6. CHAPTER 6: HIV AND AIDS KNOWLEDGE AND BEHAVIOURAL PREFERENCES OF STUDENTS

"My education was interrupted only by my schooling" Winston Churchill[14]

6.1 Introduction

Winston Churchill suggests that education and schooling are different. His quote does not deny the power of education, but implies that schooling may impede the potential of education to empower people. The current chapter therefore explores this view in the context of HIV and AIDS. In this regard one wonders whether Life Sciences "educates" or "schools" students, so that their behavioural preferences are safe and informed by knowledge.

Wang and Chiew (2010) suggest that behavioural preferences and behaviour itself, are acts of displaying one's decisions about particular phenomena. According to Wang and Chiew (2010: 81), "most decisions that an individual makes everyday are related to certain problems needed to be solved." While behaviour is not considered as an act of solving problems, some researchers suggest that there is a significant link between problem-solving and behaviour (Magnani *et al.*, 2005; Pakaslahti, 2000). Pakaslahti notes that some forms of behaviour are associated with problem-solving tasks.

Simply put, researchers suggest that there is a link between availability of knowledge, problem-solving and behavioural preferences. As stated in Section 1.4 and based on this premise the researcher hypothesises that Life Sciences students have more academic and functional HIV and AIDS knowledge compared with non-Life Sciences students. Furthermore the researcher believes (going into the study) that academic and functional HIV and AIDS knowledge correlate positively with safe behavioural preferences of students, so that Life Sciences students should report safer behavioural preferences compared with those of non-Life Sciences students. These hypotheses were tested in the study in response to two subquestions.

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

Subquestion 2:

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:

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

a) Functional HIV and AIDS knowledge?

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

As stated in Chapter 4 a mixed-methodology approach was used to respond to these questions. Results and a discussion are presented below.

6.2 Results

The researcher calculated the reliability of the questionnaire used in the study using *SPSS Statistics 17.0 Ink.* Results indicate that the Chronbach alpha value was 0.710 for the questionnaire, which is an acceptable level (Maree, 2007) for statistical analyses. Other results are presented below.

6.2.1 Students' understanding of academic HIV and AIDS knowledge

As stated in Section 4.4 it was first determined whether Life Sciences students and non-Life Sciences students differ in their understanding of academic HIV and AIDS knowledge (Appendix 8). Furthermore the researcher used this information to determine whether academic HIV and AIDS knowledge taught in Life Sciences is only available to Life Sciences students.

Looking at individual items, results indicate that in all items testing academic HIV and AIDS knowledge, Life Sciences students performed better than non-Life Sciences students (Table 6.1). Table 6.1 indicates that in all five areas related to HIV and AIDS content, namely virology, bacteria, circulatory system, immunology and vaccination, Life Sciences students performed better. However it is noteworthy that, even though this knowledge is formally taught only in Life Sciences, no less than 16 per cent of non-Life Sciences students were able to respond correctly. In particular, non-Life Sciences students seemed to know that "cells of the immune system such as CD 4 cells are found in the blood" (item V6 in Appendix 8). This suggests that this group of students is aware of what CD4 cells are, which is a central concept to HIV infection. Non-Life Sciences students also scored highly in the question testing their knowledge of Bacteria (that is, V3 in Table 6.1).

Table 6.1 The difference in percentage of students from the two groups, who correctly responded to individual questions

Item[15]	Question testing knowledge related to:	Life Sciences Students (%)	Non-Life Sciences Students (%)	Difference (%)
V1	Virology	41	16	26
V2	Virology	50	19	31
V3	Bacteria	81	53	27
V4	Bacteria	40	35	5
V5	Circulatory system	58	38	20
V6	Circulatory system	81	67	14
V7	Immunology	46	28	18
V8	Immunology	46	32	14
V9	Immunology	31	16	15
V10	Vaccination	55	21	34
Average		53	33	20

Results show that Life Sciences students had difficulty with questions on immunology, the number of students who responded correctly to the questions in this regard was less than 50%. For example more than 50% of Life Sciences students seemed not to understand concepts of antigens, antibodies, the body's defences against invasion by microbes as well as immune deficiency diseases (Appendix 8). This suggests that even if Life Sciences students know about HIV, the biochemistry thereof (which includes how the virus invades immunity cells, how the body defends itself as well as the consequences of infection) may not be fully understood. Life Sciences students however performed well (that is, they achieved more than 50%) on questions probing the understanding of the circulatory system.

Further analysis of the data suggested that the groups' knowledge differed most in terms of item V2 and V10 (Table 6.1). Item V2 required students to know factual knowledge about the

[15] Due to the length of individual items, full items are only presented in Appendix 8.

composition of the structure of a virus, while V10 was testing knowledge of the role of vaccination in slowing microbial metabolism. Not having Life Sciences as a subject means the majority of non-Life Sciences students did not have the necessary knowledge to answer these items correctly. The average number of students who correctly answered was almost the same for both groups in item V4 (which tested knowledge of bacteria) (Table 6.1). Overall the number of Life Sciences students who passed[16] the test was 53% (159 out of 300). Non-Life Sciences students' pass rate exceeded 33% (80 out of 243) in academic HIV and AIDS knowledge items even though they were not enrolled in this knowledge field.

Looking at the overall scores, results related to the understanding of academic HIV and AIDS knowledge indicate that there was a significant difference between the mean scores of Life Sciences students (53%) and those of non-Life Sciences students (33%) (Tables 6.2 and 6.3). These results suggest that Life Sciences students generally performed better in academic HIV and AIDS knowledge (Items V1 to V10 in Appendix 8) while non-Life Sciences students did not.

Table 6.2 Representing the average scores of the two groups on academic HIV and AIDS knowledge

Background		Academic HIV and AIDS Knowledge	Functional HIV and AIDS Knowledge
Life Sciences students	Mean (%)	52.87	74.37
	N	300	300
	Std. Deviation (%)	21.006	16.191
Non-Life Sciences students	Mean (%)	32.75	65.19
	N	243	243
	Std. Deviation (%)	24.593	19.716
Total	Mean (%)	43.68	70.26
	N	543	543
	Std. Deviation (%)	24.855	18.413

Given the asymmetric distribution of the scores a Mann Whitney test for non-parametric data was performed to determine if the median scores were significantly different (Section 4.4.4; Nachar, 2008; Hart, 2001) by testing the null hypothesis (that is, H_0: the population medians are not different). Results of this analysis are presented in Table 6.3.

[16] Pass rate in this thesis refers to the number of students who scored above 50% on average for all items.

Results in Table 6.3 suggest that overall there was a significant difference between the medians of the two groups (that is, Life Sciences and non-Life Sciences students) and therefore the null hypothesis was rejected. This means there was a significant difference in the performance of the two groups with Life Sciences students performing significantly better (in terms of the median) than non-Life Sciences students. This result (Table 6.3) indicates that the test (Item V1 to V10 in Appendix 8) was able to show that academic HIV and AIDS knowledge is possibly taught only to Life Sciences students and not to non-Life Sciences students. Given that non-Life Sciences students on average failed the academic HIV and AIDS knowledge test (that is they scored less than 50%), results suggest that, if academic HIV and AIDS knowledge positively influences the understanding of functional HIV and AIDS knowledge (as hypothesised in Section 1.4), Life Sciences students would be expected to perform better than non-Life Sciences students with regard to functional HIV and AIDS knowledge.

