The fallacy of measuring mathematics 'competencies' in a context of a 'high stakes' external examination

Presented at the 4th Sub-Regional Conference on a Assessment in Education, hosted by Umalusi from the 26th to the 30th June 2006

Thabiso Nyabanyaba, University of the Witwatersrand, Education Policy Unit

Abstract

Recent curriculum reforms have led to a wider variety of assessment practices, including more novel methods of assessing 'higher-order' skills and more examination items that are based on 'realistic' contexts. My study of Basotho students' epistemological access to school mathematics revealed that, in the context of 'high stakes' examinations, students from different sociological background are positioned differently as they attempt these examination items with novel requirements and standards. In this paper, I will use extracts from in-depth interviews with three experienced Basotho[1] teachers to highlight the failure of these well-intended reform initiatives to attract the critical engagement of teachers because of the teachers' peripheral involvement in such initiatives. This raises serious concerns around the legacy of post-colonial education in which school-leaving examinations are still set outside of some African countries. I will also use extracts from interviews with Basotho students selected from a variety of socio-cultural backgrounds to draw attention to the tendency for high stake external examinations to promote socio-economic access rather than epistemological access. The findings of this study raise questions about reform initiatives driven by international examination boards and whether the standards derived from such initiatives can accurately measure individual learner 'competencies' in local contexts.

[1] Refers to the people of Lesotho.

Introduction

There is growing concern that schools are not producing citizens that are able to apply their knowledge across a variety of contexts. The argument that in this *information age* the knowledge, skills and behaviours needed for students to achieve at high levels require the ability to access, interpret, analyse and use information for making decisions is very persuasive (Bond, 1994). It is hard to refute the claim that today's world requires that citizens and the workforce should possess more than basic reading and arithmetic skills. Advocates of the standards-based reform movement argue that dissatisfaction of employers and leaders in higher education about the quality of knowledge and skills presented by graduates of public schools prompted calls for higher standards in public education (Reville, 2002). Many believe that the impetus for the current wave of standard based reform can be traced back to the alarming United States federal report entitled *A Nation at Risk* by the National Commission on Excellence in Education in April 1983. This report claimed that American students were not studying the right subjects, were not working hard enough, and were not learning enough and their schools suffered from slack and uneven standards.

Internationally, assessment of learner competencies has played a significant role in the hegemony for standards-based reform initiatives. In a number of countries such as Australia and the United Kingdom the growing concern with the monitoring of standards are accompanied by a great deal of focus on student outcomes (Rowe, 2000). In the latter country, the impact of standards-based policy focus has resulted in an obsession with comparing schools' average achievement scores on tests and public examinations. Publication of these 'league tables' of examination and national curriculum tests results is more explicitly said to be intended to help inform parental choice about schools, and less explicitly about public demand for accountability and the maintenance of educational standards (Hill, 1994). Assessment has been referred to as 'arguably the most powerful policy tool in education (Broadfoot, 1996: 21). However, in developing countries, examinations are often the sole means of judging educational standards and are rarely ever used as a means for improving pedagogy (Kellaghan & Greaney, 1992; Pennycuick, 1993).

Arguments against the surge of reform in school mathematics assessment practices include caution against initiatives based on political-economic ideals rather than research. Criticism of standards-based reform and the surge of outcomes-based education has also focused on the influence of market-oriented ideals for competitiveness which often background education research (Rowie, 2000; Jansen, 2002). Another element of recent reform initiatives that has been under scrutiny lately has been the increasing inclusion of 'realistic' contexts in school examinations. Findings from this study and other studies (Cooper & Dunne, 2000) show that the inclusion of 'realistic' items can lead to an underestimation of students' mathematical competencies. However, what emerges here is the profound implication that the 'high stakes' attached to examinations for selection in post-colonial countries pervades any epistemic explanation for access to school mathematics through 'realistic' tasks.

Background

To fully understand the 'contextual parameters' of assessment practices in Lesotho, one needs to have some insights into the colonial legacy. A former British Colony, Lesotho (previously Basotholand) is completely surrounded by its more economically viable neighbour, South Africa. The secondary school leaving examinations in Lesotho were run by the Joint Matriculation Board of the Universities of South Africa (JMB) until 1961. Since then, the University of Cambridge Local Examining Syndicate (UCLES), based in the United Kingdom (UK), has been offering the Cambridge Overseas School Certificate (COSC) Examination as a school leaving examination for Basotho students (Pule, 1991). Although the marking of this examination is now being done locally in Lesotho, the actual examination itself is still set in the UK. All examinations in Lesotho, from the Primary School Leaving Examination to the COSC, are external in that no internal assessment contributes to the student's final mark. The high stakes attached to such an examination for selection, and not for feedback, and the sociological inequities being perpetuated through such a system, shall become a major focus of this paper.

School mathematics is a particularly rich research subject because the subject is often used to distribute social opportunities for young citizens. School mathematics has always been a recontextualisation from the discipline of mathematics and that of education, and what counts as school mathematics is as much a matter of the discipline of mathematics as it is a question of different philosophical and political orientations. The various philosophical movements such as the ethnomathematics movements; the Realistic Mathematics Education movements; and the various political imperatives such as those describes by Jansen (2002) further recontextualise what counts as school mathematics differently in their regards for what should constitute the school mathematics practice. Whatever their philosophical basis, their political imperatives, or their educational intentions, Cooper and Dunne (1998) argue that reform initiatives such as the inclusion of realistic contexts in the school mathematics curriculum in the UK has followed on official documents such as the Cockcroft Report (Cockcroft, 1982), which gave sound epistemological arguments for the inclusion of 'relevant' contexts rather than findings from empirical research. In this argument they are supported by Gipps (1996) who argues that politicians have the inclusion of such contexts as a pre-determined path. A particular concern here is with regard recent curriculum reforms that have led to a wider variety of assessment practices, including more novel methods of assessing 'higher-order' skills and more examination items that are based on 'realistic' contexts.

