5. CHAPTER 5: HIV AND AIDS KNOWLEDGE FOR BEHAVIOUR TRANSFORMATION IN THE BIOLOGY CURRICULUM

"He who opens a school door, closes a prison" Victor Hugo[11]

5.1 Introduction

Going into this chapter, the researcher pondered on Victor Hugo's thoughts that education should lead to freedom. While this is a good thought, one wonders if it is true, in the context of Life Sciences and HIV and AIDS. Does learning Life Sciences close the door of unsafe behaviour that could lead to HIV infection? The researcher explores Hugo's thoughts in this chapter in which results on the relationship between the Life Sciences curriculum and behaviour transformation are presented and discussed. This is in response to the first research subquestion of the study that asked:

> *How does the Life Sciences curriculum address HIV and AIDS for safe behavioural preferences among students?*

As discussed in Chapter 2 a curriculum ideology determines the aims and the nature of knowledge, the learning process, how the student is viewed, the teaching process and assessment for any subject (Schiro, 2008; Pinar, 2004; Kliebard, 1996; Posner, 1992; McNeil, 1977). Through the above research subquestion therefore, the researcher investigated the curriculum ideology for Life Sciences, with a view that the ideology will indicate if HIV and AIDS are presented in Life Sciences for behavioural transformation (Schiro, 2008). Furthermore content knowledge taught in Life Sciences was investigated. As argued earlier the researcher believes that by identifying and quantifying specific concepts related to HIV and AIDS, it is possible to understand how the Life Sciences curriculum addresses HIV and AIDS, and whether behavioural transformation is in any way signified.

[11] http://www.brainyquote.com

5.2 Results

5.2.1 Curriculum ideology for Life Sciences

As stated in Chapter 4 the researcher used a specific criterion to examine components of the curriculum to determine the curriculum ideology for Life Sciences. The document analysed was the National Curriculum Statement (NCS) for Life Sciences (Department of Education, 2003a).

5.2.1.1 The aim of the subject of Life Sciences

The aim of Life Sciences is embedded in its purpose as stipulated in the curriculum statement. According to this document (Department of Education, 2003a: 9), the aim of Life Sciences is to ensure that:

> "Learners explore those concepts that are essential for understanding basic life processes and the interrelationship and interdependence of components of the living and the physical world. Learners will develop inquiry, problem solving, critical thinking and other skills, and will use them to interpret and use Life Sciences concepts in explaining phenomena. They will be able to apply scientific knowledge in their personal lives and as responsible citizens in ways that will contribute to a healthy lifestyle and the sustainable management of resources. Through the study of the Life Sciences, learners can develop an understanding of the nature of science, the influence of ethics and biases, and the interrelationship of science, technology, indigenous knowledge, environment and society.
>
> The subject Life Sciences enables learners to understand biological, physiological, environmental, technological and social processes that impact on the environment (e.g. food production, distribution and consumption, health promotion, conservation, sustainable living and genetic engineering). All these have implications for the socio-economic and technological advancement of society. A study of concepts and processes in the Life Sciences uses contributions from the past to inform the present, and therefore promotes construction of new knowledge. Exploring indigenous

> knowledge systems related to science exposes learners to different worldviews and allows them to appreciate, compare and evaluate different scientific perspectives."

According to the above extract from the curriculum statement (Department of Education, 2003: 9), students should develop scientific skills that can be used for constructing content knowledge and then use such knowledge to better understand the environment and also apply such knowledge in their lives. What emerges strongly from the above extract is that with Life Sciences knowledge and skills, students are envisaged to improve their lives. In relation to HIV and AIDS, the curriculum statement particularly indicates that students should use knowledge and skills in order to live healthy lifestyles.

While the above aims are not directly associated with any curriculum ideology as indicated in Table 2.1, it is important to note that Life Sciences is founded on the ideology of "*social transformation*" (Department of Education, 2003a: 2). However this social transformation is not related to social efficiency or social reconstruction (Section 2.3.3.3), even though the terminology appears to be synonymous. Social efficiency and social reconstruction as defined by Schiro (2008), Cotti and Schiro (2004), Kliebard (1996) and Schubert (1996) refer to development of academic skills and knowledge that can be used to prepare students for their responsibilities as adults and eliminate deleterious practices in society by alerting students to these practices and teaching them corrective measures. On the other hand Life Sciences' social transformation "is aimed at ensuring that the educational imbalances of the past are redressed, and that equal educational opportunities are provided for all sections of the population" (Department of Education, 2003a: 2).

The social reconstruction ideology is however reflected in the curriculum. This is because the curriculum indicates that students should be taught to "apply" knowledge in everyday life. As indicated in Chapter 2, the use of scientific knowledge to better society can be regarded as social reconstruction.

Results also show that Life Sciences uses a student centred ideology to foster "construction" of knowledge. According to Schiro (2008) (see also Table 2.1) a student-centred ideology encourages students to construct their own knowledge through personal creative response to experience (Table 2.1; Schiro, 2008). However, by teaching a pre-determined set of scientific concepts, Life Sciences can be viewed as also adopting a scholar academic ideology because the curriculum is not "adapted according to students' or society's needs". Overall, based on

the subject aims, it appears that Life Sciences adopts and merges different curriculum ideologies.

5.2.1.2 Knowledge prescribed in the Life Sciences curriculum

Content knowledge prescribed for Grade 11 Life Sciences learners is organized within Learning Outcome 2 which deals with the construction and application of Life Sciences knowledge. Here a scholar academic ideology is evident from the curriculum's prescription of content knowledge to be taught (and acquired). The curriculum statement (Department of Education, 2003a) indicates that Life Sciences content knowledge is divided into four knowledge areas, which develop progressively from Grade 10 to Grade 12.

Table 5.1 Content knowledge within the three knowledge strands extracted from the Grade 11 Life Sciences curriculum statement (Department of Education, 2003: 32 - 40)

Knowledge area	Content
1. Tissues, cells and molecular studies	• Micro-organisms (viruses, bacteria, protists and fungi): • Diseases (e.g. rust, blight, rabies, HIV/AIDS, cholera, tuberculosis, malaria, thrush); • Immunity.
2. Structure, control and processes in basic life systems of plants and humans	• Support (structural). • Transport. • Excretion. • Nervous and endocrine systems. • Related diseases of the above. • Medical conditions (e.g. stroke, diabetes, hyperthyroidism).
3. Environmental studies	• Human influences on the environment (air, land and water issues). • Sustaining our environment. • Air, land and water-borne diseases.
4. Diversity, change and continuity	• Population studies: - characteristics of populations, - population growth, - population fluctuation; - limiting factors. • Social behaviour: - predation; - competition. • Managing populations.

These knowledge areas are *i)* tissues, cells and molecular studies (Knowledge Area 1), *ii)* structures and control of processes in basic life systems (Knowledge Area 2), *iii)* environmental studies (Knowledge Area 3), and *iv)* diversity, change and continuity (Knowledge Area 4) (Department of Education, 2003a: 32). Within each knowledge area, there is specific content that must be taught (Table 5.1). This prescription of content knowledge to be taught is typical of a scholar academic ideology, where knowledge organized as didactic statements that accurately represents a discipline (such as biology) is acquired by students (Cotti & Schiro, 2004).

As shown in Table 5.1, knowledge related to HIV and AIDS which is the focus of the current study is addressed under Knowledge Area 1, Tissues, Cells and Molecular Studies. Within this area, students are taught about different organisms including viruses such as the Human Immunodeficiency Virus. Diseases caused by such organisms (for example AIDS) are also taught within this Knowledge Area. Students are also taught how the human body defends itself through its immune system.

