4. CHAPTER 4: METHODOLOGICAL APPROACH TO THE STUDY

"Do all you can with what you have, in the time you have, in the place you are" Nkosi Johnson[9]

4.1 Introduction

The researcher notes the challenges of education to transform HIV and AIDS related behavioural patterns as discussed in the previous chapters. However inspired by Nkosi Johnson's call for action, the researcher engaged the main objective of the study to investigate the relationship between the Life Sciences curriculum and behavioural transformation by comparing HIV and AIDS knowledge and behavioural preferences of Life Sciences and non-Life Sciences students. The research question in this regard is:

> *How can the curriculum-behaviour transformation relationship be understood when comparing Life Sciences students with non-Life Sciences students on HIV and AIDS knowledge and behavioural preferences?*

As argued in Chapters 1 to 3 this question assumes that knowledge may play a key role in students' behavioural preferences. As a result, before this question could be answered the variables that are embedded in the question needed to be explored. Looking at the research question the two main variables requiring exploration were HIV and AIDS knowledge and behavioural preferences. Questions related to these variables may be whether students have sufficient understanding of HIV and AIDS knowledge, and what their HIV and AIDS related behavioural preferences are. Given these variables, the researcher decided to respond to the main research question by first breaking it down into subquestions (Section 1.7), addressing each variable individually. Each subquestion also determined methods used in data collection and analysis. In this regard the researcher will in this chapter first present an argument for the overall research methodology used to respond to the main research question.

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

4.2 Justification of methodological and metatheoretical paradigms

While there are various methodological paradigms that could be used to respond to the main research question of the study, the researcher, based on the adoption of a realism paradigm, decided to use a mixed method approach (Creswell, 2008; Bazeley, 2003). A mixed method approach was chosen because the researcher concurs with researchers (for example Libarkin & Kurdziel, 2002) who argue that mixing methods strengthens research findings in that each approach is validated by the other when used together. The need to substantiate each approach is that each individual approach has its limitations that may be minimized by the other (Derry *et al.*, 2000).

Given the above argument the researcher saw a mixed method paradigm described by realism as best suitable to respond to the research question. Realists argue that in order to compensate for the misgivings of any one research approach, a multiplistic mixed method approach is preferred (Leahey, 2007; Page *et al*., 2006; Tashakkori & Teddlie, 2003; Derry, 2000; Alford, 1998). Like other realists, the researcher acknowledges that the study/research cannot be absolutely objective or subjective because of differences between reality and what the researcher perceives as reality (Krauss, 2005). Nevertheless, given the use of a mixed method approach to minimise the misgivings of either the qualitative and the quantitative approaches, the researcher believes that the findings of the study will "probably be true" – a realist ontology and epistemology (Healy & Perry, 2000).

In relation to this study the use of a qualitative method alone would have been a disadvantage in that qualitative research, as described by critical theorists (Healy & Perry, 2000) relies mostly on the researchers' subjectivity (Bogdan & Biklen, 1992). This is because there are no universally established rules for analysing or interpreting data, and each researcher may analyse or interpret data differently (Bogdan & Biklen, 1992). To cater for this limitation, a quantitative approach of data collection and analysis were also employed. Scholars (for example Ary, Jacobs, Razavieh & Sorensen, 2006; Johnson & Christensen, 2004; Libarkin & Kurdziel, 2002; Hoepfl, 1997; Creswell, 1994) suggest that in quantitative approaches, as described by a positivist paradigm (Healy & Perry, 2000), subjectivity is minimal. Another advantage of employing quantitative methods together with qualitative methods is that findings can be generalized (Creswell, 2008; 2007; 1994). This is because according to Hoepfl (1997: 2), "quantitative researchers seek causal determination, prediction, and generalization of findings" by employing statistical principles to collect, analyse and report data. On the other hand qualitative approaches are not generalizable in that they generate knowledge of context-specific phenomena (Hoepfl, 1997). At the same time qualitative methods alone would not provide the causal effect (Creswell, 2008; Ary *et al*., 2006) of HIV and AIDS knowledge on behavioural preferences, a measure that can be predicted using quantitative elements such as correlations and regressions (Libarkin & Kurdziel, 2002; Hoepfl, 1997; Creswell, 1994).

By using qualitative methods together with quantitative methods, limitations of the latter could also be addressed (Creswell, 1994; Bogdan & Biklen, 1992). For example qualitative research uses a "wide-angle and deep-angle lens to examine the breadth and depth of phenomena" (Johnson & Christensen, 2004: 31). This means qualitative methods are phenomenological enquiries that are used to study opinions, behaviours and experiences of a given individual or population through explorative means (Creswell, 2008; 2007). Given that the researcher wanted to determine the influence of HIV and AIDS knowledge on behavioural preferences of students, it was not sensible to rely only on a quantitative approach which would not be able to determine phenomenological phenomena such as opinions, behaviours and experiences of students and other sources of data (Ary *et al*., 2006; Johnson & Christensen, 2004).

About the realist approach to mixed method the researcher acknowledges limitations as documented in literature. One limitation of mixed methods is that the researcher would require expertise in both methods (Tashakkori & Teddlie, 2003). While this may be viewed as a limitation, the researcher saw it as an opportunity to learn and develop as a scholar. Such learning was obtained through the guidance of a number of experts in both fields coupled with reading of relevant literature. Scholars also suggest that a mixed method approach requires extensive data collection and may be lengthy (Creswell, 2007; Tashakkori & Teddlie, 2003). However the researcher was willing to collect extensive data as this would provide enough information to respond to the research question.

Libarkin and Kurdziel (2002) also suggest that it is not always possible to blend qualitative and quantitative methods. To this end the researcher planned a clear research strategy (Table 4.1) before any data collection or analysis was performed, in order to know specifically how the two methodologies would be used (Leahey, 2007; Tashakkori & Teddlie, 2003; Alford, 1998).

As shown in Table 4.1 the researcher opted for a concurrent embedded mixed method design (Creswell, 2008; 2007). For instance in responding to the first research subquestions (see Section 1.7), a predominantly qualitative document analysis approach was used (Creswell, 2008). During data analysis descriptive statistics (such as frequencies) were calculated emphasising elements of a quantitative approach.

Table 4.1 An outline of the research methodology used

Question	**Subquestion 1**	**Subquestion 2**	**Subquestion 3**
Methodology	QUAL + quan	QUAN + qual	QUAN + qual
Data source	Life Sciences curriculum statement & 2 textbooks	300 Life Sciences students & 243 non-Life Sciences students	300 Life Sciences students & 243 non-Life Sciences students
Analysis approach	Document analysis	Questionnaire analysis	Questionnaire analysis
Analysis procedure	**QUAL** (Generate themes & meanings inductively) + **quan** (calculate descriptive statistics such as frequencies)	**QUAN** (calculation of frequency distribution, mean comparisons & correlations) + **qual** (use written text to explain statistics)	**QUAN** (calculation of frequency distribution, mean comparisons & correlations) + **qual** (use written text to explain statistics)

In responding to research subquestions 2 and 3, survey questionnaires were used for data collection and data were analysed mainly from a quantitative approach to determine inferential statistics such as correlations (Table 4.1; Creswell, 2008). Elements of qualitative methods were also used in seeking meanings embedded in responses. The manner with which these methods were used in each subquestion is discussed in the following sections.

