

Whither Relevance? Mathematics Teachers' Discussion of the Use of 'Real-Life' Contexts in School Mathematics

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As a mathematics teacher, I have been concerned about students' access to school mathematics. In post-apartheid South Africa, there has been a commitment to make school mathematics not only more accessible, but also more relevant for students. To that effect, a new curriculum, *Curriculum 2005*, which seeks to make learning more integrated and more 'relevant and connected to real-life situations' (DoE, 1997, p. 7) is currently being implemented. This article sets out to discuss emerging issues of how mathematics teachers, as critical agents of change at this important historical time in South Africa, understand the notion of 'relevance' and what they perceive to be some of its intricacies.

South Africa's commitment to access and relevance in school mathematics is shared by many educationalists elsewhere (e.g. Schoenfeld, 1988; Volmink, 1994; Bishop, 1985). With that commitment has come a new impetus to develop a better and more critical understanding of the issue of 'relevance' or 'real-life contexts' in school mathematics. Work done in this sphere includes Boaler's (1993) argument that many school mathematics tasks are covered by 'real' life contexts, where:

students are required to engage partly as though a task were real whilst simultaneously ignoring factors that would be pertinent in the 'real life version' of the task (p. 14)

A similar observation is made by Cooper and Dunne (1997) regarding an examination question that required students to work out the number of times a lift that can carry a maximum of 14 people would have to go up (and down) in order to carry 269 people to the top floor. Such a question ignores real-life issues such as that some people might choose to use the stairs rather than wait for the lift. Connecting mathematics to 'real' life continues to be the subject of much study and debate within mathematics education.

In her discussion of 'word problems', Gerofsky (1996) notes that while national documents such as the UK Cockcroft report (DES, 1982) or the US *Standards* (NCTM, 1991) have called for curricular relevance, debates concerning the issue of 'relevance' show a much more complex side to this notion. Gerofsky cites research by Lave (1988) and Nunes, Schliemann and Carraher (1993) to support her argument that:

people who are successful and efficient mathematical problem solvers in 'real-life' (i.e. life outside of school) may be unable to solve school word problems with

pencil and paper, even when these word problems appear similar to 'real-life' problems that the person is quite capable of solving. (p. 36)

This revelation has led to further questions about the degree to which mathematics skills are transferable across contexts. Ensor (1997), indicating that school mathematics is a specific practice, also questions the view that school mathematics can prepare students for the workplace.

Gerofsky goes further to argue that students often have difficulties reading the intentions in word problems (Thomas and Gerofsky, 1997). The intention might be to exercise the student's creativity in a situation where there exists a variety of approaches. Yet many students see word problems or 'relevant' mathematics tasks simply as opportunities to execute algorithms. Christiansen (1997) also reveals that students often experience difficulties in mathematics concepts based on 'real-life' contexts or 'virtual reality'. She indicates that the meaning is not simply independent of the task. Students can encounter serious problems of conflict where they are not sure whether what is at stake is the meaning as related to the use of the everyday context within mathematical school practice (i.e. *virtual reality*) or the use of the everyday context within the conventions of everyday practices (i.e. *actual reality*). Since 'meaning is always meaning in a particular context', it is important that the understanding of such situations as everyday contexts brought into classrooms is not 'taken-to-be-shared' (p. 1).

In the UK, the work of Cooper and Dunne (1998) has produced a very intricate argument about the performance of students, particularly from working-class backgrounds, in examination items based on 'real-life' contexts. The authors make a serious claim that:

test items contextualising mathematical operations within 'realistic' settings might be expected to cause particular problems of interpretation for working class students. (p. 117)

In that study [1], it is suggested that working-class children's tendency to interpret such questions using their everyday experiences leads them to give inappropriate answers. As a result, such contexts do not reveal the true level of the children's mathematical competence.

An observation made by Morgan (1996) regarding recent trends in assessment in the UK is quite pertinent here too:

In the UK, the introduction of the assessment of extended investigative tasks for students at age 16+ has placed unprecedented linguistic demands on students

whose teachers themselves have, on the whole, little experience of producing lengthy mathematical texts and few supportive strategies available to them. (p 2)

Like these extended assessment items, 'real'-life contexts often have long texts that place very serious linguistic demands on students. This is a particularly important issue in South Africa, where the majority of teachers (and students) are second-language speakers of English

Several complexities and disjunctions have been suggested regarding the use of 'real-life contexts' in school mathematics practices. Generally, there is need for more work on the issue of 'relevance' and how it is perceived in mathematics. The focus of most studies is on what *pupils* do with regard to the use of 'real'-life contexts in school mathematics. The absence of the literature on *teachers'* understanding of 'relevance' is not only conspicuous but quite worrying for South Africa. As I have already mentioned, teachers are important agents of change. In the context of curriculum change, the teachers' understanding can be quite pivotal in the implementation of the new curriculum for the South African context

