

Investigating learner experiences and views of learning Mathematics in the context of HIV and AIDS

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Education.**

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Declaration

I declare that this is my own, unaided work. It is being submitted for the Degree of Masters of Science Education in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in any University.

**Vincent Tebogo Ndhlovu
23rd day of November 2007**

ABSTRACT

In order to investigate mathematics learning where a context of HIV and AIDS is used, I chose a case study research method. The method includes interviews, questionnaires, classroom observations, video recording of teacher lessons, participant observation and field notes. I focused on one grade 9 class with 25 learners and one mathematics educator.

The study shows that context assists learners to participate meaningfully in the classroom, while motivating them and making learning fun. Secondly, in activities that foregrounds mathematics, learners shifted from the application of their general knowledge of context to focus on mathematical knowledge.

Learners tend to ignore factors that are significant to real life or context of the task. When the researcher probed learners their responses shifted towards establishing an authentic connection between mathematics and application of mathematics in everyday lives. In other words in this case study context enables learners to see the value of solving problems within and outside mathematics. Furthermore, in this study context assisted learners to develop positive values and attitudes, and appropriate the role of mathematics in responding to social, political and economical issues.

Dedication

**In memory of my parents Daniel & Patricia and my brother George Themba
Ndhlovu**

**You've been an inspiration
You were able to turn failure into fertilizers
And used it to grow a scholar in your son and a brother**

Acknowledgements

My supervisor, Dr. Mellony Graven: to you a special word of thanks for unreserved support and sound encouragement, straightforward feedback and a critical way of reading my work. Thank you *ever so much* for believing in me. I am indebted to you; I cannot explain the respect I have for you it is beyond that of the researcher and a scholar.

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Nomenclature

AIDS – Acquired Immune Deficiency Syndrome.

HIV – Human Immuno-deficiency Virus.

DOE – Department of Education

ELRC – Education Labour Relation Council

FET – Further Education and Training

GET – General Education and Training

GDE – Gauteng Department of Education

NCS – National Curriculum Statements

NDE – National Department of Education

RME – Realistic Mathematics Education theory

RNCS – Revised National Curriculum Statements

SADTU – South African Democratic Teachers Union

WITS – University of Witwatersrand

Chapter 1: Contextualising the study: introduction and rationale

“HIV and AIDS is among us. It is real. It is spreading. We can only win against HIV and AIDS if we join hands to save our nation. For too long we have closed our eyes as a nation. For many years we have allowed the virus to spread, and at a rate in our country which is one of the fastest in the world. Every single day a further 1 500 people in South Africa get infected. To date, more than 3 million people have been infected.

And so today we join hands in the Partnership, fully aware that our unity is our strength. The simple but practical action that we take today is tomorrow’s insurance for our nation. Accordingly, we pledge that wherever we meet and study, work and sing, play and enjoy one another’s company, we will protect ourselves and our partners against HIV and AIDS”.

(Declaration of Partnership against AIDS by President Thabo Mbeki)

1 Introduction

As South Africans our entire reconstruction and development will depend upon our determination and creativity in addressing the HIV and AIDS pandemic. While the task is daunting, we need to remain committed to understanding its constitution, and be determined to respond in a holistic way to its challenges. Responding to the HIV and AIDS pandemic, and supporting South Africans who are both infected and affected, will continue to demand priority focus across government and within education in particular.

It is clear that mathematics education has an important role to play in integrating mathematics and HIV and AIDS. For example, the policy documents see mathematics as an important social and economical force to use when “dealing with data in significant social, political and economical environmental context ... to explore relevant issues e.g. HIV and AIDS” (DoE, 2002: 66).

To ensure that this research contributes and adds value in the local, national and global arena, I will describe the curriculum transformation that is currently taking place in our country. This chapter explains the significance of this study, and the dynamic context within which the study takes place.

In the last eight years I have been employed by the Gauteng Department of Education. Part of my job function is to develop mathematics educators professionally and improve the quality of learning and learner performance. In my day to day work I am expected to mediate policy in the following ways:

- Participate in developing illustrative learning support materials.
- Training educators to be able to implement new educational policies.
- Monitoring and supporting educators in implementing the new curriculum.

The challenges of implementing the new curriculum have left me with many questions and a desire to conduct research integrating mathematics learning in the context of HIV and AIDS. For example; Teaching in a country where human rights are protected – is teaching about HIV and AIDS violating learners’ rights? The interest for this study was further inspired by the definition of mathematics as stated in the Revised National Curriculum Statements (RNCS) that says:

“Mathematics is a product of investigation by different cultures – a purposeful activity in the context of social, political and economic goals and constraints”
(DoE, 2002: 4)

The above definition reflects the utility aspect of mathematics, which I regard as most suitable; for example, if an HIV and AIDS context is used, then social, political and economical issues all coalesce. Furthermore, education policy emphasises the importance of educating learners about HIV and AIDS, which places it high on the agenda. The National Curriculum Statements (NCS) at both General Education and Training (GET) and Further Education and Training (FET) bands, state that HIV and AIDS should be used as a specific context in the teaching of mathematics.

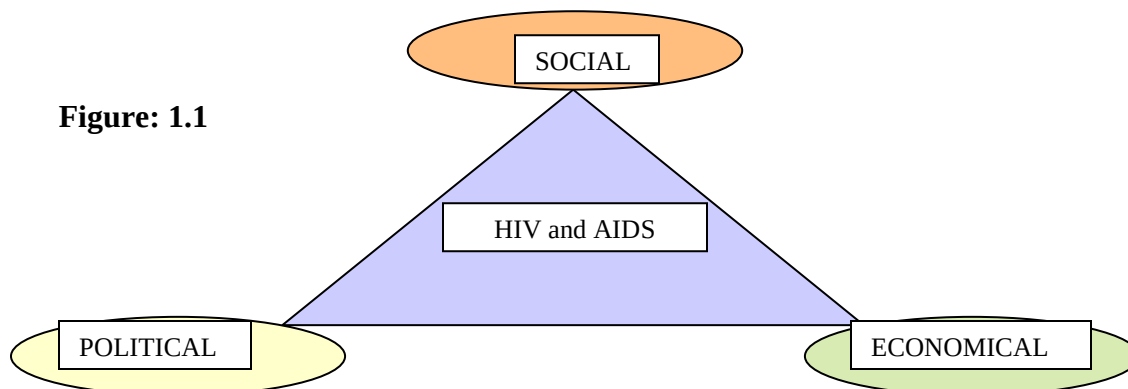


Figure: 1.1

Figure 1.1 above illustrates the interrelationship between HIV and AIDS and social, political and economic milieu operating in society.

The HIV and AIDS challenge lends itself well within the topic of statistics which is one of the sections of the Senior Phase mathematics curriculum in South Africa.

Consequently, this study wants to investigate how mathematics, and in particular, mathematics learning, is compatible within a realistic paradigm. That is how “non – mathematical everyday realities can be used as a platform to access it” (Sethole, 2004:18).

1.1 Problems of HIV and AIDS in education

In this section I present a picture that reflects problems of HIV and AIDS that prevail in education generally. The former minister of education Professor Kader Asmal (2002) argued, and is worth quoting what he said at some length, since it is relevant to problems of HIV and AIDS discussed below:

“Many schools are already experiencing the effects of the epidemic as teachers, learners and members of their families fall ill. I suspect that before the epidemic is brought under control, such effects will become harsher and more widespread. Almost every educator will eventually be teaching some learners who have HIV. And in most staff rooms, one or more teachers will be infected; other school employees will not be exempted.

Illnesses will disrupt learning and teaching. Well teachers will have to take on an extra load when sick teachers are absent. Learners who are ill will stay at home or in hospitals for a longer period and thus fall behind with their studies. When family members get ill or die, teachers and learners will carry the burden. When teachers and learners die, schools will experience and suffer disruptions, loss and sorrow. Many

schools will be crippled by the impact of the disease on staff, learners and their families.”

The above quotation from the previous minister of education explains the widespread effects of HIV and AIDS, and also the extent in which education will be affected by the epidemic. This reality is evidenced by reports in several newspaper articles: For example, the Citizen newspaper (1st April 2005, 3) reported that

“More than 4 000 teachers died of AIDS last year, depleting teaching resource and eroding the quality of education in South Africa.”

In the same article the South African Democratic Teachers Union (SADTU) claimed the

“Health status of thousands of teachers was becoming a huge burden for many colleagues.”

This report was as a result of findings of a study by the Education Labour Relation Council (ELRC) into factors that influence the supply and demand of teachers in the public sector. In the same article the general secretary of the ELRC, Govender warned:

“If South Africa cannot curtail the levels of infection and progression of HIV and AIDS among its teachers, the consequences will be bequeathed not just to present pupils... [but will add]... to poverty and social stagnation in the following decades.”

The Business Day and the Pretoria News ran similar reports on the 1st April 2005 confirming the findings by the ELRC. Similarly findings by Mtshali (2005) and Shisana et al. (2005) claimed mortality was a major factor for attrition in the teaching profession (Mtshali, 2005). Shisana et al. (2005) argued that HIV and AIDS affected both the supply and retention of teachers in the profession. Mtshali et al. (2005: 2) highlight the importance of teacher recruitment and retention as follows:

“A 1999 educator demand and supply projection model in South Africa suggests that AIDS would add to existing high levels of educator attrition and that the cumulative attrition rate may require replacement of many as 60 000 educators by 2010.”

It is beyond the aim of this study to discuss teacher recruitment and retention, and in particular how teachers are affected by HIV and AIDS. In the above section of the chapter I have focused on depicting a picture on the relevance of conducting such a study - that HIV and AIDS has a powerful social, political and economic impact in the lives of individual South Africans, as well as for the country as a whole.

Next I wish to provide evidence on how this study is relevant in the context of South African curriculum reform, where the curriculum demands that the ‘real’, ‘everyday’ world should be more central in school mathematics. Importantly I want to focus on the role of mathematics education when dealing with the integration of mathematics within an HIV and AIDS context.

1.2 The context of South African curriculum reform

In analysing the context of South African curriculum reform one notes that the pedagogy of the apartheid education system emphasised memorisation, fact-based learning and an uncritical engagement with content. Rote learning i.e. narrow technical skills did not allow the enjoyment of the process of learning. Rather it promoted the application of the skills of literacy and numeracy.

This contrasts with the National Curriculum Statement that emphasises the principle of contextualisation. Contextualisation is the imperative of a democratic nation and that of the global arena that are radically different. The underlying presupposition of using the context of HIV and AIDS to teach data handling, or in particular, probability, is that it has high potential to realise the intended curriculum that promotes ability to locate, synthesise and analyse emerging and new sources of information. It is important to stress

that use of context increase creativity, conceptual and lateral thinking, and critical engagement amongst learners.

In an increasingly complex world, the emotional and social ‘skills of life’ move more centrally into the education domain. So this justifies the importance of conducting a study of mathematics education within an HIV and AIDS reality that embodies a social, political and economic context in which education is seen as a vehicle for transforming the curriculum.

1.3 The purpose and critical questions of this study

The purpose of this research is to investigate the learning of mathematics in an HIV and AIDS context in the Senior Phase, in relation to the process of education transformation and implementation of a new curriculum in South Africa.

1.4 Critical questions

The central question of the research is to determine how mathematics learning occurs when integrated in an everyday context of HIV and AIDS. To address this I will look at various sub-questions. The following critical sub-questions will help me explore the central question.

- Is mathematics learning aided or impeded by integration within the context of HIV and AIDS?
- How is mathematics learning aided or impeded by its integration within the context of HIV and AIDS?
- Does contextualisation make mathematics learning real and meaningful?
- Do learners see HIV and AIDS as a real life problem?
- How does contextualisation assist to develop or promote creativity, conceptual and lateral thinking, and critical engagement?

- What are the effects of integration on learner interpretation and use of the recognition and realization rules within the classroom?
- What affective factors emerge as important in aiding or impeding the learning of mathematics?
- To what extent do learners' living contexts make learning mathematics interesting or fun for learners?

In addition I will explore these questions by looking at how learners deal with the issues of 'realisation and recognition' rules (Bernstein: 1996). I will also refer to what new role(s) emerge for educators when teaching in such a context? Since learning (rather than teaching) was the main focus of this study these are only mentioned as implications for teaching emanating from the study.

1.5 Rationale

In the following section I describe briefly why the study focuses on the integration of mathematics within the HIV and AIDS context. In this project I want to investigate what possible issues arise in the learning of mathematics in such an environment. I regard such a study as important because both mathematics education and HIV and AIDS education are a priority in this country. To this end I wish to investigate how can they be brought together in ways which will educate learners about them simultaneously?

The new curriculum in both the GET and the FET bands places emphasis on the integration of mathematics with various social, political and economic contexts. Furthermore, education policy emphasises the importance of educating learners about HIV and AIDS (see the section that follows below). Combining these two requirements the new mathematics curriculum (both GET and FET) locates HIV and AIDS as specific contexts which should be used in the teaching of mathematics. According to the RNCS (DoE, 2002: 67):

“Understanding of probability should enable the learner to engage with expressions of chance and probability in life (e.g. ‘The HIV test is 85% reliable’), and not merely rely on formulae.”

Similarly the National Curriculum Statement (NCS) (DoE, 2003: 9) states that:

“Mathematical problem solving enables us to understand the world and make use of that understanding in our daily lives”.

These policy documents have influence both the teaching and learning of mathematics, as well as the newly published mathematics textbooks (e.g. Classroom Mathematics; Laridon *et al*: 2001) have taken up the challenge and included activities involves links between mathematics and everyday context. Research literature in mathematics education, both nationally and internationally, debate the various advantages and disadvantages of teaching mathematics within everyday or realistic contexts. Many focus on the issue of how mathematics becomes backgrounded as a result of bringing in everyday contexts and thus mathematics learning is weakened. Sethole (2004: 20) draws from Floden et al (1987) when he writes.

“The everyday restricts the students’ scope of vision and exaggerates reliability of close-to- home experiences in the learning of mathematics which makes it difficult for learners to understand the academic discipline”

This represents a view of scholars opposed to incorporating the everyday into mathematics. Those who hold such views claim that the use of the everyday is insignificant in mathematics, suggesting by implication that a boundary exists between the everyday and mathematics. Other researchers argue that there is merit in including the everyday into mathematics, Brenner (2002: 63) for example writes:

“There are many good reasons for including everyday mathematics in what we do in the classroom. Benefits are claimed both for the individual learner and for society at large”.

Sethole (2004) describes how Skovsmose (1994), Freudenthal (1973, 1979) and Mukhupadhyay (1998) all argue in favour of inclusion of the everyday into mathematics for the reasons that it will make learning of mathematics meaningful and increase learners’ performance.

In this section I highlight the different viewpoints of teaching mathematics within everyday or realistic contexts. In chapter 3, I discuss the literature review in detail and focus on these different viewpoints of inclusion of the everyday into mathematics. While this is so, it is interesting to note that I have not come across literature that specifically focuses on the learning of mathematics in the context of HIV and AIDS. However, significant research has been conducted locally by Sethole who highlighted tensions that arises when mathematics teaching is embedded into the everyday and one such context in one of his case studies was HIV and AIDS. For example, he argues that

“Foregrounding the social aspects of the everyday renders mathematics invisible or inaccessible.” On the other hand “if mathematics is foregrounded then everyday use becomes insignificant.” Sethole (2004: 24)

Although these claims are intriguing, I hold the view that more research is needed to investigate how the inclusion of everyday mathematics affects learners learning and what factors create this ‘backgrounding’. It is such challenges that motivated me to explore the way in what learning is aided or impeded by incorporating the everyday into mathematics.

In this chapter I have shown why this study is important in the context of the new mathematics curriculum and the current broader socio-political and economical context in which education is seen as a vehicle for change. I have argued that schooling is a crucial

factor in social and personal development, which is used to attain the ideals of peace, freedom and justice.

Chapter 2

A Theoretical Framework

In this chapter I explain the tools I would use to analyse the process of South African curriculum change, and focus on changes in the mathematical curriculum. In doing this I highlight the implications that the introduction of the new curriculum has for learners learning mathematics, and for the role of everyday contexts in making mathematics accessible. This focus on implications for learning rather than teaching concurs with the focus of my critical questions on *learning* in the context of HIV and AIDS.

Skovsmose (1994) cautions us about challenges of implementing mathematics integration within the everyday life. Sethole (2004: 18) cites arguments raised by Skovsmose (1994):

“Mathematics may be integrated to such a degree that it disappears for both the children and teachers. Then it becomes important that time is spent on getting hold of imbedded competence. Mathematics has to be recognised and named, and that is the task of mathematics archaeology.”

It is within the context of these tensions that this study explores the learning of mathematics and the effects of incorporating the mathematics within an HIV and AIDS context. This analysis points to changes as outlined briefly in chapter 1 the new curriculum brings major changes in the conceptualisation of mathematics as a purposeful activity in the context of social, political and economical goals and constraints (DoE, 2002: 4)

Bernstein has been noted as particularly useful in the analysing the South African curriculum change as written in the National Curriculum Statements (Taylor & Vinjevoold, 1999; Graven 2002; Adler 2001; Adler, Pournara & Graven, 2000; Sethole, 2004; Parker 2006)

Graven (2002: 27), on providing tools for the analysis of curriculum changes, writes the following:

“The work of Basil Bernstein is widely noted for its usefulness in providing tools for the analysis of contemporary changes in education ... and for providing a language, which describes the pedagogic mechanism through which education produces, and reproduces, social inequalities.”

Following Graven I draw on Bernstein’s work as a framework to analyse generally the South African new curriculum, with a particular emphasis on what does “integration” mean for the learning of mathematics in particular, where everyday context of HIV and AIDS is used. It should be noted as pointed out by Adler et al. (2000: 2) that, “the principle of knowledge integration has been central in much of general education documents”. It is for this reason that I opted for Bernstein’s tools for analyzing new curriculum transformation that is taking place in South Africa. The reason for this is that the boundaries around subjects will either be ‘blurred or fully collapsed’ in new curriculum changes.

I concur with Graven (2002: 28) that Bernstein’s “concepts of classification and framing, recognition and realisation rules, collection and integrated knowledge codes, competence and performance based pedagogic modes, recontextualisation” (Bernstein, 1982; 1996) are useful concepts for analysing curriculum transformation. For this study these concepts are appropriate tools to analyse, in particular, how mathematics learning is aided or impeded by its integration within the context of HIV and AIDS and also what are the effects of this integration within the classroom on the “recognition and realisation, classification and framing, collection and integrated knowledge codes”.

