaze of research".

Within mathematics education research this claim may however, be disputed and modified. One needs only to refer to the numerous analyses with an intense preoccupation with learner performance and pass rate scores. It might be argued that the focus on learners has been achieved through the range of studies conducted on learner achievement through paper and pencil tests and surveys. Research, such as the Third International Mathematics and Science Study (TIMSS) (Howie, 1997) and TIMSS-Repeat (Howie, 2001), focus on learner performance and to a limited extent on learner background. No doubt the third round of data production in TIMSS undertaken in Grades 8 and 9 in 2002 in South Africa (HSRC, Reddy 2004), well after the introduction of OBE and C2005, will be thoroughly examined for the implications of the changes introduced through the new reforms. In South Africa, the largely quantitative TIMSS type of studies, has come to dominate publicly what is known about mathematics learners. Such media discussions often do not qualify learner outcomes with respect to the huge inequalities still

inherent in the education system or take account of issues of methodology such as problems of language, curriculum match and unfamiliarity of test format in mathematics teaching and learning in South Africa. These approaches continue to be used, despite these types of tests and methods being thoroughly criticised in mathematics education research. Long established tried and tested methodologies of large scale research in mathematics education that typically follow paper and pencil tests with learner interviews (in well known earlier studies for example by Hart, 1981, and more recently Cooper and Dunne 2000) have highlighted many of the difficulties of studies that rely exclusively on quantitative approaches that seem to dominate in South Africa. TIMSS-type studies, here and abroad, have been critiqued for how they are conducted, who conducts the studies, whose interests are served in how the design is negotiated, who pays for the research, and how they are used in reforms to make judgments, comparisons and generalisations about learners and teachers nationally and globally (Keitel & Kilpatrick, 1998).

It is in part in response to this critique that the international Learners' Perspective Study (LPS, 2000) was conceptualised, to attempt to produce alternate, deeper and more nuanced learner and teacher scripts. In South Africa, despite the dominance of constructivist theories of learning and the rise of a focus on respect for indigenous systems of knowledge, most of the large macrostudies of learners and teachers, often not conducted by mathematics education researchers and experts, are in the main described in deficit modes both in policy evaluations and reviews. It is this deficient perspective, often implied or assumed and silence about what learners think, say and experience about the mathematics curriculum reforms, that is being addressed here. The research design of the LPS makes learners the focus and seeks to develop a view of the mathematics classroom from their vantage point, to explore their perspectives, practices and reasons for learning, whatever it is that they come to learn in a mathematics classroom. In this article we focus specifically on what South African learners reflect on their knowledge and experience of the curriculum reform introduced through OBE and C2005 (these terms are used interchangeably by learners and teachers in the study).

It is important to observe that mathematics education reforms are being introduced across countries. Even though different countries refer to their reforms through different kinds of discourse, there is remarkable consensus on what are deemed desirable progressive practices in mathematics teaching and learning within each of these reforms. Learner-centredness, group work, alternative assessments and activity-oriented approaches are widely advocated within mathematics curriculum reforms across a broad diversity of countries. South Africa is no exception. The focus on learners, what they say, feel, think and do, beyond assessment measures is increasing (Allen, 2004; Jeffrey, 2003; Pollard *et al*., 2002). Is this article we explore what specific changes (if any) learners have noticed and observed taking place in their mathematics classroom since the curriculum reforms have been introduced and what they mean to them. In listening to learner voices and views, this article distills and discusses five themes, which resonate with some of the key design features and principles of the mathematics curriculum reforms themselves and hence are brought into sharper relief against the policy intentions.

Methodology and context: LPS in South Africa

In the LPS design three schools in one city area were selected that were in a sense typical of public school types in each of ten countries. In South Africa the three secondary schools were chosen in the Durban area where the study was based: a former "Indian" (Himalaya) school, a former "White" (Settlers) school, and an "African township" (Umhlanga) school, resulting from the schooling system demographics of the city and the still enduring effects of apartheid's racial classification. This selection however, also depended on the choice of mathematics teachers. The study sought to include teachers who were deemed competent and exemplary by the particular community in which they worked. The focus across countries targeted Grade 8

mathematics classes (one of the bands selected in TIMSS). In South Africa the criteria included teachers who had attended OBE workshops since data production began in 2001, the year that OBE and C2005 were introduced in Grade 8. In both Himalaya and Umhlanga, the teachers selected for the study were also responsible for facilitation of the new curriculum within their schools and fully versed in and committed to the curriculum reforms of OBE. They had specifically requested the opportunity to teach Grade 8 classes to take up the challenges of the new curriculum. The selection of a teacher in a former "White" school as a research site faced a number of different challenges which included finding a public co-ed school, issues of access for black researchers (Khuzwayo, 2005) and the view held by teachers in these schools, including the one who participated in the study, that they were "doing OBE" well before its implementation. All three teachers were well qualified to teach mathematics, had had considerable experience, having taught mathematics up to Grade 12 and enjoyed a very good reputation as mathematics teachers with leadership roles in their schools.