4.3 Methodology for research subquestion 1

4.3.1 General approach

The first research subquestion asks, "*How does the Life Sciences curriculum address HIV and AIDS for safe behavioural preferences among students?*" The researcher investigated two areas as a way of responding to this question. Firstly the Grade 11 Life Sciences curriculum statement (Department of Education, 2003a) was examined in order to make inferences about its curriculum ideology (Schiro, 2008). As discussed in Chapter 2 the curriculum ideology would indicate if the subject is meant to affect students' values, norm, beliefs and ultimately behavioural practices. Secondly, content knowledge taught in Life Sciences was investigated to identify specific concepts taught in Life Sciences with the aim of understanding the presence of academic and functional HIV and AIDS knowledge in the curriculum. Document analysis (Nicholls, 2003) was used because documents (that is, the curriculum statement (Department of Education, 2003a) and textbooks (Ayerst, Langley, Majozi, Metherell, Raciborska, & Smith, 2008; Clitheroe, Doidge, Marsden, van Aarde, Ashwell, Buckley, & Dilley, 2008)) were regarded by the researcher as the suitable sources of the data, and thus document analysis was the appropriate way to respond to the research question.

Table 4.2 A framework for document analysis (adapted from Nicholls, 2003)

Focus	Description
Area of specialization	- The researcher must be familiar with the field under study in order to make appropriate judgements.
Sampling	- Sample size is not a major factor if the process is more qualitative rather than quantitative.
Analytical instrument	- An instrument must be developed (or adapted) and used to guide and frame the process of analysis. - The instrument must be able to provide robust and critical analysis of the document. - The instrument must allow for a coherent and free-flowing analysis.

In the study Nicholls' (2003) document analysis framework was used (Table 4.2). This framework consists of parameters set by the researcher and are used to determine what is regarded as useful during the analysis (Asay & Orgill, 2009; De La Caba Collado & Atxurra, 2005; Gingras, 2005; Nicholls, 2003; Evans & Davies, 2000). The first parameter that was set is that the document analyst must be a specialist in the field (Table 4.2; Nicholls, 2003). This is because "it is only on the basis of the extremely specialized often painstaking work of area scholarship that a comparative student can attain the required breadth of perception"

(Bereday, 1964: 10). As a result the researcher familiarised himself through reading (Asay & Orgill, 2009) with curriculum studies and science education (including Life Sciences and HIV and AIDS education).

As suggested earlier this predominantly qualitative methodology was chosen because the researcher wanted to inductively generate knowledge of context-specific phenomena (Nicholls, 2003; Hoepfl, 1997). Consequently generalizability was not the intention (Nicholls, 2003). To this end the researcher acknowledges that his response (and methodology) is limited in that it is subjective to the researcher. This limitation is also echoed by other researchers (Healy & Perry, 2000; Bogdan & Biklen, 1992). Furthermore validity is only as correct as the instrument used which, in this study, were validated by the panel of experts as explained in Subsections 4.3.2 and 4.3.3 (Nicholls, 2003). Other validation methods such as theory triangulation where a single set of data are interpreted by different investigators (Guion, 2002) were not considered. This was because the study was carried out by a single researcher for an academic qualification purposes and therefore no second researcher was engaged to analyse the data.

The second parameter was that a suitable sample of documents had to be selected (Table 4.2). Since the analysis is usually qualitative with respect to subjects (documents being analysed) there are no specifications in relation to sample size (Asay & Orgill, 2009; Nicholls, 2003; Evans & Davies, 2000). To this end the researcher decided to use purposive sampling (Maree & Pietersen, 2007; Taylor–Powell, 1998) by focusing on the South African Life Sciences curriculum for Further Education and Training (FET), that is Grades 10 to 12. The FET level was chosen because the study intended to specifically investigate knowledge taught in Life Sciences Grade 11. In this regard the researcher focused on the curriculum statement (Department of Education, 2003a) and textbooks (Ayerst *et al.*, 2008; Clitheroe *et al.*, 2008) that would provide information regarding the construction of scientific knowledge as taught in Grade 11.

Nicholls' (2006: 44) framework (Table 4.2) also suggests that "it is critical to construct a robust analytical instrument." This analytical instrument is made up of questions that the researcher develops and uses in the analysis (Britton, Letassy, Medina & Er, 2008; Gingras, 2005; Evans & Davies, 2000). Two sets of instruments were developed and used in this regard (as discussed in the following subsections), namely an instrument to determine the curriculum ideology favoured in Life Sciences and another to investigate concepts that are taught in Life Sciences that may affect behaviour transformation.

4.3.2 Investigating the curriculum ideology for Life Sciences

An inductive analysis approach was used to determine the curriculum ideology for Life Sciences. The researcher first reviewed components of the Life Sciences curriculum (Department of Education, 2003a) and then compared these components with similar components of various established curriculum ideologies as indicated in Table 2.1 (Britton *et al.*, 2008). This procedure is known as curriculum mapping (Plaza, Draugalis, Slack, Skrepnek & Sauer, 2007). The objective of curriculum mapping is to determine the intentions of the curriculum by examining specific sections of the curriculum document (Plaza *et al.*, 2007).

The first step in reviewing components of the Life Sciences curriculum (Department of Education, 2003a), that is curriculum mapping, was close reading of the Life Sciences curriculum statement (Creswell, 2008; Nieuwenhuis, 2007; Ferreira, Lucen, Stoffels, & Soobrayan, 2003). Text was read in detail so that the researcher could familiarise himself with the content. During this critical reading the researcher examined "the overarching aims or purposes of education, the nature of the child or student, the way learning must take place, the role of the teacher during instruction, the most important kind of knowledge that the curriculum is concerned with and the nature of this kind of knowledge, and the nature of evaluation" or assessment (Schiro, 2008: 7). Secondly the researcher used a standard data collection instrument (Britton *et al.*, 2008; Nicholls, 2003; Evans & Davies, 2000) to examine specific portions of the curriculum in order to determine its ideology (Schiro, 2008). Other researchers suggest that a researcher may develop his own instrument for analysing the curriculum (Nicholls, 2003; Evans & Davies, 2000). This instrument consists of a pool of questions which the researcher believes could be used to analyse documents based on the objectives of the study as well as the research question understudy (Nicholls, 2003; Evans & Davies, 2000).

