FROM THE EVERYDAY, THROUGH THE INAUTHENTIC, TO MATHEMATICS: REFLECTION ON THE PROCESS OF TEACHING FROM CONTEXTS

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This paper highlights an attempt by two grade 8 teachers, Bulelwa and Kevin, to draw in the everyday in the teaching of mathematics. Though located in different South African contexts and settings, both teachers tend to enable their learners' access to mathematics by rendering the everyday inauthentic. I argue that inauthenticating the everyday is an unavoidable strategy by which the everyday considerations are silenced and not necessarily teachers' lack of empowerment, as it is sometimes claimed.

Within the mathematics education community, the relative merits and demerits of incorporating the everyday in mathematics remains one unresolved aspect. Whilst a number of studies cite the benefits of summoning the everyday in the teaching of mathematics (e.g., Skovsmose, 1994; Santos & Matos, 2002), others suggest that the everyday, when recruited into the mathematics, tends to conceal or draw some learners' attention away from the latter (Cooper & Dunne, 2000). Therefore, the challenge of balancing access to mathematics with recruitment of the everyday remains one of the central themes regarding the mathematics-everyday relationship.

The new South African education curriculum, Curriculum 2005 (C2005) has offered a definition of mathematics which makes the mathematics-everyday relationship important to reflect on. In its definition, C2005 advances an epistemological position of mathematics as a unique subject, "with its own symbols and language" and suggests the teaching of mathematics which incorporates the everyday. (DoE, 2000:16) This definition presents a practical challenge for teachers with regard to, on the one hand making mathematics accessible and, on the other, recruiting the everyday.

In this paper I draw on the experiences of two grade 8 teachers, Bulelwa and Kevin[*], who were trying to implement C2005. I particularly highlight and reflect on the way the two negotiated the challenge of summoning the everyday in order to enable their learners' access to the mathematics content. I will organize this discussion into four sections. In the second section I will provide the context in which the study took place. I will then, in the third and fourth sections respectively discuss the teachers' motivations for drawing in the everyday and the way in which they moved from these contexts to the mathematics. The final section will provide some reflections and

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[*] Not the teachers' real names

implications for the inclusion of the everyday in mathematics. I start this discussion though, by reflecting on studies and opinions expressed in relation to the tension between the everyday and mathematics.

BLURRING THE MATHEMATICS-EVERYDAY BOUNDARY

Bernstein offers, at a more general level, analytical tools by which it is possible to infer that recruitment of the everyday into mathematics entails 'interfering' with the boundary between these two discourses. Using a theoretical construct of classification, Bernstein's (2000) argues that a discourse attains its uniqueness on the basis of the extent to which it manages to insulate itself from other discourses. He draws a distinction between weak and strong classification. "In the case of strong classification, each category has its unique identity, unique voice, its own specialized rules of internal relations. In the case of weak classification, we have less specialized discourses, less specialized identities, less specialized voices." On the basis of this theory, one may infer that that there exists an epistemological boundary between mathematics and the everyday and incorporation of the everyday into mathematics renders mathematics difficult to identify.

That mathematics looses its 'voice' in the face of the everyday contributes towards the suspicion that other researchers have on the value of including the everyday in mathematics. As Gellert, Jablonka and Keitel claim, keeping mathematics insulated from everyday realities is, for the majority of academic mathematicians, "the most powerful aspect of mathematics" (2001: 57). Pimm (1987) observes how the use of everyday English words *some* and *all* tend to confuse students' interpretation of mathematics statements. In particular, students regarded the two terms as contrastive rather than inclusive; that is, some entails not all. Rowlands and Carson (2002) maintain that mathematics transcends cultural practices. The substance of arguments which discourage summoning the everyday is that access towards mathematics is thus made difficult for learners. Other researchers (Verschaffel & De Corte, 1997; Nyabanyaba, 2002) appreciate the challenge brought by the inclusion of the everyday in mathematics, nonetheless, they cautiously argue in favour of blurring the boundary between the two.

Some studies have however highlighted the potential gains of drawing in the everyday in mathematics. For example, drawing from a socio-cultural perspective, Mukhopadhyay (1988: 135) outlines the way in which an activity on a popular doll Barbie helped learners realize that a real-life Barbie would be unnatural and unreal. Within the domain of ethnomathematics, Stillman (1995) has shown the way in which patterns made during the imprinting of tapa can be useful for teaching contents such as matrices vectors and sequences.

The substance of the studies cited above hinges on the relative merits or demerits of blurring the epistemological boundary between the everyday and mathematics. In the next section I turn to one aspect of this particular study; the context.