Each teacher, in turn, selected a Grade 8 class that they were teaching for the research process. A series of consecutive lessons were videoed – 14 at Himalaya over 6 weeks in the first term of 2001, 9 at Umhlanga over 4 weeks in the third term of 2001; and 14 at Settlers over 5 weeks in the second term of 2002 – using three cameras in each lesson: one that focused on the teacher, another on a group of selected learners and a third focused on the whole class. The images from the camera focused on the teacher and the group of learners selected for that lesson were mixed on site to show the teacher and learners in a single screen and used immediately after the lesson for the focus group interviews with the group of learners who were the target for that lesson.

The data analysed in this article draw primarily from these post-lesson interviews in which learners could refer to the video, worksheets, or their written work to reflect on the lesson or any aspect of the teaching and their learning. The interview questions included open questions, both specific to the lesson and more broadly about learners' mathematics educational experiences and views. That is, reflections on their understanding of and engagement with the mathematics, the contexts, the relation between these, the teachers' practices, peer and group workings, about OBE and changes in the mathematics lessons, homework, and their feelings and attitudes towards mathematics and possible future choice of mathematics in further studies. The specific probes for the generation of the data related to the OBE curriculum reforms typically began well into the interview, and depending on earlier responses, first established if learners knew or had heard about OBE or C2005; if they had, then what had they noticed or experienced as having changed in their classrooms and in how mathematics was taught (in primary school, high school, or since the researchers had come to the class); and what they thought about those changes.

All learners – 45 at Himalaya, 48 at Umhlanga and 27 at Settlers – were interviewed within the groups that they worked in their class, at least once. Some groups were split up for the focus group interviews, according to their preference to be interviewed in English or isiZulu. It should also be noted that the data analysed here draw on learners who had experienced curriculum changes over a two-year period since the reforms were introduced during their primary schooling in Grade 7 of the previous year (2000), whereas the teachers in the study were implementing OBE and C2005 for the first time in Grade 8 in high schools (2001). Hence some learners drew comparisons between their primary mathematics Grade 7 classroom and their present Grade 8 experiences when responding to questions related to OBE changes. Other data produced for the study included teacher questionnaires for each lesson, teacher interviews; all lesson materials from learners and teachers, researchers' field notes and learner performance on an International Benchmark Test based on TIMSS.

Themes in learners' perspectives on OBE

This analysis is based on learners' responses to questions about what had changed in their mathematics lessons since the introduction of OBE and C2005. As such it does not focus on how learners are experiencing the learner-centred design feature of the new curriculum reforms, rather it is to make visible and available what thoughts and opinions learners have on what they see and experience as changes as they live their mathematical lives in "reformed" mathematics classrooms. The questions emerged in different ways in the interviews depending on what had occurred in the lessons. However, since the teachers at both Himalaya and Umhlanga were actively implementing OBE based on their own in-service education and understanding, these two classrooms were very different in form and substance from those at Settlers. In Umhlanga and Himalaya all lessons observed were organised with learners arranged in groups, which included strong activity-based real life contexts (e.g. substance abuse and HIV/AIDS) in the lessons. At Settlers learners were seated in conventional rows facing the teacher engaging in mainly textbook type problems. The interview and learner data for Settlers with respect to reflections on OBE curriculum reforms were therefore markedly different from the other two classrooms. [Detailed lesson content and context have been described elsewhere for Himalaya (Goba, 2004) and for Umhlanga and Settlers (Sethole, 2004).]

The learners' responses appeared to span and resonate with different key design features and principles of the new curriculum. Hence this analysis is organised around five themes that emerged in the data, which also happen to be reflected in the new curriculum policy frameworks. The data discussed below point to learners' focus on group work, a different mathematics, changes in learning materials used and in assessment and finally on their engagement with the new language and discourse of OBE.

Theme 1: OBE is group work

Group work is a widely advocated progressive pedagogy in mathematics education that has been reinforced in the new curriculum reforms and a feature observed in many classrooms in which teachers claim to be implementing the new curriculum (Brodie *et al*., 2003; Brodie & Pournara, 2005). Learners at both Himalaya and Umhlanga were organised in groups throughout the consecutive lessons observed, even though there were various combinations of group work activity and whole class teaching in any one lesson. Not surprisingly for many students OBE was synonymous with group work and it was one of the most frequent references made by them as signifying change in their mathematics classroom both in primary and secondary school mathematics teaching:

Int: What do you think OBE is?
L2: Group work
Int: What about in the learning of math, is that different? Is there an OBE math like you think, or is that the same?
L3: Its different.
Int: Its different, how?
L3: Working in groups, maybe we work much in groups.