Table 6.3 A Mann-Whitney test results comparing Life Sciences students and non-Life Sciences students in academic HIV and AIDS knowledge. Background refers to whether students enrol for Life Sciences or not. "1" denotes Life Sciences students and "2" denotes non-Life Sciences students.

Ranks				
	Background	N	Mean Rank	Sum of Ranks
Life Sciences knowledge	1	300	328.46	98538.00
	2	243	202.30	49158.00
	Total	543		

Test Statistics[a]	
Mann-Whitney U	19512.000
Wilcoxon W	49158.000
Z	-9.380
Asymp. Sig. (2-tailed)	< .001

a. Grouping Variable: Background

The researcher acknowledges that there are numerous factors that could affect students' performance in the test. While it was not possible to control for all these factors, the researcher did investigate whether differences in sample sizes was a factor. In this regard data were analysed per school to determine whether Life Sciences students would still perform significantly better even if the sample sizes were smaller and the local context different. This within school comparisons excluded schools 4 and 5 because in these schools only Life Sciences students participated in the study (Table 4.6).

Results in individual schools (Figure 6.1), largely supported the view that Life Sciences students scored higher on items testing academic HIV and AIDS knowledge than non-Life Sciences students. For instance in school 8, the mean difference for all items is more than 30%. This result mirrors that of the Mann Whitney analysis (Table 6.3) where Life Sciences students' scores were higher than those of non-Life Sciences students.

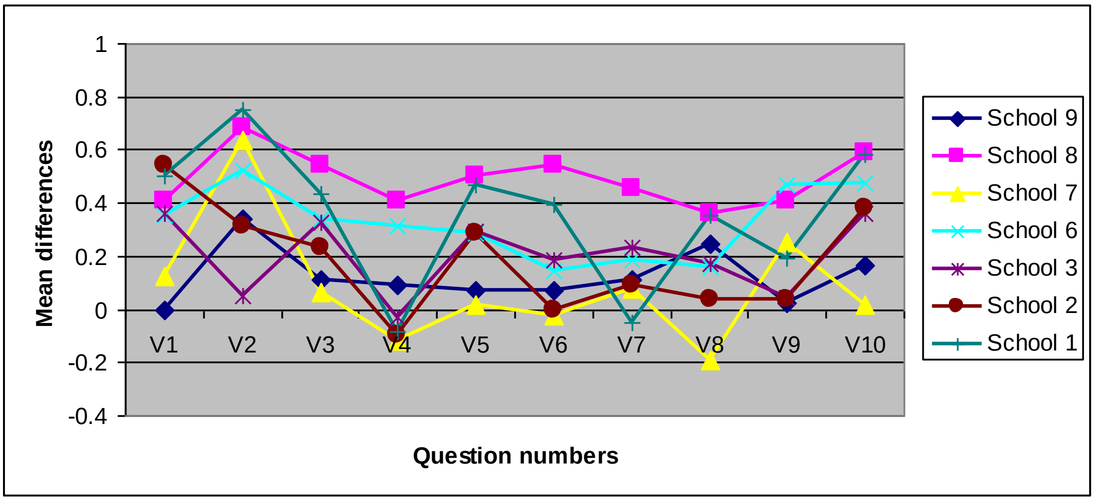

Figure 6.1 Indicating mean differences (in percentages) in scores per school for Life Sciences and non-Life Sciences students

However in some schools scores of Life Sciences students were low. For example in school 7, Life Sciences students' scores were higher (than non-Life Sciences') on items V2 and V9 but low on items V4 (which tested knowledge of HIV and AIDS related opportunistic infections), V6 (which tested knowledge of CD4 cells of the immune system) and V8 (which measured knowledge of defence mechanisms used by the human body) (see Appendix 8). A similar fluctuating trend was also observed in schools 1 and 3 (Figure 6.1). In this instance, it appears that item V4 was difficult for most Life Sciences students and easy for non-Life Sciences students (Figure 6.1). As alluded to, this item asked students to identify opportunistic infections caused by bacteria, a concept that is not only learnt in Life Sciences but also in other HIV and AIDS and sex education related areas (Table 2.1).

The above results suggest that student performance varied from one school to another. In some schools, Life Sciences students had more knowledge about academic HIV and AIDS knowledge than the non-Life Sciences students and vice versa in other schools. As a consequence, it can be argued that in some schools, having Life Sciences as a subject does not determine whether students could demonstrate academic HIV and AIDS knowledge (Items V1 to V10 in Appendix 8). It appears that other factors affect student knowledge of academic HIV and AIDS knowledge. Of particular note it appears that within schools, Life Sciences students (particularly from school 7) do not fully understand the concepts of bacteriology and immunology (items V4 and V8 in Appendix 8, respectively). Therefore one may conclude that within schools, there may be a specific reason why students struggle with certain concepts. These factors were however outside of the scope of the study and thus not investigated.

6.2.2 Students' understanding of functional HIV and AIDS knowledge

Results indicate similar trends in students' understanding of functional HIV and AIDS knowledge (V11 to V20 in Appendix 8), as with academic HIV and AIDS knowledge. Life Sciences students' average score in the functional HIV and AIDS knowledge test was 74% and 65% for non-Life Sciences. However one of the noticeable trends in the results of functional knowledge was that in six out of ten items, the difference in the score between the two groups was less than 10% (Table 6.4). In fact, non-Life Sciences students performed better in two items (V11 and V12), albeit the difference is only two per cent.

Table 6.4 The difference in percentage of students from the two groups, who correctly responded to individual questions testing functional HIV and AIDS knowledge

Item	Question	Life Sciences Students (%)	Non-Life Sciences Students (%)	Difference (%)
V11	AIDS is caused by HIV.	83	85	-2
V12	There are different strains (types) of HIV.	23	25	-2
V13	HIV cannot be transmitted through exchange of bodily fluid For example blood, between an infected person and another person.	84	84	0
V14	People with AIDS cannot be infected with HIV.	79	73	6
V15	People who have been infected with HIV do not show signs of infections immediately after infection.	86	80	6
V16	HIV disrupts the immune system leading to immune deficiency.	88	76	12
V17	People living with AIDS are highly vulnerable to many opportunistic infections that are easily cured in HIV negative people.	76	49	27
V18	There is a vaccine that can stop people from getting HIV.	67	43	24
V19	AIDS can be cured with antiretroviral drugs.	80	73	7
V20	HIV can be eliminated from the body.	76	63	13

With regard to specific content results indicate that students from both groups generally do not have knowledge of the various strains of HIV. This may suggest that while students know that a person can be re-infected (see item V14), they do not know that different strains of HIV exist. Other notable items were items V17 and V18. It appears here that a high fraction of non-Life Sciences students do not understand the concept of opportunistic infections (tested in item V17). This view is supported by the results in Table 6.1 (item V4), where students, particularly non-Life Sciences students, had did not know the concept of opportunistic infections. Another observation was that non-Life Sciences students did not know the concept of vaccination as tested in item V18. In the academic HIV and AIDS knowledge test, the concept of vaccination was also failed by 79% of non-Life Sciences students.