Teachers' notions of relevance

In September 1997, I conducted an inquiry into teachers' understanding of 'relevance' as it refers to relating students' learning of mathematics to their (students') everyday experiences. Thirty-three practising teachers participating in the University of the Witwatersrand's Further Diploma in Education took part in one of a number of focus group interviews. I divided them into six groups: three groups of primary teachers and three secondary. Six topics were identified for discussion. In each group, there was a facilitator [2] with some guidelines as to how he/she should probe and shape the discussion

I will present an extract of a discussion of a football log table set in an actual mathematics examination as an illustration of the nature of what occurred in the group interviews. Then, drawing from this group interview, I will discuss some emerging 'understandings' of the teachers with reference to current debates on 'relevance' and the implementation of the new curriculum.

The 'focus group' interview

The teachers were to read and discuss a football context set out in the box below and were asked to discuss whether they would use such an item for assessing students' mathematics ability in their own teaching and what mathematics content they would be assessing. As I was interested in the complexities and limitations of such an item, I provoked discussion by including a report that in the actual examination students had answered the question by claiming that:

Moroka Swallows would still be on top as it was a good team and they [the students] had seen it play.

The following football log tables were part of a mathematics examination item for grade 9. In the examination, learners were asked to say whether Amazulu is doing better than Moroka Swallows on the 5th of May. They were asked to base their answers on the log tables and to explain their answers.

Castle League Log 26-04-93

Club	P	W	D	L	F	A	Pt
Moroka Swallows	10	6	2	2	11	9	14
Santos	9	3	5	1	10	6	11
Amazulu	8	4	3	1	10	7	11
Umtata Bucks	10	3	5	2	8	8	11
Albany City	9	3	2	2	10	8	10
Pirates	7	4	1	2	10	6	9
C I Spurs	7	4	1	2	7	5	9
Celtics	7	3	3	1	7	5	9
Ratanang	8	3	3	2	11	8	9
Sundowns	5	4	0	1	10	2	8
Dynamos	7	3	2	2	8	5	8
Chiefs	6	3	1	2	9	8	7
Hellenic	6	3	1	2	9	8	7
Jomo Cosmos	9	2	3	4	5	8	7
Wits	9	2	2	5	8	7	6
Callies	8	2	2	4	8	13	6

Castle League Log 25-05-93

Moroka Swallows	12	6	4	2	13	11	16
Amazulu	10	4	5	1	13	10	13
C I Spurs	9	5	2	2	11	3	12
Ratanang	10	4	4	2	13	8	12
Santos	11	3	6	2	11	9	12
Albany City	11	4	4	2	13	12	12
Umtata Bucks	11	3	6	2	10	10	12

Celtics	9	4	3	2	11	9	11
Sundowns	5	5	0	1	14	4	10
Pirates	7	4	1	2	10	5	9
Wits	7	4	1	2	10	5	9
Dynamos	7	3	2	2	8	5	8
Chiefs	8	4	0	4	10	10	8
Callies	9	3	2	4	10	13	8
Vaal Pros	11	2	3	6	9	12	7
Jomo Cosmos	10	2	3	5	5	10	7

The teachers in this focus group were unanimous in their agreement that they would use this kind of context for assessing their students. The particular content to be assessed by this item was agreed upon as interpreting information and making predictions as is the case in school probability. This unanimous agreement reflects prevailing discourses that 'real'-life contexts are a 'good thing'. Yet as the interview unfolded, discussions between teachers revealed a far more textured and yet implicit exploration of the complexities of 'relevance'. The following extract is illustrative.

A practical exploration extract

[F represents the facilitator and T1 to T8 are teachers who took part in this interview. The ... are meant to illustrate pauses in the discussions, either because of changes in the direction of the talk or as a result of interruptions.]

F: So, the third question says: "Some students answered that Moroka Swallows would still be on top of the log table, it is a good team, they had seen it play." How would you have assessed such answers?

T1: Biased! I would say those answers are biased because then they're based on whether you've seen Moroka Swallows or not.

T6: Those are not straight-forward. I mean, if you were concentrating on what is happening, even if I don't know Moroka Swallows or Amazulu, I must be able to [...] what I've read here tells you that now they are moving at the same pace. Now, you cannot say the other one is better than the other. You don't know whether ...

F: But they say that they saw it play some time and it was very tough. So basing themselves on their knowledge of the team, they believe that it is likely to win

T8: That's why we say that answers are biased ...

T2: If it is data interpretation, you read it like you know nothing about those teams. It's like, now, those answers saying: 'we know' and 'we saw that' should not be allowed. Such answers should not be allowed.