(Himalaya; post lesson 8)

Within the focus groups learners could articulate and argue how they experienced group work both positively and negatively from difference perspectives. The strength of working in a group for some learners was about being helped in class – and this was an important change that the new curriculum brought.

L3: You doing alone, now you have 550 people to tell … if you don't understand the topic they help you

L1: People around you help you
L4: And also in the old system you did not know what was right or wrong and now the group helps you and tells you what is right or wrong
Int: Does the group sometimes give you the wrong answer?
Ls: Sometimes

(Himalaya; post lesson 6)

What was surprising is how learners understood the relation between what they often referred to as the "old" and "new" system, and the payoff that each provided for themselves in pointing to a rather sophisticated connection between individualised work and group work. It is clearly not easy to work in groups but the old is also recognised in the new.

Int: You all saying you like the old system better?
L1: The old system was better.
Int: What about the old system was better?
L2: Cause you like relied on yourself.
Int: You feel you not relying on yourself now?
L2: I do, but, cause sometimes I just wish I could do my own work. But, I have to contribute to the group
Int: And that's not such a good thing?
L2: Yes
Int: Why is it not a good thing to help somebody else?
L1: Cause it's hard to explain.
L2: Ya it's hard to explain.
L1: Cause when you explain it to somebody, they don't get it and we have to explain it over and over again and we are getting delayed back with our work.
Int: But sometimes doesn't explaining help you to understand better?
L1: Yes it does.
Int: So in that way you are benefiting when you are explaining, what do you think?
L3: In the old method of teaching, one person can do his work, his assignment. If you have an assignment in OBE then everybody will have to give their input and some people won't do the job right and stuff to contribute to the assignment.
L1: But it is kind of like the old system because sometimes we do get individual work which we do ourselves. But in the old system we did it by ourselves and if we didn't understand we didn't ask the teacher sometimes, we asked each other, whoever is sitting next to us, and in this it is just working in groups, and some people do all the work and they get credit for it and it's kind of going back to the old system.

(Himalaya; post lesson 13)

Learners at Umhlanga, were much more positive about group work than those at Himalaya, often citing how group work helped to provide explanations for understanding mathematics that were not always available during the lessons where the teacher had a large class to attend to or from their home situations as indicated in responses about who helps them with homework. Very similar findings are also observed by Adler *et al.* (2001) in Grade 7 township and non-urban learners who were explicit that what was new in their learning of mathematics was that they now discussed and solved problems in groups and claimed that this assisted their understanding. For those learners at Himalaya, who preferred individualised learning in which they could regulate their own pace, the implementation of group work as a mandatory aspect of OBE implementation was an unnecessary annoyance and regarded as a waste of their time. However

it was also important to observe that learners did change their perspective about a particular position or viewpoint when challenged by other learners or the interviewers about observed benefits or difficulties experienced during classroom discussions in their groups.

Although both teachers assigned specific roles to the individual members of the group such as "group leader", "scribe", "encourager", "spokesperson", "manager", learners did not refer to these in their interviews. These two main aspects for learners – being helped to understand mathematics and its link to assessment – need to be understood also with reference to the looming Grade 12 individualised, paper and pencil, time-limited, mathematics content-focused, high stakes national exams. The fact that learners have to co-operate during group work within a context in which the assessments that are valued and count most are individualised tests for exams was ever-present in the discussion.

Theme 2: More worksheets

Another aspect of pedagogy learners in both Himalaya and Umhlanga noticed and commented on were changes in the resources teachers used to teach mathematics. The move to group work was connected by learners to other aspects of classroom practice, like getting more worksheets and doing less writing.

L1: So usually if you work with the old system you work individually … but when working the OBE system you work in groups and I get more worksheets than written work.

L2: We only got that worksheet because mostly we are doing activities in groups.

(Himalaya; post lesson 6)

This change in how mathematics is presented through the resources teachers deploy is connected with what the teacher does in the classroom, for instance using more activities to teach mathematics. The issue of resources for teaching and learning in the implementation of the new curriculum reforms has been foregrounded especially the provision of adequate and appropriate textbooks and other materials (Adler *et al*., 2003). As one group explained:

L2: This (OBE) is more interesting because you don't do a lot of writing. You are just given worksheets to complete. You don't have to write on the board. Learners simply paste the worksheets onto their exercise books.