The issue of treating and curing HIV and AIDS emerged as one of the most difficult for students from both groups. For example results show that 73% of non-Life Sciences and 80% of Life Sciences students know that AIDS cannot be cured by antiretroviral drugs (item V19 in Table 6.4). Of the 73% non-Life Sciences though, 10% responded to item V20 by stating that HIV can be eliminated from the body. A total of 37% non-Life Sciences students and 24% Life Sciences students believe that HIV can be eliminated from the body. Furthermore 57% non-Life Sciences students stated that there is a vaccine that can stop people from becoming infected with HIV (item V18). Evidently students (mainly non-Life Sciences) have misconceptions regarding prevention of HIV infection as well treating and curing AIDS.

To determine if students' understanding of functional HIV and AIDS knowledge was statistically different the researcher performed a Mann-Whitney test through which the medians of the two samples were compared. Results here indicate that the p-value (Asymp. Sig. (2-tailed)) is less than 0.05 (Table 6.5), indicating that data distribution was not normal and the medians of these two groups of students were significantly different (Table 6.5). This means Life Sciences students have a significantly greater understanding of functional HIV and AIDS knowledge compared with non-Life Sciences students. Based on this result the researcher hypothesized that perhaps academic HIV and AIDS knowledge helps eliminate or correct misconceptions regarding HIV and AIDS. This view was tested in Section 6.2.4.

Table 6.5 Presenting students' understanding of functional HIV and AIDS knowledge

Ranks				
	Background	N	Mean Rank	Sum of Ranks
HIV and AIDS Knowledge	1.00	300	304.48	91344.00
	2.00	243	231.90	56352.00
	Total	543		

Test Statistics[a]	
Mann-Whitney U	26706.000
Wilcoxon W	56352.000
Z	-5.439
Asymp. Sig. (2-tailed)	.000

a. Grouping Variable: Background

Given students' scores of functional HIV and AIDS knowledge (Table 6.1 and 6.3), the subsequent question is whether sample size and local context is a factor for Life Sciences students performing better than non-Life Sciences students. Correspondingly data were again analysed per school.

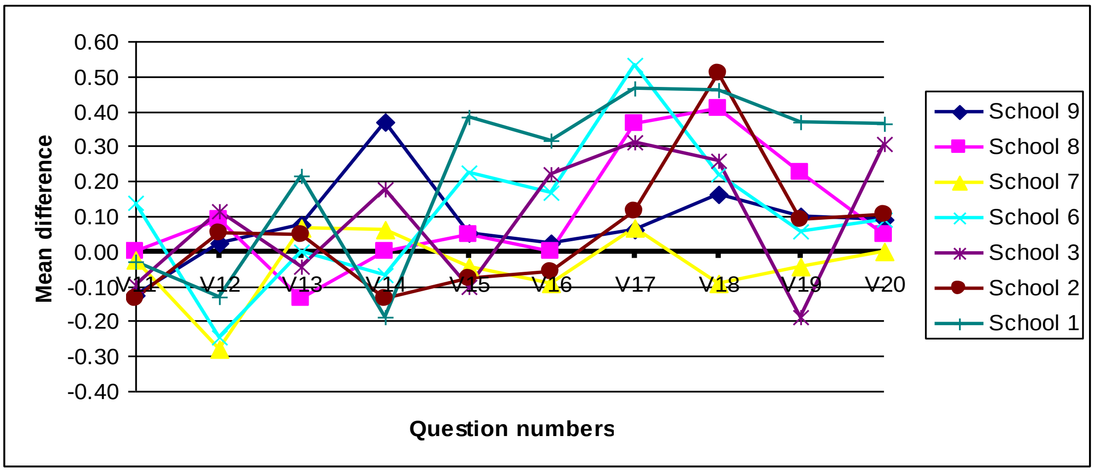

Figure 6.2 Mean differences between Life Sciences and non-Life Sciences students' scores in functional HIV and AIDS knowledge items

It emerged that school 9 was the only school where Life Sciences students' scores were higher in nine of ten items (that is, items V12 to V20 of Appendix 8) (Figure 6.2). Life Sciences students in schools 1, 6 and 7 did not get item V12 (testing knowledge of the different strains of HIV) correctly. Similarly, students from school 1 had failed item V14 (testing knowledge of multiple infections), while schools 3, 7 and 9, did not. This may also suggest that there are school-specific factors that influence students' performance. This may also explain why in school 6 Life Sciences students did not get items V12 and V14 correct.

Within the context of this study, it was not clear why non-Life Sciences students scored better in items V12 and V14. Further research is needed in this regard.

Results also indicate that Life Sciences students from seven schools (Figure 6.2) had a better understanding of concepts related to items V17 and V20 where they scored higher than non-Life Sciences students in all schools. These items measure understanding of concepts related to the effects of HIV in the body as well as curability of HIV and AIDS. Non-Life Sciences students had a better understanding of concepts related to the cause of AIDS, transmission of HIV as well as symptoms of HIV and AIDS (that is, items V11, V12, V14 and V15) than Life Sciences students.

6.2.3 Students' behavioural preferences

The researcher went on to investigate behavioural preferences of students (items V21 to V30 in Appendix 8). Here the researcher asked students to select one of two choices (Option 1 which is "agree" or Option 2 which is "disagree") which they agreed with (see Appendix 8). Thereafter the researcher plotted the frequency of students' choice in which Life Sciences students were compared with non-Life Sciences students. Results indicate that the trends between these two groups of students were generally the same (Figure 6.3).

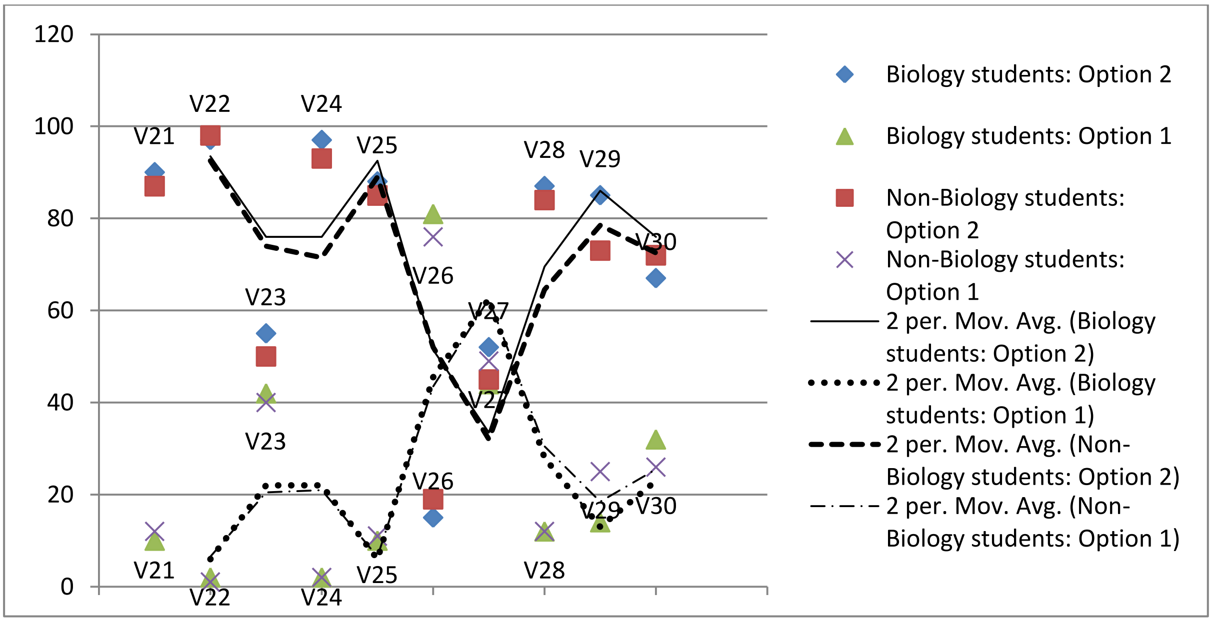

Figure 6.3 A distribution of students' responses on behavioural preferences

For example 10% of Life Sciences students chose option 1 for item V21 which was selected by 12% of non-Life Sciences students. A major difference in students' choices was only observed in item V29, where 85% and 73% of Life Sciences and non-Life Sciences students indicated that they would not have unprotected sexual intercourse respectively (the difference was 12%). Otherwise the percentage difference between students' choices was always less than 10%. These results suggest that irrespective of whether they take Life Sciences or not, students' views are similar.