Methodological issues

The focus of the paper shall be on Basotho teachers' and students' positioning in relation to reforms reflected in the O level mathematics examination as revealed by the interviews. Two education officers who were most intricately involved in secondary mathematics were interviewed regarding the extent of support given to teachers. However, the focus of this study was on teachers' professional identity and positioning as indicated by the extent to which they critically engaged with such reforms. This analysis was undertaken through an interview with three purposively selected Basotho teachers, whose wide experience would have been expected to assist them relate to and engage with reforms. The second level of analysis of the impact of these reforms was on how Basotho students are positioned in

relation to the trends and what they attribute their positioning to. This was undertaken through interviews following an administration of a recent examination item in three groups of students from three schools that typically draw from students from different socio-economic backgrounds.

The analysis began with a study of the changes in the COSC mathematics examination and that analysis led to a development of a language of description that illuminated the impact on students' access and performance. The analysis then focused on Basotho teachers' and students' positioning with regard the reform initiatives as revealed in the interviews. In conclusion, the paper argues that the post-colonial context of external examination continues to pervade 'noble' reform initiatives aimed at higher-order thinking skills and the ability to apply knowledge across contexts.

A language of analysis

An investigation into the embedding of examination items in real-life contexts introduced a very interesting dimension to the issue of standards. However, it became important to develop a language for analysing the requirements of this novel demand on Basotho students. Empirical work done by Dowling (1998) developed a sophisticated language that allowed for an analysis of the inclusion of 'realistic' items into school mathematics textbooks and the negative impact of that inclusion on the very activities they were trying to affirm. The term 'esoteric' has been used by Dowling (1998) and Cooper and Dunne's work (1998; 2000) to distinguish between mathematical and non-mathematical activities. In their work, Cooper and Dunne (2000) define a 'realistic' examinations item as one that contains either persons or non-mathematical objects from 'everyday' settings. Otherwise the item is referred to as 'esoteric' (or in the grammar of mathematics). Cooper and Dunne (2000) use a sociological approach to develop a language of description around the analysis of the difficulties that children experience around mathematical items embedded in 'realistic' contexts. They draw on Bernstein's (1996) 'recognition rules' and 'realisation rules' to describe differential access across social class. Cooper and Dunne (1998) define the 'recognition rules' as the means an acquirer employs to "recognise the speciality of the context" they are in and the 'realisation rules' as the means of allowing for the production of "legitimate text". This ability to recognise the speciality of the context can also be referred to as the possession of 'educational ground rules', a theoretical construct originally used by Edwards and Mercer (1987) but also used by Cooper and Dunne (1998).

Cooper and Dunne (2000) illustrate how, given a 'realistic' item as opposed to an 'esoteric' item, children from working class families remain tied to their 'everyday' meanings in a manner that is self-defeating. In one illustration, a student, 'Mike,' is required to sort rubbish "from the sports field into one of two circles drawn". The 'rubbish' to be sorted included a newspaper, a can of drink, a bottle of mustard, a pen and a carton of milk. The marking scheme indicated that it was acceptable for children to sort "by shape of container, by being edible or drinkable and so on" (Cooper and Dunne, 2000: 50). Mike's sorting is very much related to the materials themselves as either paper or metal (he wrote "meatle"). Another student, 'Diane,' responded by illustrating the recognition of both material and metacognitive sorting. She also demonstrated an awareness of the priority attached to the metacognitive level in school. Diane's sorting prioritised 2-dimensional over 3-dimensional diagrams, although she also illustrated an awareness that sorting can be done at a material

level. Further investigation revealed that Mike could also make appropriate recognition of appropriate practice but would not illustrate the explicit priority that could Diane. As a result, such items lead to an underestimation of the working class children's mathematical competencies.

The distinction that Cooper and Dunne (2000) make between 'realistic' and 'esoteric' question provided me with a useful framework for analysing general patterns in the O level examination over the past 15 years. For example, the difference between these two opening O level mathematics questions, one set in 1984, and the other set in 1996, illustrates the move away from esoteric to realistic contexts.

1 *(a)* Find the value of $(1\frac{1}{2} + \frac{2}{3}) \times 1\frac{1}{5}$, giving your answer as a fraction in its lowest terms. [2]

(b) Evaluate 5.4 + 4 x 0.3. [2]

(c) Calculate 6% of $5450. [2]

(d) Express 42 cm as a percentage of 1.05 m. [2]

(4004, 1984)

1 **(a)** 100 g of beans contains 4.7 g of protein.

Calculate the mass of protein in 3.3 kg of beans. [2]

(b) To make a chicken and mushroom pie Mrs Lee requires 550 g of chicken and 125 g of mushrooms.

Express the mass of the mushrooms as a percentage of the mass of the chicken, giving your answer correct to the nearest whole number. [3]

The author of a cookery book uses the formula

$$T_2 = T_1 \sqrt[3]{m^2}$$

to make up a table of cooking times for meat.

In the formula

T_1 is the time in minutes to cook a mass of 1 kilogram of meat.

T_2 is the time in minutes to cook a mass of *m* kilograms of meat.

Calculate T_2 when $T_1 = 20$ and $m = 2.5$. [3]

(4004, 1996)

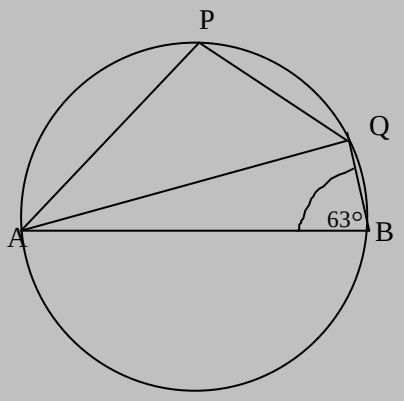
In a context of examination, however, the distinction between 'realistic' and 'esoteric' tasks needed to be extended further to capture the more textured differences, both in terms of the contexts and the demands, displayed by the questions. The growing concern for higher-order skills is also illustrated by these two sets of questions on angle properties of a circle:

2 *(c)* P and Q are points on a circle whose diameter is AB.