In the study however the researcher opted to use Schiro's (2008) standard inventory for curriculum analysis as this tool has been successfully used by other researchers (Williams, 2010; Cherubini, 2009). In Table 4.3 the instrument used in the study is described. It indicates the overall objective of curriculum mapping as well as the actual questions (adapted from Schiro, 2008) that were asked and responded to by the researcher (Britton *et al.*, 2008). In responding to these questions, the researcher collected evidence from the curriculum by extracting actual phrases used in specific text segments (Creswell, 2008; Nieuwenhuis, 2007; Ferreira *et al.*, 2003; Thomas, 2003).

Table 4.3 An instrument used for reviewing components of the Life Sciences curriculum statement (Adapted from Schiro, 2008).

Purpose of analysis	Data Sources	Actual questions used
To examine the Life Sciences curriculum in order to determine its curriculum ideology	- Life Sciences curriculum statement (Department of Education, 2003a)	1. What is the aim of the curriculum? 2. What kind of knowledge is prescribed in the curriculum?
		3. How is learning supposed to take place?
		4. What is the nature and the role of students in the learning process?
		5. What is the role of teachers during instruction?
		6. What is the purpose of assessment?

Having collected these evidence-based responses, the researcher went on to determine which curriculum ideology is best reflected by the Life Sciences curriculum. Here the researcher used Table 2.1, which details characteristics of various curriculum ideologies with respect to the questions in Table 4.3, to determine the curriculum ideology of Life Sciences (Cochran, 2010; Britton *et al.*, 2008). This was done by classifying and narrating the extracted data according to the characteristics of various curriculum ideologies as given in Table 2.1. Final results of the above process are presented in Chapter 5.

4.3.3 Determining Life Sciences concepts that may affect behavioural preferences

Document analysis was also performed to identify specific concepts related to HIV and AIDS as taught in Grade 11 Life Sciences with the aim of influencing behavioural preferences. The Grade 11 Life Sciences curriculum statement (Department of Education, 2003a) and Life Sciences textbooks (Ayerst *et al.*, 2008; Clitheroe *et al.*, 2008) were purposely selected for analysis as they provide a fundamental overview of content, assessment procedure and learning outcomes (Department of Education, 2003a). The instrument used for content analysis was constructed and validated by the researcher since no previous comparable study could be identified.

In constructing the instrument for content analysis, the researcher first developed a pool of nine questions which he believed could be used to analyse the documents (Figure 4.1; Appendix 1; Evans & Davies, 2000). These questions were constructed by the researcher and based on the objectives of the study as well as the research question under study (Nicholls, 2003). Since research has shown that cognitive skills have an influence on behavioural preferences, through the content analysis instrument, the researcher first investigated cognitive and life skills acquired through Life Sciences (Table 4.4) (Lesley, 2007; Williams & Noyes, 2007; Pakaslahti, 2000).

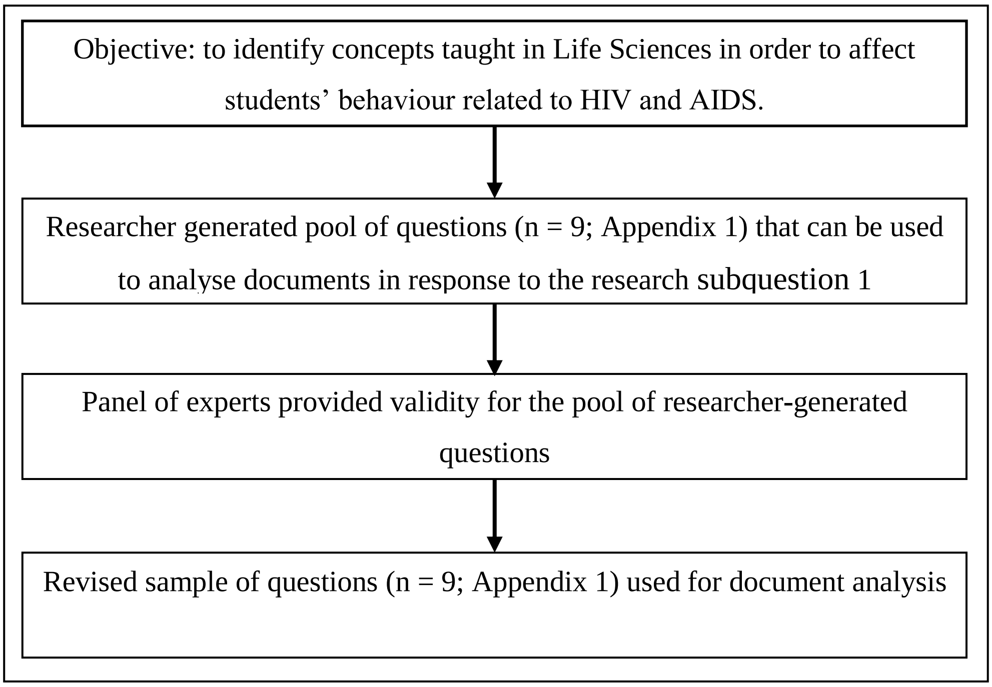

Figure 4.1 An overview of how the instrument for document analysis was developed

Secondly the researcher identified concepts taught in Life Sciences (Table 4.4). These concepts would present knowledge (taught in Grade 11 Life Sciences) that will be integrated with prior knowledge (learnt in previous Life Sciences Grades, other subjects and informally outside classroom settings) for the development of skills. Thirdly learning outcomes for Life Sciences curriculum were investigated (Table 4.4). In this regard based on the research question of the study, the researcher deemed it important to establish whether there was any intention to transform students' behaviour by learning Life Sciences. Another critical area was that of assessment (Table 4.4). The researcher investigated whether the strategies used to assess students' skills and concept understanding would be effective in assessing changes (if any) in behavioural preferences of students.

Table 4.4 Instrument for identifying concepts and skills foregrounded in Life Sciences as important to influence behavioural preferences of students

Action	Details
Sampling	Life Sciences curriculum statement collected from Department of Education. Life Sciences textbooks recommended and used by teachers and students.
Analysis procedure	Analyse each document to determine concepts that are taught to students.
Instrument for Life Sciences curriculum analysis	1. Which skills (competences) does the document encourage Grade 11 students to attain regarding HIV and AIDS? 2. Which concepts does the curriculum foreground for Grade 11 students in relation to HIV and AIDS? 3. What are the expected learning outcomes of Life Sciences in relation to HIV and AIDS? 4. Which assessment strategy is the document endorsing?
Instrument for textbook analysis	5. Which HIV and AIDS related concepts have the highest text page volume in the textbooks? 6. What is the textbooks' approach to HIV and AIDS related concepts? 7. What is the frequency of appearance for HIV and AIDS related concepts? 8. How does the content of the textbooks relate to HIV and AIDS? 9. What assumptions underlie the textual discourse?