5.2.1.3 Instructional process

The ideology of the curriculum can also be identified by understanding the prescribed instructional process (Schiro, 2008; Table 2.1). The Life Sciences curriculum statement however does not indicate which instructional process should be followed. Instead this document refers to another document, the Learning Programme Guideline (Department of Education, 2007).

The Learning Programme Guideline (Department of Education, 2007) indicates that there is no universally adopted instructional strategy for Life Sciences. Instead, "individual teachers should design Lesson Plans using the grade-specific Work Schedule as the starting point" (Department of Education, 2007: 4). These lesson plans and work schedules are designed by teachers within their school based on the needs and abilities of their students.

Lesson plans "contain a coherent series of teaching, learning and assessment activities... and also indicate other relevant issues to be considered when teaching and assessing a subject" (Department of Education, 2007: 5). Each lesson plan must stipulate a teaching method

preferred by the teacher which indicates "how teaching and learning will take place, that is, how each activity will be presented in the classroom" (Department of Education, 2007: 16). Recommended teaching methods include "microscopy work, research, excursions, group work, experimental work, case studies, problem solving, interviews, questionnaires, guest talks and career opportunities" (Department of Education, 2007: 32). No further details are provided as to how the above methods should be used and whether teachers have the skills to use these methods. It also means each school will probably have a unique instructional process that suits both teachers and students within the school. It must be pointed out that there is no indication of whether teachers have the skills and resources required to carry out this task.

Nevertheless one can infer that a student-centred ideology is adopted in that teachers retain the freedom to use their creativity to develop instructional processes based on the needs of their students. Furthermore an overlap of ideologies is also evident in that the curriculum (Department of Education, 2007) does not prescribe particular instructional strategies. Instead teachers have the freedom to expand concepts and to design and organise learning experiences according to their local circumstances. This implies that the curriculum may not always be implemented as is (that is, scholar academic and social efficiency ideologies), but can be adapted to suit the needs of students and societies (an element of student-centred and social reconstruction ideologies).

5.2.1.4 The nature and the role of students in the instructional process

Regarding the role of students, the Life Sciences curriculum (Department of Education, 2003a: 2) "encourages a student-centred and activity-based approach to education." This view clearly demonstrates that a student-centred ideology is favoured. The curriculum (Department of Education, 2003a: 2) also emphasizes elements of a student-centred ideology in that students are expected to "work effectively with others as members of a team, group, organisation and community" as well as "organise and manage themselves and their activities responsibly and effectively." Based on Table 2.1 the nature and the role of students in the learning process in Life Sciences can be regarded as tilting towards a student-centred ideology.

The curriculum statement (Department of Education, 2003a: 5) also states that Life Sciences students should "be imbued with the values and act in the interests of society." This view suggests that Life Sciences' vision of their students is based on the social efficiency ideology which seeks to ensure that students play particular and important roles in and to the benefit of the society.

5.2.1.5 The role of teachers during instruction

Whereas the curriculum statement (Department of Education, 2003a) indicates that students play an active role during instruction, teachers are assigned a number of critical roles. The curriculum statement indicates that teachers are "mediators of learning, interpreters and designers of Learning Programmes and materials, leaders, administrators and managers, scholars, researchers and lifelong learners, community members, citizens and pastors, assessors, and subject specialists."

A number of inferences can be made from the above extract from the curriculum statement. For instance, it emerges that teachers are viewed as a source of information for students, which is characteristic of scholar academic ideology. However, the curriculum statement also implies that teachers need to make "decisions regarding the [instructional] sequence" based on students' abilities, which is a characteristic of a student-centred ideology. This also means teachers ought to have a sound understanding of how to recognize and address barriers to learning, and how to plan for diversity. In other words, teachers should adapt the curriculum and instruction according to the needs and abilities of students, which is an element of a student-centred ideology.

Besides the above, teachers are responsible for assessing students by "designing assessment tools" (Department of Education, 2003a: 43) which are used to assess students in all skills throughout the course of learning. Life Sciences teachers are also expected to design and use assessment tools using specific procedures that are prescribed by the Department of Education. Therefore it appears that teachers' assessment in Life Sciences favours scholar academic and social efficiency ideologies. This is because in these ideologies, the nature of assessment tools is normative and criterion reinforced (Table 2.1). In general, the role of Life

Sciences teachers overlaps between student-centered, scholar academic and social efficiency ideologies.

5.2.1.6 The purpose of assessment

According to the Department of Education (2003a: 41) "before a teacher assesses learners, it is crucial that the purposes of the assessment be clear and unambiguous. Understanding the purposes of assessment ensures that an appropriate match exists between the purposes and the methods of assessment. This, in turn, will help to ensure that decisions and conclusions based on the assessment are fair and appropriate for the particular purpose or purposes. There are many reasons why learners' performance is assessed. These include monitoring progress and providing feedback, diagnosing or remediating barriers to learning, selection, guidance, supporting learning, certification and promotion."

This implies that one of the purposes of assessment is to measure student progress and to certify that students have the skills that are developed in a particular grade, a feature of scholar academic and social efficiency ideologies. In this regard there are two types of formal assessment, namely continuous or school-based assessment as well as internal end-of-year examination. As indicated above, continuous assessment is used to measure students' progress in attaining skills and knowledge within a grade. Continuous assessment may also be used to diagnose students' abilities to facilitate further learning. End-of-year assessment is used to certify that students have attained skills and knowledge required in the subsequent grade. Both continuous and end-of-year assessments described here are typical of scholar academic and social efficiency ideologies. However it also appears that assessment may be used to rank students for a future in the discipline (a scholar academic ideology), such that only those students who acquire a certain level (rank) are deemed ready to progress to the next grade. The curriculum statement provides a clear guideline for the development of assessment tools. In this regard continuous assessment weighs 25 per cent and end-of-year examination 75 per cent toward the final mark. Therefore, as far as the assessment is concerned, Life Sciences favours a social efficiency and scholar academic ideology.

5.2.1.7 Conclusion: the curriculum ideology for Life Sciences

Based on the above results there is no clear indication as to which single curriculum ideology is favoured in Life Sciences. The aim of Life Sciences suggests that a scholar academic ideology is preferred seeking to ensure that students accumulate prescribed knowledge (Ravitch, 2000). This scholar academic ideology is further observed in that the curriculum specifies which discipline-specific knowledge should be taught. Looking at the instructional process however there seems to be an indication that Life Sciences does not strictly adhere to a scholar academic ideology. As shown in the results both student-centred and social reconstruction ideologies are incorporated. Furthermore a student-centred ideology was observed with respect to the role of students and teachers during instruction. To this end scholar academic and social efficiency ideologies were also evident. While there is obvious overlap between curriculum ideologies, there is little evidence of social reconstruction, suggesting that behavioural transformation may not be a focus in the existing curriculum for Life Sciences. In the context of the study this deduction means it is less likely that Life Sciences students will display a unique behavioural output compared with non-Life Sciences students. Furthermore one can deduce that the Life Sciences curriculum is primarily concerned with the teaching of HIV and AIDS knowledge, and probably not with the purpose of transforming social norms, values and beliefs.

5.2.2 Life Sciences concepts and skills that may affect HIV and AIDS behavioural preferences

As stated in Section 4.3, to identify prescribed content knowledge and skills, both the NCS for Life Sciences and textbooks were analysed. Hence results of the two data sources are provided separately in the following subsections.

5.2.2.1 Curriculum Analysis

The NCS for Life Sciences (Department of Education, 2003a) was analysed through generic items applied to the curriculum analysis as outlined in Table 4.4 and Appendix 1. Below are the responses formulated from this Life Sciences curriculum document.