Given that angle ABQ = 63º, calculate

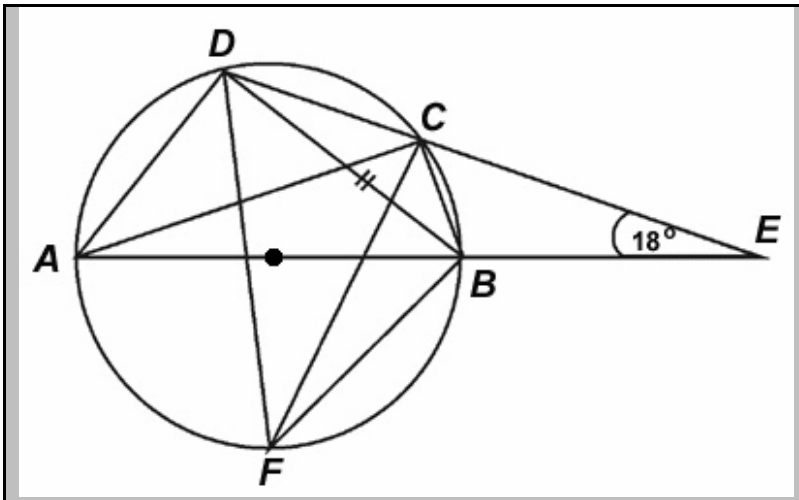
(i) A $\hat{P}$ Q,

(ii) Q $\hat{A}$ B. [2]



(4004, 1984)

4



AB is a diameter of the circle AFBCD shown in the diagram.

E is the point on the AB produced, where BD = BE and A$\hat{B}$D = 18º.

(a) explain why C$\hat{F}$B = 18º. [2]

(b) Find A$\hat{B}$C. [2]

(c) Show that BD bisects A$\hat{B}$C. [2]

(d) Given also that B$\hat{D}$C = 51º, calculate F$\hat{B}$C. [1]

Concepts that I found further useful in analysing the questions in the examination were those applied by Blum and Niss (1991) in their argument for 'proper' applications in school mathematics. In differentiating between an 'exercise' and a 'problem', they define a problem as:

> [A] situation which carries with it certain open questions that challenge somebody intellectually who is not in immediate possession of direct methods/procedures algorithms etc. sufficient to answer the questions.
> (Blum and Niss, 1991: 37)

Otherwise, if one is simply rehearsing the application of some learnt algorithm, then the situation becomes an exercise. The authors, of course, concede that a problem is relative to the person involved: what to one person is a problem, to another is an exercise. The following question which appeared in the 1998 O level mathematics paper begins to illuminate a question that could for many students be novel both in the context and demand.

7 [The value of p is 3.142 correct to three decimal places.]

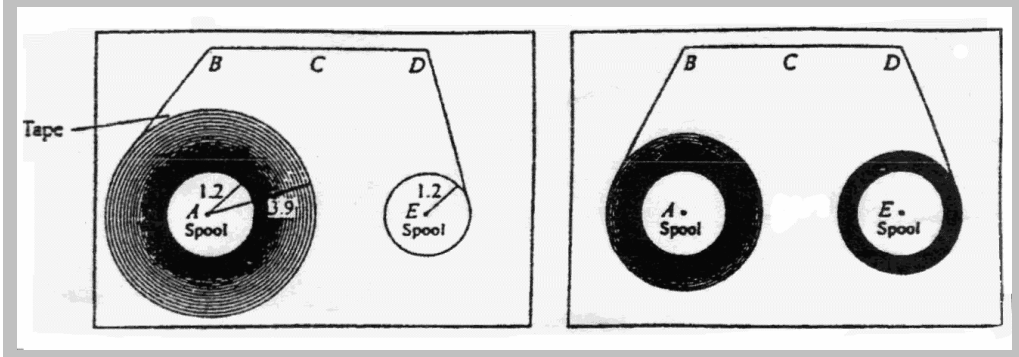


Diagram I **Diagram II**

Diagrams I and II represent the cross-section of a video cassette.

A tape runs from one circular spool, centre A, past B, C and D, to a second circular spool, centre E. Each end of the tape is fixed to one of the spools, both of which have a radius of 1.2 cm.

Initially as much tape as possible is wound on to the spool with centre A.

It is represented on Diagram I by the shaded area, whose outer radius is 3.9.

(a) Show that this shaded area is approximately 43.3 cm². [3]

(b) Diagram II represents the situation when some of the tape has been wound onto the second spool. The total shaded area remains unaltered, so that it is always approximately 43.3 cm².

At a certain time there are equal lengths of tape on each of the spool.

Calculate the outer radius of the tape on one of the spools at that time. [4]

(c) The tape runs at a speed of 23.4 millimetres per second past C.

It takes 3 hours for the tape to run from one spool to the other.