Having developed a pool of questions, a panel of six science teachers (including two researchers) and an English language expert (Table 4.5) were purposively selected to validate the pool of questions shown in Table 4.4. The number of experts was guided by Lynn (1986), who suggests that the minimum number of experts should be five. These experts (Table 4.5) were chosen because of their familiarity with the curriculum statement. As a result the panel could determine how suitable questions were for the curriculum analysis. The expertise provided by the English expert was also important as she ensured that the questions were concise, clear, elegant, self-explanatory and grammatically correct (Maree, 2007).

The panel of experts scrutinized the nine questions (given in Table 4.4) based on Maree's (2007) description of a good question for document analysis (see Appendix 1) in order to determine whether each question asks what it intended to (i.e. face validity). The aim was to eliminate irrelevant items (questions) from the instrument (Chaiyawat & Brown, 2000) and rephrase items where clarity and grammatical errors are reported (Hughes, 1998). Validity of the questionnaire was therefore demonstrated by asking experts to review the content of the instrument by responding to the validation questionnaire (see Sections A and B in Appendix

1; Hyrkas *et al*., 2003). In this regard experts either agreed or disagreed with the statement given in the suitability questionnaire.

Table 4.5 Panel of experts participating in the validation of instruments in the study. Research IDs are used instead of real names for ethical reasons

Research ID	Occupation	Work place
E1	Life Sciences teacher & researcher	Tertiary institution
E2	Life Sciences teacher & researcher	Tertiary institution
E3	Life Sciences teacher	Township government school
E4	Life Sciences teacher	Township government school
E5	Life Sciences teacher	Urban private school
E6	English specialist/teacher	Urban private school

Thereafter percentage agreement between experts (Hyrkas *et al*., 2003) was calculated for all items (Sections C in Appendix 1). Experts justified their views using written responses. Results indicated that Question 9 (Appendix 1) was not necessary for the study and therefore must be eliminated. At the end of the process explained above, it emerged that experts generally felt that the questions in the instrument were suitable for the study.

According to Mohammed (2007) the Life Sciences curriculum statement that was analysed provides only a guideline of what needs to be taught whereas textbooks are primary vehicles for delivering content knowledge. Therefore as stated earlier, other than the analysis of the curriculum statement, the researcher also analysed textbooks. This was done to avoid a premature assumption that textbooks and curriculum statements profess the same message. For example the researcher wanted to establish if the concepts and skills recommended by the curriculum are actually addressed in the prescribed textbooks. As a result prescribed Life Sciences textbooks were also analysed.

Textbooks were selected based on purposive, non-probability sampling according to which a specific set of documents which best fit the aims of the study was used (Maree & Pietersen, 2007; Taylor–Powell, 1998). Textbooks were selected purposively because only Grade 11 Life Sciences textbooks were deemed relevant. These textbooks were identified through a brief structured telephonic interview (Appendix 2) with teachers from various schools in KwaZulu-Natal, South Africa. Participating teachers were selected using a purposive, non-probability sampling method because their schools would participate in other sections of the study (see later). In this regard a sample of Life Sciences teachers (n = 12) were asked questions (Appendix 2) telephonically to indicate which textbook they preferred for Life

Sciences Grade 11. From the interviews two textbooks were identified as preferred by most respondents (that is, 7 of 12). These are *Focus on Life Sciences* (Clitheroe *et al.*, 2008) and *Shuters Life Sciences Grade 11 Students Book* (Ayerst *et al.*, 2008). Teachers indicated that they rely on these two textbooks when selecting HIV and AIDS related content knowledge to be taught in Grade 11 Life Sciences (Appendix 2). Teachers also indicated that *Focus on Life Sciences* (Clitheroe *et al.*, 2008) and *Shuters Life Sciences Grade 11 Students Book* (Ayerst *et al*., 2008) are prescribed for students (in cases where students have access to textbooks).

Having identified textbooks the researcher performed document analysis of this data source (Table 4.4). Textbook analysis was done independently of the curriculum analysis. Thus the purpose was not to verify what was found during the analysis of the Life Sciences curriculum statement, but rather to determine scientific concepts foregrounded as important in the Life Sciences textbooks which could potentially influence the behavioural preferences of students related to HIV and AIDS infection risks (see Table 4.4 for specific questions).

Scholars (Dimmock *et al.*, 2007; Audesirk *et al.*, 2004) suggest that knowledge of viruses, bacteria, HIV and AIDS, tuberculosis, immunity, circulatory system and vaccination serves as point of reference for disseminating knowledge on HIV and AIDS. Knowledge in the above areas is presented in the section titled “tissues, cells and molecular studies” in the Life Sciences curriculum (Department of Education, 2003a). As a consequence the researcher decided to investigate these seven areas (viruses, bacteria, HIV and AIDS, TB, immunity, the circulatory system and vaccination) to respond to research subquestion 1.

Matson and LoVullo (2009) as well as Ott and Donnelly (1999) suggest that the level of emphasis on a certain concept is proportional to the frequency of that concept in a document and indicates the value of such a concept. Therefore with regard to the question “which HIV and AIDS related concepts have the highest page volume in the textbooks?” (Table 4.4; Appendix 1), the researcher calculated page volume devoted to presenting knowledge on viruses, bacteria, HIV and AIDS, TB, immunity, the circulatory system and vaccination in the section of the textbooks titled “tissues, cells and molecular studies” (Department of Education, 2003a). In this instance, the researcher believes that page volume on each of the above areas indicates the level of significance of that particular area in relation to students’ understanding of HIV and AIDS (Matson & LoVullo, 2009; Ott & Donnelly, 1999).

According to Dimmock *et al.* (2007) and Audesirk *et al.* (2004), scientific knowledge of HIV and AIDS can be subdivided into eleven themes. These themes are definition of HIV and AIDS, types of HIV, biological domain in which HIV belongs (that is, type of organism), transmission mechanisms of HIV, target cells of HIV, the binding mechanism, HIV's entry into target cells, reproduction of HIV, effects of HIV in the body and the prevention of HIV infection (Dimmock *et al.*, 2007; Audesirk *et al.*, 2004). The researcher therefore investigated "how does the content of the textbooks relate to scientific understanding of HIV and AIDS" (Table 4.4; Appendix 1) by calculating the frequency of appearance of the above eleven themes (and their related concepts) in relation to the total number of pages dealing with "tissues, cells and molecular studies" (Matson & LoVullo, 2009; Department of Education, 2003a). The presence of the concepts did not include those that are presented in statistical data, assessments and case studies used as these would differ with textbooks. For example statistical data presented in a textbook would be relative to the date of publication of that particular textbook.

Finally, given Baumgartner's (2001) argument of student empowerment through education, the researcher wanted to discover if the textbooks envision empowerment of students through specific learning outcomes. For example the researcher investigated whether there was any learning outcome that addressed students' empowerment in relation to HIV and AIDS. Results of document analysis in response to research subquestion 1 are presented and discussed in Chapter 5.