1. ***Which skills (competences) does the curriculum encourage Grade 11 students to attain regarding HIV and AIDS?***

While the curriculum addresses several skills in a broader context, there are particular skills that Life Sciences intends imparting to the students. According to the Life Sciences curriculum statement (Department of Education, 2003a: 10), through Life Sciences, Grade 11 students will develop:

a) "Scientific enquiry and problem-solving skills,
b) Construction and application of scientific knowledge, and
c) Life Science, Technology, the environment and society."

The curriculum indicates that by ascertaining the above-listed skills, students will (amongst other things) become "responsible citizens" (Department of Education, 2003a: 10). According to Schiro (2008) and Table 2.1, "responsible citizenship" is a characteristic of both social efficiency and social reconstruction. By inference it means Life Sciences students would be expected to use their knowledge to take informed decisions in issues such as behaviour. This is reflected in the learning outcomes of Life Sciences which states that the module aims to produce "students who are able to apply knowledge in daily lives for a healthy life style" (Department of Education, 2003a: 9). While the NCS for Life Sciences (Department of Education, 2003a) clearly defines specific skills (such as scientific enquiry and problem-solving skills) that students are expected to attain through Life Sciences, the curriculum does not provide strategies that can be used to develop such skills.

2. ***Which concepts does the curriculum foreground for Grade 11 students in relation to HIV and AIDS?***

In Life Sciences the prescribed knowledge areas are (Department of Education, 2003a: 10):

a) Tissues, Cells and Molecular Studies
b) Structures and control of processes in basic life systems
c) Environmental studies, and
d) Diversity, change and continuity.

HIV and AIDS forms part of the Tissues, Cells and Molecular Studies knowledge area in the Life Sciences curriculum (Department of Education, 2003a: 35; Table 5.2).

Table 5.2 Content knowledge related to Tissues, Cells and Molecular studies for Grades 10 to 12 extracted from the Life Sciences curriculum statement[12]

Grade 10	Grade 11	Grade 12
- Cell structure. - Cell division (mitosis). - Tissues. - Related diseases (for example cancer).	- Micro-organisms (viruses, bacteria, protists and fungi): • Diseases (for example rust, blight, rabies, HIV and AIDS, cholera, tuberculosis, malaria, thrush); • Immunity.	- DNA, protein synthesis. - Chromosomes, meiosis, production of sex cells, diseases (for example Down's syndrome). - Genes, inheritance, genetic diseases.

In relation to HIV and AIDS analysis of the NCS for Life Sciences revealed that Grade 10 Life Sciences teaches cytology (Department of Education, 2003a: 34; Table 5.2). This includes "cell structure, cell division (mitosis) and Tissues and Related diseases (e.g. cancer)." In Grade 11 students learn about micro-organisms, such as viruses and bacteria (Department of Education, 2003a: 35). Here the structure, characteristics and values of these organisms are taught. The Grade 11 Life Sciences curriculum specifically refers to HIV in teaching about viruses (Department of Education, 2003a: 35; Table 5.2). With respect to characteristics of viruses, AIDS is used as a model. Other micro-organisms include tuberculosis (bacteria), malaria (protists) and rusts (fungi). Grade 11 students also learn about the human immune system, particularly the human immune response against drugs, that is drug resistance (Department of Education, 2003a: 35). Students also learn about the immune response by humans against infectious agents such as viruses and bacteria (Table 5.2). Grade 12 Life Sciences students then learn genetics, that is, DNA, RNA and protein structure and function (Department of Education, 2003a: 35).

3. What are the expected HIV and AIDS related learning outcomes of the module?

Grade 11 Life Sciences learning outcomes are the same as those of Life Sciences Grade 10 and 12. The main difference is with respect to continuity where Life Sciences Grade 10 forms a foundation, and Grade 11 and Grade 12 a consolidation (Department of Education, 2003a). As in the other grades, there are three learning outcomes that Life Sciences Grade 11 aims to achieve. These learning outcomes are given in Table 5.3 as they appear in the curriculum statement (Department of Education, 2003a: 11).

[12] This content knowledge is in relation to Learning Outcome 2 which is the construction and application of Life Sciences knowledge

The focus of Learning Outcome 1 is exploring and investigating (Table 5.3). This learning outcome focuses on developing scientific skills related to the scientific process, that is experimental and data-handling skills (Department of Education, 2003a: 11). The specific skills that together make up experimental skills in Life Sciences are following instructions, making observations and measuring trends (Department of Education, 2003a: 11; Table 5.3). The curriculum lists at least six data-handling skills, namely identifying, selecting, organizing, presenting, translating and manipulating data (Department of Education, 2003a: 11). In this regard the curriculum breaks down the learning outcome into smaller components which will define whether students have achieved the data-handling skills or not.

Table 5.3 Summary of learning outcomes for Life Sciences (extracted from Department of Education, 2003a: p. 11-12)

Learning outcome	Focus	Definition
Learning outcome 1	Scientific Inquiry and Problem-solving Skills	The student is able to confidently explore and investigate phenomena relevant to Life Sciences by using inquiry, problem-solving, critical thinking and other skills.
Learning outcome 2	Construction and Application of Life Sciences Knowledge	The student is able to access, interpret, construct and use Life Sciences concepts to explain phenomena relevant to Life Sciences.
Learning outcome 3	Life Sciences, Technology, Environment and Society	The student is able to demonstrate an understanding of the nature of science, the influence of ethics and biases in Life Sciences, and the interrelationship of science, technology, indigenous knowledge, the environment and society.

The second learning outcome for Life Sciences Grade 11 is construction and application of knowledge (Table 5.3). According to the Life Sciences curriculum this learning outcome can be attained through four key areas, namely accessing information, interpreting information, constructing knowledge as well as using knowledge (Department of Education, 2003a: 11). Accessing and interpreting information depends on several factors such as the ability to communicate in the field using written, spoken or visual language (as used in textbooks) (Lowe, 2003).

Another focus area of the second learning outcome concerns the application of knowledge in daily lives (Department of Education, 2003a: 11; Table 5.3). According to Bloom's taxonomy, students are expected to use their knowledge and skills in new situations (Forehand, 2005; Anderson *et al.*, 2001). Baumgartner (2001) calls this the cognitive-rational approach to transformative learning. Here learned skills and information are used by students

to deal with known and novel situations. This application of skills and knowledge results in empowerment of students (Baumgartner, 2001). The researcher believes that Learning Outcome 2 (Table 5.3) could be related to behaviour transformation where students apply academic and functional HIV and AIDS knowledge to adopt safe behaviour.

The third learning outcome deals with the integration of knowledge (Department of Education, 2003a: 12), particularly integrating new knowledge with "old" knowledge. This may refer for instance to the need for the integration of western knowledge with indigenous African knowledge.

4. ***Which assessment strategies is the Life Sciences curriculum endorsing for HIV and AIDS knowledge and skills?***

The Life Sciences curriculum recommends a variety of assessment methods that can be used in Life Sciences Grade 11 to assess presumably all knowledge and skills (including that related to HIV and AIDS). These include baseline assessment, diagnostic assessment, formative assessment and summative assessment (Department of Education, 2003a: 42). According to the NCS for Life Sciences, baseline assessment should be used to "establish what students already know and can do" (Department of Education, 2003a: 12) that is, prior knowledge. According to the curriculum, baseline assessment is important to help teachers design their lessons in such a way that students are able to build on their already existing knowledge and skills (Department of Education, 2003a). Diagnostic assessment should be used to identify or discover learning barriers (Department of Education, 2003a: 42). The Life Sciences curriculum statement argues that diagnostic assessment helps teachers decide on remediation strategies that would help students perform better (Department of Education, 2003a). Formative assessment is explained as any form of assessment that is aimed at giving students feedback on their progress (Department of Education, 2003a: 42). This form of assessment (according to the curriculum statement) is used to monitor and support the learning process. Finally, summative assessment should be used to "record a judgement of the competence or performance of the student" (Department of Education, 2003a: 42). With all these assessment methods, the Life Sciences curriculum also stipulates specific guidelines for assessment (Department of Education, 2003a: 43-47). Guidelines are important as they ensure that across the spectrum, Grade 11 students are assessed in a standardized manner (Department of Education, 2003a).