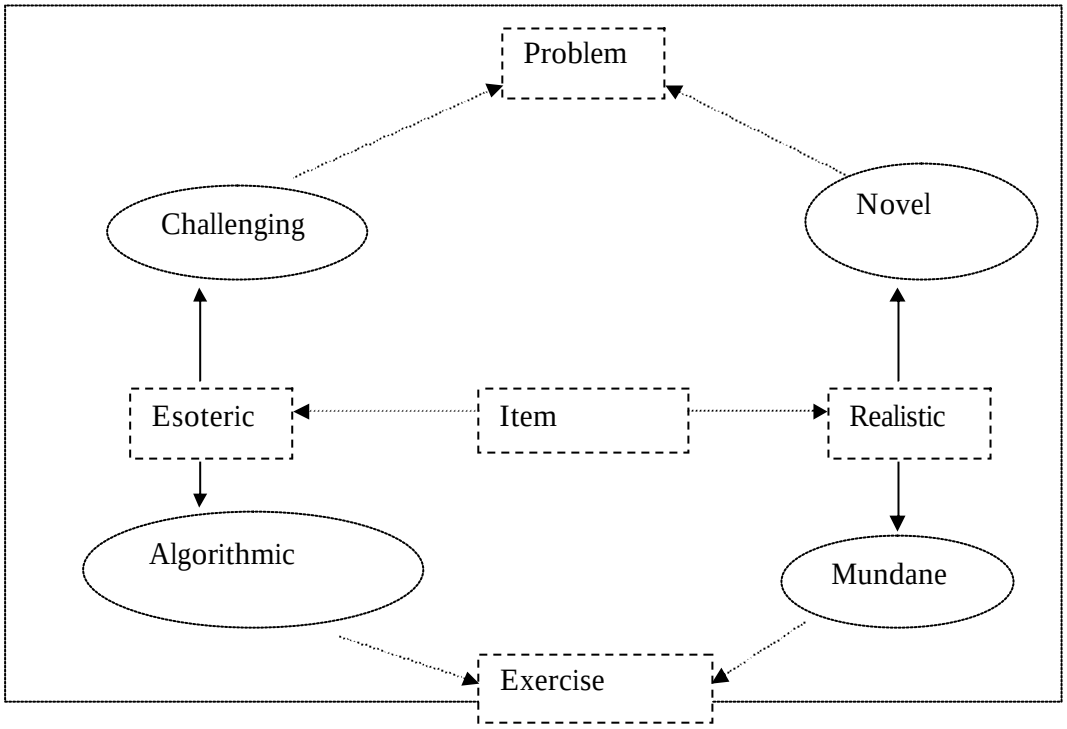
Show that the length of the tape is approximately 250 metres. [3]

(d) Using the results of parts (a) and (c), calculate, in millimetres, the thickness of tape. [2]

This analysis begins to challenge the conception that ‘standards’ are merely high or low. It strongly suggests that it is not merely a vertical order; it also brings in the intersection

between the novelty of the demand made in the question and the possible unfamiliarity of the context in which the question is embedded. The diagram below describes what emerged for me as a language of distinguishing the various impacts of the curricular trends.

Emerging language



In short, a question can either be 'realistic' or 'esoteric' depending on the context. Depending on their mathematical demands some esoteric questions are able to differentiate between different mathematical competencies to a greater or lesser extent. On the one hand, they differentiate to a greater extent if they are so challenging especially in their mathematical demands that they become a problem. On the other hand, they differentiate to a lesser extent when they have been so well rehearsed by students that they only demand mere algothrims on the part of the students. As noted before, whether a question is challenging or algorithmic is not solely dependent on the question, but is also a function of the learner's relationship with the question.

A realistic question can be so mundane that learners can recognise the mathematical demands without any reference to the 'realistic' context. Some questions are mundane in and by themselves. Again some learners may be so familiar with the context of the question that the context is rendered mundane. However, the contexts of some 'realistic' questions may be so novel that they require close reference to the context and may even become inaccessible to those students who are unfamiliar with their contexts. Note that an additional problem with a 'realistic' question is that whether it is 'mundane' or 'novel', it can still be challenging or algorithmic with its mathematical demands on the learner. But much of what determines the degree to which questions are accessible to learners, whether in their contexts or in their

mathematical demands, depends on the internalised 'ground rules' of the learners. These internalised 'ground rules' are evidenced through the rounder parts of the diagram. An item can be either esoteric or realistic and can even be a problem or an exercise on and by itself. However, largely depending on the 'ground rules' internalised by students the item can be challenging or algorithmic and its context can be ritualistic or novel. In a more developed language employed by Cooper and Dunne (2000) these 'ground rules' are generally the recognition and realisation rules. Therefore, in the context of 'realistic' items, particularly those that are novel, the standards concern is not merely whether they are highly demanding, but whether they are also familiar. As shall be noted later, how different learners deal with these novel 'realistic' question differs so significantly as to introduce a greater element of socio-economic background than such reform initiatives would acknowledge.

Investigating teachers' peripheral positioning in a context of external examinations

I focus in this section on the extent to which teachers in Lesotho have developed a strong sense of professional identity, particularly in relation to recent curricular reforms. There was disagreement between the accounts of the education officers and the teachers interviewed regarding the extent to which teachers received support on curricular reforms. Education officers described workshops in which teachers were 'alerted' to changes in the examination format but conceded that there was neither document nor dialogue regarding these reforms. Teachers argued that even the workshops were either too few or inadequate for a proper exploration of these reforms. However, what was of interest to me was the extent to which teachers were able to engage critically with some of the curricular issues that I put before them in probing for their reflections, for instance on the trends in the mathematics examinations.

Even in the most participatory education system, some teachers might find it difficult to articulate curricular issues. Moreover, the examination-focussed nature of the curriculum in Lesotho meant that many teachers were more concerned with preparing their students for the examination than reflecting upon its appropriateness. Also the 'inadequacy' of in-service programmes for teachers could mean that many do not have ample opportunities to talk about curricular issues. Nevertheless, one would expect these particular teachers to be able to talk about the two examinations and be much more involved in issues arising, not least because all of them had a great deal of experience, two of them as long-time markers in O level mathematics.

Regarding recent trends School C teacher vaguely referred to how there was a gap between local demands in the classroom and the requirement to apply their skills in the O level examination, but was unable to describe the trends in terms of curricular reforms:

> **CI** What do you think might be the cause [of the gap]?
>
> **CT** I think … I don't know. There's more … I don't know. They do have the basics. The syllabus expects them to have the basics. And I think they basically study, and we teachers actually train them for the examination. That is why they get

into COSC not being able to apply those basics because COSC mathematics is applications.