4.4 Methodology for research subquestions 2 and 3

4.4.1 General approach

In collecting data for research subquestions 2 and 3, a non-experimental survey design was used (Maree & Pietersen, 2007). This survey was aimed at assessing the respondents' level of content knowledge and behavioural preferences related to HIV and AIDS (McMillan & Schumacher, 2001) as per subquestions 2 and 3. Subquestion 2 asks:

How do Life Sciences students compare with non-Life Sciences students in:

a) Academic HIV and AIDS knowledge?

b) Functional HIV and AIDS knowledge?

c) Self-reported behavioural preferences related to HIV and AIDS?

Subquestion 3 is a follow-up question which asks:

To what extent does academic HIV and AIDS knowledge correlate with:

a) Functional HIV and AIDS knowledge? and,

b) Self-reported behavioural preferences related to HIV and AIDS?

The hypotheses that led to these questions are that:

a) Life Sciences students have higher academic HIV and AIDS knowledge than non-Life Sciences students.

b) Having a higher understanding of academic HIV and AIDS knowledge translates to a better understanding of functional HIV and AIDS knowledge.

c) Academic and functional HIV and AIDS knowledge are associated with safe behavioural preferences.

These hypotheses were tested using a predominantly quantitative mixed method approach (Table 4.1; Creswell, 2008; 2007). By means of a survey, Life Sciences students were compared with non-Life Sciences students with respect to their knowledge of academic and functional HIV and AIDS knowledge. Thereafter self-reported behavioural preferences of students from both groups were compared. Before delving into how this phase of the study was conducted, the researcher will first describe the sampling strategy that was used.

4.4.2 Sampling and sample description

In selecting students to participate in the study, a non-probability convenience sampling approach was followed. The researcher chose schools around Umsunduzi district because this location is in KwaZulu-Natal, a province which has been reported to have a relatively high HIV and AIDS prevalence in South Africa (Nicolay, 2008). This district is also where the provincial legislature and the provincial offices of the Department of Education are located. The district was also the most accessible to the researcher in terms of knowing where the schools were located.

For the study the researcher aimed for a demographically representative sample. This would mean each type of school (that is, government or private) and location (that is, rural, urban and township) as they occur in Umsunduzi district needed to be part of the study. At the time of the study, Umsunduzi district had about 42 government and private high schools which were located in urban, rural and township areas. The researcher arranged the 42 schools alphabetically according to their names. Thereafter a 1/3 sampling rate was used to select schools, so that every third school within each type-location category was selected for participation (Kasonga, 2009). This yielded a total of nine schools, that is, two rural/government schools, two suburbs/government schools, three suburbs/private schools and two township/government schools. All of the selected schools had Life Sciences students and class sizes ranged from 25 to 28, with some schools having more classes for the same grade than others. Within these schools a total of 300 students were enrolled for Life Sciences and selected for participation. Two hundred and forty three non-Life Sciences students from the same schools also participated (Table 4.6). All students were in Grade 11 and aged between 15 and 17. Non-Life Sciences students from schools S04 and S05 did not volunteer to participate and were therefore excluded.

Table 4.6 Summary of students participating in the study. (A complete profile of students is given in Appendix 3)

School ID	School type	Students' ID	Total students	Males	Females	Average age	Life Sciences students	Non-Life Sciences students
S01	Rural/government schools	L448 to L544	96	71	25	17	37	59
S02	Rural/government schools	L387 to L448	61	43	17	17	22	39
S03	Urban/government schools	L311 to L386	75	56	17	16	22	53
S04	Urban/government schools	L252 to L310	30	14	16	17	30	0
S05	Urban/private schools	L200 to L251	52	25	27	17	52	0
S06	Urban/private schools	L135 to L199	84	44	40	18	59	25
S07	Urban/private schools	L098 to L134	42	11	30	17	27	15
S08	Township/government schools	L065 to L097	40	18	21	17	26	14
S09	Township/government schools	L001 to L064	63	22	40	17	25	38
TOTALS			**543**[10]	**304**	**233**	**17**	**300**	**243**

[10] Six students who participated in the study voluntarily did not disclose their gender.

The researcher obtained ethical clearance to conduct the study from the University of Pretoria (reference CS08/11/04), KwaZulu-Natal Department of Education (reference 0046/2008) and the schools (Appendix 4). Furthermore students and teachers (and parents in case of minors) signed a consent that explained, in their first language (isiZulu) and English specific conditions and implications of participation (Appendix 4). Participation in the study was voluntary.

4.4.3 Instrument design and validation

The researcher systematically developed a questionnaire for data collection. The purpose of this questionnaire was to measure three areas, namely students' understanding of academic HIV and AIDS knowledge, functional HIV and AIDS knowledge as well as self-reported behavioural preferences in relation to contracting HIV and AIDS. The development of the questionnaire is described below.

4.4.3.1 Drafting the questionnaire

The questionnaire that was used in this phase went through various stages of preparation (Figure 4.2). As shown in Figure 4.2 the first step in preparing the questionnaire was identifying which HIV and AIDS related concepts needed to be incorporated into the questionnaire for investigation.

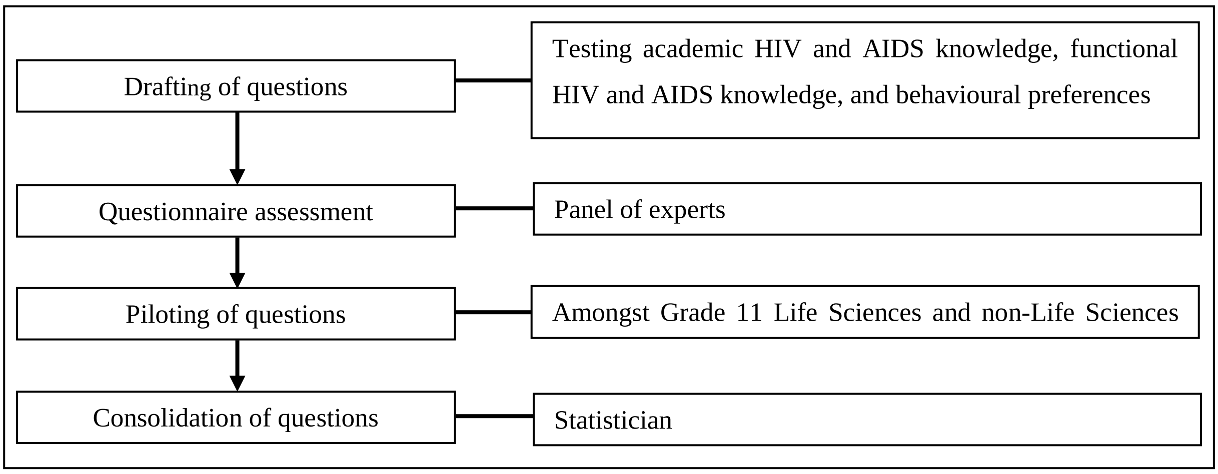

Figure 4.2 The process used to prepare and validate the questionnaire

Scholars (Dimmock *et al.*, 2007; Audesirk *et al.*, 2004) indicate that the scientific nature of HIV and AIDS can be understood by learning academic HIV and AIDS knowledge. This academic HIV and AIDS knowledge describes viruses, bacteria, HIV and AIDS, immunity, the circulatory system and vaccination. During curriculum analysis (Section 4.3 and Chapter 5), the researcher found that academic HIV and AIDS knowledge is taught in Grade 11 Life Sciences (Ayerst *et al.*, 2008; Clitheroe *et al.*, 2008; Department of Education, 2003a). Even though not exclusive to HIV and AIDS, this academic knowledge is used to provide a scientific description of HIV and AIDS. It is this knowledge that was tested in the study (that is, Section 1 in Appendix 5).