The Life Sciences curriculum statement suggests that assessment should (Department of Education, 2003a: 43):

a) "be understood by the student and by the broader public;
b) be clearly focused;
c) be integrated with teaching and learning;
d) be based on the pre-set criteria of the Assessment Standards;
e) allow for expanded opportunities for students;
f) be student-paced and fair and
g) be flexible."

These above listed parameters are consistent with the basic principles of Outcomes Based Education as discussed by Killen (2002). It is not clear from the document analysed whether teachers have sufficient skills, time and resources to carry out all the above assessments. Overall therefore, any of the above strategies can be used to assess content knowledge and skills related to HIV and AIDS.

At this stage results from the textbook analysis will be presented.

5.2.2.2 Textbook analysis

With regard to textbook analysis the researcher investigated sections relating to microorganisms, diseases and immunity which are part of Tissues, Cells and Molecular Studies (Section 4.3.3). Also investigated in the current phase of the study were those that relate to virology (including viruses and HIV and AIDS), bacteriology (including bacteria and TB), immunology (including immunity and vaccination) as well as the circulatory system. The literature also indicates that the above concepts can be used to describe HIV and AIDS (Starr, Taggart, Evers, & Starr, 2009; Dimmock *et al.*, 2007; Audesirk *et al.*, 2004). As suggested in Chapter 4 specific items were used to analyse the two sampled textbooks, namely *Focus on Life Sciences* (Clitheroe *et al.*, 2008) and *Shuters Life Sciences Grade 11 Students Book* (Ayerst *et al.*, 2008). Results are presented in the following subsections[13].

[13] Henceforth in the current section reference to the textbooks that were analysed does not include author names in order to improve readability and avoid unnecessary repetition.

1. ***Which HIV and AIDS related concepts have the highest page volume in the textbooks?***

The researcher determined concepts that have the highest page volume in the textbooks (Ott & Donnelly, 1999). The first analysis of selected textbooks therefore dealt with the extent of the coverage given to each HIV and AIDS topic (Ott & Donnelly, 1999). As argued in Chapter 4, this view was because researchers (Ott & Donnelly, 1999) argue that textbooks use high page volumes formulating concepts that are valued the most, while those concepts that are less important are given less attention and page volume (Matson & LoVullo, 2009; Ott & Donnelly, 1999).

In the textbooks under study, there was variation in page volume for each HIV and AIDS topic per textbook (Table 5.4). For instance *Shuters Life Sciences Grade 11 Students Book* dedicates 7% page volume (pages 175-177 and 189) on viruses while *Focus on Life Sciences* spends 13% (pages 78-83). Related to viruses, *Shuters Life Sciences Grade 11 Students Book* dedicates 3% page volume (that is, 291 and 221) to HIV and AIDS, while *Focus on Life Sciences* dedicates 6% (81-82 and 161) (Table 5.4).

Table 5.4 The variation in page volume given to concepts related to HIV and AIDS in Shuters Life Sciences Grade 11 Students Book and Focus on Life Sciences

Topic	Shuters Life Sciences			Focus on Life Sciences		
	Number of pages	% out of total pages [58]	Reference Pages	Number of pages	% out of total pages [47]	Reference Pages
Viruses	4	7	175-177 & 189	6	13	78-83
Bacteria	6	10	180-182 & 187-189	16	34	64-76
HIV and AIDS	2	3	291 &221	3	6	81-82 & 161
TB	2	3	188-189	1	2	77
Immunity	8	14	212-219	0	0	
Circulatory system	18	31	270-272 & 275-290	21	45	139-160
Vaccination	3	5	222-224	2	4	84-85

As shown in Table 5.4 *Shuters Life Sciences Grade 11 Students Book* dedicates two pages on HIV and AIDS knowledge. However it is noteworthy that such coverage consists only of two paragraphs (pages 221 and 291). The researcher noted that on page 221, *Shuters Life Sciences Grade 11 Students Book* indicates that Unit 11 (page 229) further discusses HIV and AIDS. However the researcher found that Unit 11 (page 229) does not discuss HIV and AIDS but is

titled "Unit 11: Transport and support in plants." It is not clear to the researcher as to why the textbook authors presented "Transport and support in plants" instead of HIV and AIDS as they suggested on page 221. The researcher posits that, *Shuters Life Sciences Grade 11 Students Book* misses an opportunity to further present scientific knowledge of HIV and AIDS.

2. What is the textbooks' approach to HIV and AIDS related concepts?

The results indicated that there is a difference in the approach to HIV and AIDS knowledge between Grade 11 textbooks analysed in the study. For example unlike *Shuters Life Sciences Grade 11 Students Book's* two paragraphs on HIV and AIDS, *Focus on Life Sciences* uses a different approach to describe HIV and AIDS. For example on page 80 the authors discuss lymphocytes and viral reproduction. (HIV resides and reproduces in immune cells called lymphocytes (Starr *et al.*, 2009; Dimmock *et al.*, 2007; Audesirk *et al.*, 2004)). On page 81, *Focus on Life Sciences* discusses AIDS using a case study, a diagram illustrating HIV as well as text. On page 82 the authors of *Focus on Life Sciences* present HIV and AIDS statistics in South Africa, particularly related to teenagers. On page 161 *Focus on Life Sciences* presents information on HIV and AIDS under four topics, namely "what causes AIDS, how is AIDS spread, how do you know if your have AIDS, and what happens to someone with AIDS?"

It was also found that the two textbooks place the most emphasis on the circulatory system (Table 5.4). The motive behind this trend could be that it is a tradition for the circulatory system to be presented as is in the Grade 11 textbooks. The researcher however posits that it is critical that students understand this system as it plays a significant role in HIV and AIDS. For instance research has shown that one of the most common ways through which HIV is transmitted between persons is through exchange of contaminated blood (as well as other bodily fluids) (Dimmock *et al.*, 2007; Audesirk *et al.*, 2004). As a result by understanding the characteristics of the circulatory system, for example blood, students may be in a better position to understand how blood infection occurs and what the effects of this contamination are.

Studies of virology have also shown that viruses such as HIV require a specific environment for survival (Dimmock *et al.*, 2007). Therefore by understanding the composition of a circulatory system students may be in a better position to understand why HIV resides in

certain types and concentrations of bodily fluid. However to enhance this understanding, the researcher believes that it is important that students also understand the structural and functional characteristics of viruses, especially HIV, which is covered in both *Focus on Life Science* and *Shuter's Life Science* (Table 5.4). This knowledge could help students integrate their knowledge of viruses with knowledge of the circulatory system and be able to understand how HIV enters the body, how it gets transported throughout the body and what the effects of having HIV in the body are.