Another teacher was only able to imply that such reforms led to some difficulties regarding accessing the demands, particularly for second language speakers of English:

BI What changes are you aware of in the mathematics syllabus, reflected through the COSC examinations?

BT … what I've also noticed is that the questions are long and verbose; two, they're too diagrammatic, OK? Some of the diagrams, you know, you need actually to sit down take some time before, as a students, before you can easily identify what the question is about.

While there was a general feeling that such trends make it difficult for Basotho students to access such question, all three teachers, irrespective of the school in which they worked, expressed helplessness regarding what was happening in the examination. School B teacher continued to describe how he at first tried to write to the locally set Junior Certificate (JC) examinations board, only to be snubbed:

BI … have you ever been compelled to write remarks about the COSC paper?

BT No!

BI Why not?

BT Umm.. one, it's not local. Two, I thought I should start from home. That was why I wrote for this JC. There was no reaction. In fact, they didn't write back at least saying we have received your something, and therefore thank you, or we shall look into that, or some … at least, a word of encouragement, yah, never came. And I felt it was not worthwhile if they don't recognise your efforts. They don't appreciate what you're doing, yah. So I didn't write anything about COSC.

The other two teachers admitted that they did very little - or nothing at all - to comment on or contribute to even the local Junior Certificate examination trends. For example, the teacher in School C admitted that she had come across questions that she was unhappy with, yet she did nothing. She argued that all she felt she could do was prepare her next students better:

CT If I see … if there's a question I didn't expect or surprises me, then the following year I try to look into it.

She felt that as a teacher she has no control over what happened in the examination, except to make her next students aware of the possibility of such a question. Even the teacher in School A, who had been involved in the marking of the O level mathematics examination for a long time, expressed the feeling that she would not critically engage with the setting of questions in the O level examination, at least not as a 'mere' teacher:

AI … Do you ever complain; do you ever communicate with the setting people?

AT That we do when we are writing the report after marking. That is the only time that we usually communicate with them.

AI But as an individual teacher you never do it?

AT No, I've never really done it!

AI Why not? Why didn't you feel you have the right to write from your position as a teacher?

CT As a teacher … I have no reason.

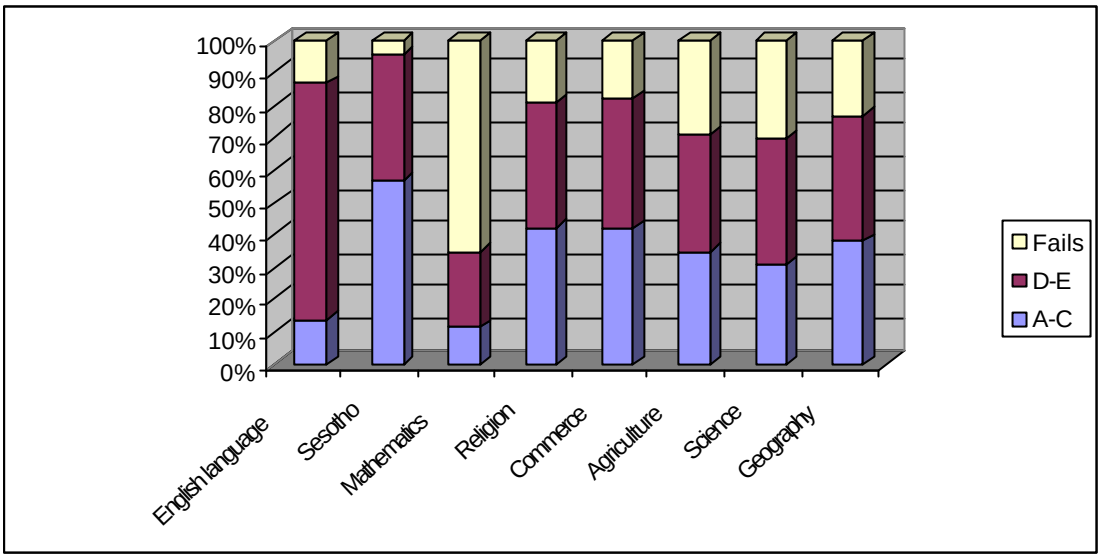
It is apparent that teachers' professional capacity has not been legitimated by the emphasis on summative and external examinations in Lesotho. Even in the local examination the system is relatively detached from teachers, acting as an independent agency. Remarks such as the one made by Teacher BT—that it did not make any difference to write to the local examination board about teachers' unhappiness—indicates the peripheral position of teachers relative to curricular developments in Lesotho. Descriptions of how secondary mathematics teaching is limited to 'exposition-example-exercise' abound in Lesotho's education literature (Kokome, 1990, Moru, 1994). However, this study indicates that Lesotho's examination driven curriculum might account for some of the absence of reflections and innovative teaching approaches by teachers. The disjuncture between an externally-based assessment system in Lesotho and teachers' practice does not help improve engagement of pedagogic practice. That even the local examination does not engage with teachers' comments and there is a general feeling that it is fruitless to communicate with the examination authorities does contribute to the peripheral positioning of the teachers. This absence of a teachers' voice must affect the teachers' legitimacy as players in the system.

This study suggests that teachers are almost incapable of reflecting on curricular issues. The system inherited by Lesotho, where events in the curriculum, which is supposed to be delivered by local teachers, do not concern or involve them, only results in their putting in very little reflection into their practice. Because of the post-colonial context and teachers' peripheral position, teachers tended not to be able to think about or engage with curricular trends. As a result, there was an *absence* in the teachers' talk of indicators of their professional identity, not only with regard to conditions of service, but also to curriculum issues.