T4: Because the figures do not say that it is better.

T3: But it is important to entertain such questions such that you have [...] you move from diversity to commonality because these are open answers. So from this, you need to direct them in terms of asking them on the [...] during April, Moroka Swallows was No. 1, fine. Amazulu, No. 3. Now, Amazulu is No. 2, Moroka Swallows, No. 1. So which of the two teams has progressed? Amazulu!

F: So, the fourth question is what are some of the limitations of such an examination item?

T3: He mentioned some of them here; he said let's not assume that everybody else will understand the key [3], the key used. Give the [...] Let's not assume that everybody understands the graphs. Second, let's [...] if the concept that [...] if the concept you're trying to assess is based on what the children [...] a real life that the children know, then they may give you biased questions ...

T1: Answers. So maybe it's better ...

T3: Because it's based on what they know, not on figures in front of them

T8: And the aim here is data handling, are they able to handle data. Because according to this answer, it shows that they're not able. Now, in this case, it might be the question was not well-directed, I don't know.

T1: Maybe the use the teams from abroad, maybe. In [...] to avoid such answers.

T4: Which the students do not know

T3: Yah, let's look at [...] their concentration should be at the information there. Because most of them will be already concentrating on what my favourite team [...] what is my favourite team doing. You give him this question and he is not concentrating on the question. Maybe their minds can flounder [on] some other things.

T5: As, you know, as he says; if, say for instance, I know that on the 26th of April, let's say Chiefs, it was found on the same position as Amazulu, then I know that they've bought the one [...] one of the most top strikers ...

- T3: Biased, I'm gonna be saying: 'Oh, that date, I know they will be doing well'. Because I know they've just bought a top striker somewhere.
- T4: But on the same hand, won't that lose the meaning? What is the aim here? The aim is to relate mathematics to what the pupils know. Now, if you put foreign clubs, the pupils don't know about foreign clubs [...] so I still ...
- T3: They know soccer [...] they know soccer.
- T4: Now, my question is ...
- T3: You're relating mathematics to soccer ...
- T4: .. to soccer or data-handling? If [...] those two are different.
- T3: That's why I'm saying to you, you want to bring [...] er [...] mathematics [in order]; it's like I'm saying to you, you want to see if this concept of [just ...] I know what happens also when you buy a newspaper, some people hardly look at the log and relate that as mathematics. It is just: 'How did Chiefs play?' That's it.
- T1: That's it.
- T3: It's got nothing to do with the other teams. People just look at their team, and they are satisfied. Or it's position four or it's position six now. What is going on with the rest [...] is it moving up or down.
- T5: Cannot take a look at the previous one and take this one and check whether his team is doing better or not

Relevance to whom and to what, and for what end

There are two key issues in this extract from the teachers' discussion that I would like to pursue: *relevance to whom and to what*, and *relevance for what end*.

Relevance to whom and to what

The question of the 'relevance' of such contexts as this football scenario to students' everyday experiences raises some very intricate issues in this study. First is the unanimous agreement by the teachers in this study that an answer such as 'I know that Moroka Swallows is a good team' is irrelevant. This is particularly the case with the statement that teacher 2 (T2) makes that 'you read it [the question] like you know nothing about those teams' (turn 6). This statement raises the question of what the 'relevance' in those questions is if one cannot use his/her everyday knowledge? A further difficulty is noted regarding the fact that not everybody would understand the key used in such contexts (turn 10). The key refers to abbreviations such as *P* (games played), *W* (games won), etc. The teachers argued that girls might be at a serious disadvantage in the use of such contexts and especially without an explanation of these abbreviations. Too much knowledge (in terms of everyday experiences) as

is indicated by those students who referred to their having seen Moroka Swallows can be just as detrimental to their school mathematics practice as too little knowledge (as was argued could be the case with girls) of the context or the 'key'.

In a class situation, there is less of a danger if such items are used to move students knowledge 'from diversity to commonality' by mediating the students' responses. Even then, it can be a very difficult task and one wonders if teachers would be able to handle this as well as such contexts demand. It is what both Mercer (1995) and Christiansen (1997) imply by suggesting that there is a critical demand for the teachers to assist students across everyday contexts into the school mathematics practice. This might be the ideal situation in the classroom, and it might even be possible for teachers to handle this.