CONTEXT OF THE STUDY

This paper emerges out of a two-year national collaborative research project, the Learners' Perspective Study (South Africa), in which I participated as a novice researcher. The overall intention of this study was to gain insights into learners' perspectives about their experiences of mathematics lessons. Thirty eight Grade 8 mathematics lessons in three different schools were observed and videotaped. For each lesson we (1) focused on the interactions of a particular group of learners (2) collected their written work and (3) interviewed at the end of the lesson. In addition, teachers shared their impressions about each lesson by completing a questionnaire. At the end of the data collection process at each school, each teacher was interviewed about various aspects of their lessons. All the three schools are situated in Kwazulu-Natal province and are within a 30 km radius of the major city, Durban. Whilst differently resourced; all these schools had access to telephone services and electricity and were thus not a representative sample of schools in the province, the majority of whom have no access to these resourses ((Financial Mail, 02/1999 page 25). For purposes of this paper I focus on two of the three teachers whose lessons I was more exposed to and in whose interview I was able to participate.

Both Bulelwa and Kevin are regarded by their peers and learners in their respective schools as good teachers. Both hold senior positions in their respective schools and by South African standards they are amongst the better qualified teachers. In particular, Bulelwa holds a Barchelor's degree in Science with Mathematics and Statistics majors, a Higher Diploma in education and a B.Ed (Honours). She teaches in Umhlanga High school which is situated in Umlazi township, a single race residential area for blacks. She has been a teacher for over ten years, though she had only been teaching at this particular school for just over one year. All the staff members and learners at this school were black. We observed 9 of Bulelwa's mathematics lessons in a class of 38 learners. Kevin taught at Settlers High school situated in a predominantly white affluent suburban area. He held a four year teaching diploma and had been teaching at Settlers for twelve years. Kevin's class had twenty-eight learners, three of whom were non-white. We observed fourteen of the grade 8 mathematics lessons at Settlers.

Bulelwa and Kevin thus had different backgrounds both in terms of their educational tours, race and teaching settings. In the following section I focus on the way in which the two rationalized the use of the everyday.

INTRODUCING THE EVERYDAY

The mathematics content for all the nine lessons that we observed at Umhlanga was number patterns. It was only in five of these lessons that Bulelwa drew in the everyday. She used worksheets as teaching resourses. The everyday themes that she drew in were *Ancient Societies' practices* (lessons 1 and 2), *AIDS* (lessons 7 and 8) and *Flowers* (lesson 9). For purposes of this paper, I will only focus on Bulelwa's drawing in of the theme AIDS. Of the fifteen lessons we observed at Settlers, it was

five in which the everyday was drawn in. Kevin, unlike Bulelwa, did not plan a lesson around a particular theme, instead, he used word problems. Some of these word problems drew from the everyday realities. For this paper I will focus on the experiences of the first lesson.

Bulelwa's rationale for including the everyday: The first paragraph in the worksheet that Bulelwa used for lesson 7 provided a rational for the incorporation of the everyday to the students. It particularly made reference to the relationship between 'mathematics and the natural environment'. The rationale for blurring the boundary between mathematics and the everyday was rooted in the utilitarian value of mathematics for everyday experiences. In other words, Bulelwa presented mathematics as a tool to engage the everyday.

Mathematicians have studied number patterns for many years. It was discovered that there are links between mathematics and our natural environment and sometimes events occurring in our societies. For this reason an understanding of algebra is central to using mathematics in setting up models of real life situations. (Worksheet 5, lesson 7 & 8)

 In setting up the scene for lesson 7, Bulelwa (T) reiterated the significance of mathematics with specific reference to engaging or solving the escalation of AIDS. She told learners,

> **7 T**:… we are still looking at the number patterns but now we are trying to relate what is happening in mathematics classes to real life situations. We are actually trying to see whether what you learn in mathematics classes is actually relevant… Do they help mathematicians to figure out what is happening in real life? So I picked that one where mathematicians are trying to use mathematics to solve real life problems. Problem which is actually epidemic… which is big for South Africa. We are having so many people dying of AIDS.

The AIDS context had an emotional appeal to this classroom community because of the proximity of the school to an area where an AIDS activist Gugu Dlamini was stoned to death for declaring her HIV-positive status.

Kevin's rationale for the everyday: In his written reflection about the first lesson, Kevin indicated that his use of word problems was motivated by a desire to illustrate connections between ordinary English and mathematics equations. On the basis of the worksheet he used, 'ordinary English' referred to tasks whose wording referenced both the everyday contexts like the price of chocolate and mathematics context like the area of a rectangle. In setting the scene for the lesson the first lesson, he (K) said to the learners:

> **32: K**: ….. Okay what we're doing now we're doing equations and often you want to know how you can use something in, in maths, in real life. So can you remember the problems I was giving you; things like three CDs cost you three hundred and sixty Rand what does one cost? Okay that's a real life situation you use in equations.

One purpose of the lesson, according to Kevin, was to illustrate the value of 'equations' in real life settings. He, like Bulelwa, argued that there was a place for mathematics in the learners' lived experiences. To illustrate this point, he made up an example by making use of one of the learners, Kelley. He asked for Kelley and her sister's age. On establishing that Kelly was thirteen and her sister fifteen, he phrased this question.