If, as this section illustrates, teachers feel themselves at the periphery of curriculum and professional developments, it would be surprising to find any more 'presences' with the students. As the next section illustrates, there were just as many 'absences' in the students' positioning relative to 'realistic' items. These occurred irrespective of the quality of student-intake the school attracted.

Investigating positioning in a context of 'absences'

The performance of Basotho students has generally been described as poor, particularly in mathematics (ECOL, 1999). Failure rates in O level mathematics in Lesotho currently stand at 65%, as illustrated by the chart below.



In contrast to these high failure rates in mathematics, failure rates in all other subjects commonly taken by Basotho students for their school leaving examination, stand at less than 30%. Even in the foreign language (English language), the only notable concern would be for the modesty of the performance, with most (72%) learners scoring a modest pass (D-E) and only 14% attaining credits (D-E). However, it is fast becoming the story even in developed countries that performance does not tell all, especially about who is 'being left behind' (Darling-Hammond, 1994). The performance of Basotho students certainly does not tell the story of what is going on in schools and why they are happening. Using the language I developed earlier it may not be clear why a question such as question 7 is a problem until one has had insights from students. For example, a question can be a problem merely by being so novel or just by being so challenging in its demand that it becomes inaccessible to the majority of students. Some questions may become problems because they are both novel in their contexts and challenging in their demands.

In order to further investigate what the problem with such questions was and why not everyone failed the examination, I assigned question 7 on a cassette (cited earlier) to several groups of students who were in a context where I could follow up on their positioning. This task was assigned to completing students in 3 schools in Maseru, the capital city of Lesotho. The selection of the schools was opportunistic in that I knew the teachers and expected that they would be willing to provide me with insights into their positioning and allow me access to their students. But I was also conscious in choosing the three schools that they, on the basis of the 1998 and previous results, covered a spectrum of performance to below average, average and above average results. The task or scenario was administered to students in the second half of 1999 and was then followed by interviews with students. Both the teachers and students testified that the task had never been administered in class. Even those students

who had access to past examination papers were likely to have ignored the task as the interviews cited here will reveal.

Within the broader study, the task above was analysed more extensively in terms of both the authenticity of the 'realistic' context and the depth of the mathematical demands (Nyabanyaba, 2002). In terms of its authenticity the context raises questions about how familiar some Basotho students would be with a context of a video cassette. Those who are unfamiliar with the context of a cassette, perhaps from the rural area, would be at a disadvantage regarding how a cassette operates. This would have serious consequences regarding their interpretation of the relationship between Diagram I and Diagram II which would be a given for anyone who is familiar with the context. The issue of the relationship between the diagrams was raised and will be further discussed in relation to students' recognition of the mathematical demands of the question later.

Although, the interviews were conducted in English, students were allowed to respond in mother tongue (Sesotho). Only the English versions are provided here but the original transcripts, including where students responded in Sesotho, are available in the thesis document (Nyabanyaba, 2002). In the transcripts provided below, **I**, represents the interviewer who was also the researcher. Respondents are distinguished according to whether they belong to school **A**, **B** or **C**, whether they are students (**S**) or teachers (**T**). Where necessary, the respondents are further numbered. For example as **BS1** would be the first respondent within this extract which was from an interview of students from School B.

Only about 18% of the students had returned their scripts with more than one sub-question (e.g. (a)) out of four attempted. This situation constitutes a high level of absences which illustrate just how reluctant students were to complete the task, unless explicitly guided as was the case in School C. In this extract, I had asked students why so many of them had given very limited to no responses to the task.

> **BS** No, we didn't even try it because when you see that something is very difficult, you don't know how to start.

But the nature of that 'difficulty' became subtler as I probed further for what constituted the difficulty. The next section looks into what led to these 'absences' and reluctances as revealed by more interviews with the students.

Basotho students: recognition and realisation

I extended my interviews with students so as to probe for reasons why they had not answered this question as well as what specific 'difficulties' they experienced. Important issues were raised about the deep 'realistic' context of this question, and especially how it affected Basotho students. The following extracts are from class or group interviews:

> AS The diagram itself is confusing.
>
> AI What is confusing about it?
>
> AS What is happening there.

'What is happening there' and what students have to figure out is as much the mathematics concepts embedded as the relationship between the two diagrams. In school B, the students stated more explicitly that the tape context was very confusing for them, particularly how the different diagrams related to the context.

> **BS** ... and this way it confused me when it says they what ... the total shaded area remains unaltered, and yet the tape moved to the other side.

The context of the question made very complex demands on Basotho students in terms of interpreting the relationship between the diagrams from their experiences. The context also made very specific linguistic demands for the students to hold several pieces of information together in a second language. In fact, the students indicated that they found the whole context quite intimidating. In School A, I literally had to go over the whole context before I could even discuss the question or its demands. However, what is worrying is that once the context had been discussed and the demands demystified many students were able to demonstrate the mathematical demands required by the question. This was interesting because it could point towards the difficulty students were having recognising those mathematical demands. Such lack of recognition, which can impede the realisation of mathematical competencies, can also mislead examiners into assuming that they point towards a lack of competence. Therefore, while the performance of students can be described at a more superficial level as poor, there do appear to be more subtle reasons for any description of these 'poor' performances. This demonstration, and the fact that students in School A generally continue to do well in spite of their inability to recognise the mathematical demands, was an interesting difference to investigate. Just how the lack of recognition might be disadvantaging some students more than others is the focus in the next section. In Cooper and Dunne's (2000) study, the recognition rules were easier to relate to the social class because there were 'presences'. In the 'absences' of the 'presences', I then looked more closely at what were the different dispositions of students in relation to the 'realistic' questions and how the dispositions or 'habitus' impacted on different students' performance.