Int: So the teacher no longer writes on the board?

L4: In most cases we are given tasks to work out on our own. The teacher does not tell us what to do. She only corrects what we have done.

L1: Sometimes we are given worksheets where the task is to measure lengths and heights of objects.

(Umhlanga, post lesson 3)

Both teachers were observed using a number of texts including their own to construct worksheets but they also relied on worksheets provided during departmental workshops which they copied and distributed to the whole class. For learners at Umhlanga and Himalaya there was a significant shift from dominant traditional teaching approaches of working out examples on the board and then requiring learners to copy these and complete exercises written on the board or in textbooks. None of them referred to exercises but rather to having to do activities.

Int: Is the maths different in any way now from what you were doing before OBE?

L2: No, we are mostly getting more activities.

L1: And mostly do written work, see like now we are only getting worksheets.

Int: Okay, whereas before?

L1: We shouldn't get the worksheets, sir should just write things on the board and we should just copy all that down. So now it's just like worksheets, so we

only got like one maths book where we have activities, but the rest of the work is like how sir told us to do.

Int: And do you prefer that or do you don't like that?

L1: I prefer that.

Int: Why?

L1: It's easier, like mostly like, maybe we will do geometry but we do it on worksheet, like it's better to carry one file than so many books.

Int: Okay so you just keep one, but you have an algebra book?

L2: It's prepared. Like if they write it on the board, everything, it takes time to copy it down and then figure out the answers.

L1: Unless the teacher writes it down.

L2: Just figure out the answers.

(Himalaya; post lesson 14)

Learners' preference for the newer mathematics learning materials produced for the new reforms have been observed in other studies (Adler *et al*., 2001). However, the use of more worksheets and including activities requiring less writing are seen as pedagogical practices that are also questions of practical classroom organisation matters about the time used during lessons to copy work and the number of books to carry. Although the teacher at Settlers also used worksheets as the dominant resource none of the learners from this school remarked on this because worksheets were a more long standing and established practice in this school whereas both the other teachers had made shifts from their past practices from chalk board and textbook use. A further reason is also that the problems in the worksheets used in lessons at Settlers were similar to those commonly found in more traditional textbooks, whereas the other two teachers constructed several worksheets of their own to incorporate practical activities relevant to the environment in which the school was located and that embodied contextual issues (Sethole, 2004).

Theme 3: OBE mathematics is different

Besides having to work in groups and noting specific practices being engaged such as the teachers' use of activities within greater use of worksheets, at both Umhlanga and Himalaya learners expressed their observation of another key change in mathematics pedagogy – how mathematics was now contextualised and linked to aspects of reality. The shift they were experiencing was away from a previous procedures-bound abstract mathematics curriculum towards a more reality-based context-bound pedagogy.

L3: So this mathematics is more useful than the previous curriculum.

Int: What is the difference?

L4: The old curriculum was more theoretical … and this is more practical, for instance you can use maths to give the percentage of cholera sufferers. And this one is more useful because we now know how many people were infected with cholera and how many people are dying from cholera. So we now know the statistics. We know the percentage. We can calculate percentages.

L2: And we never applied the percentages before.

L1: They used to give us numbers to multiply like seven times something.

L2: You just calculate and calculate till you get the answer.

L1: In OBE we do lots of things.

Int: So in other words you like OBE and you find it helpful.

L2: Its very helpful.

L1: So now you are able to apply what you have learnt at school to real-life situations. (Umhlanga; post lesson 3)

Learners from Umhlanga were most vociferous about their appreciation for a mathematics that was more meaningful and connected to their lives. This appeared to be related to the concerted effort of the teacher to deal with a range of topics that connected directly with aspects of their learners' lives. They referred to several other practical activities outside those observed during the classroom observations, that made visible to them the direct connection between mathematics and their world such as measuring lengths for building and learning to "account for water consumption in the school", which were done earlier in the year. These types of lessons, for instance observed on HIV/AIDS and mathematics at Umhlanga (Sethole *et al*., 2002, 2004), made a strong impact on learners.

L1: OBE is good in that we learn about other issues in mathematics. Unlike before when math only dealt with numbers but OBE has included issues like AIDS. We talk about AIDS then include numbers. We now know what we are talking about. We write statements that are accompanied by numbers.

(Uhlanga; post lesson 7)

While similar comments were also elicited from learners at Himalaya, a sharper tension was observed. Although all the teachers teaching Grade 8 at the school were dealing with the theme of substance abuse, some students complained about this cross-disciplinary approach because of the repetition they experienced in the different learning areas.