Bernstein (1996) describes two distinct concepts: “one for translation of power and power relations, and the other for the translation of control relations”. He claims that classification (the degree of boundary maintenance) refers to the relationships between contents. This means a degree of boundary strength between contents. He further describes two types of classifications, namely, a strong classification and a weak classification. A strong classification has insulated contents between boundaries, here

each “category has its unique identity, its own voice, and its own specialised rules of internal relation” (Bernstein, 1996: 21).

A weak classification has a weak insulation that is blurred between contents; “we have less specialized discourses, less specialized identities, less specialized voice” (Bernstein, 1996: 21). All forms of classification always carry power relations. In this study I investigate the meaning of integration in relation to the learning of mathematics in school, where the familiar context of HIV and AIDS is used to make mathematics comprehensible. Integration, it can be argued tends to provide an opportunity to create a close link between subjects and ensuring that knowledge acquired at school relates to everyday real world knowledge. This means school knowledge has to be transferable and flexible to life predicaments and actual existence.

Framing on the other hand refers to the “form of context in which knowledge is transmitted and received” (Bernstein, 1982, 151). According to Bernstein framing refers to the “specific pedagogical relationship of teacher and taught but it does not refer to (the) contents of pedagogy.” In the pedagogical relationship it refers to what may be transmitted or not be transmitted, it determines what is controlled by whom. This means that framing regulates relations within a context and determines the scope of what is transmitted and received in a pedagogical relationship. Similar to classification, framing can be described as either a strong framing or a weak framing. Where a strong framing exists there is a sharp boundary, with reduced options. Bernstein (1996: 27) writes:

“Where framing is strong, the transmitter has explicit control over selection, sequence, pacing, criteria and social base. Where framing is weak the acquirer has more apparent control.”

This resonates evocatively with the principle of the National Curriculum Statements 10 – 12 (General, 2003) that promotes sensitivity to issues of diversity such as inequality, age, and gender. It further specifies intentions to adopt an inclusive approach that addresses learners’ intellectual, social, emotional, spiritual and physical needs. Educators are

expected to be more creative and innovative, rather than mere deliverers of prescribed curricula. On the other hand learners are expected to be involved in their own learning by determining their own pace of learning and deciding when they are ready to be assessed.

Graven (2002: 29) observes that Curriculum 2005 attempts to weaken classification and she asserts that “framing is weakened in all respects except the criteria of critical and specific outcome.” I assent with her observation; this point is aptly captured in the National Curriculum Statements Grades 10-12 (2003: 6):

In an outcome-based curriculum like the National Curriculum Statements Grades 10 – 12 (General), subject boundaries are blurred. Knowledge integrates theory, skills and values. Subjects are viewed as dynamic, always responding to new and diverse knowledge, including knowledge that has been traditionally excluded from the formal curriculum.

A subject in outcomes-based curriculum is broadly defined by learning outcomes, and not only by its body of content ...learning outcomes are defined in broad and flexible terms, making allowances for inclusion of local inputs.

Graven (2002) describes how Curriculum 2005 moves from collection code to integrated code. Bernstein (1982) describes collection code as an organization of educational knowledge that involves strong classification. The integration code is therefore weakly classified. The National Curriculum Statements Grades 10 – 12 (General) prescribes a curriculum that is strongly classified as indicated by different subjects allocated specific times and related status. For example, Life Orientation is allocated two hours per week, while languages are given 4, 5 hours a week.

Bernstein (1996) goes on to describe recognition and realisation rules. He says recognition rules are at the level of the acquirer. He argues that a recognition rule enables one to recognise the speciality of the context. It provides the key to distinguish features of the context, and “determines what context demands and enables the reading of the

context” Bernstein (1996: 32). Bernstein (1996) argues if the recognition rule is not shared by all members “contextually legitimate communication is not possible” Bernstein (1996: 32), which means in the classroom meaningful learning will not occur. The recognition rule therefore refers to power relations.

The realisation rule determines how we put meanings together and how we make them public. This realisation rule is a prerequisite for producing legitimate text.

A study by Cooper and Dunne (2000) observed that learners from the working class differed in response from middle class learners when the context demands application of the recognition rule and realisation rule. According to their findings children from the working class were unable to acquire the specialised recognition rule, which means that these children offered reasons which had direct links to specific material.

Graven (2002, 38) raises a legitimate concern about the possibilities that most educators in South Africa might be ‘unlikely to acquire the recognition and realisation rules for implementing the new curriculum’. The majority of these educators ‘come from background disadvantaged by the apartheid system, politically, economically and educationally’. In this study I will investigate how these issues play themselves, and how the everyday context of HIV and AIDS enhances or obscures mathematics learning.

The question we should ask is how can useful contexts make recognition rules more elusive? The question is important to determine the role played by the coding instruction. Is it taken at face value? If so why? More importantly I will investigate if learners make any shift, that is are they able to move between identifying the context as either specialised or non-specialised. For example, if learners were told that there are five birds on a tree, and then asked how many would remain if the farmer shot one. If learners offer reasons which have a direct relation to specific material (that is their everyday life context) their response would be that there would be none remaining.

However the recognition that a strong classification between home and school is bias towards the official pedagogy practice, rather than the local pedagogy practice- will result in learners' responses that demonstrate their mathematical skills. If learners respond that four birds remain, then use of everyday life as a platform to make mathematics content more meaningful, becomes insignificant.

The issues described above are important as they affect the implementation of integration - in particular the use of everyday life in the learning of mathematics. I argued earlier in chapter 1, that both mathematics and HIV and AIDS education are important in South Africa. Having described Bernstein's concepts of analysing curriculum I turn to policy documents to provide a clear description of the implication for mathematical learning in this study. I begin with the concepts of classification and framing as explained above. I focus on two mathematics policy documents of the GET and FET bands, namely the Revised National Curriculum Statement – aimed at assisting teachers to develop their own learning programmes (RNCS, 2003 and the NCS, 2003 for Grades 10-12).

The attempt to weaken classification is evidenced, for example the RNCS (DoE, 2003, 7)

“While, each of the Learning Area Statements has been developed according to the same framework and philosophy, careful examination will show that subtle differences exist between them. These differences are a natural consequence of peculiarities of each of the Learning Areas. Furthermore, as teachers in one Learning Area look for integration opportunities with other Learning Areas, they should be aware of the peculiarities of those other Learning Areas”.

Similarly RNCS (DoE, 2003: 25) encourages integration across Learning Areas and it asserts that, “When mathematics is integrated in other Learning Areas, mathematics becomes a tool for exploring and understanding aspects of other learning Areas”.

The revised national curriculum statements (DoE, 2003: 25-26) go on to clearly illustrate integration across Learning Areas (see the adapted extract).

Mathematics in Arts and Culture

In the Arts and Culture Learning Area Statement we read:

Learning Outcome 1: Creating, Interpreting and Presenting

The learner will be able to create, interpret and present work in each of the art forms:

Grade 5 Assessment Standards (p. 41)

We know this when the learner:

- Improvises and creates dance sequences that use the concept of contrast, while making clear transitions from one movement or shape to another focusing on:
space (measurement)
time (measurement)
- Improvises and creates dance sequences that explore:
geometry concepts such as parallel, symmetry, distance, volume and mass, rectangles, pentagon, hexagon, octagon.

This Learning Outcome and these Assessment Standards are drawn from the Mathematical knowledge, skills and values development in Learning Outcome 3 (Shape and Objects, Transformation and Position Assessment Standards clusters) and Learning Outcome 4 (Perimeter, Area and Volume Assessment Standards cluster).

Similarly in the Social Sciences (Geography) Learning Outcome 3 learners are expected to focus on the impact of HIV and AIDS. The revised curriculum describes what has to be remembered or taken into account when planning for integrated activities:

“Conceptual development must not be compromised by integration; integration should support conceptual development by providing a context or opportunity to practice using concepts”. (DoE, 2003)

The above statement is rather ambiguous and misleading because it may suggest that there should be some insulation between mathematics concept development and integration; however it is accurate in stating that integration should support conceptual development. In this study I developed a unit of work with the Mathematics Learning

Outcome 5 (Data Handling) as the focus Learning Outcome and drew from Social Sciences activities which form the basis for mathematics work in everyday life.

There is an implicit assumption in the curriculum documents that through integration learners will develop broader societal concerns. How this learning occurs will be analysed using Bernstein tools discussed above. In pedagogical terms the new mathematical curriculum requires that there should be integration within mathematics, which suggests that there should be integration between learning outcomes where one of the learning outcomes is used as a context for consolidating the knowledge and skills learnt in another learning outcome.

I situated the above discussion on mathematics documentation so as to argue the usefulness of Bernstein's concepts of analysis, particularly the concepts of recognition and realisation rules. Graven (2002: 35) strongly argues that weakening classification will leave both the recognition rule and realisation rule elusive for teachers. She writes:

“It has already been argued that Curriculum 2005 indicates a move away from a collection type code towards an integrated type and therefore the strengths of classification and framing are weakened. Since classification ‘provides us with our voice and the means of recognition’ and framing it ‘is the means of acquiring the legitimate message’ the recognition and realisation rules within the integrated code will be different from those in the collection code.”

From this we observe that changes in knowledge codes demand major changes in the teacher's role. These changes are important in that they have implications for learning, which is central to this study. I therefore focus my discussion on possible challenges facing learners resulting from the changes in knowledge codes as prescribed by policy documents.

According to the RNCS (DoE, 2003:24) learning will be effective if learners “may be solving problems related to their lives or problems of purely mathematical nature”. This

point is aptly captured by the definition of mathematics outlined in the NCS (DoE, 2003:9) which is that:

“Mathematics enables creative and logical reasoning about problems in the physical and social world and in the context of mathematics itself. It is a distinctly human activity practised by all cultures. Knowledge in the mathematical sciences is constructed through the establishment of descriptive, numerical and symbolic relationships. Mathematics is based on observing pattern; with rigorous logical thinking, this leads to theories of abstract relations. Mathematical problem solving enables us to understand the world and make use of that understanding in our daily lives. Mathematics is developed and contested over time through both language and symbolic interaction and thus open to change.”

The above definition of mathematics represents the nature and content of mathematics as illustrate by the following diagram.

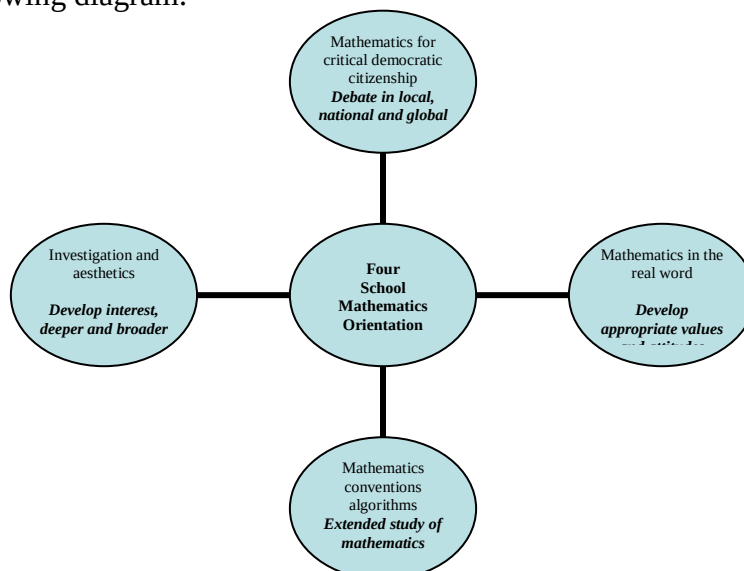


Figure 2.1: the four different orientations of school mathematics (adapted from Graven, 2002: 57).

In learning terms the new curriculum demands that learner develop a deep and coherent conceptual understanding of mathematics while engaged with worthwhile and challenging mathematics tasks, which is a socio-constructivist approach. An important

question to ask in the South African context is: how will integration influence learner performance? We know from Grade 12 mathematics results that learners' performance is very poor – the National Grade 12 pass percentage for the standard grade is 35%.

Recent research based on Curriculum 2005, though the studies are argued from different perspectives, they all highlight challenges of integration in terms of knowledge demands, time demands, and resources demands in particular for teachers; where a significant emphasis is on contextualisation of mathematics socially, politically, economically and historically (Taylor & Vinjevold, 1999; Adler, Pournara & Graven, 2000; Graven, 2002, Sethole, 2004).

This raises questions as to what is an added burden for teachers that emerge as result of integration in the new curriculum. Graven points that “Emphasis on integration does not resonate well with the traditional absolutist philosophy that has dominated teacher training in South Africa (2002:49). In this study I want to find what effects of recognition and realisation rules are where HIV and AIDS is an everyday contextual reality.

In this chapter I have highlighted and used various Bernstein's concepts to do an analysis of curriculum documentation for mathematics that reflects a shift in terms of the nature and contents of mathematics and the problem of the implementation process.

Chapter 3

Literature review

In this chapter I reflect on literature where everyday life contexts were used in learning mathematics and highlight the challenges in the implementation of curriculum changes. This analysis is important because the study explores learning mathematics using everyday contexts as demanded by the National Curriculum Statements. This chapter provides further contextual elaboration that locates the study and renders account of proper connections between Mathematics as a discipline and its application in the real world.

In part 1, following from chapter 1 where I argued that HIV and AIDS and Mathematics education are a national priority. I focus in educational policy on learning and teaching of mathematics in the context of HIV and AIDS.

In part 2, I analyse available resources that support implementation, in particular mathematics textbooks (from South African authors) containing learning of mathematics in our HIV and AIDS context.

In part 3, I first draw from international literature to illustrate the tensions that prevail within the mathematics education community which relates to worth and the shortcomings of connecting mathematics to everyday life.

In part 4, I draw on local literature to illustrate tensions that have been noted in relation to the implementation of the new mathematics curriculum and its emphasis on connecting mathematics to everyday life.

3.1 The school curriculum on HIV and AIDS

The National Education Policy Act 27 of 1996 make provision for a national policy on HIV and AIDS for learners and educators in public schools, and for students and

educators in further education and training institutions. The policy (DoE. 2000, 23) states:

- the ministry of education acknowledges the seriousness of the HIV and AIDS epidemic, and international and local evidence suggest that there is a great deal that can be done to influence the course of the epidemic,
- the ministry commits to minimize the social, economic and development consequences of HIV and AIDS on the education system, the learners, students and educators and provide leadership to implement an HIV and AIDS policy,
- this policy seeks to promote effective prevention and care within the context of the public education system.

The first part of the statement indicates the seriousness of HIV and AIDS and the intentions of the National Department of Education to deal with the course of the epidemic as explained in the introduction above. The second part demonstrates the intention by the department of education to intervene, while the last part acknowledges that education has a role to protect participants within the education sector. It is from this that I believe that education has an important role to play in assisting with challenges associated with HIV and AIDS, and I wish to investigate in an open a way as possible the effects of the integration, particularly using the context of HIV and AIDS.

The focus on integration or the ‘context of the familiar real world’ stems from the political motivation that education is a vehicle to promote personal, social, political and economic transformation (NDE, 1997). The National Department of Education appears to place HIV and AIDS education high on the agenda of the revised curriculum. According to the South African Education Law and Policy Handbook (2001: 137), the “Roles for educators in the schooling” on community, citizenship and pastoral role includes descriptions such as:

“Within the school, educators will demonstrate an ability to develop a supportive and empowering environment for the learners and respond to the educational and

other needs of learners and fellow educators. Furthermore ... [a]... critical understanding of community and environmental development issues [are roles for educators]. One critical dimension of this is HIV and AIDS education. ”

This requirement is as per Criteria for the Recognition and Evaluation of Qualifications for Employment which is based on the norms and standards for educators (2000).

Mathematics policy documents on HIV and AIDS

In support of the broader educational and curriculum goals as stated above, the Mathematics Learning Area policy documents express similar views. The importance of these documents’ position centres on the claim that “being mathematically literate enables persons to contribute to and participate with confidence in society” (DoE, 2002: 4).

According to the RNCS (DoE, 2003: 6) mathematics policy document, “integrated learning is central to outcomes – based education”. This document advocates for integration within Learning Areas, and across Learning Areas; and teachers are encouraged to seize opportunities for integration both within and across Learning Areas. More importantly educators are encouraged to integrate mathematics with the real world, in particular learners’ everyday experiences.

Below I draw from mathematics policy documents RNCS (DoE, 2002) to cite evidence of the intended curriculum that promotes moving away from abstract mathematics towards mathematics in context – which are deemed to reflect demands of everyday life that learners require. I also reflect the role of the mathematics curriculum in integrating mathematics and HIV and AIDS, which educators have to use to ensure that learners develop their mathematical understanding.

The teaching and learning of mathematics aims to develop the following in the learner:

- a critical awareness of how mathematical relationships are used in social, environmental, cultural and economic relations,
- develop deep conceptual understandings in order to make sense of mathematics

(National Department of Education, 2002: 5)

The Mathematics Learning Area develops:

- a critical awareness of how mathematical relationships can be used responsibly in addressing human rights issues such as social, political and economic relations and environmental problems and risks

(National Department of Education, 2002: 5)

Mathematical knowledge, skills and values will enable the learner to:

- display critical and insightful reasoning and interpretative and communicative skills when dealing with mathematical and contextualised problems
- apply mathematics in a variety of problems.

(National Department of Education, 2002:5)

Similarly, as a result of efforts to develop clearer policy documents the Revised National Curriculum Statements (DoE, 2003: 23) list examples of Assessment Standards: for example the learner would be able to:

- critically read and interpret data with awareness of source of error, and manipulation to draw conclusions and make predictions about:
- social, environmental and political issues (i.e. crime, national expenditure, conservation, HIV and AIDS)
- characteristics of target groups (i.e. age, gender, race, socio –economic group)

- attitudes of opinions of people on issues (smoking, tourism, sport)

(Learning Outcome 5 senior Phase)

This represents a position based upon a view that the use of the everyday context in school mathematics teaching develops learners' abilities to be responsive to contemporary societal and economic needs. This intended curriculum has in my experience resulted in a fear of many (including learners, parents, teachers, and some subject experts) that the use of the everyday context will certainly lower mathematics standards at our schools. For this reason research is needed to determine how the use of everyday context impact on *learning* of mathematics.