But in an examination situation this can be quite significant in terms of what mathematical ability such items reveals as possessed by students. As Cooper and Dunne (1997) observe, when the students' everyday knowledge interferes with their responses then such items fail to demonstrate the level of competence of students. A further complication observed by Morgan (1996) regards the linguistic demands that such examinations items make on students. But, as Boaler (1997) has recently indicated, different school experiences can prepare students to do well in the face of these new demands. Therefore, the suggestion is that everyday experiences should not be taken for granted as enabling or revealing of competence. Instead, they require the conscious preparation of students. At a superficial level, teachers see the use of everyday experiences as enhancing mathematics meaning. Yet, when probed, teachers seriously engaged with very important issues such as that everyday experiences of students can be both disabling and revealing. Teachers' roles are going to be even more intricate in ensuring that the experiences reveal students' mathematics competence.

Relevance for what end

The effect of such 'relevant' contexts is an even more contentious issue. Throughout this study, teachers maintained that they would use such contexts and that they lead to much enjoyment by students. But research has begun to reveal that such new teaching methods as group work are not being used to good effect. [4] If all there is to 'relevance' is for pupils to enjoy the activities, then one wonders what mathematical competences are being derived from the activities. When and how teachers intervene and mediate in such activities is a subtle issue.

There is an indication in this study that most teachers would dismiss students' answers based on their everyday knowledge as irrelevant to the task. Only one teacher argued for the use of such contexts in order to mediate the diverse experiences of students to a more common understanding of the demands. It is quite likely that many teachers would find it very difficult to deal with these diverse everyday experiences and opportunities to work with students' knowledge will be missed. The result would then be for students to regard such contexts as merely covering up traditional school mathematics algorithms.

The ultimate end for the teacher of bringing students' everyday experiences to bear in mathematics classes is mathematics learning rather than the greater illumination of that reality by mathematics. The teachers constantly refer to the goal of this activity as testing the data handling skills of students. But if it is not clear to students what the goal of such an item is, then it may fail to test the students' mathematical competence. Therefore, it requires in the teachers a thorough preparation of students in handling such items. Even then the immediacy of everyday experiences can be a danger to school mathematics competence. There is a subtle, but incomplete discussion in the extract about whether it would be better that teams from abroad be used in such examination items (turns 14-20). Yet the observation by teacher 4 (T4) that relating school mathematics to 'foreign clubs' (turn 19) would miss the very point of relating school mathematics to everyday experiences of students is not quite addressed.

Whether such 'relevant' contexts would prepare students to be more competent citizens and workers is also a very complex issue. As one teacher (T3) observes here, people never really call upon their school mathematics experiences in their everyday dealings (turn 24). Since the revelation by Lave's (1988) study that people do not necessarily transfer their experiences across contexts, the instrumental regard for mathematics shown by such claims to 'relevance' as preparing students for their future has been seriously questioned.

Conclusion

The intricacies of 'relevance' suggested by this study imply that there is need to inform many teachers' understanding of 'relevance'. The ways and extent to which such contexts can be 'relevant' depend upon very careful choice. Furthermore, assisting students across everyday contexts into school mathematics is crucial to the success of offering 'relevant' mathematics in schools. Teachers, in particular, need to be aware of these very subtle demands, so that they do not dismiss students' responses as simply 'biased' and therefore irrelevant.

For the implementation of *Curriculum 2005*, a deeper understanding of issues such as 'relevance' by teachers is crucial. The understanding shown by the teachers in this study shows some textured awareness. But it is clear that a more explicit and enabled understanding would emerge from a deeper and more practical exploration of the issues and complexities involved.

The teachers in this study stated that they are aware of the 'need' to use everyday experiences of students to enhance mathematics learning. Therefore, teachers apparently do not need to be persuaded - at the level of advocacy, at least - to use relevant contexts. However, where work is needed is on the complexities revealed in this study and how teachers may be enabled to work successfully with these complexities at a practical level to achieve their ends as mathematics teachers.

Notes

[1] The term 'working class' is reported to have raised some controversy during the conference (whence this article originated) as to what should determine one's class, especially in the case of foreign parents who may be very well-qualified and yet hold jobs that would typically be classified as working-class jobs. The term could be even more irrelevant for my study in Lesotho where social class divisions have not been explicit. It might, however, be quite interesting to consider the educational and occupational backgrounds of parents, as these might advantage some students in terms of their linguistic and motivational resources, especially as English is the second language of most students in Lesotho.

[2] The facilitators were colleagues doing their M. Ed. studies at Wits University.

[3] That not everybody will understand 'the key' refers to an earlier gender comment made by one of the teachers. It was argued that girls might be unfamiliar with this context and therefore might not know what 'P', 'W', etc. stand for on the table.

[4] There was extensive coverage of the new demands of Curriculum 2005 in the sixth annual conference of the Southern African Association for Research in Mathematics and Science Education (SAARMSE) and research reports such as Graven (1997) published in the proceedings of the conference show that teachers in South Africa still need a more textured understanding of how group work can be used to good effect.

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