Int: And the math you are learning is it different or is it the same?
L1: It is different, it's different.
Int: What is different?
L1: When we have other subjects into maths with drugs and all that.
Int: And you think that is a nice way to learn it or is it not nice? What is it that you don't like?
L2: Because we learn about it in other subjects.
L3: Every subject we learn HIV.

(Himalaya; post lesson 8).

Although the teacher at Himalaya had indicated that Grade 8 teachers planned their lessons as a team, a practice advocated in the new curriculum reforms, learners pointed to how this lead to much overlap – "they ask the same questions" – and also complained because it seemed to compromise their time for learning mathematics. Some students were resentful of what appeared to them to be a deviation away from mathematics – "our whole maths lesson is supposed to go on maths but we learn more about drugs" (Himalaya; post lesson 8). In some focus group interviews, however a debate erupted about this aspect in which learners countered such assertions on the same lines as the learners at Umhlanga argued, demonstrating that students had in fact grasped the trade-offs being made in the new curriculum reforms and the new official intentions even if they did not always agree with how these got played out in their classroom. For the high performers and those that enjoyed or understood the importance of mathematics, this approach was seen as compromising their mathematics learning while for those who sought relevance and connectedness, the new approach provided a different entry into mathematics and made mathematics interesting and relevant to their lives.

While not all aspects of mathematics can be taught with reference to a contextual reality, the strong imperatives of the new curriculum to offer mathematics in ways that could be experienced by learners as meaningful and contextually relevant was evident. Within a single theme of substance abuse, the teacher at Himalaya engaged a number of different contexts: *real-life contexts* directly relevant to learners' actual lives; *realistic contexts* which referred to some future, or everyday context that was not directly familiar; and *pseudo contexts* in which a context was manipulated to reflect some mathematical idea (Goba, 2004). Learners' engagement

with the mathematics changed with shifts in the kind and quality of contexts used. Learners failed to make connections or see relevance in pseudo contexts (like packaging of drugs) where the mathematics was strongly foregrounded but also lost focus on the mathematics when a context used (like HIV Aids transmission) was presented. This may be explained by referring to a complementarity in the relation between mathematics and context, in which the one gets excluded when the other is made visible (Vithal, 2003). This does not mean that the one is absent but rather that when learners are engaged with one, they cannot engage the other.

Learners' views on the value and use of contexts were shaped by the nature and type of context and the quality of their experience of it in the lesson. Some learners expressed a clear dislike for the use of a context like drug abuse, referring to knowledge about people who used and distributed these where they lived. Ironically the closer the distance of the context to learners' lives, the greater the resistance some of them expressed because the context evoked strong emotions and hence argued against its inclusion and relevance for learning mathematics (Vithal, 2003).

Int: What do you think that your teacher gives you math problems but at the same time gives you drug abuse, is it a good thing to do?
L1: I don't like this thing, I don't think it should involve all that in maths.
Int: Are others also thinking it should be kept out of maths. [Two other learners agree]
L4: No, I disagree. I mean working in math, solve realistic problems so that at the same time working with numbers, you learn then. We are coping with what you can expect later on …
L5: Maybe sir must put more examples of drug abuse like in maths but mustn't go like in detail about, lets talk about drugs etc … we all know about drugs.

(Himalaya, post lesson 3)

In her analysis of the Himalaya teacher's use of context, Goba (2004) shows how the integration of context in mathematics may be enjoyed or disliked, create confusion for some learners, is ignored and also contributes to a gendering of the activity. While all three teachers used pseudo contexts in some lessons, this was most dominant in the lessons of the teacher at Settlers. Not surprisingly learners at Settlers did not refer to issues of context as any noticeable change and when pressed made very superficial and elementary links.

L1: if you like only have twenty rands and you..
L2: … and you go there with stuff that comes up to like two hundred rands, it gonna look …
L3: … and also like since you don't know how to count and you give him a two hundred rand note and he gives you the wrong change, you'll never know 'cause you don't know maths

(Settler, post lesson 1)

For learners to be aware of the connection between mathematics and context requires teachers to make these links in explicit and in direct ways but also requires acknowledgement of how the same activity may be experienced in very different ways.

Theme 4: Changed assessments

Assessment also emerged as a theme in the post-lesson interviews as a change observed by learners as a result of the reforms. This was to be expected, not only because this is an issue that is highlighted in the new curriculum reforms, but also since both the teachers at Himalaya and Umhlanga were observed using multiple new assessment formats including self-assessments and peer assessments as advocated. For some learners, the use of multiple, less individually

competitive assessments were welcomed and were given as a reason for liking OBE because of a reduced focus on pass and fail: "They say they like that (OBE), they say nobody fails" (Umhlanga, post lesson 5).