Given the above the researcher believes that it is crucial that students understand the body mechanisms responsible for minimizing the viral effects, especially in relation to the failure of the body to eliminate HIV (that is immunodeficiency). In this vein *Shuters Life Sciences Grade 11 Students Book* dedicates significant page volume (14%) addressing the theme of immunity (that is pages 212-219; Table 5.4). It is through learning about the immune system that students will know HIV's target cells, related binding mechanisms and factors that lead to immune deficiency (Dimmock *et al.*, 2007; Audesirk *et al.*, 2004). This information is critical as students will also learn medical means that are available to boost the immune system when attacked by the virus. Related to this *Shuters Life Sciences Grade 11 Students Book* spends three pages (that is 222-224) addressing the theme of vaccination (Table 5.4). Through the knowledge of vaccination, students get to learn more about supplements that are available to lower the impact of immune deficiency. Notably, whereas *Shuters Life Sciences Grade 11 Students Book* spends such page volume on immunity and vaccination issues, *Focus on Life Sciences* does not address this topic at all even though this topic is recommended in the curriculum statement (see Table 5.4).

The researcher observed that both textbooks do not show learners how the different concepts are related to each other (for example, link between immunity and the circulatory system). The researcher also noted that even though concepts related to HIV and AIDS are presented, there is no clear link with HIV and AIDS. Instead concepts are presented as fragmented knowledge. This means students have to create links for themselves, which might not be possible for some. The implications of this remain to be determined.

3. What is the frequency of appearance for HIV and AIDS related concepts?

The researcher also determined the frequency of specific HIV and AIDS-related terms (Section 4.3.3). As stated in Section 4.3.3, the frequency of appearance of the terms was based on the total number of pages that attend to HIV and AIDS related knowledge as given in Table 5.4. Here the researcher sought to first identify terms used by the two textbooks to describe HIV and AIDS. These terms are found in sections discussing HIV and AIDS specifically (Table 5.5). Thereafter the frequency of appearance was calculated manually by the researcher. It must be noted that concepts that are regarded in the literature as significant for HIV and AIDS education that did not appear in the Life Sciences textbooks were also identified.

In Table 5.5 it is notable that there is a substantial difference in coverage of concepts in the textbooks. For instance *Focus on Life Sciences* uses the term "Human Immunodeficiency Virus or HIV" two times more than does *Shuters Life Sciences Grade 11 Students Book*. *Focus on Life Sciences* uses the term virus two times more than *Shuters Life Sciences Grade 11 Students Book*. This variation in the use of terms may reflect what the textbook values more (Krippendorff, 2004). For instance as seen in Table 5.4 *Shuters Life Sciences Grade 11 Students Book* seems to place more emphasis on immunity rather than any one disease. In this vein, it is noteworthy that *Shuters Life Sciences Grade 11 Students Book* does not address the question of HIV transmission from one person to the other (Table 5.5). Researchers (Anderson & Beutel, 2007; Page *et al.*, 2006) have argued that based on the pandemic nature of HIV and AIDS, this question needs to be addressed. One way of doing this could be to use HIV to demonstrate how viruses enter their hosts, reproduce and exhibit their effects. Here the concepts of immunity could be emphasised using HIV and AIDS as a practical and most relevant concept. Furthermore using HIV and AIDS to discuss viruses and immunity can ensure that not only do students have a better understanding of these concepts (that is, immunity) but also understand the biochemistry of HIV and AIDS (Dimmock *et al.*, 2007).

Both textbooks, (*Shuters Life Sciences Grade 11 Students Book* and *Focus on Life Sciences*) do not present any information related to multiple strains of HIV, CD 4 + T cells (the specific immune cells targeted by HIV), the effects of HIV in the body as well as the use of antiretroviral drugs in HIV and AIDS treatment (Table 5.5). The concepts not presented in the Grade 11 text books (*Shuters Life Sciences Grade 11 Students Book* and *Focus on Life*

Sciences are however regarded by other researchers (Dimmock *et al.*, 2007; Audesirk *et al.*, 2004) as important for students to understand scientific knowledge of HIV and AIDS.

From the above results the researcher wonders about the effects of knowledge presented in the textbooks on students' understanding of HIV and AIDS. In this regard students' understanding of HIV and AIDS will be directed by the curriculum and textbook (Mohammed, 2007). Therefore, it remains to be seen whether students have a complete understanding of HIV and AIDS given the apparent superficiality of HIV and AIDS knowledge presented in the Life Sciences textbooks that were examined.

Table 5.5 List of HIV and AIDS related concepts and their appearance frequency in Grade 11 textbooks

Theme	**Concepts**	**Frequency of appearance of concepts in textbooks**	
		Focus on Life Sciences	**Shuters Life Sciences**
Definitions	Human Immunodeficiency Virus – HIV	19	9
Types	HIV I, HIV II	0	0
Domain	Virus	49	27
Transmission	Unprotected sexual intercourse	2	0
	Transfusion of infected blood	0	0
	Vertical transmission	1	0
	Injection needles	1	0
	Multiple infections	1	0
Target cells	White blood cells	5	6
Binding	Antigen	7	17
	Antibodies	9	23
	Glycoprotein	0	0
	CD 4 receptors	0	0
	Helper T lymphocytes	0	4
	Macrophages	1	2
	CD4 + T cells	0	0
Entry to cell	Plasma membrane glycoproteins	0	0
	Invasion	4	3
	Infection	19	4
Reproduction	Reverse transcription	0	0
	Host cell reproduction machinery	3	7
Effects	Non-specific flu-like symptoms	0	0
	Increase of viral concentration	0	0
	Viral spread	0	0
	Organ infection	19	14
	Asymptomatic phase	0	0
	Drop in CD4 + T cell count	0	0
	Symptomatic phase	0	0
	Acquired Immune Deficiency Syndrome – AIDS	12	6
Treatment	No cure	3	1
	antiretroviral drugs	0	0
Prevention	Condom	1	0
	Safe sex	0	0

Furthermore the researcher wonders whether students' behavioural preferences are directed by textbook content (which determines their concept understanding). Furthermore if students have a limited understanding of HIV and AIDS concepts, what do they base their behavioural practices on? Based on the theory of planned behaviour, one may argue that based on the limited knowledge that students have, societal misconceptions about HIV and AIDS may inform youth's behavioural choices and lead to the spread of HIV and AIDS. This view is in line with transformative learning which indicates that learning should be able to promote responsible behaviour amongst the students by providing them with realistic and scientifically valid information (Baumgartner, 2001; Freire, 2000; Mezirow, 2000).

4. How does the content of the textbooks relate to HIV and AIDS?

As stated earlier, the textbooks examined do not directly indicate how the different HIV and AIDS related concepts are integrated. However looking at Table 5.5, scientific knowledge on HIV and AIDS can be divided into at least eleven themes (Section 4.3.3). These themes are, definition, types, domain, transmission, target cells, binding, entry to cells, reproduction, effects, treatment and prevention (Table 5.5). As stated in Section 4.3.3, the researcher used these domains to explain how the content of the textbooks relates to HIV and AIDS (Table 4.4).

Looking at Table 5.5 it appears that both textbooks (*Focus on Life Sciences* and *Shuters Life Sciences Grade 11 Students Book*) frequently refer to HIV in an attempt to describe what HIV and AIDS are. However these textbooks do not explain the concept of multiple HIV infections, through which the variants of HIV are most relevant (Audesirk *et al.*, 2004). While one of the textbooks, *Focus on Life Sciences*, briefly discusses the modes of transmission of HIV from person to person, this concept (of transmission) is not discussed in detail. Audesirk *et al.* (2004) suggest that HIV can be transmitted through at least five different mechanisms. However *Focus on Life Sciences* mentions only four of the transmission mechanisms (Page 161; Table 5.5). *Focus on Life Sciences* only mentions the modes of transmission (Page 161) but does not discuss what these modes entail.