The researcher performed a Mann-Whitney test to further determine whether having Life Sciences as a subject implies reporting safer behavioural preferences compared with non-Life Sciences students. Results of the Mann-Whitney test (Table 6.6) showed that Life Sciences students' reported behavioural preferences were not significantly different from those reported by non-Life Sciences students (p-value of 0.564 is greater than alpha value (0.05), therefore null hypothesis accepted). In other words reported behavioural preferences of Life Sciences students were statistically not different than for non-Life Sciences students.

Table 6.6 Mann-Whitney test comparing the behaviour of students who take Life-Sciences and students who do not take Life Sciences

Ranks				
	Life Sciences	N	Mean Rank	Sum of Ranks
Behavioural preferences	0	243	267.80	65075.00
	1	300	275.40	82621.00
	Total	543		

Test Statistics[a]	
Mann-Whitney U	35429.000
Wilcoxon W	65075.000
Z	-.577
Asymp. Sig. (2-tailed)	.564

a. Grouping Variable: Life Sciences

Given the similarities in students' reported behavioural preferences (Figure 6.3, Table 6.6), the researcher went on to determine combined students' (n = 543) attitudes, subjective norms and perceived behavioural control in relation to sexual engagement, HIV and AIDS protection/prevention strategies, acceptance (of being infected and of those infected), and, beliefs concerning personal susceptibility. With regard to attitudes (V21 to V24 in Appendix 8), results suggest that the most students (see Table 6.7 for Figures) view it as unacceptable to *have unprotected sex outside marriage*, *have multiple sexual partners* and *use unsterilized razor blades*. Of particular note regarding attitudes is that 97% of the 543 students who responded to the item believed that having multiple sexual partners was not acceptable. However students were split on the issue of using unsterilized needles. Forty one per cent of respondents suggested that it was "*okay to use sterilized needles for injections*." This result indicates that 53% of responding students do not see an HIV infection risk in using unsterilized needles.

Regarding subjective norms (V25 to V27 in Appendix 8 and Table 6.7), results indicate that according to 10% of the 543 students, *it is acceptable to have multiple sexual partners* in their communities. Furthermore 49% of the 543 students indicated that some youths do not protect themselves from HIV and AIDS. It also emerged from the data that 79% of the responding students report that most students dislike condoms. Another area that was explored was perceived behavioural control (V28 to V30 Table 6.4). Students reported that they would protect themselves from HIV infection (Table 6.7). Nevertheless it is noteworthy that 12% of the respondents indicated that they would have sexual intercourse with someone whose sexual practices (for example number of sexual partners) were unknown to them. Furthermore 19% of the respondents reported that they would have unprotected sexual intercourse.

Table 6.7 Summary of behavioural preferences of students on selected variables

Items	Agree (%)	Disagree (%)	No response (%)
V21. It is okay for unmarried people to have unprotected sexual intercourse.	10.87	88.4	0.74
V22. It is okay for people to have many sexual partners.	1.66	97.24	1.10
V23. It is okay to use sterilized needles for injections.	41.44	52.85	5.71
V24. It is okay to share one razor blade without sterilizing it before use.	2.21	95.40	2.39
V25. In my community it is okay for people to have multiple sexual partners.	10.31	86.56	3.13
V26. Most students dislike condoms.	78.82	16.57	4.60
V27. Young people in my community protect themselves from HIV infection.	46.41	49.17	4.42
V28. I would have sexual intercourse with someone whose sexual activities I do not really know.	12.15	85.45	2.39
V29. I would have unprotected sexual intercourse, For example without a condom with my boy/girlfriend.	18.97	79.56	1.47
V30. I am at risk of getting HIV.	29.47	69.06	1.47

The "within" school data revealed that there were school-specific factors that could affect behavioural preferences. This is because there were school-specific trends that emerged regarding students' attitudes, subjective norm and perceived behavioural control (Tables 6.8 and 6.9).

With regard to attitudes (items V21 to V24 in Tables 6.8 and 6.9), the results showed that students' views were sometimes school-specific and at times group-specific. For example when asked about unprotected sex outside marriage (item V21 Appendix 8), 19% Life Sciences students and 27% non-Life Sciences students in school 7, indicated that it was ok to have unprotected sex outside marriage. This was the highest observed proportion with this view in all the schools. Similarly, in school 1 and 3, a majority of non-Life Sciences students (69% and 58% respectively) recognise the danger of sharing unsterilized needles. In the other schools, the majority of students (non-Life Sciences) did not recognize this danger. Meanwhile the proportion is different for Life Sciences students, where Life Sciences students (68% in school 1 and 41% in school 3) recognized the danger of unsterilized needles. Evidently the proportions in school 1 indicate that most of their students held a similar view, whereas in school 3, there were differing views between the Life Sciences and non-Life Sciences students.

Table 6.8 Proportion of Life Sciences students who disagree with statements given in V21 to V30 of Appendix 8

Items[17]	School 1	School 2	School 3	School 4	School 5	School 6	School 7	School 8	School 9
V21	100	88	96	90	96	97	81	95	81
V22	96	100	100	95	100	97	105	100	100
V23	68	46	41	81	69	59	24	62	22
V24	100	100	96	95	100	100	105	100	100
V25	100	100	81	83	88	97	90	95	86
V26	12	19	11	16	16	10	33	14	11
V27	72	62	37	50	57	45	62	38	58
V28	96	96	78	83	80	100	95	95	89
V29	92	88	81	76	88	100	86	100	83
V30	60	54	74	57	65	97	90	90	53

Regarding subjective norms (items V25 to V27 in Tables 6.8 and 6.9), data analysis showed that students across all schools, both Life Sciences and non-Life Sciences indicated that young people generally do not like condoms. In this regard school 7 reported the highest

[17] Due to the length of individual items, full items are only presented in Appendix 8.

percentage of dislike of condoms (that is, 77% among Life Sciences students and 53% among non-Life Sciences students). Related to condoms, the majority of Life Sciences students from school 3, 6 and non-Life Sciences students from schools 1, 2, 5, 7 and 9, indicated that most young people do not protect themselves from HIV infection. Notably students from school 8 were the only group where both Life Sciences (68%) and non-Life Sciences (53%) students believed that young people did protect themselves from HIV infection.