In addition to academic HIV and AIDS knowledge the questionnaire tested functional HIV and AIDS knowledge (Section 2 in Appendix 5). Researchers report that this knowledge is necessary to influence behavioural practices by transforming social norms, values and beliefs (Maticka-Tyndale & Barnett, 2010; Kaponda *et al.*, 2009; Mahat *et al.*, 2008; Page *et al.*, 2006). Furthermore functional HIV and AIDS knowledge is taught in a number of HIV and AIDS awareness campaigns (Maticka-Tyndale & Barnett, 2010; Kaponda *et al.*, 2009; Levy, 2009; Ssewamala *et al.*, 2009) as well as in Life Orientation (Francis, 2010; Du Plessis, 2008; Kirby *et al.*, 2007; Mackenzie *et al.*, 2007; James *et al.*, 2006; Motepe, 2006; Visser *et al.*, 2006). It provides information on the nature of HIV (that is, what HIV is), HIV mode(s) of transmission between persons, the nature of AIDS (that is, what AIDS is), curability and treatability of AIDS, as well as HIV/AIDS prevention strategies. In the study students' understanding of functional HIV and AIDS knowledge was therefore tested (Section 2 in Appendix 5).

The researcher also wanted to determine self-reported behavioural preferences of students (Section 3 in Appendix 5) as defined in Chapter 1. To investigate behavioural preferences of students, the theory of planned behaviour was used as a framework for developing the questions. According to the theory of planned behaviour, attitudes, subjective norms and perceived behavioural control are factors affecting behaviour (Ajzen, 1991). From this premise, questions probing these factors were incorporated in the questionnaire. These questions were adapted from other studies related to the current study (Anderson & Beutel, 2007; Anderson, Beutel & Maughan-Brown, 2007; Guo *et al.*, 2007). Questions testing for behavioural preferences are presented in Section 3 of Appendix 5. At the end of this "drafting stage" (Esposito, 2002) a total of 116 questions had been drafted (Figure 4.2, Appendix 5).

4.4.3.2 Validation through a panel of experts

The 116 items were given to a panel of experts (n = 6; Table 4.5) for validation using a validation questionnaire (Appendix 6). As stated earlier the panel consisted of science teachers and an English specialist. The validation questionnaire given to the panel of experts was designed to address two fundamental questions, through which face and content validity of the probes would be established. These questions were:

a) *Do questions (items) in the questionnaire test what they ought to?* Given that each item was meant to assess specific knowledge, the panel was therefore meant to determine whether the questions were able to test for such knowledge, that is academic HIV and AIDS knowledge, functional HIV and AIDS knowledge and behavioural preferences.
b) *Is the questionnaire suitable for the purpose it is designed for?* In this instance the main focus of questionnaire assessment was on the conceptual background of each question. Experts were to assess the use of terms, especially Life Sciences terms so that non-Life Sciences students would be able to understand the questions. The experts were also asked to check whether, in their view, the questions were suitable for the educational level of the students, that is, Grade 11.

The validation questionnaire consisted of closed and open-ended items (Appendix 6). Expert responses to the closed questions were analysed using a four-point rating scale that is, strongly agree = 3, agree = 2, disagree = 1 and strongly disagree = 0 (Hyrkäs *et al.*, 2003). The open-ended questions were used to explain responses to the closed questions. For example if the respondent "agrees" with a particular statement in the questionnaire, the respondent was asked to explain his/her reasoning in spaces provided (Appendix 6). In this way, the researcher aimed to determine content and face validity of the items in Appendix 5.

Expert responses to the questionnaire (that is, closed questions) were then used to calculate content validity indices (CVI) which according to Hyrkäs *et al.*, (2003) can be used to determine validity. The CVIs were calculated for each question according to Hyrkäs *et al.*'s formula:

$$\text{CVI} = \frac{\text{number of experts giving a rating of '2' or '3'}}{\text{Total number of experts}}$$

Here "experts" are the panel members (Table 4.5), and ratings '2' or '3' (that is, strongly agree or agree, respectively) are generated from a four-point rating scale. In the study the total number of experts is six, since there were six panellists. As suggested by Hyrkäs *et al*. (2003), for the CVIs obtained, those questions in relation to the items in the questionnaire that scored a CVI above 0.79 were regarded as acceptable, those between 0.7 and 0.78 as in need of attention and those below 0.69 as requiring revision or elimination.

Data from the CVIs indicated that the panel of experts had two concerns with the questionnaire (Figure 4.3). This means, of the questions sent to the panel, only two received CVIs lower than 0.69 and required revision or elimination. Qualitative analysis of this trend suggested that the experts (that is 2 out of 5) were concerned about some questions being ambiguous. To this expert *E6* (Table 4.5), commented that "some terms are complex and might be hard for students to understand." Related to this, another expert (*E1*) was concerned with some spelling errors which rendered relevant questions ambiguous or meaningless. Another area of concern from the experts was the length of the test. In this case, three out of five experts (that is, *E1*, *E3* and *E6*) felt that the test was rather too long with 116 questions. Related to this, experts suggested that some questions were repeated and thus should be removed. In such instances the experts used the open-ended questions to specify the questions of concern.

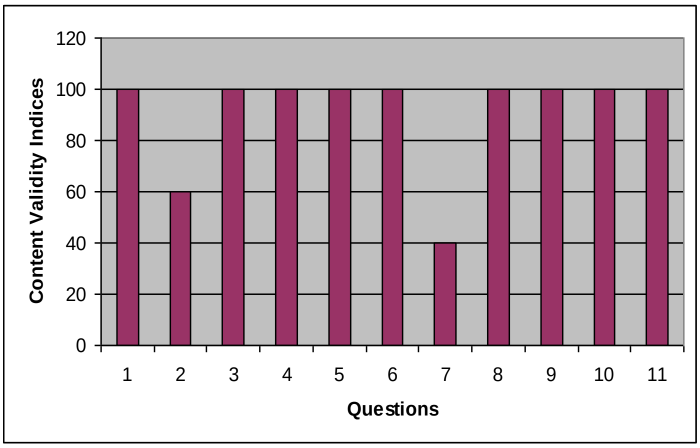

Figure 4.3 Content validity indices obtained from the panel of experts

Other than the concerns reported above, the experts were fairly satisfied with the standard of the questionnaire. For example one expert (*E3*) suggested that the questionnaire is "excellent and appropriate for the intended group of students." Attesting to this, another expert (*E5*) reported that the questions in the questionnaire are "well thought and practical." Nevertheless adjustments were made in line with the recommendations of the panel of experts, that is shortening the questionnaire and clarifying some complex terms. At the end of this process, 44 knowledge questions and 22 behavioural questions were deemed useful for the study (the number of questions was reduced from 116 to 66) (Appendix 7).