The target cells of HIV are white blood cells (Dimmock *et al.*, 2007; Audesirk *et al.*, 2004). Both the Grade 11 textbooks mention this concept (of HIV target cells) at almost the same

frequency (Table 5.5). However the biochemistry of why HIV targets white blood cells is not discussed. For instance the concepts of glycoproteins, CD 4 receptors and CD 4 + T cells are not mentioned (Table 5.5). The textbooks only refer to the "invasion" and "infection" of the host cells by the virus. For example on page 161, *Focus on Life Sciences* states: "The virus gets into your blood and *infects* your body." In explaining the concepts of invasion and infection, the textbooks used generic terms "enter" and "attack." For example *Shuters Life Sciences Grade 11 Students Book* on page 221 states: "HIV *attacks* the helper T-lymphocytes of our body and destroys them."

Generic viral reproduction is used in both textbooks to describe how HIV reproduces. In this instance simplified schematic diagrams are used to depict various stages of viral behaviour inside the host cells. The Grade 11 Life Sciences textbooks use artistic, greyscale pictures that do not provide the magnification (for example Figure 4.2 on page 80 in *Focus on Life Sciences*). In *Focus on Life Sciences* some of the diagrams (for example Figure 4.21 page 78 and Figure 4.24 page 81) are not discussed or referenced in the text, which would make it difficult for students to understand according to Mayer (2001).

5.2.2.3 Conclusion: Life Sciences concepts and skills that could influence behaviour

Data analysis in Sections 5.2.2.1 and 5.2.2.2 (curriculum and textbooks analyses) indicates that Life Sciences is concerned with the development of scientific skills. Even though application of knowledge to real life is referred to in the curriculum, no further guidance is provided as to how these skills should be developed, especially in relation to HIV and AIDS behaviour. Instead there is evidence that HIV and AIDS knowledge is taught primarily from a scholar academic perspective. This view is supported by the recommended assessment strategies and learning outcomes (Section 5.2.2.1), which focus on assessing students' understanding of concepts rather than their behavioural practices.

Results also show that according to the NCS for Life Sciences, Life Sciences develops specific concepts and skills and has assessment strategies to evaluate specific learning outcomes. The idea of integrating the construction of content knowledge (which is presented in Section 5.2.2.1 number 2) and development of skills (as indicated in Section 5.2.2.1

number 1) in a single learning area is in line with Carnine and Carnine (2004) who argue that when science content incorporates instructional design principles, students' comprehension of scientific content and development of skills improves.

While the study has been able to identify a set of skills (from curriculum analysis) and content knowledge (from textbook analysis) that is intended to be taught in Life Sciences, there is no evidence to suggest that these skills and content knowledge could influence students' behavioural preferences in the context of HIV and AIDS. However the curriculum statement suggested that students should "apply scientific knowledge in their personal lives and as responsible citizens in ways that will contribute to a healthy lifestyle" (Department of Education, 2003a: 9). Furthermore according to researchers (Maynard *et al.*, 2001; Pakaslahti, 2000) there is an association between acquisition of knowledge and certain types of behaviours. For example aggressive behaviour among students can be associated with problem-solving skills and concept understanding (Williams & Noyes, 2007; Maynard *et al.*, 2001; Pakaslahti, 2000).

Textbook analysis also showed that content knowledge taught in Life Sciences in relation to HIV and AIDS covers various topics which differ according to textbook. In this regard it emerged from the study that textbook interpretations of the NCS for Life Sciences vary. This variation is evident in the manner in which textbooks attend to various concepts. This variation was also reported by other researchers such as Lemmer, Edwards and Rapule (2008) and Sikorova (2005). According to Sikorova (2005) there is no optimum textbook. While it is acceptable that textbooks will vary, the question, in the context of South Africa, is whether teachers are trained to select textbooks for particular reasons. According to Lemmer *et al.*'s (2008) findings some biology teachers do not have the necessary scientific and pedagogical content knowledge to effectively evaluate and select textbooks. Given the variation in textbook content, the researcher argues that teachers' lack of textbook selection skills and variation in textbook content may impede effective construction of knowledge and development of skills among students. For example students using *Shuters Life Sciences Grade 11 Students Book* (Ayerst *et al.*, 2008) (with only two paragraphs on HIV and AIDS) have a limited chance of effectively developing HIV and AIDS-related content knowledge.

5.3 Making sense of the results: reflecting on literature

The researcher observed two trends with regard to the results from the curriculum and textbooks analyses presented in this chapter. Some results support existing literature in curriculum studies and HIV and AIDS education. Other results however provide new insights into the field. Results that provide new insights are particularly so in the context of Life Sciences curriculum and HIV and AIDS education. As stated in Chapter 1 the researcher is not aware of any work that explores a biology curriculum in order to understand the curriculum-behaviour transformation relationship.

5.3.1 Results that echo existing literature in curriculum studies and HIV and AIDS education

Results that support existing literature are that *i)* Life Sciences has a generic curriculum framework, *ii)* Life Sciences is knowledge-oriented and *iii)* HIV and AIDS content is incorporated into Life Sciences as extra content. These are discussed below.

5.3.1.1 Life Sciences has a generic curriculum framework

As indicated in Chapter 2 researchers agree that a formal curriculum for any subject area ought to have *i)* predetermined subject matter, *ii)* a planned sequence of learning experiences *iii)* certifiable completion *iv)* the institution of learning *v)* socialization and *vi)* social benefits (Waks, 2003; Tanner & Tanner, 1980; Good, 1959; Smith *et al.*, 1957). There is an exception though regarding socialization and social benefits when researchers indicate that some curricula may lack these components (Waks, 2003). Results in the study indicate that the Life Sciences curriculum has the generic curriculum framework which is made up of predetermined subject matter as well as a planned sequence of learning experiences in terms of content knowledge.

5.3.1.2 Life Sciences is knowledge-oriented

According to MacDonald (1971) most subjects in natural sciences such as mathematics, physics and biology are regarded as knowledge-oriented (MacDonald, 1971). In these

subjects students are taught content knowledge and empirical methods of the discipline. This is to ensure that at the end of the learning process students have mastered founding knowledge and modes of enquiry of that particular discipline (MacDonald, 1971). In line with these views, results in the study show that the Life Sciences curriculum statement does prescribe content knowledge in a form of didactic statements. This knowledge should be taught across Grade 10 to 12 presumably to ensure that at the end of the learning process students have an understanding of the overall principles of biology.

The researcher also observed that it is not indicated how content knowledge presented in the examined Life Sciences textbooks relates to everyday life of the students. This observation is in line with findings of other researchers who argue that knowledge-oriented curricula may not address social issues (Schiro, 2008; Waks, 2003; Zuga, 1992). In Schiro's (2008) terms, Life Sciences is not likely to empower students for social progress. Instead students should be taught knowledge and skills that will ensure that they are able to function within the parameters of the discipline (Schiro, 2008; Cotti & Schiro, 2004). Because of this focus on "discipline-ing" students, the researcher believes that Life Sciences can therefore be regarded as knowledge-oriented (Van Manen, 1978).

Furthermore looking at the skills developed through Life Sciences (Section 5.2.2.1 number 1) and the Learning Outcomes (Table 5.3), there is indication no of how students should apply their knowledge to their everyday experiences (Simsek & Kabapinar, 2010). In fact the Learning Outcomes do not seem to relate to students' everyday experiences. Overall these observations imply that the Life Sciences curriculum is probably not informed by social, cultural and/or personal contexts of students (MacDonald, 1971). Based on the Learning Outcomes, particularly the definition of Learning Outcome 2 as presented in Table 5.3, the researcher also argues that the Life Sciences curriculum is only concerned with the acquisition of knowledge and does not address citizenship (Warde, 1960; Waghid, 2002). Furthermore the mention of Learning Outcome 2 (application of knowledge) in the curriculum is not followed up with substantial evidence in the textbooks. As a result the researcher believes that the ability of Life Sciences to foster behaviour transformation would be minimal.