Students' habitus: differential socio-economic status

There were various indications that students' socio-economic backgrounds were vastly different. But one very interesting element of the backgrounds of students was the emergence of the privatisation of education in Lesotho. This privatisation was evidenced by some students attending extra-lessons after school. These extra-lessons or evening classes are often referred to in Lesotho as 'tutorials'. The tutorials or 'evening classes,' which focus on examination preparation, provided a strong advantage to those students whose parents could afford to send their children to them. In School A particularly, the teacher described the practice amongst students of attending evening classes, as well as that of purchasing past examinations papers, as prevalent. In our discussion of the 'realistic' item I had given to her students, the teacher revealed these practices:

> AT They have all the question papers and they discuss. But rarely … they rarely ask us [the school teachers] really, you know the outside question, other than the

questions that we do with them or we ask them in class.2 Very few of them would come. Sometimes they do them in their evening classes.

AI What would you say would be percentage of students attending evening classes?

AT Here?

AI Yah.

AT Um-m, a big percentage!

Although less prevalent, the practice of purchasing past examination papers existed in the other two schools. However, in the other two schools which attracted students of parents with poorer socio-economic backgrounds, students would not be able to afford to purchase the papers. Even with attending 'tutorials', there were fewer to no students in those two schools.

CT There're not that many! But there're students who do attend private tutorials.

In school B the students' inability to attend the evening classes also had to do with the fact that they attended school until late.

BT Eh, unfortunately we don't …our students don't do it.

It appears from this analysis that not as many in School B and C would have afforded the tutorials as in School A. In fact, students in School B in particular requested me to supply them with past examination papers, unlike those in School A who, as the teacher maintained, had purchased their own. The value attached to these tutorial and the purchasing of past examination paper by students was an interesting finding because it illustrated differential resources beyond that which schools were able to distribute. Students who could afford to could then purchase past examination papers and attend evening classes. It is clear that these distributed advantages were very closely connected to families' economic and educational backgrounds (i.e. favouring School A over Schools B and C). This for me formed a very distinctive cultural capital, which was distributed differentially. These advantaged students were then able to make informed choices about what they should do in examination situations. Asked why they were reluctant to attempt the 'realistic' item, the students indicated that it would not normally be their choice of question in an examination:

AS1 I never even bother with such questions because I think there are enough questions in Section B … at least, there must be some graphs questions which will appear. And I have tried to make sure that with graphs, I attempt everything. It's because here in school we haven't done this topic; even there [in the tutorials], we haven't done this topic, those which refer to … Normally when I open a question paper, any question that is based on this topic I never … I just look at it and then proceed to graphs and perhaps vectors.

---

[2] The teacher here means that there are a variety of questions that students have purchased from the Examinations council of Lesotho (ECOL). Such questions, which are 'outside' the activities of the class, are discussed in the tutorials.

I OK? [Referring to the other student]

AS2 Yes, I never do this one.

I You don't do it at all?

AS2 Even when I revise, … even on my own, I never do it at all. That's because even when I attempt it, I fail.

The students have received extensive support on their preparations for the O level mathematics examination. These students who have attended tutorials would have been exposed not only to the mathematics, but also the specific context of examination. This awareness translates into a strong cultural capital that guides the students in the specific context of such high stakes examinations as the O level mathematics examination. This awareness emerged only in School A, where the students were able to articulate their awareness of the choices they had. The students in Schools B and C could not even articulate their position in relation to 'realistic' questions. In general, because the students come across the 'realistic' trends in a context of external examinations, the epistemological and motivational intentions are backgrounded by the high stakes associated with external examinations.

The examination is external and as removed from the teachers as it is from the students. In the context where many students find mathematics difficult, there are those who bring a strong socio-economic background into the examination. This background provides a strong cultural capital borne out of extensive preparations that the students' parents have been able to put them through. Such students show a great awareness of the choices they have in the examination and this clearly puts them at an advantage over the difficulties that all others experience with such novel demands and 'realistic' contexts as reflected examination question 7 on a cassette. These differences among students, generated by their generally poor backgrounds, some strong socio-economic backgrounds, and a few strong individual drives, is what I will refer to as the 'habitus' developed by the students. Within the 'habitus', the socio-economic backgrounds appear to play a very strong role in distributing advantages and disadvantages among students.

Conclusion

The concern for educational standards is very interesting in the contexts of high stakes examinations systems in developing countries. Particularly, in post-colonial countries such as Lesotho where school leaving examinations are still set outside the country, teachers' professional identity and practices are marginalised by the extent to which these curricular reforms are removed from them. While the marking and grading of scripts locally are events that are beginning to engage the professional judgement of teachers, the high stakes associated with these examinations means that teachers have as their prime concern the preparation of students for the crucial examinations that serve to determine their entire futures. Being entirely summative and external, the examination is as removed from the teachers as it is from the students. More meaningful and relevant mathematics practice is not necessarily contradictory to good examination preparation. However, the authority of teachers having been removed from them by an entirely summative examination, meant only

for selection, they can only act as conveyors of knowledge legitimated by the examinations-driven education system.

An analysis of the curricular reforms reflected in Lesotho O level mathematics examination indicates that the standard embedded in the questions in only about high or low demands. It is quite intricately related to the socio-economic background and the cultural capital they bring to bear on their positioning. What is much more significant about what the post-colonial context of this study adds to the concern about standards in school mathematics is that the context of high stake examinations pervades any noble curricular intentions such as the inclusions of 'realistic' items. It is all about passing the examination and students with a stronger habitus have the ground rules to select out questions with more confidence. These ground rules are not found in schools but are inherent of learners whose parents can take them through the 'private' tutorials that are becoming a central part of education in developing countries. The advantages come not from an 'epistemological' concern to show what one understands, but an almost conscious admission that the context of Lesotho is one in which everyone is doing poorly. In such a context, the recognition and realisation rules so unambiguously displayed by Cooper and Dunne's (2000) students are only partly about the awareness of the boundaries between the 'realistic' and 'esoteric' contexts. The recognition and realisation rules are about an awareness of the contexts they are in, the context of high stakes examination and the use of the disposition or habitus to select out confidently so that one maximises one's performance in an examination for selection. It is indeed not about the curricular reforms but about the high stakes associated with examination for selection. Whatever reform mathematicians will come up with will always be backgrounded by this context of high stake examinations.