Data also showed varying views regarding perceived behavioural control (items V28 to V30 in Tables 6.8 and 6.9). In this regard the majority of students in all the schools suggested that they would not have unprotected sex with strangers. Furthermore Life Sciences students generally said they would not have unprotected sex with their boy/girlfriends. While the majority of non-Life Sciences students said the same, 37% and 38% in schools 1 and 8 respectively, indicated that they would have unprotected sex with their boy/girlfriends. Another noteworthy observation was that a majority of students across all schools said they were not at risk of HIV infection.

Table 6.9 Proportion of non-Life Sciences students who disagree with statement in V21 to V30 of Appendix 8

Items[18]	School 1	School 2	School 3	School 6	School 7	School 8	School 9
V21	89	83	83	91	73	100	92
V22	97	94	100	100	100	100	100
V23	69	39	58	46	27	36	27
V24	92	92	92	97	100	91	100
V25	76	94	85	86	87	100	88
V26	14	25	8	17	47	9	31
V27	49	33	50	51	40	45	38
V28	80	81	94	80	100	73	85
V29	63	69	81	83	87	91	62
V30	65	75	77	74	73	91	69

Two observations can be made from the above report. Firstly, there were schools that seemed to have the highest unsafe behavioural preferences. For example school 7 reported the highest number of students who did not see a problem with unprotected sex outside marriage, a high dislike of condoms and high number of young people who did not protect themselves from

[18] Due to the length of individual items, full items are only presented in Appendix 8.

HIV infection. On the contrary, school 1, reported the safest behavioural preferences except for the dislike of condoms. This suggests that there were school-specific factors that affected behavioural preferences of students. Data however did not show much distinction between behavioural preferences of Life Sciences and non-Life Sciences students.

6.2.4 Does knowledge correlate with behaviour?

At the core of the study is the question whether students' understanding of academic HIV and AIDS knowledge and functional HIV and AIDS knowledge related to infection and treatment (as conveyed in the Life Sciences curriculum) correlate with the behavioural preferences of students. Having determined students' understanding of academic HIV and AIDS knowledge (Section 6.2.1), functional HIV and AIDS knowledge (Section 6.2.2) and their behavioural preferences (Section 6.2.3), the researcher investigated the correlation between academic HIV and AIDS knowledge and functional HIV and AIDS knowledge as well as behavioural preferences.

Table 6.10 Spearman's correlations between academic HIV and AIDS knowledge, functional HIV and AIDS knowledge and behavioural preferences for Life Sciences students (N = 300)

		Academic HIV and AIDS knowledge	Functional HIV and AIDS Knowledge	Behavioural preferences
Academic HIV and AIDS knowledge	Correlation Coefficient	1.000		
	Sig. (2-tailed)	.000		
	N	300		
Functional HIV and AIDS Knowledge	Correlation Coefficient	.481**	1.000	
	Sig. (2-tailed)	.000	.	
	N	300	300	
Behavioural preferences	Correlation Coefficient	.140*	.104	1.000
	Sig. (2-tailed)	.016	.073	.
	N	300	300	300

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

To start with, within group correlations (Life Sciences students' data only) were calculated. For Life Sciences students (n = 300), results suggested that there is a significant correlation (at 0.01 level of significance) between academic HIV and AIDS knowledge of students and their functional HIV and AIDS knowledge (Table 6.10). Furthermore it was found that academic HIV and AIDS knowledge correlates significantly with behavioural preferences at the 0.05 level of significance. Functional HIV and AIDS knowledge however did not correlate significantly with behavioural preferences. Results in Table 6.10 imply that those students who do well in academic HIV and AIDS knowledge will most likely display a better knowledge of functional HIV and AIDS knowledge.

For non-Life Sciences students (n = 243) no significant correlation was found between academic HIV and AIDS knowledge and reported behavioural preferences (Table 6.11). However it was found that academic HIV and AIDS knowledge correlates significantly with functional HIV and AIDS knowledge at the 0.01 level of significance. Further analysis of the data showed a significant correlation between functional HIV and AIDS knowledge and reported safe behavioural preferences (Table 6.11).

Table 6.11 Spearman's correlations between academic HIV and AIDS knowledge, functional HIV and AIDS knowledge and behavioural preferences for non-Life Sciences students (N = 243)

		Academic HIV and AIDS knowledge	Functional HIV and AIDS knowledge	Behavioural preferences
Academic HIV and AIDS knowledge	Correlation Coefficient	1.000		
	Sig. (2-tailed)	.		
	N	243		
Functional HIV and AIDS knowledge	Correlation Coefficient	.534**	1.000	
	Sig. (2-tailed)	.000	.	
	N	243	243	
Behavioural preferences	Correlation Coefficient	.095	.214**	1.000
	Sig. (2-tailed)	.142	.001	.
	N	243	243	243

**. Correlation is significant at the 0.01 level (2-tailed).

The results suggested that for non-Life Sciences students, knowledge of academic HIV and AIDS knowledge alone will not translate to safe behaviours. Furthermore academic HIV and AIDS knowledge improves understanding of functional HIV and AIDS knowledge, which in turn translates to reports of safer behavioural practices. While noting the significance between correlations presented in Tables 6.10 and 6.11, the researcher sought a clearer understanding of the trends. This is because the apparent significance of correlations between the different variables may be due to the large sample sizes (that is 300 and 243). An analysis of the data by schools was therefore made (Table 6.12).

Table 6.12 indicates that for seven of the nine participating schools, academic HIV and AIDS knowledge of students correlated significantly with their functional HIV and AIDS knowledge. However correlations of knowledge (both Life Sciences and HIV and AIDS) and behavioural preferences were not significant except for school 7, where a negative correlation (significant at 0.05 level) was observed.

A negative (but insignificant) correlation was also observed between academic HIV and AIDS knowledge and behavioural preferences for schools 2, 3 and 4. There was no significant correlation for functional HIV and AIDS knowledge and behavioural preferences in any of the participating schools. The results reported here suggest that in smaller samples, having academic HIV and AIDS knowledge does not translate to reportedly safer behavioural preferences, even though it does mean a better understanding of functional HIV and AIDS knowledge. In other words, it can be deduced that reported behavioural preferences may be influenced by factors other than knowledge.

Table 6.12 A summary of the correlations between Life Sciences, functional HIV and AIDS knowledge and behavioural preferences in schools

		Spearman's Correlation with Behavioural Preferences		Spearman's Correlation between
School	**Sample Size**	**Academic HIV and AIDS knowledge**	**Functional HIV and AIDS knowledge**	**Life Sciences and HIV and AIDS Knowledge**
1	96	0.136	0.166	0.493**
2	62	-0.008	0.165	0.303*
3	76	-0.076	0.028	0.307**
4	59	-0.034	0.152	0.119
5	52	0.014	0.057	0.357**
6	65	0.086	0.098	0.496**
7	37	-0.333*	-0.143	0.078
8	33	0.107	-0.100	0.348*
9	63	0.139	-0.124	0.451**

**. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).

6.3 Making sense of the results: reflecting on literature

The researcher made two observations on reflecting on literature with the results presented in this chapter. Firstly there are results that echo existing literature in HIV and AIDS education albeit there are some contradictions. Secondly some results provide a new insight into HIV and AIDS education. With regard to findings that support the literature, the researcher argues that scientific knowledge (such as academic HIV and AIDS knowledge taught in Life Sciences) improves students' understanding of HIV and AIDS. What is not apparent in the literature is whether scientific knowledge could also promote safe behavioural patterns. The literature (Ajzen, 1991) however indicates that knowledge is generally not related to behaviour. However the literature does not indicate why knowledge, particularly HIV and AIDS knowledge, tends to have no effect on behaviour. Consequently as a contribution to HIV and AIDS education, the researcher posits that higher understanding of scientific HIV and AIDS knowledge does not translate to safe behavioural preferences among Life Sciences students. The researcher in this regard argues that the hidden curriculum as well as the nature of knowledge (e.g. scholar academic knowledge), which is based on curriculum ideologies, could prevent knowledge from affecting behaviour. These findings are discussed in detail below.