The teaching of mathematics in the context of HIV and AIDS should involve open – ended discovery and encourage unique responses as opposed to right or wrong answers that are often predetermined. This point is aptly captured by Graven (2002, 43 – 44), who referring to the new mathematics curriculum, writes that “it requires teachers to adapt more social constructivist approaches to mathematics teaching and learning rather than simply ‘passing on’ to learners pre-determined mathematics algorithms.”

I hold the view that a desire to use any new, creative teaching approach requires teachers' personal motivation and willingness to take risks. The context of HIV and AIDS, perhaps more than any other everyday life context, demands a high degree or a significant shift in attitudes because mathematics on its own is regarded as a difficult subject in many nations.

Integrating mathematics and HIV and AIDS

HIV and AIDS provide a good context for explaining mathematics embedded in South African social, political and economic systems since it is an issue that impacts and plays out within all three of these. Furthermore HIV and AIDS as a context lends itself well to data handling and the language of probability. The Revised National Curriculum Statement Grades R to 9 describes Learning Outcome 5 (data handling) thus:

“The learner will be able to collect, summarise, display and critically analyse data in order to draw conclusions and make predictions, and interpret and determine chance” (DoE, 2002: 66).

It further explains the benefits of this learning outcome for the learners as follows:

- Through the study of data handling, the learner develops the skills to collect, organise, display, analyse and interpret this information. This enables the learner to participate meaningfully in political, social and economic activities,
- ... drawing conclusions and making predictions,
- ... developing skills and techniques for making informed choices, and coping with randomness and uncertainty (DoE, 2002:66)

I therefore believe that HIV and AIDS as a learning context has a potential to influence learners to understand the value of data that they may come across from any source and possibly encourage them to participate youth structures where they are encouraged to focus on social, political and economical matters that may affect them and pose threats to their future.

Following this the Senior Phase curriculum specifies HIV and AIDS as an example of an appropriate context for explaining LO 5 in this phase: Learners should

“Deal with data in significant social, political, economical and environmental contexts with opportunities to explore relevant issues (e.g. HIV and AIDS, crime, abuse, environmental issues). In the analysis and interpretation of data, the learner should be critical and aware of the use and especially abuse, of data representing statistics” (DoE, 2002: 66.)

But the ‘intended’ curriculum implementation is associated with problems. Graven (2002, 15) citing Christie (1999) strongly argued against judging curriculum policy without

considering implementation “...[Christie] questions the assumption that curriculum policy can be judged as ‘good’ without considering its implementation.”

The changes in the mathematics curriculum are paralleled by changes in the philosophy of mathematics which relates to the approach to mathematics teaching, the nature and contents of mathematics and the role of mathematics education. I therefore expand on challenges for implementing the integrating of mathematics within HIV and AIDS context.

3.2 Available resources for the implementation of integrating mathematics and HIV and AIDS

In the above section I have illustrated the intended curriculum with respect to the integration of mathematics in the context of HIV and AIDS as reflected in the South African mathematics curriculum in the Revised National Curriculum Statements. In the following section of the chapter I will explore some of the challenges associated with the implementation of mathematics and HIV and AIDS – the availability of resources.

The inclusion of HIV and AIDS in school education is relatively new and only a few learning materials or text books are currently available that deal with the issue. As part of this research I reviewed mathematics materials in the context of HIV and AIDS in the Senior Phase. I found a few textbooks which included HIV and AIDS as a context that are currently available. For example, mathematics textbooks like Outcomes-based Classroom Mathematics include HIV and AIDS as a topic of national concern in its content.

The quest for appropriate mathematical learning material is paramount in supporting successful implementation of this new curriculum. The principles, underlying norms and standards for educators are at odds with the notion that teachers passively receive learning materials suitable to the cultural and social context in which they teach. The

central issue is how learning materials might be systematically failing, or reducing teachers' autonomy in developing and planning their own curriculum materials.

As part of my literature review I chose to review grade 9 mathematics textbooks with particular focus on use of the HIV and AIDS context. It is not my intent to unravel how learning materials deal with this issue. In this section I discuss two recent mathematics textbooks for grade 9, namely *Maths for All* and *Classroom Mathematics*. These textbooks are based on the principle of Outcome Based Education. I begin with an analysis of *Maths for All* and *Classroom Mathematics* respectively.

The authors of Maths for all are more specific and provide an explanation to teachers about their textbook as a resource. They claim that:

Maths for all is a totally new series of learners' activity books and teachers' resource books written for Outcome Based Education. Maths for all is based on the needs of learners for sound mathematical skills for living, working and further educational or training. In addition the series encourages the development of learners' general language and comprehension.

(Jonson Y; Liebenberg R; Davodson P; and Jaffer S, 2001: vii)

In my view, the textbook seem not deal with an HIV and AIDS context as prescribed by the above policy documents. In my discussion with Dr Graven (2005) she informed me that as one of the authors of this textbook they debated about the inclusion of HIV and AIDS. Ultimately they concurred as team of authors that due to the emotional challenges associated with this topic it would be best not to include use of HIV and AIDS in their textbook. I note that the absence of integrating mathematics learning and teaching with HIV and AIDS context, in this textbook will result in a gap between policy and the intended curriculum, in particular implementation.

On the other hand, Maths for All (Grade 9) promotes a learner - centred approach. This textbook however promotes many other policy issues such as acknowledging different

learning styles, barriers in learning and socio-cultural challenges. These policy issues were mentioned above.

In classroom mathematics the authors claim that they used six (6) guidelines to develop learners' book; guidelines are discussed below namely;

- **Contextualisation**

Real - life examples are used as a basis from which the mathematics is extrapolated. Learner experiences are called on.

- **Integrated across the broad curriculum**

Contextualisation assists in using issues related to other learning areas where such provide for realistic starting points towards meaningful sense-making.
(Classroom Mathematics: vi)

An important and distinctive feature of this textbook is the importance of using meaningful context and investigative approach, and more specifically the extended activities encourage learners to understand the HIV and AIDS context. Laridon et al (2001) elaborates on this issue: For example the extended activity 4, with a title “**AIDS affects us all**” has sub activities namely,

1. Facts and figures

This activity gives learners to ‘a brief history of the HIV and AIDS virus and the way it has spread in South Africa and the rest of the world’. The following mathematics skills: are fostered:

- Using of formulas and calculations
- Reading of graphs
- Calculating percentages
- Predictions

2. The bodies defence system and HIV

This activity assists the learners to develop an understanding about ‘how the virus affects the immune system’. The mathematics content embedded in the task includes:

- Ratio
- Formulae
- Cartesian plane

3. The effects of AIDS on communities

This activity looks at ‘How society can be affected by AIDS. The mathematics content embedded in the task includes:

- Rate
- Reading of graphs
- Applications of statistics

4. Looking for a cure

The activity is about ‘The treatment of the virus’. The mathematics content embedded in the task includes:

- Formulae
- Simple and Compound interest

5. Aids awareness

The activity focuses on giving learners an opportunity to make others aware of the threat of the HIV virus. The mathematics content embedded in the task includes:

- Axis of symmetry
- Plotting of points
- Rotation, reflection and translation

In this study I investigate the effects of integration within mathematics and integration across other learning areas as well as integrating mathematics with real world, learners' everyday experiences. For example, in the classroom mathematics textbook discussed above the following Learning Outcomes from other Learning Areas are indicated (Laridon et al. 2001:p. 225) LLC 4, 7; NS 4, 5, 7; TECH 3, HSS 1, 4, 6, 7; LO 157; and EMS 5, 7 and 8. What are the implications for such integration to educators who certainly are not experts in all Learning Areas, in particular for policy implementation?

Despite these noble goals for social and educational transformation, that underpins principles such as: 'learner centeredness, teachers as facilitators, relevance and contextualised and cooperative learning' (Chisholm et al., 2000), educators cannot simply purchase and use textbooks. It must be acknowledged that educators require support to achieve this professional emancipation where they are: Interpreter(s) and designer(s) of learning programmes and material developers added to a problem of insufficient or lack material in the context of HIV and AIDS. For example, C2005 Review report (2000: 20) argues that "in the majority of context teachers do not have time, resources and often skill to develop their own materials". I developed material for this study because Classroom Mathematics activities seemed not sequenced to allow conceptual development of a specific mathematics topic; but general and useful as an extended activities across topics .

Thus in this research I identified an absence of material that really engages with the integration mathematics and HIV and AIDS in a way which can meet the aims of the intended curriculum discussed above. Due to scarcity of resources which engaged the integration of mathematics in the context of HIV and AIDS I designed mathematics materials appropriate for the senior phase which integrate mathematics learning in HIV and AIDS contexts. For the purpose of this research project I have chosen the mathematical topic of data and probability for this purpose as this topic lends itself well to a rich mathematical discussion as discussed before.

The research will explore various challenges associated with use of everyday context of HIV and AIDS and thus challenges associated with implementing the intended curriculum.

While the focus of this chapter is not about sex education, HIV and AIDS will raise questions or tensions for educators that relate to their culture and religion such as

- Talking about sex? It's not against our culture!
- We won't encourage immorality amongst our learners!
- Teaching in a country where human rights are protected – is teaching about HIV and AIDS violating learners' rights?
- Shouldn't we just tell our young people not to have sex?
- Aren't our children too young for this sort of information?
- And the question about educators' views on what the role of education should be?

3.3 The International theoretical debate of mathematics (learning in context)

I have argued that in recent decades school mathematics has been a topic of frequent public discussion. The discussion has centred on two issues: the application of mathematics learned in schools – one cannot assume transfer into the real world; and the inconsistency of mathematics performance across “school’ and “everyday” situations. These issues are still with us, they are subsumed by a much larger question: how can we make school mathematics useful for the economic, socio-cultural and political environments of learners. As a result of such debates about the role of school mathematics, there seems to emerge perceptions that school mathematics is failing children and employers (Cooper and Dunne: 2000).

According to Cooper and Dunne (2000:1) mathematics has a high status, for example they argue that,

‘It is not difficult to see why mathematics in particular should have been so often a matter of public debate. It has a long history as a high status school subject and connected with this importance, has played a central role in the selection of children for higher education by means of public examination’.

The NCS (DoE, 2003: 9) expresses the same view and writes that, “It is understandable, therefore, that a variety of stakeholders in society exert demands on school mathematics”, it is argued that mathematics should ensure that learners acquire a functioning knowledge of mathematics that empowers them to make sense of society.

The NCS (DoE, 2003) goes on to argue that mathematics contributes to personal, social, scientific, and economical development. Furthermore it claims that its Learning Outcomes and Assessment Standards in mathematics are designed to develop learners into citizens that can apply mathematics in the society in which they live and in their daily lives. Therefore mathematical knowledge, skills and values learned should serve the needs of the learner and society. This position indicates a high expectation by society on the role that mathematics has to play.

In order to understand the role of school mathematics in producing and legitimating existing social relations, it is imperative to understand the contradictory roles that emerge from two conflicting views, namely (1) learning transfer theory and (2) the situatedness of learning in context.

However, we know that the contextualization of mathematics in various ‘everyday’ contexts is not unproblematic. The context of the familiar real world can be discussed either under the ‘utilitarian’ or pedagogical argument. For example, Boaler (2002, 251) claims that ‘real-world context, requires familiarity with the situation’ but such familiarity cannot always be assumed. Ball (in Boaler, 2002) argues that context can be ‘unevenly familiar or interesting’. Research studies conducted both in South Africa (e.g. Taylor & Vinjevold, 1999; Sethole, 2004) and abroad (e.g. Bernstein, 1982 & 1996; Cooper & Dunne 2000; Boaler, 1993 and De Lange, 1996), reveal a range of issues

which arise when mathematics is contextualized in various social, political and economic settings. Boaler (1993: 114) concurs with Lave that

‘It is inappropriate to assume that students can learn something, by retrieving it from memory and transferring it to the new situation, and this process will happen independently of the activity, setting, or processes of socialisation’.

She suggests that transfer can be enhanced by factors of learning environment; despite this she agrees with Lave that, all learning is situation-specific.

Boaler (1993) further argues that context may be useful in relation to transfer, although in many instances contexts are generally not useful due to numerous and complex factors; also the fact that contexts used in lessons tend to have little to do with a depiction of the real world which students will eventually encounter in their lives. For example, task such as: a small rocket is fired into the air from the ground. It reaches its highest point after 4s, and then falls back to earth after 4s. The equation of the path of the rocket is $y = 1 - 4x^2$, with x and y both measured in metres, such task use words from everyday life and pretends to be application problems.

On the contrary mathematics on data handling can be “used to misrepresent situations and to justify decisions that are socially or morally unsound” RNCS (DoE, 2003: 19). In other words mathematics could be used as a filter to exclude learners from proceeding to institutions of higher education to pursue whatever discipline they decide to follow.

I acknowledge that there exist widespread misconceptions of context in both school mathematics textbooks and assessment tasks. The use of context has limitations because it assumes that learners share the same previous experience, mathematical goals, and beliefs (Boaler, 1993). It is precisely the reason that in this study I investigate the use of HIV and AIDS contexts in the learning of mathematics. The assumption is that this context affects all of us, both the infected and the affected.

The other misconception arises when those who advocate for use of everyday life contexts tend to believe that mathematics in real life is easier than its abstract context-free equivalent. For example, according to subject grouping in the FET band all learners who are not taking Mathematics are required by the NCS policy to take Mathematical Literacy.

So why teach mathematics in contexts if there are these difficulties?

The increasing tendency to motivate and make mathematics interesting to students tends to result in what Boaler (1993: 115) refers to as “the random insertion of context into assessment questions and classroom examples in attempt to reflect real life demands”. The broad assumption is that school mathematics is a useful tool that tends to assist towards developing strategies for real life problem solving. The second argument is that, if everyday life contexts are used, it motivates and makes mathematics interesting for learners. This is a more pedagogical notion, that it is seen to increase chances for a more successful learner performance.

It is important to stress the primacy of many researchers on learning transfer theory; claims that use of everyday life context strengthen the discontinuity of mathematical performance and choice of procedure between settings (Boaler, 1993: 114). Lave illustrated the effects of this in a research study in which a shopping context was used to disguise mathematical relationships, and concluded that the ‘choice of mathematical procedure was more related to the setting than to the mathematical requirements of the task’.

Broomes (1989, in Boaler, 1993) claims that: advocates of everyday mathematics assert that this focus prepares students for the specific content studied as well as provide learners with a bridge between the abstract role of mathematics and their role as members of society. The argument suggests that everyday life contexts enhance mathematical understanding as opposed to traditional emphasis of series of abstract calculations. It is argued by many that use of everyday contexts will assist in changing the negative view of

mathematics, because it is more subjective and personal than the abstractness of mathematics as a cold, detached, remote body of knowledge.

Everyday context is also seen as creating opportunities which enable students to identify with the local community thus presenting mathematics as a means to understand reality. The notion held by many proponents of context assumes that it (context) motivates and provides learners with exciting real life examples that engage their interest and promotes participation. On this issue Mogari (2000: 329) writes that “teaching strategies should be sought to bridge a contextual gap.” The assumption made here is that meaningful learning can occur when learners’ informal mathematical knowledge, and principles embedded in their (learners) everyday experience, can be modified to conform with formal existing mathematical principles.

The arguments levelled against the use of everyday life context occur, particularly when observing how students tend to deal with everyday context; students ignore factors that will be pertinent to real life versions of the task. Students tends to believe what they are told within the confines of the task and do not question what it means from reality. Cooper (1992: 231) argues that learners succeed on tasks that deal with everyday contexts if (1) they suspend or bracket their knowledge of ‘real’ and (2) know how to approach the solution of practical mathematics. This view suggests the influence of the everyday in mathematics is insignificant in relation to how learners engage with mathematics.

According to Boaler such use of context perpetuates the mysterious image of mathematics, and contributes to students’ dichotomous view of mathematics. Maire (1991 in Boaler, 1993: 118) claims that everyday context processes are “school problems, coated with a thin veneer of ‘real world’ associates”. Which means the use of context in school mathematics as the ‘real world’ is not necessarily the same as the real world of students.

De Lange (1996) identifies four categories of word problems that are used to contextualise mathematics. Problems that:

1. Have immediate uses in everyday living,
2. Use words from everyday life and pretend to be application,
3. Are not meant to do the real application but are worded as if they were; and,
4. Have educational value, but we are not dealing with applications in a true sense.

De Lange's last three categories illustrate ways in which the use of contexts departs from real experience of learning. Put succinctly, the important issue that pervades the discussion of everyday context is if transfer across contexts fails then initial learning did not induce perceptions of underlying connections. It must be admitted that the individual's ability to discover, explore, negotiate, discuss, understand and use mathematics is not intrinsically related to the use of context; but through the recognition of students' own cultural value in the mathematics classroom. Or to be more exact, everyday context enhances learning transfer and encourages school mathematics in the real world outside school; and it also makes mathematics more meaningful to the individual.

In the broadest sense, Lerman (2000: 23), attempts to locate use of everyday context when he makes a claim that 'studies in epistemology, ontology, knowledge, and knowledge acquisition tend to focus on how the individual acquires knowledge and the status of that knowledge in relation to reality. He decries that theories in mathematical education research tends to "see meaning, thinking and reasoning as products of social activity". This view is similar to Ernest (1991) who claims that "knowledge of mathematics exists in and through the social world of human actions, interaction and rules, supported by individuals' subjective knowledge of mathematics". This implies that in performing mathematical activities procedures used are situated within and are products of those social situations.

If what I have described is at all accurate, then it is not coincidental that the first South Africa's democratic election of 1994 saw curriculum as a means of enabling personal, social, political and economic change (National Department of Education, 1997). To summarise, education in general, and the new curriculum in particular, obligates itself to address the imbalances of the past by empowering individuals with conceptually useful knowledge, and in producing just, democratic and global competent citizens. The message that teachers receive about the educational priorities and value of using everyday life (including issues of HIV and AIDS) in the school comes from many sources such as the media, department policy documents and national politicians.

In the above section I have analysed the curriculum debates across the world – where mathematics seem to shift from an ‘elegant, abstract subject, to be learned transferred and applied’ Boaler (1998: 112) towards making school mathematics more relevant to learners’ everyday lives.

3.4 Local research on the use of context in mathematics education.

Locally research based on benefits and limitations of the realistic approach, I concur with Sethole (2004: 20) when he claims that:

“In South Africa, a number of scholars (like Taylor & Vinjevold, 1999; Muller & Taylor, 1985; C2005 Review report, 2000) have registered their discomfort with teaching approaches which favour the inclusion of everyday in school mathematics”.