4.4.3.3 Piloting the questionnaire

While the experts' comments were taken into consideration a number of issues still remained concerning the validity of the questionnaire, particularly in relation to Taylor-Powell's (2008) perspectives on questionnaires. Taylor-Powell suggests that researchers should ensure that:

a) The items in the questionnaire measure what they are supposed to measure.
b) All the words are understood by the respondents.
c) All respondents interpret the item in the same way.
d) All response choices are appropriate.
e) The range of response choices is actually used.
f) The respondents correctly follow the instructions.
g) The questionnaire creates a positive impression that motivates students to respond.
h) Length of time available to complete the questionnaire is adequate.

In line with Taylor-Powell's views, other researchers (for example Creswell, 2008; Maree & Pietersen, 2007; Libarkin & Kurdziel, 2002) suggest that questionnaires should be piloted on a sample of respondents within the same context as the actual study. As a result a group of Grade 11 Life Sciences students (n = 37) were purposively sampled to participate in a pilot study to pilot the questionnaire described in this phase. This sample of students was sampled because their living conditions (that is, they reside in semirural areas where HIV and AIDS is relatively high) and schooling conditions (that is, their Life Sciences curriculum and textbooks) are similar to those of the students who would participate in the actual study (Nicolay, 2008). Given this similarity of the living and schooling conditions the researcher decided that this pilot group would provide a sensible indication of how students of the actual study would respond to the questionnaire.

Only the 66 questions (Appendix 7) recommended by the experts were piloted. During the piloting of the questionnaire, the researcher administered the test at a school which pilot students attend. Two Life Sciences teachers from the same school were also present and assisted with the administration of the test, namely distributing and collecting the questionnaires. In the pilot study a specific procedure for administering the questionnaire was followed. This procedure is similar to that used in administering Aptitude Tests (O'Neill, 2007), namely announcing all relevant instructions, providing an example or a practice question, recording time for completion, ensuring that students work independently and collecting the scripts soon after the students finished answering the questionnaire. This procedure was also used during later data collection of the validated questionnaire.

After administering the test all questionnaires were collected and scored by the researcher against a set of correct answers prepared by him (Section B in Appendix 8). It must be mentioned here that the behaviour-related questions (Section C in Appendix 7), were not scored for marks but were analysed for expediency (Section B in Appendix 8). In this instance, the researcher evaluated the responses qualitatively to determine whether students *i)* understood the question, *ii)* answered what was asked, *iii)* used the range of response options available, and *iv)* followed the instructions (Taylor-Powell, 2008). For knowledge questions (Sections A and B in Appendix 7), students were allocated one mark per correct response and zero for an incorrect response. Thereafter a total score was calculated based on the total number of marks scored by each student out of the total marks available.

Upon analysing the data from the pilot study it appeared that the questionnaire (Appendix 7) generally met Taylor-Powell's (2008) stipulations for good questions (Table 4.7). In this regard results showed that students were able to respond to all the items in the questionnaire. However some students provided multiple answers for the same questions, even though no item required more than one response. In this regard the questionnaire had failed to indicate that only one answer was required for each item.

Besides the multiple responses cases mentioned above, students generally interpreted the questions (that is 80% of all questions) similarly by giving exactly the same response, for example all students selecting choice A for item 3. Students' response pattern was however influenced by the fact that most questions had two options that is true or false. The researcher noted this to be a possible limitation because some students may simply guess the response from the two options without thinking through other options; which may be the reason for the response time of as low as 15 minutes (the average time was 25 minutes).

Table 4.7 Students' response patterns to the questionnaire, adapted from Taylor-Powell (2008)

Guiding question	Response from data
a. The questions in the questionnaire measure what they are supposed to measure	- All responses given were appropriate.
b. All the words are understood	- All questions were answered. - Varying response choices chosen by respondents. - 2% of questions answered with multiple answers which was incorrect.
c. All respondents interpret the item in the same way	- 80% of questions were given exactly the same answers.
d. All response choices are appropriate	- Varying response choices chosen by respondents.
e. The range of response choices is actually used	- All response choices were used in 84% of the questions.
f. The respondents correctly follow directions	- Instructions correctly followed for example using an "X" to select response. - Only 2% of questions answered with multiple answers which was incorrect.
g. The questionnaire creates a positive impression that motivates students to respond	- A 100% response to questionnaire was obtained.
h. Length of time that it takes to complete the questionnaire	- The response time was between 15 and 30 minutes.

With respect to following instructions (Table 4.7), students generally performed well. For instance all students used an "*X*" to mark their choice as they were instructed. Regarding the attitude towards the questionnaire, it was found that 100% of participating students completed it.

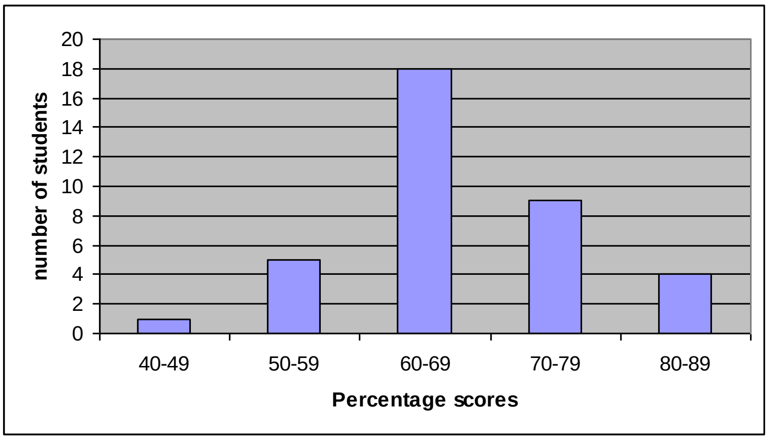

Figure 4.4 Distribution of students' scores in the pilot study

To obtain further clarity on the issue of whether the questionnaire was clear, students' responses in the pilot study were analysed. Results of the pilot study suggest that the average score for the 37 respondents was 67% (Figure 4.4). This relatively high score is an indication that the concepts covered in the test are probably addressed in Grade 11 Life Sciences. In this instance, only one student obtained a score of less than 50%.

Furthermore a normal distribution of scores (Figure 4.4) was found suggesting that most respondents clustered around the mean of 67%. This suggests that students in this group had a relatively similar understanding of the HIV and AIDS concepts as well as the cognitive ability to respond to them. This may further suggest that there are probably very few cases where "other" knowledge is required to respond to the test. For instance if the knowledge tested in the questionnaire is not covered in the curriculum, then a more skewed distribution would have been found, suggesting an imbalance in respondents' knowledge.