> **38 K:** Okay if we were to say we didn't know you're thirteen and she is fifteen. Okay Kelly's age and her sister's age add up to twenty-eight and if Kelly is two years younger than her sister how old is Kelly? Okay something like that. Okay, out of your minds goes thirteen and fifteen jot down for me on how you would work that out. (At this stage learners take their books out and begin working the sum out).

Bulelwa and Kevin thus drew in contexts which were qualitatively different. The AIDS context was not benign; it had the potential to spark different types of non-mathematical arguments and discussions. Kevin, on the other hand, used a context which was not as emotional. In addition, the visibility of the context in Bulelwa's and Kevin's class differed. Bulelwa followed up a theme of AIDS over two lessons whilst Kevin mentioned a range of contexts in one lesson. Therefore, Kevin's learners spent relatively less time reflecting on the given contexts.

Despite these differences, both Kevin and Bulelwa saw the value of blurring the boundary between the mathematics and the everyday. They made public to their learners, the potential of a dialogue between mathematics and the everyday. Mathematics, as they presented the subject, stood in an "open relationship" with the other realities (Bernstein, 2001:10). Having blurred the mathematics-everyday boundary, the next section focuses on how the two attempt to make mathematics visible.

FROM THE EVERYDAY TO MATHEMATICS

Bulelwa handed out a worksheet, in lesson 7, which showed two tables (Figure 1). The first table depicts the rate of increase in the world population (in millions) and the second shows world increase in the number of AIDS sufferers (in millions).

The first question required learners to 'describe the pattern of population increase every 40 years' and the second required them to 'describe the pattern of increasing AIDS sufferers'. Even though world population trends and the rate of increase of AIDS sufferers are real world phenomena, the figures in the tables are not. The use of these figures renders these contexts inauthentic. Yet, the use of these figures also enable learners to notice a 'describable' pattern. A pattern which fit the exponential functions, $f(n) = 3.2^{\frac{n-1960}{40}}$ (n≥1960) and $16.7x2^{n-1997}$ (n≥1997) for the world population growth and rate of increase in AIDS sufferers respectively. The use of genuine figures would generate a messy data which learners may have found difficult to describe.

Year	1960	2000	2040	2080	2120
World population growth	3 000	6 000	12 000		

Year	1997	1998	1999	2000	2001
World increase in the number of AIDS sufferers	16.7	33.4	66.8		

Figure 1: Two tables in Bulelwa's worksheet

The first task from the worksheet that Kevin asked learners to engage made reference to children's ages. It stated that: "John's age is *p* years. Write down in terms of *p*, Sue's age if Sue is 10 years older than John". Whilst referencing names of real people; this context provides age as *p*, not a useful indicator of a person's age in real life settings. The use of *p* thus renders the task inauthentic from an everyday's perspective. However, the use of *p* also enables the introduction of algebraic expressions and then equations. Secondly, Kevin's use of Kelley (referred to earlier) as a person whose age was to be calculated exemplified the inauthenticity of the activity. Kelley had just highlighted her age as thirteen, it was therefore not meaningful, from an everyday perspective, to embark on a calculation of her age.

In both cases, having recruited the everyday, Bulelwa and Kevin silence it by pruning it off some its attributes. Pruned off its real life attributes, the everyday becomes inauthentic, a "strange real world" which is no more than a see-through into the mathematics content (Cooper & Dunne, 2000). So, access to mathematics is achieved through modifying and thus inauthenticating the everyday contexts.

CONCLUSION

This paper provides a practical challenge faced by two teachers of embracing the everyday whilst at the same time enabling access to mathematics. In embracing the everyday, Bulelwa could refer to AIDS as an epidemic as a result of which many people are dying. Non-mathematical discussions about the "traditional practices" and sexual habits that promote the transmission of AIDS could find legitimacy within this context (Sethole, Adler & Vithal, 2002). Similarly, Kevin could reference non-mathematical aspects about Kelley; her age and her sister's. However, engagement in these discussions conceals distinctions between mathematics and the everyday.

There has been much and substantiated criticisms regarding inauthenticating of the contexts by Bulelwa and Kevin. At a moral level, Bulelwa's figures about AIDS sufferers can be regarded as misleading. Kevin's expectation that learners should calculate Kelley's age, which she publicly announced in the classroom may seem senseless. My view is that expecting access to the formal structure of mathematics through the everyday (as does C2005) needs to be seriously reflected on. However

noble, the possible limitations and pedagogic challenges of this expectation needs highlighting. How do teachers move away from the everyday as an object of reflection to the everyday as a see-through towards the mathematics? Is it possible that teachers can enable access to mathematics without rendering the everyday as see-throughs?

Inauthenticating the everyday in order to access mathematics seems to me more a function of wishing to access mathematics through meaningful contexts than the teachers' ability or inability to recruit the everyday in their teaching.

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