He further notes that “others (for example, Volmink, 1993, Vithal, 1997; Nyabanyaba, 1999) are fairly critical but sympathetic”. Adler (2004) aptly captures this point when claiming that,

“[The] tension between mathematics as an abstract science and mathematics as applied has entered curriculum debates across the world and over time. In the

curriculum transformation process in the post –Apartheid South Africa, there has been a great deal of emphasis on integrated and useful knowledge.”

It is clear from the above synopsis that, studies on the use of everyday context lead to a pedagogical argument.

This view is supported by Laridon et al. (2005) when they acknowledge that contrasts exist between “everyday mathematics (that arising out of the socio – cultural contexts of living) and academic mathematics.” Laridon is one of the proponents of ethnomathematics which it (ethnomathematics) could be defined as informal mathematic knowledge embedded in the learners’ everyday life. Laridon et al. (2005) arguing that ethnomathematics elements are embedded in C2005 policy documents. Thus the teaching and learning of mathematics should happen in learners’ familiar culturally relevant mathematics that contrives to attain meaningful learning. It could be inferred from this that proponents of ethnomathematics support inclusion of everyday mathematics in the mathematics curriculum.

In this section I focus on two kinds of research conducted in South Africa. Firstly, I explore some of the dynamics that characterizes the use of everyday context. Secondly, I explore some of the underlying dynamics at work when HIV and AIDS in the mathematics lesson are used.

Studies on the use of everyday context lead to a pedagogical argument. A key question raised by Adler, Graven, and Pournara (2000: 2) is:

“What does “integration” in the curriculum mean, in principle, and what does it mean for the learning and teaching of mathematics in school?”

They argue that teachers also experience problems when they attempt to integrate mathematics across Learning Areas and mathematics within everyday life. Lastly they

ask the question: integration of mathematics is desirable but is it feasible? In this study I explore whether the desire to integrate mathematics and HIV and AIDS is feasible.

On the other hand, Luthuli (2000) argued that real-life applications in teaching graphs ‘will provide a welcome relief’ because examples of piecewise functions illustrate application of mathematics in real life such as the billing cost of the post office and Telkom. This suggests a response to a nagging question that is often asked about the relevance of teaching and learning school mathematics in general. The topics such as piecewise functions up date are not included in the school mathematics syllabi. However when they are used in this context, they will favour the argument that use of ‘everyday context’ does not necessarily imply the lowering of standards.

Recently Sethole (2004:24) reported on a classroom experience involving the teaching of mathematics in the context of HIV and AIDS. He argued from his classroom observation that this integration resulted in ‘two different identities, perhaps competing priorities’ for the teacher. A role of teaching mathematics knowledge and the other is of a pastoral role to alert students to the danger of AIDS.

This study highlights the fact that making mathematics relevant or incorporating the everyday into mathematics is a highly challenging task; and reveals tensions between foregrounding mathematics or social aspects. The above analysis of local research indicates that it is difficult to pull out mathematics when teaching in the context of HIV and AIDS. It may also create dilemmas for teachers who have to implement the Revised National Curriculum Statement which demands that mathematics should be used amongst others as a tool for solving problems related to modern society.

This study wants to explore and describe how learners deepen their understanding, or not, of mathematics when mathematics is embedded in everyday life, to initiate them in ways of solving real-world problems. It also acknowledges that many classrooms struggle to integrate mathematics in the context of real life issues and problem – solving. Boaler (2003: 115) argues that:

“The context may be useful in relation to learning transfer even though contexts as they are generally used are not useful”.

Although it seems to appeal to everyone that we need to relate mathematics to real life problems, like HIV and AIDS, making mathematics make sense and improving learner performance remains controversial. The curriculum policy documents promote integration and useful knowledge. Teachers are expected to consider integration when developing learning programme. This is visible in the Revised National Curriculum Statements (RNCS, 2002: 2 & 2003) which claims that learners participating in schooling are influenced by the degree and way of dealing with issues such as poverty, inequality, race, gender, age, disability and the challenges of HIV and AIDS at schools.

In the next chapter I focus on methodological issues relating to conducting research in education and, more specifically, at issues relating to conducting research on learning mathematics in everyday life context of HIV and AIDS. This study hopes to support educators to understand curriculum demands and support the South Africans who are both infected and affected.

Chapter 4 Research design and methods

In this chapter I discuss the method I have selected for conducting research on mathematics learning within a context of HIV and AIDS. The following aspects are discussed in detail: The research method; Ethics and research process; Research plan and data collection; and Trustworthiness: reliability and validity

4.1 The research method

In order to investigate mathematics learning where a context of HIV and AIDS is used, I chose the case study research method. The method includes interviews, questionnaires, classroom observations, video recording of teacher lessons, participant observation and field notes.

Opie (2004: 74) defines a case study as ‘an in – depth of interactions of a single instance in an enclosed system’. This description of a case study is commensurate with Bassey’s (1995: 7) definition that says; case studies have a singularity property that provides description of unique events. What follows is a brief explanation of each research method.

a) Classroom observation, and videos

Four classroom-based lessons were observed. In each of these observations the content of the lesson was based on HIV and AIDS. The observations and videoing of lessons were welcomed by all the learners and the educator. Each observation was videoed and this recording was used, as a tool to analyse findings of the study (in that they provided insight into integrating mathematics learning in their everyday lives). An observation schedule was not drawn up but telephone contacts were made with the teacher to ascertain the availability of the learners. Detailed field notes were taken to record the content and flow of the lesson. Videos provided a back-up for these notes and were

transcribed where sections of the lesson were used to support arguments made in this study. Each observation usually lasted a double lesson (approximately 90-120 minutes.)

While the primary activity was to observe and video I adopted the stance of the participating observer in that “I participated in the lesson in the sense that my physical presence was felt and acknowledged” (Graven, 2000: 115). Occasionally I paused to video the lesson and help learners and share my opinion privately with the educator. The key instrument of this research was the worksheets designed to investigate the learning of mathematics when integrated in HIV and AIDS context. The worksheets supported the teaching and learning and structured both classroom observation and classroom activity. This data source provided opportunity to collect both written and verbal information that informed the research in various ways and would be referred to where applicable.

b) Interviews

Graven (2000: 110) quotes Cohen and Manion that the research interview is “a two-person conversation initiated by the interviewer for the purpose of gathering research-related information”. In this study interview data was gathered for research purposes and it allowed respondents to express their ideas with greater richness and value.

The semi-structured interviews were anticipated; however the interviews took on a structured question-response form, because the researcher was unable to control and channel the conversation towards the research questions. Despite care being taken to explain at the start of each interview that the questions did not require any specific answer and interviews were not used to evaluate the participants. The fact that I am employed in the department of education as a district official, I felt an uneasiness to probe on questions relating to curriculum implementation, especially on their thoughts of integrating mathematics and mathematics learning with HIV and AIDS.

c) Questionnaires

The questionnaires were used to obtain information encouraging participants to freely express their feelings on HIV and AIDS issues, where anonymity is assured. The questionnaires were given to learners at the end of the video recording of the lessons so as to determine mainly their views on learning mathematics when integrated with everyday life, in particular HIV and AIDS.

However, due to fear of possible 'nonresponse' and the fear of time delay, insufficient data collection, and a failure to analyse or address the research question, learners' post questionnaires were administered after the last lesson observed. Fraenkel and Wallen (1990: 344) warn that lack of interest, forgetfulness and the unwillingness to be surveyed are amongst the main problems associated with non-response for questionnaires. In this research questionnaires were not expensive because the responses were not mailed and no reminders or phone calls were made to remind the respondents to return the questionnaires.

4.1.2 Why case study?

Case studies by their nature, as appropriately captured by Bassey (1995) 'cannot be used to predict probability', but may be valuable if related to other situations. Opie (2004) notes case studies have 'a temporal and spatial boundary' which is local in relation to place and time. However, a most important feature of the case studies is that they focus on real situations with real people (Opie: 74.)

The informants (educators) in this study were aware of the researcher's position in the department of education which was an added advantage as it facilitated the collection of data. It allowed the educator not to be sceptical about the researcher's possible hidden agenda. This relationship assisted in ensuring that data was collected within a reasonable short time.

The researcher was mindful that a challenge would arise when discussing the findings in terms of three ethical values, namely respect for persons, truth and democratic values. The researcher's apprehension was acute noting the case study approach has 'descriptive power' (Taylor and Vinjevoold, 1999)

4.1.3 Sample

Gatsheni High School (a pseudonym) is located in Soweto a township on the southwest of Johannesburg in South Africa. The school has enrolled a total of about 1500 learners. The school's socio-economic status reflects a poor working class society. All the learners in this school are of African origin. The majority of their parents are unemployed and possibly illiterate. About 65% of the learners come from a neighbouring informal settlement. The school's grade 12 pass percentage for the last two years has averaged 60%. Generally one will deduce that the educators in the school are hard workers, disciplined and suitably qualified.

My initial intention was to involve three grade 9 classes from different schools and an educator from each school. I decided against this due to the fact that it would have been too large to research and insufficient time available for this research study. I had to narrow my focus, and choose a manageable sample. I focused on one grade 9 class with 25 learners and one mathematics educator in one school.

To ensure that ethical issues are not compromised, I observed how the teacher valued his time and that of other teachers. I realised the implications for the data collection process such as interviews, classroom observations, video recordings, field notes, etc., particularly during videoing time when learners were busy with their grade 9 continuous assessment tasks (CTAs) and the teacher and colleagues were conducting CTAs and marking exams.

4.2 Ethics and research process

This research is part of a larger research programme which seeks to investigate mathematics teaching and learning within the context of the HIV and AIDS. The larger research programme will involve analysing data collected from teachers on their views and experience of teaching mathematics in an everyday real HIV and AIDS world; while this case study focuses on learning mathematics when integrating mathematics within the everyday life context of HIV and AIDS. The research in learning mathematics within the context of HIV and AIDS seems to raise greater ethical concerns than simply when researching mathematics in any other context. The larger study is directly confronting and exploring various ethical tensions that arise in such studies.

4.2.2 Research proposal presentation

In chapter 1 I explained the social, economic, political and development consequences of HIV and AIDS to the entire education system that is, the learners, students and educators and to the country as a whole country. HIV and AIDS is a highly emotive issue and affect all South Africans who are either infected or affected by the disease. A response to the researcher's proposal on this study when it was presented to fellow Masters students raised serious ethical issues about the dangers of revealing unintended information about learners' experiences and perhaps even regarding their sexual behaviour, and the HIV status of peers, family members and even their own. My supervisor via e-mail (2006) writes:

The ethical issues that might arise in the running of such lessons are unknown and of course, people (fellow Masters Students) are justifiably nervous of what might arise – for example, might a student unwittingly or purposefully reveal their status during a discussion – or the status of family members, peers?

The supervisor (e-mail correspondence, 2006) further justifies such concern and writes:

“HIV and AIDS is a highly charged emotive (social and political) issue that we feel that its use as a context for mathematics teaching should be investigated and interrogated. Of course, since HIV and AIDS education is the context in the lessons being researched, as a lesson topic it impacts on the research ethics”.

From the presentation, the researcher and the supervisor agreed that there will be a greater sensitivity to the ethics of the study compared to research for example on the context of taxation systems. We agreed that what seem to be confused or conflated are the ethics of the research and the ethics of teaching mathematics in the context of HIV&AIDS.

During the collection of data the researcher ensured that discussions with the educator and the observation of lessons: ethical issues such as upholding the constitution and promoting democratic values are maintained. The researcher and the educator discussed some ground rules for the lesson: for example that learners cannot refer to the HIV status of anyone they know (but it would be acceptable if a public figure e.g. Edward Cameron or Nkosi Johnson are incidentally mentioned in the classroom discussion). The discussion would focus as closely as possible on the worksheet tasks.

While ethical issues were considered the educator was requested to ensure that learners stayed focused on the activities at hand in such a way that discussions were not to be too personal in the sense that they bridge the ground rules discussed. These ground rules while necessary were however uncomfortable from research point of view. I had to ask myself what does such ground rules mean for the authenticity of the research? These are tensions that this study needed to address and explore. In the end after mature discussion with the learners I felt that learners understood that discussions were open and they were free to explore things as long as they exercised mutual respect for their classmates, educators and those in their community.

4.2.3 Consent forms-learners, parents and educator

Learners and educators were informed about issues of anonymity, sensitivity on part of researcher, the right not to participate in the lesson or in the research aspects of it, the right to withdraw at any point. I acknowledge that these issues are not specific to such a research project but as a researcher I have a duty to take into account all possible negative effects that might occur as a result of my research.

The teacher-participant was given an opportunity to review the materials and to select from them what they would wish through the completed consent form the educator was informed about the right to anonymity and to withdraw from the research process at any point (see annexure A). Similarly, learners that participated in the research were given consent forms, which parents and learners completed if they agreed to the terms of the research (see Annexure A).

The Gauteng Department of Education's letter of granting permission for conducting research was put together with letters requesting authorisation from the school, teachers, parents and learners to participate in research and the consent form were attached for all participants to see evidence.

The researcher was mindful that the data collected might be limited due to the public stigma that is associated with HIV and AIDS. The researcher became an observing participant whose function was to ensure that classroom discussions did not lead to revealing any sensitive and confidential information.

Ethical Clearance

After clearance from WITS University and a letter of permission from the department of education were granted, I requested permission from the district in which Gatsheni High School falls to conduct research. In addition, permission letters were written to the School Governing Body, the Principal and the educator.

Subsequent to granting of permission a meeting with an educator from Gatsheni High was scheduled to discuss the research process, its benefits and the material to be used.

4.3 Research plan and data collection

In this section, I discuss the advantages and disadvantages of the instruments (i.e. tools used for collecting research data) I employed in the study. According to Fraenkel and Wallen (1990) the questionnaire and the interview schedule are the most common types of instruments used in survey research. They claim that the two instruments are virtually identical but differ on how they are administered; the questionnaires are said to be self-administered by the respondent while the interview scheduled is administered verbally by the researcher. This means an interview is simply a process of obtaining information by asking someone questions in a formal meeting.

In this study both the interview and the observation were the main instruments used. The interview assisted towards collection of data both in the pre- and post- research stages of the study, while the observation was used mainly during the recording of interactions of learners. Opie (2004) claims that interviews provide opportunities of gaining insight information that tends to explain the why of the collected data.

I observed that analysis and interpretation of learners' responses that come from worksheets provided findings on performance of learners and had limited opportunities for probing. On the other hand, interviews assisted to probe issues in depth. The above point is aptly captured by Oppenheim (1992: 81) as cited in Opie, 2004: 111):

“Interviews encourage respondents to develop their own ideas, feelings, insights, expectations or attitudes and in so doing allowing the respondents to say what they think and to do so with greater richness and spontaneity”.

This argument suggests that interviews maximise response rates and most importantly, provide opportunities to acquire unedited or cosmetic data and justification of the respondents thinking. However interviews have their own associated shortcomings. Firstly they take time to design. According to Opie (2004) the challenge associated with the interview is to “translate research questions into interview questions; deciding on the degree of structure in any question; ordering of questions; and deciding how responses will be collected”.

For the inexperienced researcher and probably for most researchers designing questionnaires for interviews ‘does not come easy’ more especially if one’s objective ‘is to encourage respondents to say what they think and to do so with greater richness and spontaneity’ (Opie, 2004: 115). The second problem is the time it takes (particularly when piloting) while one attempts to ‘eliminate any ambiguous, confusing insensitive questions’(Opie, 2004: 115); determining the duration required for the actual interview; also choosing piloting samples and ‘negotiating access’ with institutions and individuals.

The challenge for conducting interviews at schools with both educators and learners was centred on identifying a venue that offered some degree of privacy and fewer interruptions. Also the researcher had to ensure that interviewees, in particular the learners, understand the research purpose and how the data generated will be used to advance and inform a particular field. The learners and some educators were tempted to put on some performance during the interview, especially in particular when video recording was used as a method of recording data.

I used a semi-structured interview, which I found to be more flexible than the structured interview that ‘are often organised around a prearranged schedule of questions’ (Opie, 2004: 117). It allowed reordering of questions, deviation from prearranged text, but maintained a proper shape of the interview that assisted to prevent uninteresting discussions. Fraenkel and Wallen (1990: 342) caution that the ‘interviewers ... need to know when to follow- up on an unusual answer or one that is ambiguous or unclear’.

Although this is a popular instrument it tends to increase chances of a researcher's biasness.

In this research there were doubts that interview responses were often determined by some contextual factors. For example, the interviewees feeling of being comfortable and their ability to understand the questions were areas of concern for the researcher. I observed that at the heart of the interviewing process there were perceptions and assumptions of the interviewee about the interviewer. For example, the interviewee seemed to have doubts or questions about the legitimacy of the researcher. In particular, the integration of mathematics using context of HIV and AIDS evoked questions amongst respondents (learners, and the educator) about what justifies interviewer's questions or claims and assumptions. Questionnaires on the other hand guarantee anonymity and have economical advantages and present the respondent with standardised questions.

The researcher was aware that data collection could be influenced by perceptions created by characteristics such as age, gender, race, dress, accent, ethnic group, height, and weight (Sapsford and Jupp in Opie 2004). To this end the researcher was sensitive to the school's dress code and complied accordingly. Fraenkel and Wallen (1990: 342) argue that 'interviewers (also) need training in gesture, manner, facial expression and dress'. It is hoped that data collection in this research was not influenced in anyway by the age, height gender and weight of the researcher.

The researcher was aware that power relations that exist between him (as the district official) and the respondents' (learners' and the teachers) responses could interfere with learner and teacher responses in interviews. To overcome this Fraenkel and Wallen (1990: 342) suggest that the "interviewer needs to establish rapport with their interviewees and put them at ease". The researcher explained to participants the study objectives and allowed questions seeking clarity as to alleviate fears and build some good rapport.

Learners in the study were provided with worksheets that prompt interaction in a small group working together; in addition to this I video-recorded the lessons. This was made easy by assistance from the researcher's colleagues who videoed the four lessons. This allowed the researcher an opportunity to ensure that enough data was collected and more attention was paid on taking notes while observing learners' interactions. The data collected via the video assisted the researcher to focus on small groups' verbal and non-verbal features. In addition, video recording was useful for analysis since it allowed the researcher to replay cassettes which are permanent records of the lessons.

Diverse data sources namely, the semi – structured interview, worksheets and lesson observations were used as main instruments to collect data for this study. The following table presents a diagrammatic summary of the methodological model used in this study.