At the end of the data analysis however further corrections were made to the questionnaire. These corrections included:

a) adding instructions regarding the number of possible responses that students had to provide for particular questions,
b) replacing "true or false" options with more options in a multiple choice format, and
c) restructuring items to combine items asking similar concepts.

Following these adjustments the number of questions was reduced from 66 to 30 (Appendix 8).

Having prepared the questionnaire with 30 items, a statistician was consulted about questionnaire validation (Figure 4.2). This statistician evaluated items to indicate whether using statistical methods, the researcher would be able to answer the research subquestion. The statistician approved the use of the questionnaire.

4.4.4 Summary of the questionnaire generated in this phase

Having obtained validity of the questionnaire, the final set of items was structured in the manner presented in Table 4.8. The final questionnaire consisted of 30 items. However the researcher noted that the reliability of the questionnaire had not been determined. This attribute is however not presented in the current chapter as it was only calculated during the actual study (Chapter 6).

Table 4.8 Categories of questions in the final questionnaire

Category	Concepts covered	Number of questions
1. Academic HIV and AIDS knowledge	- Virology	2
	- Bacteriology	2
	- Circulatory system	2
	- Immunology	2
	- Vaccination	2
2. Functional HIV and AIDS knowledge	- Cause	2
	- Transmission	2
	- Symptoms	1
	- Effects of HIV on the body	2
	- Cure	3
3. Behaviour	- Attitude	4
	- Subjective norms	3
	- Perceived behavioural control (PCB)	3

4.4.5 Data collection and analysis

Having identified the sample of students for participation (Section 4.4.2), the questionnaire (Appendix 8) was administered by the researcher for data collection. The questionnaire was administered to all students within one week in October 2009. Students were not told about the questionnaire prior to administering it in order to ensure that they did not prepare for the questionnaire by studying. The procedure for administering the questionnaire is the one used during piloting of the questionnaire. During administration of the questionnaire by the researcher, Life Sciences teachers of the relevant schools as well as three other assistants were present and helped with the distribution of the questionnaire, invigilating and collecting the completed questionnaires afterward. The time spent by students to complete the questionnaire was also recorded. Five hundred and forty three students (Table 4.6) from the sampled schools participated in the study. Students' responses to the questionnaire were scored by the researcher against a set of correct answers, developed by the researcher (Section B in Appendix 8). Students' responses to the questionnaire were scored as either correct (allocating a score of 1 point) or incorrect (allocating a score of 0 point). In cases where no responses were given or where multiple answers were given, the researcher allocated a score mark of zero. With regards to behavioural preference items (item V21 to item V20) the researcher had prepared answers that would imply safe behavioural preference.

Students responses where therefore scored against these by giving one point for a safe behavioural preference and zero for a risk behaviour. Students' scores were then aggregated such that a score of less than 50% would imply overall risk behavioural preference and a score of 50% or more implied safe behavioural preference. Since the questionnaire only entailed closed questions, no responses were partially correct or incorrect.

Following the scoring process, percentage scores were generated for each student, per school and for each section of the questionnaire (that is, academic HIV and AIDS knowledge, functional HIV and AIDS knowledge and behavioural preferences). These percentage scores were used to compare the performance of Life Sciences and non-Life Sciences students. Data were also analysed per school for all nine participating schools. All statistical analyses were performed using *SPSS Statistics 17.0 Ink* software where descriptive and inferential statistics were calculated. The primary statistical analysis performed on the data was the non-parametric Mann-Whitney (or Wilcoxon-Mann-Whitney) test which is used to detect differences in data distribution, shape and spread as well as differences in medians of two independent samples (Nachar, 2008; Hart, 2001). Non-parametric statistics are those that are used when the populations are not normally distributed. The researcher chose this statistic because of the differences in the nature of samples (Life Sciences and non-Life Sciences background). Furthermore the sample sizes differed. Non-parametric tests are also used when data is ordinal. For example, data related to students' behavioural preferences were ordinal and hence a non-parametric text was suitable for them. While there are other non-parametric tests such as the unpaired t-test that could have been used, the researcher decided to use a Mann-Whitney test. The Mann-Whitney test was chosen because it assumes that the data from two independent samples (Life Sciences and non-Life Sciences) have a similar but not normal distribution, which can only be explained by determining the median instead of the mean (Hart, 2001). Similar to parametric tests, the Mann-Whitney test is used to determine if the difference between the medians of two groups is significantly different. (Non-parametric tests compare median rather than means due to data not being normally distributed). The median is the numeric value separating the higher half of a sample from the lower half, whereas the mean is the central tendency of a sample (Nachar, 2008). Using the Mann-Whitney test, the null hypothesis could be tested by generating a probability value at which the null hypothesis could either be accepted or rejected. This probability value is termed the Asymptotic Significance value. If this value was greater than the set alpha value (which can be 0.01, 0.05 or 0.1) the null hypothesis was accepted and rejected if the Asymptotic

Significance value is lower. The researcher used SPSS to test correlation between different groups. Here Spearman's correlation coefficient (represented as "*r*") was calculated. This is a non-parametric measure of statistical dependence between two variables. The generated correlation coefficient (which ranges from -1 to +1) is compared with the alpha value to determine whether the correlation is significant or not. If $r = 0$, that means there is absolutely no correlation between the variables. A correlation co-efficient of *1* means there is 100% correlation such that the two variables are directly proportional to one another. A correlation of *-1* is as strong as that which is *1* the difference is an inverse relationship. The significance of a correlation (or lack thereof) is measured against the established alpha values and denoted with asterisks.

The statistical analyses were done by the researcher who was supervised by two professional statisticians from the University of Pretoria. These statisticians also provided guidance to the researcher regarding the interpretation of results. Findings of data analysis are presented in Chapter 6**.**

4.5 Conclusion

As explained in the above sections, the study relied on both qualitative methods as well as quantitative methods. The researcher believes that based on validation processes taken to prepare instruments, the findings and conclusions drawn are acceptable responses to the research subquestions. The researcher acknowledges some limitations of the methods used. He believes that findings would have been more sensible had a second opinion been available. In this regard the researcher feels that theory triangulation (where a single set of data are interpreted by different investigators) would have rendered the findings more trustworthy. Nonetheless the researcher believes that the measures taken to strengthen the methods as described above were sufficient for rigour in the study. This view is supported in literature where researchers (Nicholls, 2003; Healy & Perry, 2000; Bogdan & Biklen, 1992) argue that in qualitative research, findings are true only within the lens of the researcher and his instrument. Findings of the methods used here are presented in Chapters 5 and 6 of this thesis. The reason for separation is that each chapter addresses a unique question using unique methods. In conclusion a broad discussion is presented in Chapter 7 as a response to the main research question.