6.3.1 Results that echo existing literature in HIV and AIDS education

Findings that support existing literature indicate that scientific knowledge is important for students to better understand HIV and AIDS. As the results show, this is because *i)* prior knowledge plays a significant role in students' ability to answer questions related to HIV and AIDS concepts, *ii)* students who have a scientific understanding of HIV and AIDS report fewer misconceptions about the subject, and *iii)* academic HIV and AIDS knowledge is related to functional HIV and AIDS knowledge. These results are discussed below.

6.3.1.1 Prior knowledge plays a role when students answer questions

Keselman *et al.*, (2004) suggest that some prerequisite knowledge of biology is required for students to understand the scientific properties of HIV and AIDS. This argument is in a constructivism perspective in which students construct new knowledge by relying on prior knowledge. Starr *et al.* (2009), Dimmock *et al.* (2007) and Audesirk *et al.* (2004) indicate that knowledge of virology (including viruses and HIV and AIDS), bacteriology (including bacteria and TB), immunology (including immunity and vaccination) as well as the circulatory system is the basis on which HIV and AIDS knowledge can be built. Results of the study supported this view as Life Sciences students generally performed better than non-Life Sciences students in academic HIV and AIDS knowledge. This is because Life Sciences students learn knowledge of virology, bacteriology, immunology and the circulatory system in Life Sciences and therefore may use this knowledge to answer questions related to academic HIV and AIDS knowledge. However because non-Life Sciences students (do not learn Life Sciences where this knowledge is taught) do not have this prior knowledge, the majority were not able to answer relevant questions.

While the above is important to note, it is also noteworthy that the score of Life Sciences students was not very high (the Life Sciences students' average score was 53%). According to Forehand (2005), Mayer (2002) and Anderson *et al.* (2001), answering questions does not solely depend on availability of knowledge. Instead there is an array of skills that students need in order to successfully answer questions. These skills include the ability to interpret questions as well as recalling and transferring information from their cognitive structures. Consequently students can still fail to correctly answer questions even if they have the necessary knowledge. This phenomenon was also observed in that the average failure rate for Life Sciences students questions related to academic HIV and AIDS knowledge was 47% even though this knowledge is taught in Life Sciences.

The idea that knowledge alone does not lead to successful answering of questions was also observed where non-Life Sciences students performed better than Life Sciences students in some aspects of academic HIV and AIDS knowledge. For example non-Life Sciences students performed better than Life Sciences students in questions testing knowledge of opportunistic infection related to HIV and AIDS. While reasons for this trend were not investigated, based on available evidence, the researcher believes that in some cases, students can successfully answer questions even though they do not have supporting knowledge.

6.3.1.2 Academic HIV and AIDS knowledge reduces misconceptions about HIV and AIDS

Scholars suggest that scientific knowledge (i.e. academic HIV and AIDS knowledge) can be used to redress misconceptions through a constructivist form of learning (Young & Collin, 2004; Baumgartner, 2001; Taylor–Powell, 1998; Thompson, 1995; Mezirow, 1991). The argument here is that students can use their conceptual knowledge of HIV and AIDS to rectify misconceptions and myths about HIV and AIDS.

In the study the researcher observed that there was a higher proportion of non-Life Sciences students who reported on what appeared to be misconceptions compared with Life Sciences students in functional HIV and AIDS knowledge. (The researcher acknowledges that misconceptions were not directly investigated, even though they emerged serendipitously). As stated earlier these misconceptions were related to prevention, treatment and curability of HIV and AIDS. The researcher therefore believes that Life Sciences students' understanding of academic HIV and AIDS knowledge helped them to obtain a better understanding of prevention, treatment and curability of HIV and AIDS and hence the observed correlation. This is in line with Keselman *et al*. (2007) who indicate that having a scientific understanding of a phenomenon reduces misconceptions concerning that phenomenon.

6.3.1.3 Academic HIV and AIDS knowledge is related to functional HIV and AIDS knowledge

Results indicated that for both Life Sciences and non-Life Sciences students, there was a significant correlation between academic and functional HIV and AIDS knowledge. The study however did not show whether this relationship was causal or not. Nevertheless it is important to note that academic HIV and AIDS knowledge correlates with knowledge of functional HIV and AIDS knowledge (Askew *et al*., 2004; Bhuiya *et al*., 2004; Diop *et al*., 2004; Mathur *et al*., 2004; Frontiers in Reproductive Health, 2001). From this perspective the researcher believes that having academic HIV and AIDS knowledge may have improved students knowledge of functional HIV and AIDS knowledge. This view is also based on the fact that Life Sciences students had a better knowledge of both academic and functional HIV and AIDS knowledge than non-Life Sciences students. If non-Life Sciences students had a better knowledge of functional HIV and AIDS knowledge than Life Sciences students, then it would be plausible that the apparent correlation between academic and functional HIV and AIDS knowledge is only accidental. However under the current circumstances, the researcher has shown that there is a significant relationship between these two forms of knowledge, where higher academic HIV and AIDS knowledge significantly correlates with higher understanding of functional HIV and AIDS knowledge.

The data however suggest that there may be other factors that affect the relationship between academic and functional HIV and AIDS knowledge. For instance in some schools (schools 4 and 7, the combined total number of students in these schools was 72), the researcher did not find a correlation between the above two forms of knowledge. This observation indicates that even though there is generally a correlation between academic HIV and AIDS knowledge and functional HIV and AIDS knowledge, such a correlation may be dependent on other context-specific factors. In the case of the schools referred to above, these factors may not have been in play in other schools.

6.3.2 New insights for HIV and AIDS education

As stated earlier, findings in the study indicate that academic and functional HIV and AIDS knowledge do not correlate with behavioural preferences of students. In this regard the study showed that apparently the hidden curriculum has a greater impact on students' behaviours than the formal Life Sciences curriculum. This view is in line with other scholars' observations (e.g. Askew *et al.*, 2004; Bhuiya *et al.*, 2004). However what emerged as new insight in the study is that knowledge prescribed in the formal Life Sciences curriculum does not correlate with students' behaviours preferences probably because students have difficulty relating knowledge taught in Grade 11 Life Sciences to real life, particularly because such knowledge is presumably taught from a scholar academic perspective (see Chapter 5). Evidence of this claim is that students *i)* do not understand some HIV and AIDS concepts taught in Life Sciences, *ii)* seem to rely on other alternative means to respond to questions for which they do not have the necessary content knowledge, and, *iii)* do not take ownership of social problems but instead shift the blame to other members of society. The researcher argues that if students had a knowledge of HIV and AIDS concepts, which is taught from a social reconstruction ideology, they would have probably used such knowledge to confront social ills, such as unsafe behaviour, thereby leading to behaviour transformation. This argument is in line with researchers who promote transformative citizenship education and critical pedagogy (Waghid, 2005; Waghid, 2002; Baumgartner, 2001; Christopher *et al.*, 2001). The researcher engages each of the above points in detail below.