Teacher and learners activity “say and do”	Data Source / activity
Talking – about teaching & learning practise	Interview
Talking – within teaching & learning practise	Observation notes/videos, worksheets
Talking – about learning & learning with a context	Observation notes/videos, worksheets
Talking – about teaching & learning practise	Interview, questionnaires, observation notes/videos
Action – in context teaching & learning practice	Worksheets, observation notes/videos
Actions – in broader professional practice	Interview, questionnaires, observation notes/videos

Table 4.1: The methodological model used in the study (adopted in Graven, 2000: 118)

The methods and procedure involved developing instruments for the study, drawing time schedules for interviews, and lesson observations in consultation with the informants. The researcher was aware that videoing might result in informants ‘staging a show’ for the researchers. Data was collected in three lesson observations as a means to ensure that data collected is valid and reliable. The following section describes the necessary steps that were followed to collect data:

I began by firstly ensuring that the interview with the educator was conducted in a venue that offered some degree of privacy and minimal interruptions.

Secondly, I ensured that the group surveyed were familiar with the context of HIV and AIDS, according to policy as taught in Life Orientation in all the schooling grades. From the pilot study it became clear that many grade nine learners were exposed to knowledge of HIV and AIDS. I made an assumption that if everyday life was embedded in the teaching of mathematics in a context of HIV and AIDS, then it became relevant and interesting because it affects them and their communities directly. It (HIV and AIDS) also has a great chance of introducing the mathematical skill that is associated with statistics, in particular probability.

Thirdly, I strove to establish a bond with the interviewees and put them at ease when asking questions. So during data collection as the researcher I was mindful that my gestures do not influence the kind of responses that come out of the respondents. For example, frowning and laughter at the wrong time were avoided because these gestures have the potential to destroy the confidence of respondents, thus discouraging attempts to answer questions (as argued by Fraenkel and Wallen, 1990). During interviews the researcher remained non-biased; opinions and leading questions were avoided.

However questions asked are regarded as questions that encouraged honest responses. Where respondents reflected discomfort and seemed to be threatened by particular questions I resolved this by moving to other questions and returning to those questions later. I had to clarify the question in particular where respondents seemed unsure about what the question asked of them; this included rewording and probing to solicit incomplete answers to get balanced responses.

The researcher complied with the dress code culture of the school. Lastly I observed the format of the interview schedule as listed below by Fraenkel and Wallen (1990: 345).

- Ensuring that sufficient space is provided for respondents (or interviewer) to fill in data that is needed
- Specify the objectives the interview schedule is intended to achieve – exactly what kind of information is wanted from the respondents
- Ensure that each item in the interview schedule is related to one of the objectives of the study
- Ensure that no psychologically threatening questions are included
- Check for ambiguity of items with a panel of judges. Revise as needed
- Pre-test the interview schedule with small a group similar to the sample to be surveyed.

The above schedule is aptly captured by Fraenkel and Wallen (1990: 344) that interviews should be administered by the interviewer in a manner that displays courtesy, where questions are posed in the most pleasant and sensitive way, the dress is appropriate and the conduct at interviews is most appropriate in relation to time and situation. Opie (2004: 116) advises that when concluding the interview one should thank and provide detailed contacts for the future and indicate how feedback will be provided to the respondents. I hope that in this research I heeded Opie’s advice correctly, because I gave learners an opportunity to view the four recorded lesson observations and discuss whatever concerns they had about the research, and particular issues about mathematics.

4.4 Trustworthiness: reliability and validity

Opie (2004) drawing from Lincon and Guba notes that trustworthiness involves credibility, transferability, dependability and confirmability. Opie (2004, 71) cites Sturman to argue that credibility is a “useful indicator of goodness in case study research”. To this end Opie provides a list of several of Sturman’s strategies that enhance the credibility of case study research:

1. Data-gathering procedures are explained.
2. Data is presented transparently and in ways that enables ready re-analysis.

3. 'Negative instances' are reported.
4. Biases are acknowledged.
5. Fieldwork analyses are explained.
6. The relationships between claims and supporting evidence are clearly expressed.
7. Primary data is distinguished from secondary data.
8. Interpretation is distinguished from description.
9. A diary or a log is used to track what took place during the study.
10. Procedures are used to check the quality of the data.

Similarly Opie argues that credibility, transferability, dependability and confirmability are “extensions or adaptations, of the traditional categories of internal validity, external validity and objectivity” Opie (2004, 71). The key words here are reliability and validity which Opie explains as “indicators” of both goodness and respective data-gathering processes, and also of relation between data-gathering process and claims. Graven (2000) opines that issues relating to research terminology differ according to research conducted and the researcher’s ontological and philosophical assumptions.

Reliability generally refers to “repetition and consistency”. Opie (2004: 66) notes that Bell defines reliability as, “the extent to which a text or procedure produces similar results under constant conditions”. In a setting like a classroom some conditions may quite reasonably be beyond the researcher’s control, so repetition of observed conditions may be a matter of sheer fortuitousness. In this case study research data collected is provided so that the reader can make his or her own judgement.

Validity like reliability is used in the literature in distinct ways. Graven (2000: 134) citing Adler (1996) observes that “validity lies in the relationship between interpretation and evidence”. Opie (2004: 68) drawing from Wellington (2000) claims that validity “refers to the degree to which a method, a test or a research tool actually measures what it is supposed to measure”. From this perspective Graven (2000) believes that it is important for the researcher to provide data from which claims or assertions are made.

The researcher has worked towards keeping the relationship between the claim and the accompanying process of data gathering. The study has provided extensive discussions of contextual factors that impact on it. This study has striven to address ethical issues such as those discussed above and required by case study research.

Chapter 5: Data analysis and interpretation

5.1 Introductions

The focus of this chapter is to analyse the effects of learning mathematics within the context of everyday life of HIV and AIDS. I explain the instruments used i.e. the nature of the worksheets then I present and discuss the findings.

5.2 Pre data analysis methods

In analyzing data I coded or classified responses according to the objective of the research. In any scientific research the assumptions made should assist in determining the independent and dependent variables. In this study the treatment was identified as the integration of mathematics within the context of HIV and AIDS. I looked for any statements and responses that suggest mathematics learning was aided or impeded by this context.

In analysing the data it was observed how the mathematics was foregrounded or backgrounded and where these two concepts come together powerfully. Instruments such as worksheets, classroom observation and interviews, were used to understand how HIV and AIDS assists or impedes mathematics learning. In addition the researcher as ‘participant observer’ probed during classroom observations and interviews to get insight into why the findings are as explained below.

A descriptive statistical methodology was used to quantify how many learners’ mathematics learning was aided or impeded. According to Opie (2004) qualitative data analysis gives a feel for social reality, which underlies any research findings. The researcher was not oblivious to the fact that collection and analysis of qualitative data is intricate or has no straightforward and quick comfortable framework. The danger with qualitative data analysis is that it is open to the subjectivity of the researcher in terms of reliability and validity. I have avoided any intention to misrepresent the data and findings of my research.

I designed the following categories to analyse data. These categories were designed to concur with my critical questions, with a view to elucidating aspects of data seen as ‘*indicators*’ of aiding or obscuring mathematical learning.

- **Aided**
 - Successful or partial achievements of mathematical outcomes
 - Focus on mathematics relevance
 - Increased participation
 - Recognition and realization rule: maths foregrounded
 - Affective factors (positive engagement): comments such as like and motivated/ enthusiasm for problem solving, enjoyment (laughter)
- **Obscured or Impeded**
 - Little achievement of mathematical outcomes
 - Focus on broad aspects of content
 - Lack of participation
 - Recognition and realization rule: HIV and AIDS fore grounded at the expense of mathematics
 - Affective factors (negative engagement): comments such as dislike and demotivated / no enthusiasm in problem solving and no enjoyment (laughter)

Table 5.1: Table for analysing data

	CONTEXT – AIDED	CONTEXT – IMPEDED
Learner performance	Improves	Remains or worsens
Recognition Rule Realisation Rule	Mathematics involved is relevant and connected to context and maths outcomes achieved	Lack of or no understanding of mathematics content knowledge in the tasks. Mathematics in the context is invisible or ignored and is not engaged with.
Affective factors	Enjoyment • Enthusiasm • Laughter • Increased participation	Depression • De-motivated • Lack of enthusiasm • Lack of participation
*Content knowledge of Data Handling and Assessment outcomes	Achieved	Not achieved

*Content knowledge of Data Handling e.g. probability, double bar graphs; critically reads and interprets data presented in variety of ways to draw conclusions and make predictions sensitive to the role of context

In the next section, the three lessons observed are clearly analysed as follows; I begin by firstly describing the nature of each activity, and then I explain the findings by describing how learners responded to each activity I also analyse how the use of the HIV and AIDS context aided or impeded mathematics learning. Lastly I discuss the findings and relate these to the literature reviewed and the Bernsteinian framework and tools I have used.

5.3 The data Analysis

The initial aim of the study is to determine how mathematical learning occurs when embedded in the context of HIV and AIDS. Does use of the everyday life context aid or impede mathematics learning? Does context make mathematical learning accessible, where context is a “resource” or a “distractor” for learning mathematics using real problems? (Adler, 2000) The three (3) lessons are listed below:

- Lesson one (1): General information and discussion of context (mathematics content was back-grounded). Mathematics content included insofar as making sense of information in numbers and percentages.
- Lesson two (2): Language of probability (mathematics embedded but weakly classified) The language of probability emerging from this activity is a hybrid of everyday language and more technical mathematics register language.
- Lesson three (3): Double bar graphs, critical reading and interpreting data to draw conclusions and make predictions sensitive to the role of HIV and AIDS context (Much stronger foregrounding of mathematics).

5.3.1 Lesson 1: nature of the activities

The focus of the activity was to assist learners to develop some conceptual understanding about the way in which HIV has spread in South Africa and the rest of the world. Indirectly the activity raised the challenges that societies could face if the high rate of infections is unattended to. The treatment of the virus and cure of the infected were discussed. Learners were expected to discuss in-depth the threats of the virus. Facts on

HIV and AIDS were included to assist learners to work with the above activity. The facts provided had information that required understanding of statistics, as is normally reflected in print media that is newspapers, magazines and electronic media, for example; More than 1500 South Africans are infected with HIV every day.

The first lesson's activities were deliberately general and aimed at familiarizing learners with the context of HIV and AIDS. They are thus not analysed from the perspective of integration with mathematics but such discussions are important for initiating learners for life and citizenship.

Activity 1.1 (see annexure B)

In the following activity learners were expected to work in pairs, where they identified familiar facts about HIV and AIDS. For example:

1. You cannot get HIV from holding hands.
2. Much of the data that we have on HIV and AIDS in SA is gained from surveys conducted on pregnant women attending antenatal public clinics. Every year the government conducts a survey to determine the percentage of pregnant women going to these clinics. In 2001 it found that 25% of pregnant women going to these clinics were HIV positive.
3. Anti-retroviral drugs can reduce the risk (by about 47%) of transmission of HIV from mother to child. These are freely available to pregnant women in public clinics and hospitals.
4. SA is considered to have the fastest growing AIDS epidemic in the world.
5. More than 1500 South Africans are infected with HIV every day.

5.3.2 The mathematics in the activity

According to learning outcome 4 [Data Handling and Probability], learners should be able to “analyze and interpret data to establish statistical and probability models to solve related problems.” Statement 2, 3, and 5 above use some mathematical (or statistics)

language to communicate facts about HIV and AIDS. However these statements (2, 3 and 5) are not sufficient to instigate or enable mathematical talk in the classroom that clearly describes with certainty mathematical or statistical fact. For example, from statement 5 alone one cannot make a conclusive judgment about the effects of HIV and mortality rates.

5.3.3 Findings of activity 1.1

On question 1.1 most learners were familiar with facts about HIV and AIDS, the number of facts claimed by learners that they knew before reading the list were between 4 and 10. The table below illustrates scores of the fourteen analysed learners' responses. The table does not illustrate which facts were known by learners but the number of facts that were known before they read the list. For example, learners knew fact number one before they could read the list.

Table 5.2: illustrates number of facts learners knew before reading

Possible number of facts known by learners	1	2	3	4	5	6	7	8	9	10	11	12
Number of learners	0	0	0	1	0	0	7	1	1	4	0	0

The above the data justifies that learners were familiar with the context of HIV and AIDS.

The majority of learners were able to identify seven (7) facts out of possible 12 facts. See below sample of learners responses.

1.1 Count the number of facts you knew before reading the list?

the are 10 of them

1.1 Count the number of facts you knew before reading the list?

Before reading this list I knew only (9) facts
from the list about HIV/AIDS

1.1 Count the number of facts you knew before reading the list?

before reading the list I knew only 7 of
this facts

1.1 Count the number of facts you knew before reading the list?

I only knew 7 facts

Findings of Activity 1.2 (see annexure C):

The following discussion provides responses that learners have provided to illustrate their understanding of the *mathematics or statistics language* used to describe HIV and AIDS risks. However, in this activity there are no correct answers. For example one learner i.e.

$\left(\frac{1}{14}\right)$ gave the following response to illustrating learner's use of mathematics or statistics language.

How is HIV contracted?

Unprotected sex, rape and mother to child transmission reflect 25% of HIV new infections.

This learner recognises in mathematics classroom a focus on such data and figures is significant and important.

How can you avoid contracting HIV?

Anti-retroviral drugs can reduce the risk (by about 47%) of transmission of HIV from mother to child.

This learner drew on statistics figures (of percentages) given in the articles. However it's not clear in the response whether these figures are really understood.

Majority of learners $\left(\frac{13}{14}\right)$ completely ignored these figures and simply worked around

their significant knowledge of HIV and AIDS context. These for example are what learners wrote in responding the above two questions:

How is HIV contracted?

- Healthy people can be HIV positive, and you cannot tell by looking at someone that they have HIV. Unprotected sex with HIV positive person could result to contracting HIV.
- None testing and unprotected sex, increase the infection rate

How can you avoid contracting HIV?

- Rape survivors have the right to *free anti-retroviral medicines* at public hospitals and clinics that might help to prevent them contracting HIV.
- Proper use of condoms makes risk of HIV negligible.

Context of this activity focus on general information as explained above, therefore it is not clear which answer is more legitimate

The table 5.3 (below) illustrates learners' responses; it is interesting that mathematics was not substantively used to justify their responses. The researcher noted that mathematical communication was not use to an extent expected in mathematical class conversation. But the context aided learners to engage with mathematics activity.

Table 5.3: A Summary of learners' responses

Types of questions from activity 1.2	1	2	3	4	5	6
No. of responses using everyday life experiences (no reference to information and figures given)	4	6	14	2	14	14
No. of responses using information given (no reference to figures given)	10	8	0	12	14	14
No. of responses referring to figures	0	0	0	1	1	0

Looking at the learners' responses to the last two questions 5 and 6, it became difficult to distinguish between what may be learners' everyday knowledge and reference to information given from the activity 1.1 as discussed above. Hence, the researcher has recorded them as both the responses that reflect learners' everyday life experiences and reference from the information. For example a statements like "stick to one sexual partner" could be an interpretation of statement like "you can not tell by looking at someone that they have HIV" particularly to learners whom English is not their home language.

Samples of learners' responses in annexure C1 – C3 discussed above are not sufficiently analysed because they are close or almost similar to extracts of class discussions that took

place between the teacher and the learners. The next section provides an analysis of an extract of a discussion between a teacher and learners on the question: How can one contract HIV? Where T denotes teacher talk and L₁ to L₉ denotes learner talk.

T:	You are a brilliant class; I like you [teacher commended the class] then he poses the question. <i>How can one contract AIDS?</i>
L ₆ :	Unprotected sex
L ₇ :	Blood transfusion
L ₃ :	Breast-feeding
L ₈ :	Sharing needles
L ₉ :	Sharing razors (blades)
L ₁ :	From mother to child, by giving birth
L ₇ :	By abstaining
L ₁₀ :	If you are having sex without a condom
L ₁ :	By having the first three letters ABC: Abstain, Be Faithful and Condomise)
L ₈ :	By using gloves when touching someone's blood

The above extract illustrates how L₁ (a learner) partly uses information from the worksheet (note the underlined section). Yet the learner ignored figures. There rest of learners, although it was difficult to tell the difference between learners' use of prior knowledge and the use of information from worksheet, it seem that context aided their mathematical learning as illustrated in the above extract.

“Anti-retroviral drugs can reduce the risk (by about 47%) of transmission of HIV from mother to child. These are freely available to pregnant women in public clinics and hospitals.”

The following extract, though the study, is not about the educator, nevertheless illustrates the non-interference or lack of using context to build on learners' prior knowledge and experiences and engage their interest in establishing an authentic connection between 'esoteric' knowledge represented by mathematics as a formal discipline and everyday mathematics. Pimm (1991) argues that the mathematics teacher's role should be to provide the learners with some means of gaining access to the mathematics register. On this point, Sfard et al. (1998) argue that 'the [classroom] participant has to communicate mathematically in a productive way.’

T:	Last question; what did you learn about HIV and AIDS in you earlier grades? (As he acknowledges learners who raised their hands, this is an indication that they want to respond to the question) He says one (1) as he points to learner number one.
L ₁ :	I have learnt that you cannot get HIV and AIDS form sharing food or toilets. (This learner dances a little bit – as sign that she enjoys herself or the class)
L ₁₀ :	I have learnt that it has no cure and has high rate of death and has killed a million of people.
L ₇ :	You cannot get HIV and AIDS from kissing and hugging
T:	Is still about love! You can kiss but don't kiss HIV and AIDS
C:	The whole class laughs

It is from this that I believe that the teacher could have taken advantage of a response from L₁₀ (namely: *I have learnt that it has no cure and has high rate of death and has killed a million of people*). To assist learners develop their mathematical concepts such as percentages and ratios to estimate how many people are HIV infected and project how many people will be infected in two (2) or more years to come.

I argue that what is a legitimate text in an introductory activity like this depends on the agenda of the teacher for the activity. If engagement of percentages and figures in an article is important for such activity then learners' ignoring this is problematic issue. However, if the agenda of the activity is merely to stimulate general interest in discussions around the context then overlooking such figures is not an issue.

5.4 Lesson 2: Activity 2: probability (see annexure D): nature of the activity

According to NCS (DoE, 2003) learning outcome 5, requires that the FET band learners should develop their “basic understanding of the ways of probability of everyday events” so as to use them to calculate and do predictions. The contexts that investigate issues like human rights, environment, and health are prioritized. So, in this activity, learners' were given an extract on the risks of getting HIV through sexual activity with a person who is HIV positive. The context of HIV and AIDS was used as a possible “resource” (Adler, 2000) or a “platform” to access and generate mathematical language of probability and risk.