As with most sociological problems the implications for practice are complex. Part of the problem might be addressed by examiners taking more care to evaluate the questions they set so that the do not obfuscate the mathematical demands. Teachers have to be brought into a more critical role regarding their positioning in relation to the curricular trends. More significantly, the impact of the external summative examination is even more significant in its impact on the distribution of social opportunities for young people in Lesotho. The obvious main solution would appear to be through an assessment practice that is geared not only towards selection, but also meant to provide feedback to the teachers through a valuing of formative assessment practices. Unfortunately, formative assessment in a context of developing countries is not a simple solution. It requires a great deal of human and material resources and therefore such a process needs to be carefully monitored so that it does not bring in further complications and injustices. But as long as these high stakes examinations are the only measure of 'competence' among young people, the system will continue to disadvantage the already disadvantaged.

As we consider the ubiquity of standards-based reforms, we need to ask how clear these standards are made to teachers and how accessible they are to students across a variety of socio-economic backgrounds. Otherwise, they just become an excuse for bashing schools that are insufficiently resourced and teachers that are inadequately supported. The second question we have got to ask is how we can improve the extent to which learner competencies associated with these reform initiatives can be measured. An even bigger question is how long we can pretend that high stakes examination systems that pervade

education systems in developing countries are distributing social opportunities fairly across learners from different socio-economic backgrounds.

References

- Bernstein, B. (1996) Pedagogy, Symbolic Control and Identity: Theory, Research, Critique. London: Taylor and Francis.
- Bishop, A. J. (1988) Mathematical Enculturation: A Cultural Perspective on Mathematics Education. Dordrecht: Kluwer.
- Bond, L. (1994) Rethinking assessment and its role in supporting educational reform. North Central Regional Educational Laboratory. Available on: http://www.ncrel.org/sdrs/areas/issues/methods/assment/as700.htm
- Bourdieu, P. (1990) *The Logic of Practice.* Oxford: Blackwell.
- Broadfoot, P. (1996) Assessment and learning: Power or partnership? In H. Goldstein and T. Lewis (Eds.) *Assessment: Problems, developments and statistical issues*. Chichester: John Wiley & Sons Ltd.
- Blum, W. and Niss, M. (1991) 'Applied Mathematical Problem Solving, Modelling, Applications, and Links to Other Subjects – State, Trends and Issues in Mathematics Instruction'. In *Educational Studies in Mathematics* **22**, 37 – 68.
- Cockcroft, W. (1982) Mathematics Counts: Report into Inquiry into the Teaching of Mathematics in Schools. London: HMSO.
- Cooper, B. and Dunne, M. (1998) 'Anyone for tennis? Social class differences in children's responses to national curriculum mathematics testing'. In *The Sociological Review*.
- Cooper, B. and Dunne, M. (2000) Assessing Children's Mathematical Knowledge: Social class, sex and problem-solving. Open University Press. Buckingham.
- Darling-Hammond, L. (1994) 'Performance-based assessment and educational equity'. In *Harvard Educational Review*. Vol. 64, 5 – 29.
- Dowling, P. (1998) The Sociology of Mathematics Education: Mathematical Myths/Pedagogic Texts. The Falmer Press: London and Washington, D.C.
- Edwards, D. & Mercer, N. (1987) Common knowledge: the development of understanding in the classroom. London: Methuen.
- Gipps, C. (1996) 'Assessment for the millennium: Form, function and feedback'. Inaugural professional lecture delivered at the Institute of Education, University of London on June 6, 1996. Institute of Education, University of London.
- Hill, P. (1994) 'Putting the national profiles to use'. In *Unicorn*, Vol. 20, No. 2, 36 – 42.
- Jansen, J. (2002) 'Can research inform education policy in developing countries? A South African experience'. In *International Journal of Education Development*, 23 (1), 647 – 664.
- Kellaghan, T. & Greaney, V. (1992) Using Examinations to Improve Education: A Study in Fourteen African Countries. World Bank Technical Paper number 165.
- Kokome, N. (1990) The teaching of mathematics in Lesotho secondary schools: A package of ideas. Unpublished Diploma in Advanced Studies in Education Dissertation. University of Bristol.
- Morrow, W. (1992) A picture holds us captive. In Pendlebury, S., Hudson, L., Shalem, Y., Bensusan, D. (eds.) Kenton at Broederstroem: Conference proceedings.
- Moru, K. (1994) Developing the quality of pupil learning in secondary mathematics in Lesotho. Unpublished M ED Dissertation. University of Bristol.

- Nyabanyaba, T. (2002). Examining Examination: The ordinary level (O level) mathematics examination in Lesotho and the impact of recent trends on Basotho students' epistemological access. Unpublished Doctoral Thesis. University of the Witwatersrand. Johannesburg.
- Pennycuick, D. (1993) School effectiveness in developing countries – A summary of the research evidence. Education Research Paper. No. 1. Available on: www.dfid.gov.uk/pubs/files/schooleffectdevcountriesedpaper01.pdf
- Pule, P. (1991) Examinations Council of Lesotho: Annual Report. April 1998 to March 1991. August 1991. Maseru.
- Reville. P. (2002) Making standards work. HGSE news. Available on the Harvard Graduate School of Education website: http://www.gse.harvard.edu/news/features/reville03212002.html
- Rowie, K. (2000) 'Assessment, league tables and school effectiveness: Consider the issues and 'Let's get real'!' In the *Journal of Educational Enquiry*, 1(1), 73 – 98.