5.3.1.3 HIV and AIDS knowledge is integrated as extra content in Life Sciences

Van Laren (2008) indicates that HIV and AIDS knowledge can be integrated into school curricula as extra content for selected subject areas. This strategy is in line with recommendations for interdisciplinary collaboration in teaching about HIV and AIDS (UNESCO, 2006). The current study also shows that, based on page volumes dedicated for HIV and AIDS-related content, Life Sciences is not exclusively about HIV and AIDS, instead selected aspects have been included and some have been left out.

Van Laren (2008) however indicates that incorporating HIV and AIDS knowledge as extra content may limit the effectiveness of this knowledge in behaviour transformation. Results of the study supported this view. For example the researcher observed that like other biology subjects, Life Sciences follows predominantly a scholar academic ideology, which has been accused of failing to address social needs of students such as behaviour transformation (Schiro, 2008). Behaviour according to researchers (Schiro, 2008, Cotti & Schiro, 2004) can only be affected if education is tailored from social efficiency, student-centred and/or social reconstruction ideologies. Consequently the researcher argues that the HIV and AIDS content incorporated in the Life Sciences curriculum will probably not lead to behaviour transformation.

Furthermore UNESCO (2006) indicates that because there is already a certain degree of content within the subject, which carries a particular level of priority, HIV and AIDS will potentially receive lesser coverage and attention. The researcher also observed this as the extent and depth of content of HIV and AIDS knowledge were limited, at times leaving out critical content. In this instance the researcher noted that some concepts regarded in literature as important for HIV and AIDS education were either missing or addressed superficially in Life Sciences. Furthermore the results of this study have shown that content coverage (such as page volume) given to HIV and AIDS content is rather minimal compared with the complexity of the topic.

5.3.2 New insights concerning HIV and AIDS education in Life Sciences

The main finding that provides a new perspective to the relationship between curriculum and HIV and AIDS behaviour transformation is that, based on the coverage of HIV and AIDS-related content in the Life Sciences NCS and the two textbooks, Life Sciences will probably not lead to behaviour transformation. Firstly the researcher notes that the curriculum makes provisions for the construction and application knowledge, presumably including HIV and AIDS knowledge for behaviour transformation. However there is no guidance for both teachers and students as regards the application of knowledge. Furthermore there is not sufficient content knowledge in the textbooks for meaningful application in everyday life to be made. Secondly the researcher argues that a Life Sciences curriculum that adopts multiple curriculum ideologies will not lead to behaviour transformation. This argument is based on the fact that while Life Sciences inclines more toward a scholar academic ideology, it however has the characteristics of at least three other curriculum ideologies, namely social efficiency, student-centred and social reconstruction ideologies. Consequently the curriculum does not incorporate elements, such as social skills, required to foster behaviour transformation. Furthermore having many curriculum ideologies means there probably will be no standard format for textbooks, particularly with regard to presentation of content. These views are discussed in detail below.

5.3.2.1 Life Sciences does not provide sufficient guidance for behaviour transformation

The researcher found that the curriculum and textbooks have three main learning outcomes (Table 5.3). Learning Outcome 1 relates to the construction and acquisition of knowledge while Learning Outcome 2 relates to application of knowledge in novel situations. With regard to Learning Outcome 1 the researcher argues that the HIV and AIDS related content knowledge recommended for Life Sciences may not be sufficient for students to have a complete understanding of HIV and AIDS. For example it emerged from data that a number of crucial concepts for prevention of HIV and AIDS infection (Table 5.5) are not reflected in the textbooks. This means students cannot have a complete understanding of HIV and AIDS particularly in relation to the transmission and prevention of HIV infection as well as treatment of AIDS if the two textbooks are used. The researcher also believes that if students

do not have sufficient knowledge they will not be able to apply such knowledge in everyday life (Learning Outcome 2). In fact the researcher believes that Life Sciences students will not be able to apply knowledge because there is no guidance in the curriculum or textbooks as regards how students should develop the skills necessary for application of knowledge. In this instance the curriculum indicates that students should be able to apply knowledge but there is no directive as to how and when should this be achieved. Therefore the researcher believes that even though behaviour transformation may be intended in Life Sciences, there is no strategy for its attainment.

5.3.2.2 Life Sciences lacks a clear curriculum ideology for HIV and AIDS education

In Chapter 2 the researcher presented views from various researchers who argue that each subject ought to have a distinct curriculum ideology which frames the subject in terms of content knowledge, instructional processes, assessment strategies as well as learning outcomes (Schiro, 2008; Cotti & Schiro, 2004). This argument was based on the belief that distinctly defining a curriculum ideology will ensure that the objectives related to the subject area are easily attained. As stated in Chapter 2 each curriculum ideology has a specific aim and rationale and therefore subject areas and their curricula could be moulded around these.

Other researchers however indicate that in reality there will be an overlap between curriculum ideologies (Þórólfsson & Lárusson, 2010; Kliebard, 1996). What was not clear from literature however is the consequence of such an overlap, particularly in relation to the development of skills and construction of knowledge that can be used to eliminate social ills and promote citizenship. In the study the researcher explored HIV and AIDS-related content in relation to behaviour transformation in the Life Sciences curriculum.

As shown in the results the researcher observed elements suggesting that at least four curriculum ideologies (namely scholar academic, social efficiency, student-centred and social reconstruction ideologies as discussed in Chapter 2) are reflected in Life Sciences. Overall, the results indicate that Life Sciences has an overlap of different ideologies without an exclusive emphasis on a particular curriculum ideology.

5.3.2.3 HIV and AIDS education in Life Sciences is a result of the epidemic of social response to HIV and AIDS

The researcher believes that the probable reason why Life Sciences lacks a single distinct curriculum ideology for HIV and AIDS is because the incorporation of HIV and AIDS knowledge is a result of the epidemic of social, cultural and economic response. Scholars (Dimmock *et al.*, 2007; Parker & Aggleton, 2003; Stein, 2003) indicate that the epidemic of social, cultural and economic response is characterized by HIV and AIDS awareness programmes, information explosion, stigmatization and discrimination of those infected, research and production of treatment drugs, research on curability of AIDS and factors leading to HIV infection and AIDS. In this regard social, cultural and economic pressure is exerted on the education system to teach knowledge of HIV and AIDS. As observed in the study the researcher believes that the risk is that there are no well defined objectives of such incorporation. Curriculum objectives are always founded on the curriculum ideology. As a result if there is no distinct ideology (such as is the case in Life Sciences) the curriculum will probably not lead to a reduction in the spread of HIV and AIDS through behaviour transformation.