Thus, in this activity learning outcomes were:

1. To develop a basic understanding of language of probability used to predict the risk of getting HIV from sexual activity with a person who is HIV positive.
2. Make conjectures. This concurs with Zevenbergen (2000) argument that: “legitimate participation is acquired and achieved through a competence with written or spoken text or both”

The activity required learners to organise analyse and interpret data, to use probability models to solve real life scenario of HIV risk. For example, learners were expected to draw from the following:

Firstly, an extract from the given worksheet on the risks of getting HIV from sexual activity with a person who is HIV positive is given below. For example:

- The risk of getting HIV increases about **ten times** when one of the people also has an STD.
- The risk of contracting HIV **increases** with the number of sexual encounters with multiple partners (when condoms are not used).

Secondly, learners were required to read the profiles of the people like Bob (see below) to use this information to solve problems within or outside mathematics.

Bob often has sex with many different partners. He doesn't use condoms. He sometimes gets STDs but doesn't always get them treated.

From information given on worksheet and profiles of peoples, learners were expected to develop a coherent explanation of their findings. The use of figures given and the language of probability was expected in order to provide a coherent explanation or justification and as such the “legitimate text”. The activity endeavors to encourage learners to consider risks and in the process become critical informed thinkers in their considerations of these risks in their everyday lives.

Possible responses (legitimate text) using mathematics on activity 2 could have been as follows:

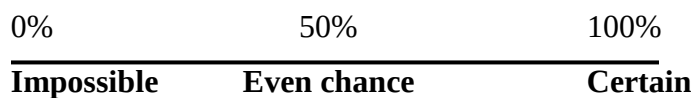
Ordering people with lowest risk to those with high risk could be represented in a form of a table or ordered list relative to phrases description of the level of risk. For example:

Table 5.4: Ordered list relative to phrases description of the level of HIV risk

Chances of contracting HIV through sexual activity	Persons Names
Impossible	
Almost impossible	
Very low risk	
Even chance, and	
High risk	
Very high risk	
Almost definitely	
Definitely	

Or probability scale

The **Figure 5.1** below illustrates the definition of probability:



(Adapted from Lovel, 1993)

5.4.1 Findings on Activity 2

Group 1 (this group consists of four girls: G1: 1 G1: 2, G1:3 and G1: 4)

(Group1, and girl number: position ascribed arbitrarily as they started to interact during the group work, with no specific attachments) (G1 represent girl one, and GM: Group Members)

Recording of interaction for this group starts when one of the girls suggest to the group that they (group) start by reading the worksheet together, rather than commencing with providing and discussing possible responses to the questions. The whole group agrees to the approach the first girl volunteers to read and provides answers (see extract below).

G1: 1 (*E reng ke bale*: Let me read, she starts to read) *Bob often has sex with many different partners. He doesn't use condoms. He sometimes gets STDs but doesn't always get them treated.*

Very high risk, because he sleeps with many partners and does not use condoms

G1: 2 (She adds) and sometimes he gets STD (*ha a di*) which he does not treat (*wa bona*), do you see. (*O tla qetela a nale HIV and AIDS.*) She will end up infected with HIV and AIDS.

Very high risk

G1: 1 OK. *Re ya dumellana* (OK, Do we all agree?)

As explained above learners seem to have been able to use legitimate text, for example, they used the given profile of Bob to determine Bob's risk of HIV and AIDS infection. Learners were able to draw directly from the text "sex with many different partners, sometimes gets STDs but does not treat them" and interpreted these as facts or lowering or increasing the risk. However the group talk did not use expressions like risk of getting HIV increases about ten times when one of the people also has an STD. Classroom talk seemed to overlook the use of this information. I suspect that this is possibly because these learners had not fully understood probability as a measure of the likelihood of the event occurring between 0 (0%) and 1(100%) (Lovel, 1993) or alternatively that the

driving question to order, did not force them to have to consider such specific information as they rather worked more simply with notions of increased or decreased risk. Further discussion of the group is given in the extract below:

- G1: 1 The second sentence (as she assumes the role of the leader, she points at the second sentence in a worksheet of the girl on her left hand, this is interpreted or understood as an instruction for her to read)
- G1: 2 (She reads out loud) *Pulane is not sexually active. She has dated several men but she has decided not to have sex with them.*
- G1: 1 and G1:3 (Almost at the same time say) I think **very high risk**
- G1: 2 Yah!! **Ke low risk** (she concur though not saying precisely what her peers have just said, as she nods her head in support) G1: 4 (She quietly raise her hand like someone hoping to be given a chance to provide an answer. But other group members focussed on their worksheets, she drops it unnoticed by other members of the group)
- G1: 3 Because she does not have sex at all (as she add reason for their argument) **But it can happen that she touches someone's blood, it can happen but it is not that high, but is possible but not high as** (she tends to consider other reasons for contracting HIV virus)
- G1: 2 Ok, we can say **Impossible** (she assist the group to decide on one definite answer)
- G1: 1 Yes (as she agrees)
- G1: 3 Yah! Not that **impossible** because AIDS. **But you can't have AIDS by only having sex, there are other ways. So, you ..., she has to think of all those things.**
- G1: 2 So our answer? (She wants confirmation of their resolution)
- G1: 1 and G1:3 (they shout together) **Impossible**
- G1: 4 (she also softly and almost inaudible adds that) **Impossible**

Girl learner 3 from group one, used her prior knowledge and experiences to conclude that Pulane's risk of contracting HIV is impossible. Here is where mathematical content knowledge of probability scale, percentages, decimal figures or research figures could have been useful and helpful. Impossible means 0%, but it seems she wants to say something like 0.001% may also mean impossible.

For example, the group 2 and 4 conversation shows how realistic knowledge in the classroom can serve learners as a resource. The recording of this group's interaction starts as recorded below:

- G2: 2 *I think a ka thola HIV and AIDS, because (As she reads) Fatima has regular sex with her boyfriend. They have both had tests and found that they do not have HIV. Fatima still always uses condoms since she feels it is always possible that her boyfriend might have sex with someone else.*
- G2: 1 It doesn't mean if we have both tested HIV negative we have to stop using condoms. We got to get on with that.
- GM What if 'cherry ya hae, e tswa ho ilo robola le motho o mong [his girlfriend have sex with another person] the whole group agree that it is not safe for them to stop using condom because any other partner may be unfaithful. (These girls seem very happy and enjoy themselves)
- G2: 4 (As she advance her argument of the group) Maybe when he goes out, *o ya cherrying enngwe a ba shapa* [goes to another girlfriend and make love to] for one round or seven round.

Another group held the following discussion.

- GM They can start having sex with someone who has HIV and they don't go to test again
- G4: 1 John believes that it is his right to sleep with anyone he chooses (***he stops reading and whistles softly, while shaking his head in denial or surprise***). He is very sexually active. He sometimes rapes women in order to have sex with them. He never uses condoms. This is sexual harassment and **very high risk**; this is crime because he rapes women and without a using condom. **Very high risk**
- G4: 5 any women?
- G4: 1 He justify his argument from the worksheet and reads: he believe that it is his right. His right!

The above excerpts reveal how learners use their everyday knowledge and worksheet data to solve real life scenario of HIV risk. From this we see how learners can work past the given mathematics data and useful language development and meet the outcomes without using probability scale or percentages ranges to support their discussion or ordering.

This resulted in a tension or a dilemma for the researcher: Is it necessary that learners draws from legitimate text or prior knowledge, when everyday context assists to develop appropriate values and attitudes without using the recognition or realisation rule, what it means to embed mathematics in the real world? If learners make authentic connection between contexts and mathematics to solve mathematical problem, then context is a

‘resource’ (Adler, 2000). On the other hand if real life context does not assist to solve mathematic problem then what would?

Table 5.5: explains chances of contracting HIV through sexual activity

This table was drawn by the teacher on the chalkboard; illustrates responses or summaries of groups’ discussions. The main question of this activity required learners to: Order the people [i.e. Bob, John, Tessa, Fatima, Sally, Sipho, Pulane and Sharon] from those with the lowest risk to those with the highest risk. And they (learners) were required to justify (give reasons for) the order that they choose.

Chances of contracting HIV	Persons Names	Typical learners reasons
Impossible	Pulane	Not sexually active
	Fatima	happen but it is not that high, but is possible but not high as but you can’t have AIDS by only having sex, there are other ways. So, you ..., she has to think of all those things.
		She is negative and uses condoms.
Low risk	Fatima	Condoms are not 100% safe and they burst if incorrectly used.
	Sipho & Sally	Does not know if the partner is cheating. They stopped using condoms.
Even chance	Tessa	She has sex with many partners she does not use condoms regularly and contracted STD which she treated immediately.
High risk	Sipho	He tested negative and stopped using condom.
	Bob	What if ‘cherry ya hae, e tswa ho ilo robola le motho o mong [his girlfriend has sex with another person]
	Sharon	He does not use condoms and he did not treat STDs.
	Sally	She can be infected by her good looking guys. She contract HIV if her boyfriend has sores.
Very high risk	Bob	He does not use condoms.
	John	He rapes women and never uses condom.
	Sharon	Handsome or healthy looking you can get HIV.

From the above table we see that learners were able to focus on legitimate text (from the Worksheets) and, their everyday life (real world) experiences; and seem to use little of, or ignore figures to justify chances of contracting HIV through sexual activity. I argue these

learners were able to apply, and recognise the demands of the activity, but failed to fully speak the expected legitimate text. That is they did not draw on some of the mathematics knowledge that could support their arguments.

Zevenbergen (2000) claims that mathematics has a particular form and newcomers must be able to decipher that language. These learners were able to call up on different discourse than that intended, for example, the following attempt to explain differences between almost impossible and impossible.

The learners said **almost impossible**, *ke hore* (that is) there is that percentage (as the learner uses her hands to show the teacher a little size of measurement or percentage) that she can get it (HIV); impossible is nothing. Learners chose not to use the language of probability which I defined as a measure between 0 (0 %) and 1(100 %). This mathematics technical vocabulary was not a resource; but everyday context was an available resource.

An extract of Classroom discussion of activity two facilitated by the teacher is as follows:

1. T	We can agree that Pulane is almost impossible for her ...
2. C	Impossible not almost impossible (as almost half members of the class corrects the teacher or argue their case)
3. T	Not almost impossible, I like that because they can see different between almost impossible and impossible. What is the difference between them? (Class members attempt to respond in unity) I want to here one person at the time.
4. L ₅	Almost impossible, <i>ke hore</i> [that is] there is that percentage (as the learner use her hands to shows the teacher some little amount of measurement or percentage) that she can get it; impossible is nothing.
5. T	What did you say
6. L ₅	So, Sir it is like the little percentage that she can get it, and impossible is nothing.
7. T	No chance (as he agrees to the argument)
8. C	Yes (satisfied that the teacher is convinced)
9. T	<i>Ke hore</i> [that is] almost impossible <i>a ka se thole</i> [she will not get] AIDS
10. C	Yes
11. T	But <i>e ka tlase</i> [its less]
12. C	Yes

13. L ₂	No Sir! I don't understand can we classify this person under Even Chance and almost impossible?
14. T	Or (as he throws the question back to the learners) which is a better chance even chance or almost impossible? Let's differentiate between almost impossible and even chance. Which one is a better chance?

An analysis of the above extract shows how learners may be disadvantaged by the embedding of mathematics into everyday contexts. Learners were unable to translate the everyday problem into a mathematical task and identify mathematics necessary for the task. The everyday and school mathematics seemed blurred.

This study concurs with Zevenbergen's (2000) findings "the context provides a high degree of motivation for participants to the point where, in many cases, school mathematics is redundant or inappropriate, or both". For example, learners are able to tell the difference between terms like impossible and almost impossible by drawing from everyday life and not mathematical knowledge. To this end Adler (2001, 70) argues "the induction of learners into mathematical discourses, and to informal and formal spoken and written mathematics, is widely acknowledged as a complex affair."

The results show that if learners lack specific mathematical knowledge then they draw on their own position (values, attitudes, morals, religion) about HIV and AIDS to participate in the classroom discourse. Therefore pedagogy can exclude some learners from classroom participation.

The study is not about investigating the educator's ability to acquire the specialised recognition rules of the new practice that moves from "authoritarian, teacher-centred approaches to learning and teaching and to mathematical knowledge itself" (Adler, 2001). However, the analysis of the role of the educator in a learner-centred approach to school mathematics proves that the educator does not control the content of the lesson. What is interesting about the analysis is that it also indicates the application of mathematics to the real-world does not come naturally for educators. The educator acknowledged that he had never used the context of HIV in his teaching before, however in an unstructured manner he has attempted to connect maths to learners' everyday lives.

5.5 LESSON 3: Worksheet 2, (Analysing data in the form of bar graphs)

annexure E

The primary goal of this activity was for learners to use mathematical content (probability) and context with the hope that it would initiate them to establish an authentic connection between mathematics and the application of mathematics in a real world context of HIV and AIDS. In this activity, mathematical content or skills were as follows (DoE, 2002: 90):

- Bar graphs and double bar graphs
- Critically reads and interprets data presented in variety of ways to draw conclusions and make predictions sensitive to the role of context

Another goal was to make sense of this data and relate it back to the context from where it comes. The test items required learners to be able to ‘recognise relations between variables in terms of numerical, graphical, and verbal representations and to convert flexibly between these representations (tables, graphs, and words); and develop effective communication skills as to arrive at conclusions and predictions that can be made from the analysis of data. (See, annexure E questions 7 and 10).

Table5.6: The analysis of mathematics content in the worksheet 2.

Questions	1	2	3	4	5	6	7	8	9	10
Use of maths concepts	✓	✓	✓	✓					✓	✓
Maths language -symbols	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Graphical interpretations		✓	✓		✓	✓	✓	✓	✓	✓
Maths skills (estimations)					✓	✓	✓		✓	✓
Use of context			✓	✓				✓	✓	

5.5.1 Findings

Here learners worked in groups (see annexure E1 to E3 for learners' responses). In the task mathematics was fore-grounded and learners seemed to shift their focus from context of HIV and AIDS to focus on the graphs and the information in them.

Recorded response from learners' discussion is present and analysed below:

Q₁ What is recorded on the vertical axis of the graph? What is the scale used on this axis?

L Percentage of all new infection, 0 – 30%,

L 0 – 30% (*vertical*)

The first response '*% of all new infection, 0 – 30%*' suggests that learners were able to interpret or understand the meaning of mathematical language e.g. percentages, vertical axis and symbolic mathematical language. However there was no emphasis on a context HIV and AIDS, which could imply that learners shifted their focus to mathematics and ignored importance of context. This shift by learners from use of their everyday life experiences indicates how insignificant context to learners is where mathematics is fore-grounded. Learners' attention moves away from context of HIV and AIDS to the structural mathematics register.

Q₂ What is recorded on the horizontal axis of the graph?

L Ages of new infections

L Age group for both males and females

Similarly learners ignored the use of context and but realised the importance of data given by the worksheet. The everyday and school mathematics was insulated and strongly classified.

Q₃ Why are there two different bars drawn for each age group?

L Because there are ... females are drawn on the left and males are on right hand side

L So that we can know which gender are they talking about?

The first response emphasis what is discussed as a shift to mathematics and drawing from worksheet, while the second response illustrates an attempt by learners to interpret data from bar graphs.

The following questions Q₄ – Q₆ tested almost the same mathematics skills of data analysis.

Q₄ What age group is expected to have the greatest number of new infections? What percentage is this?

L 15 to 19 and 20 to 24 years, 31%

Q₅ Which age group has the greatest percentage of new infections for females? What percentage is this?

L 15 – 19, which is 24% and is less than 25%

Q₆ Which age group has the greatest percentage of new infections for males? What percentage is this?

L 20-24, 16%

All the groups on the above test items were able to meet the required mathematics skills, namely: analysis of bar graphs – finding values and interpret the results back into the real world situation.

Q₇ Which age groups have the same percentage of new infections for males and females? Why do you think this is the case?

L 0 – 4, because *ba santse ba qala ho etsa graph ena* [it is the origin of graph sketching]. So, females and males *ba qala balekana* [they are equal at the beginning] between 0 – 4

This test item was aimed at fostering learners' critical and reflective reasoning, so as to recognise "real life" situations amenable to mathematical representation. Learners were able to analyse bar graphs. However, learners limited their responses to data in the worksheet, and accurately indicated that between the age groups of 0 – 4 years, percentages of all new infections for male and females are the same and ignored other age groups in particular where infection rates is almost zero. For example: between 5 – 14 years. The use of context of HIV and AIDS which seem well known by learners as explained in activity 1.2 discussed above, which seemed to enhance learners mathematics talk was ignored to justify or explain learners thinking. Learners' statement that when

starting to plot bar graphs percentages of new infections are the same suggest over generalisation about bar graphs.

- Q₈ Which age groups have a zero percentage infection rate? Remember that all the percentages are rounded off to the nearest unit so for these it could be 0,002%)
Why do you think these age groups have a zero percent new infection rate?
L 5 to 9 and 10 to 14, most are not yet sexually active

The reason that that: male and females between the ages of 5 to 14 *most are not sexual active* illustrates learners' made connections or link between mathematics and everyday context. Here context seem to aid to develop mathematics classroom talk; and legitimate knowledge in the classroom.

- Q₉ Which age groups have the following (approximate) ratios of female to male infections i) 1:1 ii) 4:1 and iii) 1:2
L i) 0 to 4; ii) 15 to 19 and iii) 25 to 29

Generally the above task questions, do not illustrates one feature, it is indeed impossible to separate the importance of back-grounding or fore-grounding everyday context or mathematics. The central design of the above task is to help learners see mathematics as a necessary tool that can be used to solve 'real world' problems. But by fore-grounding mathematics learners seemed to shift their focus to mathematics and ignore use of context HIV and AIDS.

In the next section I explain how learners (L) shifted from using limited mathematical knowledge to using their everyday knowledge of HIV and AIDS when probed by the researcher (R), for example: in responding to the following questions

1. The question on which age groups have the same percentage of new infections for males and females, and why this was the case.