6.3.2.1 HIV and AIDS knowledge does not influence behavioural preferences of students

Some researchers (e.g. Lesley, 2007; Magnani *et al.*, 2005; Pakaslahti, 2000; Crick & Dodge, 1994) argue that there is a significant link between content knowledge and certain forms of behaviour. However in the study, findings show that there is no significant correlation between knowledge and behavioural preferences. Data for Life Sciences students showed that academic HIV and AIDS knowledge correlates significantly with safe behavioural preferences, however functional HIV and AIDS knowledge does not. For non-Life Sciences students an opposite observation was made. Furthermore within schools findings indicate that there is no correlation between both academic and functional HIV and AIDS knowledge and behavioural preferences of students. These results suggest that generally HIV and AIDS knowledge has an insignificant impact on students' behaviour.

To further illustrate that unsafe behavioural preferences exists even in the presence of scientific knowledge of HIV and AIDS, findings indicate that 12% (157 of 543) of the students indicated that they would have sexual intercourse with someone whose sexual activities they did not know. Nineteen per cent (103 of 543) further indicated that they would have unprotected sexual intercourse. These statistics show that some students, even when they had knowledge, remained at risk of contracting HIV.

The researcher therefore believes that the hidden curriculum is largely responsible for students' behaviours. To this end the researcher notes that the behavioural preferences of both groups of students were similar even though their levels of HIV and AIDS knowledge were different. This suggests that there is a factor that is shared among most students, which is responsible for making their behavioural preferences similar, irrespective of the differences in their knowledge background. According to researchers (Kentli, 2009; Lempp & Seale, 2004; Margolis, 2001), because of context specificity, the hidden curriculum can be shared between schools, but is shared mostly within schools. Consequently results show that the correlation between students' behavioural preferences and their academic and functional HIV and AIDS knowledge within schools is far less than that observed between schools. In this regard the researcher observed that even though behavioural preferences of all students are similar, there are some significant differences within schools. For example results showed that school 7 has the riskiest behaviours while school 1 has the safest behavioural preferences among Life Sciences students. This indicates that there may be context-specific local factors that are influencing students' behavioural preferences. Though these factors were not identified individually, they can be collectively referred to as the hidden curriculum (Kentli, 2009; Margolis, 2001; Jackson, 1968), which excludes the formal Life Sciences curriculum and relevant knowledge.

Using findings of Chapter 5 the researcher argues that the format of the Life Sciences curriculum may be the main reason why HIV and AIDS knowledge does not correlate with students' behavioural preferences. As argued in Chapter 5, Life Sciences students seem not to be taught to construct scientific understanding of HIV and AIDS that can be used to respond to novel real-life situations. Furthermore students are not taught sufficient knowledge that would allow them to understand and take ownership of social problems related to HIV and AIDS. These views are discussed further below.

a) Students do not know some critical HIV and AIDS related concepts

Results showed that almost 50% of the Life Sciences students scored less than 50% in the test on academic HIV and AIDS knowledge. Furthermore there were indications that students do not fully understand some HIV and AIDS related concepts. An important observation in this regard is that for Life Sciences students, the area of great concern is immunology. (Immunology is regarded by Starr *et al.* (2009), Dimmock *et al.* (2007) and Audesirk *et al.* (2004) as important for understanding HIV and AIDS). In this regard Life Sciences students do not fully know *i)* which component of the immune system is responsible for recognizing antigens and triggering the immune system, *ii)* the body's defence mechanism against invasion by microbes, and, *iii)* the relationship between the immune system and immune deficiency diseases.

With regard to functional HIV and AIDS knowledge results show that some students in both groups do not have knowledge related to the different strains of HIV. Some students think there is only one type of HIV. Some of the non-Life Sciences students do not know that having AIDS increases one's vulnerability to many opportunistic infections. The same group of students also thought people can be vaccinated so that they do not get infected with HIV.

It is important to note that the concepts that were not fully known by students, were also identified by the researcher as receiving least attention in the Grade 11 Life Sciences textbooks (Ayerst *et al.*, 2008; Clitheroe *et al.*, 2008) (see Chapter 5). Therefore the researcher believes that the curriculum is partly responsible for students not having a full understanding of HIV and AIDS. The researcher also believes that if students do not have sufficient knowledge of HIV and AIDS, their ability to use knowledge to decide on behavioural preferences will be lowered. As stated by Christopher *et al*. (2001) and Kegan (2000), in order to transform students' behaviours, knowledge should provide students with new perspectives about their lives as it provides new alternatives. Baumgartner (2001) also supports this view in that concept understanding may lead to a situation in which students feel a need to change their perspectives based on the new knowledge. Consequently if students do not have knowledge, then their perspectives will not be changed. The researcher therefore argues that students' lack of concept knowledge is responsible for knowledge's failure to correlate with behavioural preferences.

b) Students rely on alternative means to respond to HIV and AIDS problems when they do not have the necessary knowledge

The researcher also believes that responses to questions and students' behaviours related to HIV and AIDS are not necessarily based on the availability of concept knowledge taught in Grade 11 Life Sciences. Instead skills required to answer questions can be learnt from the hidden curriculum (MacDonald, 1971). For example in Section 6.2.1 results indicate that 33% of non-Life Sciences students passed the academic HIV and AIDS knowledge test which tested knowledge that is taught formally only in Life Sciences. The researcher argues that these students used their "creative impulses" to correctly guess answers. This phenomenon has been reported by Martin (1976) who argues that "students do not learn to read, they do not learn math or science or any of the other subjects and skills endorsed by all parties to the educational enterprise; what they do learn is to be docile and obedient, to value competition over cooperation and to stifle their creative impulses." Consequently if students lack concept knowledge, they develop intrinsic skills that will be used to respond to questions in order to ensure that they pass a test. Similarly if students do not have transformative education (such as is the case in Life Sciences), they learn survival skills, norms, values and belief systems from the hidden curriculum, which will define their behavioural preferences.

c) Students think that society (and not themselves) is at risk of HIV infection

The researcher believes that in order to transform behaviours the Life Sciences curriculum should help students to become critical thinkers who will take ownership and responsibility for their behaviour and their contribution to society. This can be achieved if the curriculum is aligned with social challenges by teaching actionable knowledge which is context-specific. In Chapter 5, the researcher argued that the Life Sciences curriculum does not meet these requirements. As a result findings in the study show that students do not view themselves as part of the greater social HIV and AIDS challenge. In this regard data showed that students (both Life Sciences and non-Life Sciences) generally report safe behavioural preferences. However results show that students' perception of their communities and fellow students was negative. For example some students reported that other youth did not like condoms and did not protect themselves from HIV infection. This observation suggests that students think their societies, including fellow students, were at higher risk of infection than themselves. This view is also supported by the fact that the majority of students do not think they are at risk of contracting HIV. However 12% (65 of 543) of the students admitted to being at risk of contracting HIV. Twenty nine per cent (157 of 543) indicated that they would have sexual intercourse with someone whose sexual activities they did not know. Nineteen per cent (103 of 543) further indicated that they would have unprotected sexual intercourse with their boyfriend or girlfriend. These statistics show that some students remain at risk of contracting HIV even though some of them do not see themselves as part of the greater social HIV and AIDS problem.