However, for most learners one of the main concerns emerged around how assessments of group work occurred and how those who did not contribute to the group benefited and got credits. This was a serious issue for some groups of learners with several of them stating "I think OBE is unfair" and explaining:

L2: Yeh, cause like, you get that some people they good but they don't contribute. So if you want to get answers from the other people, he says "I couldn't give it to you", so when it comes to the assessment, just getting high marks for nothing.

L1: Because individuals, I mean sometimes the people don't understand what we doing because we always rely on one person and when it comes to individual assessment then we don't know the answer, cause we always relying on …

(Himalaya, post lesson 13)

L1 above explains how group work could also impact negatively on understanding mathematics for assessment purposes for those who did not, for various reasons participate fully in the work assigned to the group. As found by Allen (2004) and confirmed here, how learners position themselves as successful or unsuccessful learners is related to their positioning by assessment and by rewards. In both Umhlanga and Himalaya the large classes resulted in the classroom being organised in large groups of six to eight learners per group with considerable unevenness in participation occurring across the group.

Assessment emerged as the main, if not the only remarks that learners at Settlers made with respect to the introduction of the new curriculum. Despite what the teacher said about having implemented the curriculum reform as a part of their regular practice, a very traditional pedagogy was observed.

Int: Tell me something, have you heard about OBE?

L2: Outcomes-based education, we had it last year (in Grade 7).

Int: You had it last year?

L2: In the middle of the year they changed …

L3: I find it's like easier, cause like you know how you working, sort of, cause it's like 1's, 2's, 3's and 4's and like I got 70 per cent then it's 70 per cent. It doesn't tell you like how you quote them or something cause like if you get 60 per cent, you might be very clever and try and work your hardest.

L2: And also the OBE system was like gaining competence and all that, it doesn't tell you anything and also it gives you symbols so when you like in between, you don't know.

Int: So you don't like getting symbols, you prefer to get marks?

L3: Like my mom says that if I get a bad report, my cell phone is getting taken away, so you have to work.

Int: So what was different about your maths lesson in the OBE class?

L3: It's just like I thought that I did bad in the test, but then they told us that a one is when your marks are very bad, a two is when your marks are not that bad and three they are okay and four they good and five is excellent. And I thought I did very bad but then I got like 3's and 4's.

L2: Ya, me too.

Int: But what about the teaching and the way the lessons were done?

L1: No, we haven't done any group work in maths.

Int: And last year in the OBE class?

L3: We did do like lots of fun examples like when you working with a cube and like the capacity of that, and we had to make a cube and you filled it with water, and we did fun things like that, not like in high school.

(Settlers; post lesson 8)

While a few learners at Settlers recalled the changes in their mathematics classroom that they had experienced the previous year during Grade 7 in their primary school, it was the new mandatory forms of reporting assessments that the students remarked on and signalled as having changed in their grade eight class. In the traditional competitive environment, their positioning in the class, revealed by marks obtained, was deemed important for their status (Allen, 2004) and also for material gains as can be observed above. Learners from the other two schools also referred to this change of not being given a specific mark and not being able to know their position in class. This imperative was also strong for some learners at Himalaya, while very few learners at Umhlanga referred to assessment as important for positioning.

Theme 5: The language/discourse of OBE

Far more learners at Umhlanga appeared to be positive about the new curriculum than those at Himalaya with comments like "OBE is grand", "we like it (OBE)" and "OBE is a new education" with one student claiming he will only continue with further mathematics if it is taught in the OBE approach. The teacher was observed explaining the intended expectations of the new curriculum reforms.

As at Umhlanga, the teacher at Himalaya explicitly taught the language of the new reforms, outlining to learners what were "programme and phase organisers" and other OBE terminology. Learners gave surprisingly detailed explanations about these when asked in the interview. There appeared to be a clear link between the teacher's engagement (or lack thereof) with the reform and what their learners chose to focus on as a main feature of the reform.

Any reference to the new educational reforms was virtually absent at Settlers. Indeed, several students at Settlers asked the interviewers to explain what OBE was, either in response to the question that was posed or having heard about it from family members or friends in other schools. A covert language of reform does appear to be available to some learners through family, friendships and community networks at Settler. What the last transcript in theme 4 above also points to is how learners picked up terms and phrases related to the official OBE and C2005 discourse such as "gaining competence".

Jeffrey (2003) reports with respect to educational reforms, the "public expression of educational purposes and processes to make their intentions clearer, result(ing) in improved learner awareness of the nature of the teaching and learning process" (501). Many of the learners in this study had begun to take up the discourse related to it, were aware of the main features of the new curriculum reforms and understood what these meant to them.