- R You said is 0 – 4, because *ba santse ba qala ho etsa graph ena* [they starting to sketch the graph]. So, females and males *ba qala balekana* [they start equal] between 0 – 4 it's that the only reason? Does it mean all bar graphs where when you start to plot them they are equal? (*After waiting for about a minute*) Any one else who could provide reason for their thinking?

- L (*Learners seem puzzled, and kept quiet for about two minutes, one learner in the group seem to draw from the worksheet and said*) No, because the babies when they are born, they are born with HIV and their mothers are raped.

This response indicates a shift from focus on mathematics only. After probing learners seem to use both mathematics and context on HIV and AIDS. The initial response seems to suggest that learners ignored context on HIV and AIDS. Learners suspend or bracket their knowledge of ‘real’ and know how to approach the solution of practical mathematics as discussed in chapter 3 above.

- R Following on your response to the question: which age groups have a zero percentage infection rate? And why you think these age groups have a zero percent new infection rate? Your response was 5 to 14, because they are not sexually active. What about people from 45 years of age to 79 years of age?

- L Oh I see, *Nna* [I] think, because they are very old they are no longer having sex, they are very old.

Similarly, from the above extract see a shift from using mathematics only to a use of both mathematics and context of HIV and AIDS. Although it is unclear to determine the influence of the everyday in mathematics and its significance in relation to how learners engage with mathematics; particularly when mathematics is fore-grounded. The shift suggest that context seem to aid learners develop their relational understanding and motivates new learning.

The focus of the study is not about exploring the ability of learners to understand and interpret graphs, but to explore how the embedding of HIV and AIDS aid or impede mathematics learning. I argue that simply embedding context into mathematics does not make it relevant and worthwhile it requires teacher’s mediation. As has been mentioned already learners shift from everyday context to mathematical knowledge and vice-versa which assist them (learners) to apply both the recognition and realisation rules.

SUMMARY OF FINDINGS

It is not possible to conclude with certainty that in this particular study mathematics learning was aided or impeded by integrating HIV and AIDS as a context to develop learners' mathematical knowledge. However I observed that learners enjoy learning mathematics through the use of everyday life contexts. Learners tend to shift between the use of the everyday context and the use of mathematics content.

In activity 2, learners superficially used language of probability but never felt need to focus on mathematical information such as (ten times) nor to draw on mathematical tools (probability scale or percentages) to help justify or do the activity. Learners seem to use everyday knowledge of HIV and AIDS context, when mathematics skills appear to be unknown to them. When determining the risk of being infected (as in activity 2 above); they did not recognise that they were expected to use the realisation rule so the mathematics becomes lost and backgrounded. The mathematics of probability was not used as a resource.

In activity 3, learners moved beyond making sense of what the graph interprets to focus on the mathematics skills of reading axis numbers ignoring the context not relating it back any more to general discussions. When the mathematics is fore-grounded then they suspend everyday knowledge and use mathematics.

On reflection maybe the problem is in the activity or maybe research failure is on the role teacher in mediating discussion and making clear how content and context can and should come together. If the aim in integration is that content and context should come together in ways that each supports deeper and new learning of other; then careful teacher mediation is needed to guide learning in keeping both focus at appropriate points else focus only on the other. This is evident by the findings as discussed on activity 3, that learners were able shift from focusing on mathematics to context when the researcher probed their responses. Therefore context seem to make mathematics become relevant and worthwhile to learners.

Chapter 6

Conclusion

The point of this study has not been to illustrate the extent to which learners had general competency to communicate mathematically. The critical question of this research as explained in chapter 1 is to determine how mathematics learning occurs when integrated in an everyday context of HIV and AIDS.

The first activity was designed to initiate learners to develop some conceptual understanding about the way in which the HIV spreads and can be contracted; the in-depth discussions on HIV and AIDS were included to assist learners to communicate mathematically. The design of the task was to encourage learners towards an understanding of statistics – particularly probability, and to keep to a mathematical ‘talk’ on HIV, since statistical data is normally presented in the form of tables, words and graphs in the print media and electronic media.

It would seem from the learners’ discussion on questions such as how is HIV contracted? That the design of this task, though non-threatening, and based on learners’ everyday experiences, made unnecessary to keep to a mathematical “talk”. In activity 1 and 2 learners found ways to deal with questions without drawing in mathematics in any substantive way. Instead of the everyday context becoming a resource to engage into a mathematical talk, it seemed to be a slight distracter. Although this activity had some realistic elements, it allowed learners to use their everyday context to communicate mathematically without really using the ‘structural mathematics register’ and ‘legitimate knowledge’ (Zevenbergen , 2000). Thus context seemed to have somehow rendered mathematics imponderable.

When learners were requested to order people’s risk of being infected with HIV and AIDS from impossible to the very high risk, through sexual activity with a person who is HIV positive, learners’ responses indicated embedding everyday context into mathematics results in high motivation, fun and active classroom interaction, for the learners. These learners did not seem to be affected negatively by discussions of HIV and

AIDS. Throughout the lesson, the researcher was concerned that some learners might unwittingly reveal their own status or those of their family members, or expose learners that are known to them to be HIV positive. These fears soon disappeared because of the cheerful mood that prevailed amongst the learners in the classroom. It appeared that these learners were not concerned or surprised that a context of HIV and AIDS was used in the mathematics lesson. This activity though it does not have one specific or correct answer, it should be treated as closed, so no reference could be made outside given information to what can be considered relevant mathematics and everyday knowledge.

Neither did they raise concerns about how the learning of mathematics in general is related to HIV and AIDS. In the study, the researcher did not detect a depressing atmosphere nor was there the impression amongst learners that this was a taboo topic. I realised that this highly emotive issue did not seem to affect them, though as a researcher I was mindful that some learners might be HIV positive, or have family members who are infected, or have neighbours who are HIV positive, or know someone orphaned by HIV and AIDS.

Although the embedding of an everyday context into mathematics attempts to make mathematics learning meaningful and fun it is not without some obstacles. The familiar everyday context tends to influence positive performance in mathematics, which is the same as what is attained through other traditional methods. At the same time, everyday contexts may mislead learners into believing that their everyday knowledge is as good as their mathematical concepts. If the educator does not realise that learners experiences may make problem solving easy without drawing or using any mathematics required and relevant for the task, then use of context may lead educators to make incorrect assumptions about learners' mathematical knowledge development.

The readily available learners' general knowledge of HIV and AIDS seemed to impede opportunity to use mathematics language of probability in this activity. It is evident from the study that integration or embedding everyday context into mathematics learning creates challenges in terms of focusing on developing learners' mathematical concepts,

because learners' performance is influenced by their everyday knowledge rather than their mathematical knowledge.

On the other hand, the use of an HIV and AIDS context seemed to have been able to promote creativity, develop conceptual and lateral thinking, and also to critically engage learners. The HIV and AIDS context seem to have assisted learners to participate meaningfully in the classroom, while motivating them and making learning fun.

In activity 3, learners answered interpretive question from graphs demonstrating mathematics graph skills but did not draw or engage in some sense making relating back. The context of HIV and AIDS was ignored and seemly used like any context such as that of rainfall or population statistics. This lings to what De Lange (1996) referred to as using context educational value, but not dealing with applications in a true sense. It is of interest to note that when communicating mathematically, and when mathematics is embedded to the everyday context meaning is not conveyed, explicitly rather, it must be learned implicitly. What is not apparent to learners' interactions is the recognition of what is mathematically appropriate 'talk'.

In the case of the use of probability: analysing data in the form of bar graphs. The closure is a bit artificial as is signalled by the instruction: Study the bar graph and answer the questions that follow. Learners shifted from using everyday context to mathematical skills. In the process they ignore factors that are pertinent to real life versions of the task in other words context may be regarded as 'dead mock reality' (Sethole, 2004). That is 'real' served no real purpose.

However, this study does not allow a clear conclusion related to performance of learners in school mathematics because of using everyday context in the learning of mathematics. The elimination of variables such as the educator, learners' language competency and socio-cultural upbringing, which could affect the outcome, is very difficult to manage. This is evident in analysing the teacher's role as explained above.

On the contrary, this study tends to highlight the practical challenges experienced by learners when learning within the everyday context of HIV and AIDS. Firstly in activities that foreground social aspects or where mathematics is backgrounded learners use everyday knowledge to negotiate their way of participating in classroom interactions. In other words the everyday context assists learners to solve real problems; where everyday is embedded into mathematics learning, without a clue of what mathematics is required for or necessary in the activity. Similar to other studies where mathematics was backgrounded in everyday context mathematics was made obscured.

Secondly, in activity that foregrounds mathematics learners shifted from using everyday context to employ their mathematical skills. That is they do not use context and draw from their everyday life experiences. The researcher observed that when probing learners' responses, then learners were able to establish an authentic connection between mathematics as a discipline and the application of mathematics in their everyday lives.

In other words, context does tend to serve the real purpose for solving problems within and outside mathematics. In this study context assist learners to develop appropriate values and positive attitudes. This study does not attempt to claim that there are no challenges or difficulties associated with integrating mathematics into everyday context. Instead, it acknowledges that everyday context makes mathematics learning fun and meaningful. One crucial observation is that developing mathematical concepts and simultaneously establishing an authentic connection between mathematics as a discipline and application of mathematics in everyday lives is an extremely daunting task. Adler et al. (2000) and Sethole (2004) though arguing from different perspectives they provide evidences that integration will place new demands on teachers.

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Teacher questionnaire:

The primary purpose of the teacher questionnaire is to enable the triangulation of data:

Preliminary pre lessons interview schedule:

Semi-structured interviews to take place in the language of the teacher's choice (where possible)

1. When teaching mathematics, do you integrate your teaching with various everyday contexts? If so can you tell me a bit about this...

2. Have you encountered any problems in the teaching and or learning of mathematics when it is contextualized?

3. When teaching mathematics, have you ever integrated your teaching with HIV & AIDS contexts? If so can you tell me a bit about this...

Preliminary post lessons teacher's interview:

Semi-structured interviews to take place in the language of the teacher's choice (where possible)

1. What were your experiences of integrating mathematics learning and HIV&AIDS contexts?

-----(- free response, as wide as possible, interviewer can pick up on different points and probe: affective experiences, experiences in terms of mathematics learning outcomes (foregrounded, backgrounded, obscured?) experiences in terms of critical and developmental learning outcomes, new roles)

2. In your lessons I noticed that learners were actively involved and discussed broad issues of HIV & AIDS. What do you think?

3. In your lessons I noticed that learners were actively involved with mathematical skills of both calculations and interpretations of graphs. What do you think?

4. What do you think the experiences of your learners were in these lessons? How was their behaviour, participation, interactions etc. different from other lessons which did not involve integration in various contexts?

- (*Affective experiences, experiences in terms of mathematics learning outcomes, experiences in terms of critical and developmental learning outcomes*)

5. In your own view what are advantages/ disadvantages

6. Would you do this again?

7. Why/why not...

Post lessons learner questionnaire:

Semi-structured interviews to take place in the language of the learner's choice (where possible)

1. What mathematics did you learn....

2. What critical outcomes did you learn?

3. What developmental outcomes did learn?

4. Do you think learning mathematics through the context of HIV & AIDS made your understanding of mathematics easy? Why/why not...

5. Would you like more mathematics lessons in future to be in the context of HIV and AIDS? Why/why not...

Consent form for learner participation in Vincent Ndhlovu's research project.
If you do not agree you do not need to fill in the form

Observation and transcription

I agree to participate in the research project subject to the conditions in the accompanying letter.

I agree that what I say in class can be transcribed for research purposes and used in articles for publication in education and academic journals. I understand that my name will not be used.

Name of learner:.....

Signature of learner:.....

Name of parents or guardian:.....

Date:.....

Videotaping

I agree to participate in the research project subject to the conditions in the accompanying letter. I agree to being videotaped. I understand that only Vincent Ndhlovu and his supervisor Dr Mellony Graven will watch the video tape.

Name of learner:.....

Signature of learner:.....

Name of parent/guardian:.....

Signature of parent/guardian:.....

Date:.....

Consent form for learner participation in Vincent Ndhlovu's research project.
If you do not agree you do not need to fill in the form

Observation and transcription

I agree to allow my child to participate in the research project subject to the conditions in the accompanying letter. I agree that what my child says in class can be transcribed for research purposes and used in articles for publication in education and academic journals. I understand that his/her name will not be used.

Name of learner:.....

Signature of learner:.....

Name of parents or guardian:.....

Date:.....

Videotaping

I agree to allow my child to participate in the research project subject to the conditions in the accompanying letter. I agree that s/he may be videotaped. I understand that only Vincent Ndhlovu and his supervisor Dr Mellony Graven will have access to the video tape.

Name of learner:.....

Signature of learner:.....

Name of parent/guardian:.....

Signature of parent/guardian:.....

Date:

Letter of consent to participation

Letter of consent to parents of learners in the class

Dear Parents or Guardian

I am currently studying for a Master of Science degree in Mathematics Educations at the University of the Witwatersrand in Johannesburg. I am participating in a research project supervised by Dr Mellony Graven. This project is interested in researching math learning in the context of HIV&AIDS. Learning maths in this context is part of the new curriculum. As part of this project and for my masters thesis, I am exploring classroom interaction in which mathematics and HIV & AIDS are used as a context. I will be observing a number of lessons in order to do this. I believe that through my research, I can make a meaningful contribution to some of the current debate around teachings maths in contexts.

To this end I would like to observe your child's mathematics class. I would like to videotape the lesson with the purpose of transcribing what the learners and the teacher says in the lesson. Only my supervisor, Dr Mellony Graven, and myself will have access to the videotape, which will be destroyed on completion of the research.

The school will be anonymous and all names in the transcripts will be pseudonyms. Thus, your child's name will not appear anywhere in the research. When reporting my findings, it is not my intention to make personal comments about the teacher or the pupils involved but rather to illuminate the processes and decisions involved in the classroom. In this regard I undertake to ensure that no untoward references are made about the pupils or the teacher.

Lessons will continue as normal and as scheduled, with my presence in the back of the classroom.

I must stress that participation is voluntary. Your child is under no obligation to participate and there are no consequences should you or he/she choose not to participate. Please note that your child may withdraw from the research at any time without prejudice. I would be very grateful for this opportunity however, and if you are agreeable to this process read and complete the attached consent form and return it to school.

If you have any question or concerns or would like to discuss the aims of my research in more details, please do not hesitate to contact me on 072 906 9728. Should you wish to, you can also contact my supervisor, Dr Mellony Graven (011) 717 – 3411

Yours sincerely,

Vincent Ndhlovu

Letter of consent for participation of teachers

Dear Mr Soweto

As a follow up to our conversations, this letter aims to confirm your agreement to participate in my research project. As we have discussed, the aim of my research is to explore teaching and classroom interaction where HIV & AIDS are used as a context for mathematics learning in South Africa. In order to carry out this research, I would like to interview you and observe your practice in a few lessons. Ideally I would like to video the lessons and tape the interviews. Whatever I transcribe from the video or the tape will be available for you to read should you wish to, so that you can verify that the information is correct.

Your name and that of your school will not be given. Only myself and my supervisor, Dr Graven, will have access to the video.

Once the research is completed, I am happy to discuss some of the findings with you. It is likely that this research will be referred to in papers for conferences or journal submissions. If you would like to view the videotape of your lessons, I would be more than happy to oblige and of course if there is any way that I can be of assistance to you or the school, please let me know. At the end of the research the video will be destroyed.

Lastly should you have any queries or concerns, please do not hesitate to speak to me immediately. You can terminate your participation in the research at any point in time, should you wish to, without prejudice. If you are satisfied with the process thus far, please could you complete the attached consent form, formally granting me permission to proceed at this point. From my side, I am extremely grateful to you for taking time to talk to me and allow me access to your classroom and mathematical practices.

Yours sincerely

Vincent Ndhlovu

Consent form for teacher participation in Vincent Ndhlovu's research project.
If you do not agree you do not need to fill in the form

Observation and transcription

I agree to participate in the research project subject to the conditions in the accompanying letter.

I agree that what I say in class can be transcribed for research purposes and used in articles for publication in education and academic journals. I understand that my name will not be used.

Name of teacher:.....

Signature of teacher:.....

Date:.....

Videotaping

I agree to participate in the research project subject to the conditions in the accompanying letter. I agree to being videotaped. I understand that only Vincent Ndhlovu and his supervisor Dr Mellony Graven will watch the video tape.

Name of teacher:.....

Signature of teacher:.....

Date:.....

WORKSHEET 1: HIV AND RISK

One of the greatest risks that young people face in South Africa today is contracting HIV. While a lot of research is being conducted on finding a cure for HIV, no cure has yet been found.

1 In pairs

Read the facts below.

Some known facts about HIV and AIDS:

1. You cannot get HIV from holding hands.
2. Healthy people can be HIV positive.
3. You cannot tell by looking at someone that they have HIV.
4. Rape survivors have the right to free anti-retroviral medicines at public hospitals and clinics, that might help to prevent them contracting HIV.
5. HIV stands for Human Immuno-deficiency Virus.
6. AIDS stands for Acquired Immune Deficiency Syndrome.
7. Much of the data that we have on HIV and AIDS in SA is gained from surveys conducted on pregnant women attending antenatal public clinics. Every year the government conducts a survey to determine the percentage of pregnant women going to these clinics. In 2001 it found that 25% of pregnant women going to these clinics were HIV positive.
8. Anti-retroviral drugs can reduce the risk (by about 47%) of transmission of HIV from mother to child. These are freely available to pregnant women in public clinics and hospitals.
9. Proper use of condoms makes risk of HIV negligible.
10. You can get HIV from sharing syringes when using drugs.
11. SA is considered to have the fastest growing AIDS epidemic in the world
12. More than 1500 South Africans are infected with HIV every day

1.1 Count the number of facts you knew before reading the list?

NB. Above you have been given some of the facts about HIV and Aids. Use these facts to help you to work with the following activity.

Class discussion

ANNEXURE C

As a class discuss the following. You might want to invite a health worker to come to the class to help with the discussion.

1. What is HIV?
2. What is AIDS?
3. How are HIV and Aids connected?
4. How is HIV contracted?
5. How can you avoid contracting HIV?
6. What have you learnt about HIV and AIDS in earlier grades?

Group Activity:

1. Read the information below on the risks of getting HIV from sexual activity with a person who is HIV positive:

- The risk of getting HIV increases about ten times when one of the people also has an STD.
- The risk of getting HIV increases about ten times in cases of rape (This increase is for both the victim and for the rapist).
- The risk of getting HIV from a healthy looking person and a sick looking person are about the same. This is because healthy looking people can also carry the HIV virus.
- The risk of getting HIV is almost negligible when condoms are used always and correctly.
- The risk of contracting HIV increases with the number of sexual encounters with multiple partners (when condoms are not used).
- Anal sex and sex during menstruation can increase the risk of contracting HIV.