5.3.2.4 Consequences of a lack of a distinct curriculum ideology for behaviour transformation in Life Sciences

The findings of the study indicate that there are several HIV and AIDS-related consequences of having multiple curriculum ideologies in one subject area that teaches HIV and AIDS knowledge; these consequences, to the researcher's knowledge, have not been reported in literature. These consequences are that *i)* the curriculum will not be able to respond to the social needs of students, *ii)* the curriculum will not respond to the epidemics of HIV infection and AIDS, *iii)* students will not be prepared for HIV and AIDS-related social challenges, and *iv)* textbook will not have a clear framework for selecting content knowledge. The researcher discussed these below.

a) Inability to respond to social needs of students

Previous research shows that the epidemic of social, cultural and economic response to HIV and AIDS is greatly influenced by social needs (Parker & Aggleton, 2003; Luginaah *et al.*, 2005; Stein, 2003; Tobias, 2001). This means, ideally, that social needs related to HIV and AIDS, which are specific to the socio-economic status of the society, should be reflected in the curriculum design and content knowledge incorporated. This can be enhanced by adopting a specific curriculum ideology which will respond directly to the social needs of the students (Schiro, 2008). For example if the social context is such that students need discipline-specific knowledge, then a scholar academic curriculum would be suitable. Alternatively, if the students need to redefine social values, norms and beliefs, then a social reconstruction curriculum would be appropriate.

However the researcher argues that should there be multiculturalism and significant differences in the economic status of the society (as is the case in South Africa), it will be difficult to decide which curriculum ideology is suitable for social needs related to HIV and AIDS. In this case, a thorough needs analysis is required during curriculum development (Kırkgöz, 2009; Songhori, 2008).

In the study (particularly in the learning outcomes and the textbooks approach to HIV and AIDS-related concepts) the researcher found no evidence to indicate how and which social needs (including social values, norms, attitudes and beliefs) are responded to through Life Sciences. This emerges as Life Sciences adopts multiple curriculum ideologies, which by definition respond to different needs (Cotti & Schiro, 2004). Even though not empirically explored in the study, the researcher believes that this is due to multiculturalism in South Africa as well as the differences in economic status of the citizens. Overall the researcher believes that the context of South Africa as well as the multi-ideological framework of Life Sciences means the subject will probably fail to respond to particular needs of students and society.

b) Inability to respond to the epidemics of HIV infection and AIDS

The epidemic of HIV infection could be addressed through a social reconstruction curriculum (Schiro, 2008). For example the epidemic of HIV infection is characterized by people contracting HIV (Stein, 2003). Therefore, to counteract HIV infection, specific mechanisms aimed at addressing factors that are responsible for the spread of HIV and AIDS should be addressed. In this instance literature indicates that there are particular behaviour-related factors that affect the spread of HIV and AIDS in South Africa (Francis, 2010; Kirby *et al*., 2007; Donovan & Ross, 2000; Johnson *et al.*, 1999). As discussed in Section 3.4, these factors include risk behaviour, gender–related abuse, stigma and discrimination, sexuality, drug use, biological factors (such as transmission from mother to child at birth), health (for example exposure to infected blood or bodily fluids), and social factors (for example human rights, values, norms, attitudes and beliefs such as gender imbalances) (Dimmock *et al*., 2007; Parker & Aggleton, 2003). Therefore to respond to these factors, behaviour transformation could be fostered through a suitable social reconstruction curriculum that will change students' beliefs and attitudes.

With regard to the epidemic of AIDS, the researcher believes that a student-centred curriculum can help students construct knowledge and link such knowledge with their experiences. This in turn could alter their beliefs and attitudes which in turn could help them better understand AIDS and be able to adopt suitable responses. Stein (2003) indicates that the epidemic of AIDS occurs when the effects of HIV infection, such as depletion of the immune system occur. Consequently it is necessary that students have a good understanding of issues such as opportunistic infections, treatment and cure for AIDS as well as multiple HIV infections (Parker & Aggleton, 2003; Stein, 2003). Nonetheless, the researcher observed that in Life Sciences, these concepts receive least page volume in the textbooks. The researcher believes that this is because Life Sciences does not adopt a curriculum ideology that will ensure that students have the necessary knowledge and skills required for them to efficiently function in a society using socio-scientific knowledge.

The researcher also found that critical concepts related to the transmission of HIV, the effects of HIV in the body as well as prevention are either not adequately incorporated into the Life Sciences textbooks or omitted. This is appalling given numerous scholarly reports that

indicate the importance of teaching students about these topics. Furthermore the fragmentation of concepts indicates that the integration of HIV and AIDS concepts into Life Sciences was not based on a clear rationale or ideology.

c) Students are not prepared for social challenges related to HIV and AIDS

The two curriculum ideologies whose objective is to promote citizenship are social efficiency and social reconstruction (Schiro, 2008). These ideologies ensure that students have the necessary life and social skills required for them to function efficiently in society. However results show that skills recommended in the Life Sciences curriculum statement do not relate to social efficiency or social reconstruction. In this regard life skills that students would need in order to function efficiently in an HIV and AIDS world are not reflected in the Life Sciences curriculum.

As argued in Chapter 2 in social efficiency, education is aimed at teaching students various life skills and abilities which are performances that students must be prepared for as adults (Schubert, 1996). According to Schiro (2008) these performances must be stated clearly as observable behavioural skills. However the researcher did not find any behavioural skills that are recommended in the Life Sciences curriculum statement. In relation to social reconstruction, the main objective would be a transformation of behaviour of students as well as their societies. This would be achieved by alerting students to ill practices such as risk behaviour of the society and teaching them corrective measures (Schiro, 2008; Zuga, 1992). Results however showed no evidence indicating that Life Sciences addresses social issues even though Learning Outcome 3 relates to this.

According to Ciccarone *et al.* (2004), incorporating HIV and AIDS content into a curriculum requires an active participation of all stakeholders in curriculum design, development and administration in order to promote behaviour transformation. However results in the study showed that the Life Sciences curriculum and textbooks lack a strong allegiance to a student-centred ideology. This view was further supported by the fact that students are expected only to acquire and develop predetermined knowledge and skills. Scholars (Anderson & Beutel, 2007; Page *et al.*, 2006; Griessel-Roux *et al*., 2005) however argue that in order to lead to behaviour transformation, HIV and AIDS education should ensure that students' preferences

and experiences related to HIV and AIDS are integrated into the learning process through a student-centred curriculum.

d) Textbooks do not have a clear framework for HIV and AIDS content knowledge

Mohammed (2007) indicates that textbooks are primary vehicles for delivering content knowledge. While it is not expected that textbooks will be identical, it is expected that textbooks will be relatively consistent with regard to content knowledge they are covering, which is directed by the curriculum statement. This can be facilitated by an adoption of a particular curriculum ideology which will inform selection of content knowledge (Mohammed, 2007; Fraser, 1993). However if a curriculum has multiple ideologies (as it apparently is the case with Life Sciences) textbook authors are left to decide for themselves as to which and how content should be incorporated and organized. This was observed in the study where there is no consistency with regard to content knowledge presented in the Life Sciences textbooks. Some concepts that are included in one textbook (for example immunity) were not included in another (see Table 5.5) even though these are recommended in the curriculum statement. Furthermore the emphasis on different concepts varied and so was the frequency of appearance of some terms. This result suggests that the textbooks have differing views and priorities concerning certain concepts.

5.4 Conclusion

Based on the findings of the study there is no indication to suggest that scientific knowledge taught in Life Sciences relates to safer behavioural practices related to HIV and AIDS. In fact the study could not identify a clear link between Life Sciences knowledge and behavioural practices in relation to HIV and AIDS even though the application of knowledge to real life is alluded to. The effect of scientific knowledge related to HIV and AIDS as found in the study on behavioural preferences remains to be investigated. (The researcher gives a full report on this in Chapter 6). However the researcher notes that, the NCS for Life Sciences claims that Life Sciences promotes both construction of scientific knowledge and application of such knowledge in real life. However to further understand the relationship between the Life Sciences curriculum and behaviour transformation, the researcher compared Life Sciences

and non-Life Sciences students' HIV and AIDS knowledge and their behavioural preferences. The results of this exercise are presented in Chapter 6.