Final remarks: Connecting learners, teachers and curriculum reforms

The findings here are confirmed in one of the few studies that documented learners' reactions to the new South African curriculum. Adler *et al.* (2001), found that township and non-urban Grade 7 learners were explicit about what was new in their learning of mathematics in class, discussing and solving problems in groups, noticing mathematics 'outside' the classroom and finding their new learning materials 'better'. What this analysis begins to provide is some indication of how the principles and practices of the new curriculum reforms such as learner-centredness and group work, mathematical knowledge integration and its pedagogy, the new assessments and curriculum discourses are being taken up by learners and are brought into their awareness and understanding of what the reforms mean and offer them. Learners notice, experience and are able to articulate the changes intended and attained through the implementation of the curriculum reforms.

How and what learners articulate about the reforms is linked to what their teachers do and say about the reforms. The more explicitly and directly the goals, processes and principles of the new curriculum are made available to them, the more likely they are to agree and be positively predisposed to these and participate and manage their own interests and intentions in learning. What teachers value in mathematics teaching and learning is reflected in what students' notice and value in their classroom and in their learning. Learners are sensitive to and have an acute meta-understanding of what teachers do in the name of reform and how this serves or limits their own interests and intentions. When their own teachers do not refer to these, learners still have some access to these reforms through outside school networks of family, friends and communities and showed evidence that these are discussed among them.

What was most surprising was how astute and perceptive learners were about what the new curriculum was claiming and what it was actually doing in relation to their personal vested interests in the mathematics classroom, and the payoffs between the "old" and "new" curriculum, even if they did not act on this knowledge. The compromise that teachers make in how they privilege mathematics or contexts are understood by learners. In both Himalaya and Umhlanga, where teachers explicitly sought to teach about HIV/AIDS and substance abuse through and with mathematics, even learners who were critical, expressed confidence that their teachers would deal with the mathematics and related assessments.

The tensions in the new mathematics curriculum such as developing mathematical content knowledge and the imperative to engage that knowledge in real-life or reality contexts is also present among learners. However the closeness or distance of any particular context cannot be connected in any linear way to how learners might deem it as important or relevant to their mathematics learning or to their lives. Assumptions teachers or policy makers might make about what is important and relevant in the curriculum reforms are not necessarily shared by learners. The question of whose agenda of reform comes to be played out and dominates in a post-apartheid mathematics classroom is shaped by teachers as key figures who mediate the reforms but can be supported or subverted by learners through their voice and their silence, irrespective of whether researchers, teachers and policy makers choose to listen or not.

References

Adler J & Reed Y(eds) 2003. *Challenges of teacher development: An investigation of take-up in South Africa.* Pretoria: Van Schaik Publishers.

Adler J, Dickson M, Mofolo B & Sethole G 2001. *The use of written texts in mathematics classrooms: A study of Grade 7 and 9 classes in selected Gauteng and North-West schools in 2000*. Research Report, University of Witwatersrand.

Adler J, Reed Y, Lelliott J & Setati M 2003. Availability and use of resources: A dual challenge for teacher education. In Adler J & Reed Y (eds). *Challenges of teacher development: An investigation of take-up in South Africa.* Pretoria. Van Schaik Publishers. 53-71.

Allen B 2004. Pupils' perspective on learning mathematics. In Allen B & Johnston-Wilder S (eds). *Mathematics education: Exploring the culture of learning.* London: Routledge Falmer. 233-243.

Amit M & Fried M N 2002. Research, reforms and times of change. In English L (ed.) *Handbook of international research in mathematics education: Directions for the 21st Century*. Mahwah, NJ: Lawrence Erlbaum Associates. 355-381.

Bishop AJ, Clements MA, Keitel C, Kilpatrick J & Leung FKS (eds) 2003. *Second international handbook of mathematics education*. Dordrecht: Kluwer Academic Publishers.

Bishop A J & Volmink J 2002. Values and policy: Bridging the gap in mathematics education. In Malcolm C & Lubisi C (eds). *Proceedings of the 10th Annual Conference of the Southern African Association for Research in Mathematics, Science and Technology Education Research*, 22-26 Jan, University of Natal, South Africa.

Brodie K & Pournara C 2005. Towards a framework for developing and researching group work in mathematics classrooms. In Vithal, R, Adler J & Keitel C (eds). *Researching Mathematics Education in South Africa: Perspectives, Practices and Possibilities*. Cape Town: HSRC Press. 28-72.

Brodie K, Lelliot T & Davies H 2003. Developing learner-centred practices through the FDE programme. In Adler J & Reed Y (eds). *Challenges of teacher development: An investigation of take-up in South Africa. Pretoria*. Van Schaik Publishers. 94-117.