Note: These are estimates that are based on data collected. Data on the risks of getting HIV during sexual encounters is difficult to collect.

2. Read the profiles of the following people.
3. For each person describe their chances of contracting HIV through sexual activity (e.g. impossible, almost impossible, very low risk, even chance, very high risk and so forth)
4. Order the people from those with the lowest risk to those with the highest risk. You must be able to justify (give reasons for) the order that you choose.

ANNEXURE D

Bob often has sex with many different partners. He doesn't use condoms. He sometimes gets STDs but doesn't always get them treated.

Pulane is not sexually active. She has dated several men but she has decided not to have sex with them.

Tessa has sex with many different partners. She sometimes uses condoms. She has got an STD before but she had it treated immediately.

Sipho has regular sex with his girlfriend. They started having sex using condoms but since they have both had tests and found that they do not have HIV they have stopped using condoms.

Fatima has regular sex with her boyfriend. They have both had tests and found that they do not have HIV. Fatima still always uses condoms since she feels it is always possible that her boyfriend might have sex with someone else.

Sharon often has sex with many different partners. She doesn't use condoms but she always makes sure that she sleeps with good looking and healthy looking people.

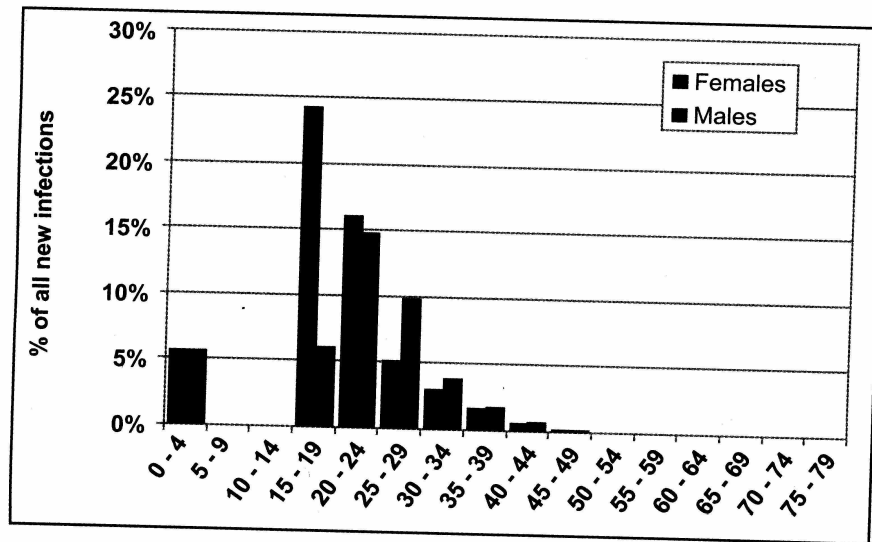
Sally has regular sex without a condom with her partner who is sick with cancer. They have both tested negative for HIV.

John believes that it is his right to sleep with anyone he chooses. He is very sexually active. He sometimes rapes women in order to have sex with them. He never uses condoms.

Example 1: Analysing data in the form of bar graphs

Study the bar graph and answer the questions that follow. Females are given first for each age group (shading is unclear in the scanning).

Figure 2. Proportion of all new infections projected between 1995 and 2010 by gender and age categories



1. What is recorded on the vertical axis of the graph? What is the scale used on this axis?
2. What is recorded on the horizontal axis of the graph?
3. Why are there two different bars drawn for each age group?
4. Why are the bars drawn in different colours (or shadings)?
5. What age group is expected to have the greatest number of new infections? What percentage is this?
6. Which age group has the greatest percentage of new infections for females? What percentage is this?
7. Which age group has the greatest percentage of new infections for males? What percentage is this?
8. Which age groups have the same percentage of new infections for males and females? Why do you think this is the case?
9. Which age groups have a zero percentage infection rate?
Remember that all the percentages are rounded off to the nearest unit so for these it could be 0,002%) Why do you think these age groups have a zero percent new infection rate?
10. Which age groups have the following (approximate) ratios of female to male infections: i) 1:1 ii) 7:2 iii) 1:2

1.2 Class discussion

As a class discuss the following. (Note to the educator: You might want to invite a life orientation educator or health worker to come to the class to help with the discussion).

1. What is HIV?

Human Immuno-deficiency

2. What is AIDS?

Acquired Immune Deficiency Syndrome.

3. How are HIV and Aids connected?

They are connected in the way that HIV is a Virus that causes AIDS.

4. How is HIV contracted?

through sexual encounters.

you can get HIV from Sharing Syringe.

5. How can you avoid contracting HIV?

by using condom

What have you learnt about HIV and AIDS in earlier grades?

I have learnt that HIV and AIDS can be cured if you use condom and abstain from sex.

1.2 Class discussion

As a class discuss the following. (Note to the educator: You might want to invite a life orientation educator or health worker to come to the class to help with the discussion).

1. What is HIV?

HIV stand for Human Immuno Deficiency Virus.
It's a disease that is contracted through unsafe sex and the mixing of sexual liquid or blood

2. What is AIDS?

Acquired immune deficiency Syndrome is the later
stage of HIV where by your immune system is
very weak and you CD4 cell count low

3. How are HIV and Aids connected?

HIV is the earlier stage of AIDS. HIV causes
AIDS

4. How is HIV contracted?

The mixing of blood with a HIV⁺ person. Unsafe
sex or using the same razor or needle of an
infected. Or through a mother to child through breast feeding

5. How can you avoid contracting HIV?

ABSTAINING IS THE BEST METHOD, CONDOMI
SING and STICK TO ONE SEXUAL PARTNER.

6. What have you learnt about HIV and AIDS in earlier grades?

In lower grades I learned how you contract
HIV and how you can protect your
self. They also told us about the precautions
you can take if you are sexually active.
I also learned about the different methods
for preventing pregnancy or HIV.

1.2 Class discussion

ANNEXURE C3

As a class discuss the following. (Note to the educator: You might want to invite a life orientation educator or health worker to come to the class to help with the discussion).

1. What is HIV?

It is a virus. You can say it kills but it doesn't really kill because it is light.

2. What is AIDS?

A collection of all diseases, and it acquires HIV and weakens the immune system.

3. How are HIV and Aids connected?

They are connected, because AIDS is build upon HIV. once you have HIV you can easy develop AIDS

4. How is HIV contracted?

Throu sexual intercoases
Sharing the same syringes
when using drugs.

5. How can you avoid contracting HIV?

By using condoms during sexual intercourse, by not sharing anyth. attracted to blood.

6. What have you learnt about HIV and AIDS in earlier grades?

That it most definateley kills.
That who ever has it can live
For more than (15) Fifteen year
if she/he is on medication.
That HIV/AIDS is a developing
disease.

2.4 Order the people from those with the lowest risk to those with the highest risk. You must be able to justify (give reasons for) the order that you choose.

Chances of contracting HIV through sexual activity	Persons Names	Reasons
Impossible	Fatima Pulane	Fatima → She always uses condoms although she is negative. Pulane → She is not sexually active, so it is not possible to contract it.
~~Almost impossible~~ High risk	Bob	It will be easy to contract HIV.
Very low risk	Sipho Gally	Because they are HIV negative and nothing stops them.
Even chance, and	Tessa	It is easy for her to contract HIV cause she does not regularly use condoms, during sexual inter
Very high risk	Sharon John	He is easily going to contract HIV because he won't know the other person's status. Sharon can contract it because either if you are HIV positive or healthy looking you can get HIV.

2.4 Order the people from those with the lowest risk to those with the highest risk. You must be able to justify (give reasons for) the order that you choose.

Chances of contracting HIV through sexual activity	Persons Names	Reasons
Impossible	FATIMA Palone	is impossible because while know that is negative she still uses condoms Palone she is not sexual active havent sleep with any boy.
~~Almost impossible~~ Low risk	Sipho Sally	because they are negative and don't use condoms and the deases can get in many ways.
~~Very low risk~~ Even chance	TESSA	because before she got an STD and had treated she has sex with different- But and she sometimes uses condoms. is easy to get infected with HIV.
~~Even chance, and~~ high risk.	Bob	because he has STDs and don't treat them and often has sex with different partners so is easy for dease to get to him
Very high risk	John Sharon	John is in a high risk because he doesn't know the status of people that he sleep with without using condoms. because can not tell whether a person is infected by looking at him and also don't use condoms.

2.4 Order the people from those with the lowest risk to those with the highest risk. You must be able to justify (give reasons for) the order that you choose.

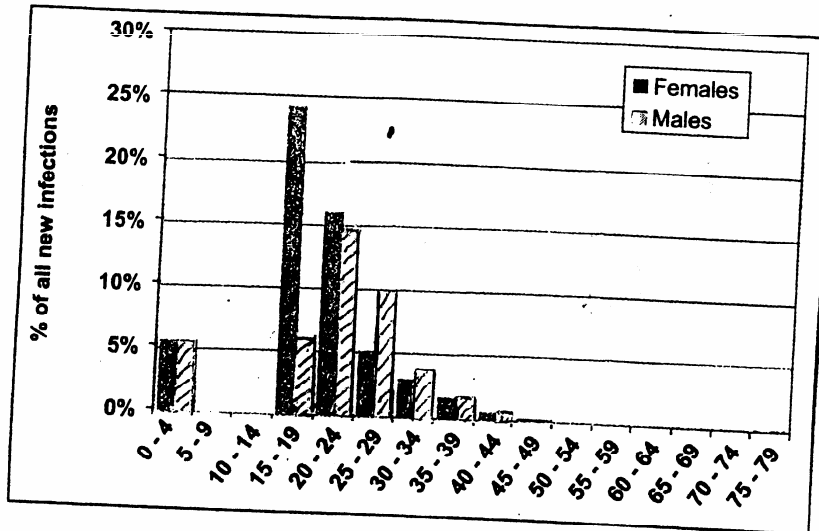
Chances of contracting HIV through sexual activity	Persons Names	Reasons
Impossible	Pulane	Pulane does not HAVE ANY sexual inter course which reduces Her chances of contracting HIV
Almost impossible LOW RISK	FATIMA	Fatima is low risk because using condoms are not 100% safe. ~~to~~ They burst when not used correctly
Very low risk EVEN CHANCE	Tessa ~~BOB~~	<u>Tessa</u> => The onetime She does not use a condom could the one time she contracts HIV
Even chance, and HIGH RISK	Sally SHARON	<u>SHARON</u> => She can contract HIV from one of her good looking. <u>SALLY</u> => SHE CAN CONTRACT STD'S IF her boyfriend has sores.
Very high risk	BOB SIPHO JOHN	John, Siphso and Bob always have sex with several partners without using a condom.

WORKSHEET 3: THE USE OF PROBABILITY

Example 1: Analysing data in the form of bar graphs

Study the bar graph and answer the questions that follow. Females are given first for each age group (shading is unclear in the scanning).

Figure 2. Proportion of all new infections projected between 1995 and 2010 by gender and age categories



1. What is recorded on the vertical axis of the graph? What is the scale used on this axis?

The percentage % of all new infections.
From 0% to 30%.

2. What is recorded on the horizontal axis of the graph?

Age for both males & females.

3. Why are there two different bars drawn for each age group?

To show the variety of infections across the age groups.

4. Why are the bars drawn in different colours (or shadings)?

To show the different genders.

5. What age group is expected to have the greatest number of new infections?

15 to 19 What percentage is this? 24%

6. Which age group has the greatest percentage of new infections for females?

15 to 19 What percentage is this? 24%

7. Which age group has the greatest percentage of new infections for males?

20 to 24 What percentage is this? 15%

8. Which age groups have the same percentage of new infections for males and females?

0 to 4, 5 to 9 and 10 to 14

Why do you think this is the case?

They are born with HIV

9. Which age groups have a zero percentage infection rate? 5 to 9
and 10 to 14

(Remember that all the percentages are rounded off to the nearest unit so for these it could be 0,002%) Why do you think these age groups have a zero percent new infection rate?

Most of them are not yet sexually active

10. Which age groups have the following (approximate) ratios of female to male infections:

i) 1:1 0 to 4 ii) 4:1 15 to 19

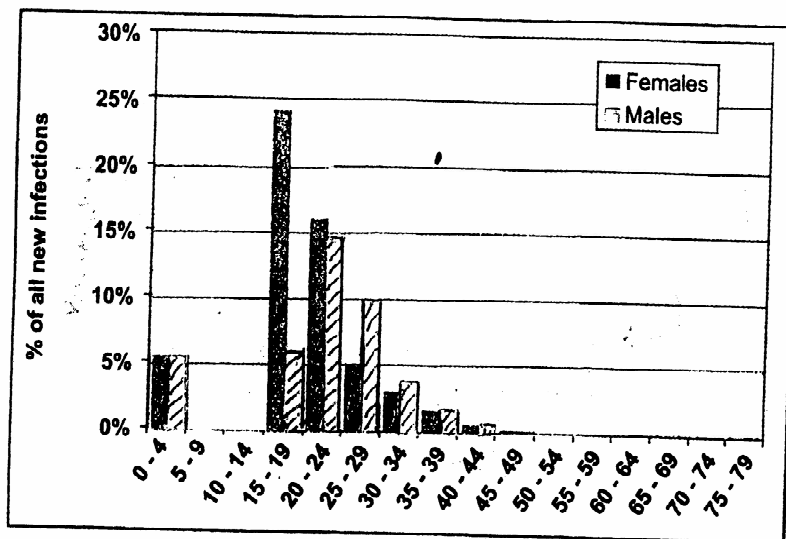
iii) 1:2 25 to 29

WORKSHEET 3: THE USE OF PROBABILITY

Example 1: Analysing data in the form of bar graphs

Study the bar graph and answer the questions that follow. Females are given first for each age group (shading is unclear in the scanning).

Figure 2. Proportion of all new infections projected between 1995 and 2010 by gender and age categories



1. What is recorded on the vertical axis of the graph? What is the scale used on this axis?

Percentages of all new infections. The scale is 5

2. What is recorded on the horizontal axis of the graph?

Gender and age categories

3. Why are there two different bars drawn for each age group?

Because they identify to genders male and female.

4. Why are the bars drawn in different colours (or shadings)?

Because the darker shadings are for the females and the lighter one is for males

5. What age group is expected to have the greatest number of new infections?

20-24 What percentage is this? 16% - 14%

6. Which age group has the greatest percentage of new infections for females?

15-19 What percentage is this? 24%

7. Which age group has the greatest percentage of new infections for males?

20-24 What percentage is this? 14%

8. Which age groups have the same percentage of new infections for males and females?

0-4

Why do you think this is the case?

Because they are not sexually Active.

9. Which age groups have a zero percentage infection rate? 45-49; 50-54;
60-64; 65-69; 70-74; 75-79

(Remember that all the percentages are rounded off to the nearest unit so for these it could be 0.002%) Why do you think these age groups have a zero

percent new infection rate? Because they are trust-with
with or they are no longer sexual Active

10. Which age groups have the following (approximate) ratios of female to male

infections: i) 1:1 0-5 ii) 4:1 15-19

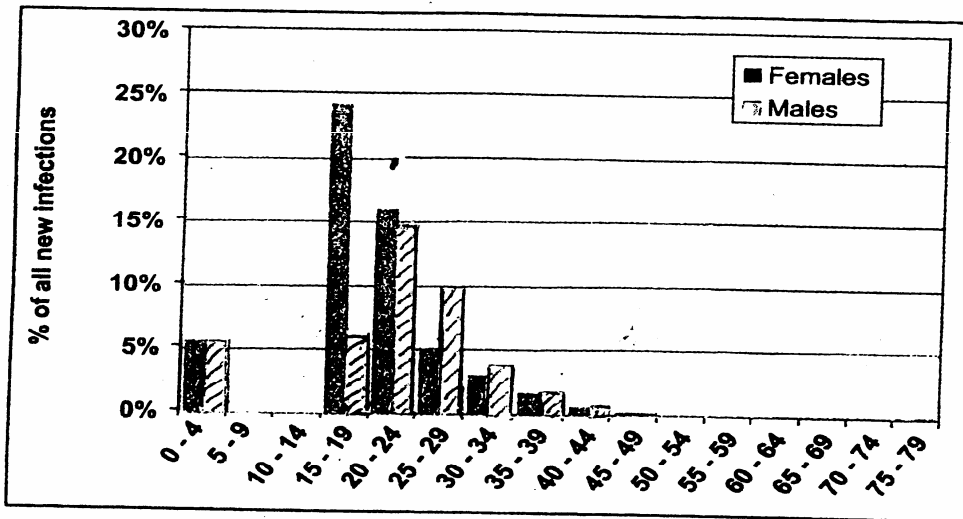
iii) 1:2 25-29

WORKSHEET 3: THE USE OF PROBABILITY

Example 1: Analysing data in the form of bar graphs

Study the bar graph and answer the questions that follow. Females are given first for each age group (shading is unclear in the scanning).

Figure 2. Proportion of all new infections projected between 1995 and 2010 by gender and age categories



1. What is recorded on the vertical axis of the graph? What is the scale used on this axis?

Vertical and horizontal scales

2. What is recorded on the horizontal axis of the graph?

%/percent of all new infections

3. Why are there two different bars drawn for each age group?

To show the percentage of males and females

4. Why are the bars drawn in different colours (or shadings)?

To present the male and female

5. What age group is expected to have the greatest number of new infections?

15 to 19 What percentage is this? 5%

6. Which age group has the greatest percentage of new infections for females?

45-49 20-24 What percentage is this? 16%

7. Which age group has the greatest percentage of new infections for males?

40-44 20-24 What percentage is this? 15% 16%

8. Which age groups have the same percentage of new infections for males and females?

0-4 and 5-9

Why do you think this is the case?

Because many people has H.I.V and A.I.D.S.

9. Which age groups have a zero percentage infection rate? 9-14 and

29-44

(Remember that all the percentages are rounded off to the nearest unit so for these it could be 0.002%) Why do you think these age groups have a zero

percent new infection rate? Because children at the age
of 9-14 aren't had sex yet.

10. Which age groups have the following (approximate) ratios of female to male

infections: i) 1:1 0-4 and 5-9 ii) 4:3 20-24

iii) 1:2 40-44