Brown M 2003. Research and national policies in primary numeracy. In Putsoa B, Dlamini M, Dlamini B & Kelly V (eds). *Proceedings of the 11th Annual Conference of the Southern African Association for Research in Mathematics, Science and Technology Education Research,* 11-15 Jan, Waterford Kamhlaba, Swaziland.

Butler-Kahle J 2003. Research and evaluation of Large Scale Reform in Mathematics and Science. In Putsoa B, Dlamini M, Dlamini B & Kelly V (eds). *Proceedings of the 11th Annual Conference of the Southern African Association for Research in Mathematics, Science and Technology Education Research,* 11-15 Jan, Waterford Kamhlaba, Swaziland.

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

Department of Education 2000. *Report of the C2005 Review Committee*. Pretoria: Department of Education.

English L (ed.) 2002. *Handbook of international research in mathematics education: Directions for the 21st century.* Mahwah, NJ: Lawrence Erlbaum Associates.

Goba B B 2004. *Grade eight learners' experience of mathematics in OBE*. Unpublished Med thesis. Durban: University of KwaZulu-Natal.

Harley J & Wedekind V 2003. Curriculum 2005 and outcomes-based education: What do we know about the real outcomes? Article presented at the Annual Kenton Education Association Conference, 30 Oct-3 Nov, Worcester.

Hart K (ed.) 1981. *Children's understanding of mathematics: 11-16*. London: John Murray.

Howie S 1997. *Mathematics and science performance in the middle school years in South Africa: A summary report on the performance of South African students in the Third International Mathematics and Science Study*. Pretoria: Human Sciences Research Council.

Howie S 2001. *Mathematics and science performance in Grade 8 in South Africa 1998/1999: TIMSS-R 1999 South Africa*. Pretoria: Human Sciences Research Council.

Jansen J & Christie P (eds) 1999. *Changing curriculum: Studies on Outcomes-based Education in South Africa*. Kenwyn: Juta & Co, Ltd.

Jeffrey B 2003. Countering learner 'instrumentalism' through creative mediation. *British Educational Research Journal,* **29**(4), 489-503.

Khuzwayo B 2005. A history of mathematics education research in South Africa: The apartheid years. In Vithal, R, Adler J & Keitel C (eds). *Researching mathematics education in South Africa: Perspectives, practices and possibilities*. Cape Town: HSRC Press. 307-327

Knapp M S 1997. Between systemic reforms and the mathematics and science classroom: The dynamics of innovation, implementation and professional learning. *Review of Educational Research,* **67**(2), 227-266.

Learners' Perspective Study (LPS) 2002. An International Collaboration on Mathematics Classroom Practice of Nine Countries (Australia, China-Hong Kong, Germany, Israel, Japan, Philippines, South Africa, Sweden, USA) http://www.edfac.unimelb.edu.au/DSME/lps/

Lerman S, Xu G & Tsatsaroni A 2002. Developing theories of mathematics education research: The ESM story. *Educational Studies in Mathematics,* **51**(1-2), 23-40.

Keitel C & Kilpatrick J 1998. The rationality and irrationality of comparative studies. In G Kaiser, E Luna, & I Huntley (eds). *International comparisons in mathematics education*. London: Falmer Press. 241-257.

Kelly AE & Lesh RA (eds) 2000. *Handbook of Research Design in Mathematics and Science Education.* New Jersey: Lawrence Erlbaum Associates, Publishers.

Pollard A, Triggs P with Broadfoot P, McNess E & Osborn M 2000. *What pupils say: Changing policy and practice in primary education*. London: Continuum.

Reddy V 2004. Performance scores in international math and science study reflective of South African Inequalities (TIMSS Media Release), Human Sciences Research Council, Pretoria. November.

Sethole S 2004. Meaningful contexts or dead mock reality: Which form will the everyday take. *Pythagoras*, **59**, 18-25.

Sethole G Adler J & Vithal R 2002. When HIV/AIDS goes to the mathematics classroom' Paper presented at the ICMI Comparative Study Conference, University of Hong Kong, HKSAR, China, 21-25 October.

Vithal R 2003. *In search of a pedagogy of conflict and dialogue for mathematics education*. Dordrecht: Kluwer Academic Publishers.

Vithal R, Adler J & Keitel C 2005. *Researching mathematics Education in South Africa: Perspectives, practices and possibilities*. Pretoria: Human Sciences Research Council.

Wilson SM, Peterson PL, Ball DL & Chen DK 1996. Learning by all. *Phi Delta Kappan,* March, 468-476.