The researcher therefore believes that the Life Sciences curriculum's failure to integrate social issues with knowledge is the main reason why students blame others for the spread of HIV and AIDS. This is in line with Zuga's (1992) observation that if socialization is not explicitly incorporated in a curriculum, students will have difficulty viewing themselves and what happens in the classroom as part of the greater society. Consequently students in the study had difficulty in relating themselves and knowledge taught in Life Sciences to everyday life

6.4 Conclusion

The researcher concludes that the Life Sciences curriculum is significant for improving students' ability to answer HIV and AIDS related questions and correct misconceptions related to functional HIV and AIDS knowledge. However the Life Sciences curriculum does not lead to behaviour transformation. This is most likely because students are not taught knowledge and skills that are required for behaviour transformation. Instead students are left to rely on an alternative hidden curriculum means to respond to HIV and AIDS questions. The hidden curriculum also helps students to develop students' belief systems that frame their behavioural preferences.

With the findings in Chapter 5 and the current chapter, the researcher believes that curricula can be manipulated so that they have a greater influence on students' everyday lives in relation to HIV and AIDS. In the following chapter, the researcher provides a succinct discussion on key findings and their implications for curriculum design in Life Sciences and HIV and AIDS education as well as recommendations for further research. In this regard the researcher will reflect on the research questions asked at the beginning of the study.

7. CHAPTER 7: IMPLICATIONS OF THE STUDY FINDINGS: AN EPILOGUE

"AIDS is the biggest challenge, the major disaster facing this country and we would have wished for something more specific and far-reaching" Mangosuthu Buthelezi[19]

7.1 Introduction

In this chapter the researcher responds to Dr Mangosuthu Buthelezi's request for something more specific and far-reaching as far as HIV and AIDS education for behaviour transformation is concerned. As stated in Chapter 3 the researcher undertook the study with a view to explore some of the strategies used to fight the spread of HIV and AIDS. In particular the researcher wanted to explore the role of formal education in behaviour transformation, on the understanding that behaviour transformation is an important key to minimize the spread of HIV and AIDS in South Africa. In the process the researcher asked, "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?" A response to this question was embedded in responses to three subquestions explored in Chapters 5 and 6.

In this chapter the researcher reflects on the research question and subquestions in order to articulate the knowledge contribution of the study. To this end, it is important to first reflect on Chapters 2 and 3 (Figure 7.1) in order to put forward what is already known in the literature in relation to the research subquestions. In Chapter 2 the researcher pointed out that curricula have objectives. These curriculum objectives may include addressing factors that perpetuate the spread of HIV and AIDS, for example risk behaviour, gender imbalances, stigma and discrimination, sexuality and human rights (Figure 7.1). However to attain these objectives, curricula are limited by issues related to curriculum theory, curriculum rationale, content knowledge and the curriculum ideology (Figure 7.1).

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

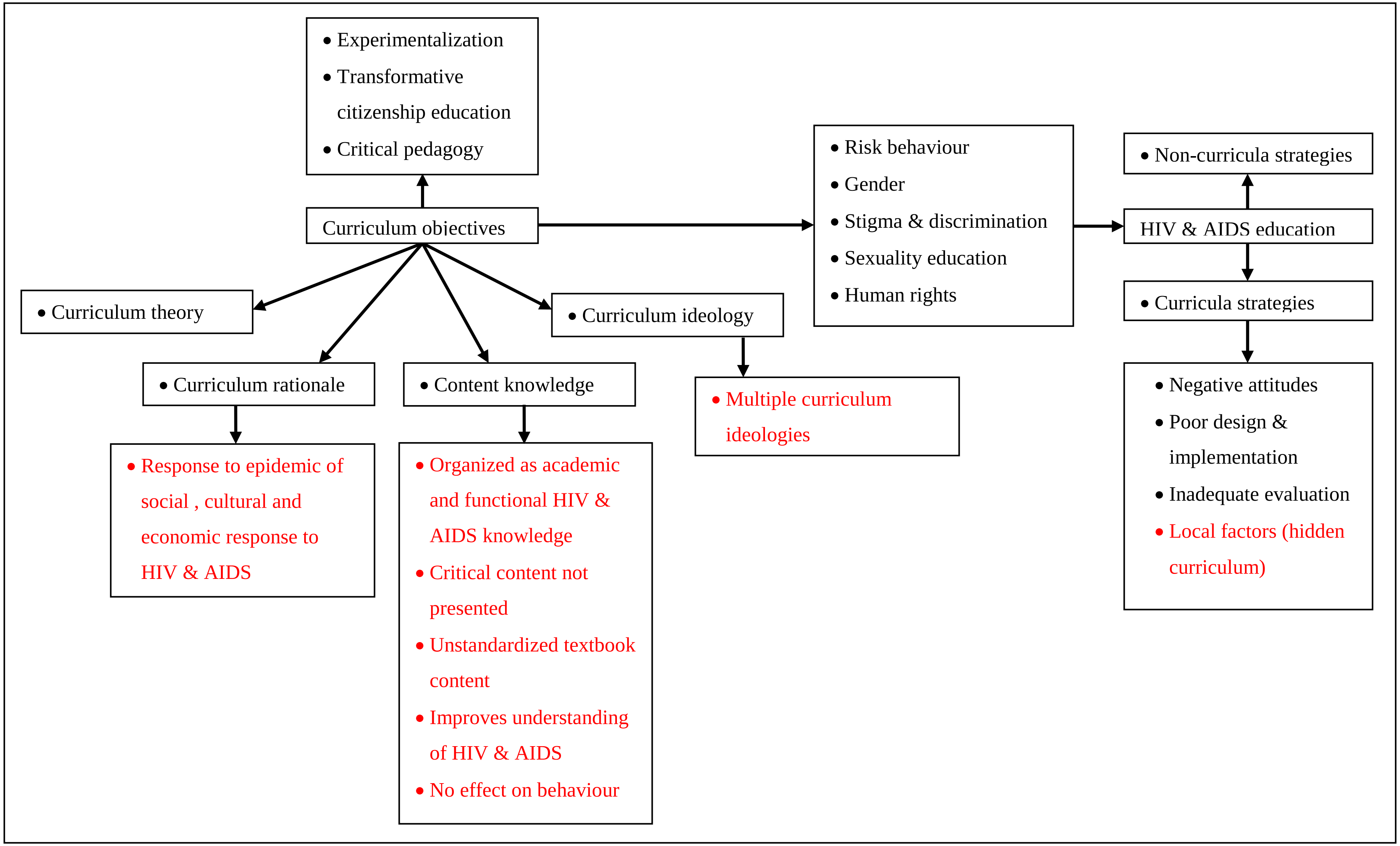

Figure 7.1 A summary of knowledge available in literature and discussed in Chapters 2 and 3 (in black). Knowledge generated in the study is presented in red. This new knowledge is in relation to Grade 11 Life Sciences curriculum investigated in the study.

To ensure that curricula are able to meet their intended objectives, especially if the objectives relate to socialization, the curriculum must follow transformative citizenship education and/or critical pedagogy (Figure 7.1). In Chapter 3 the researcher indicated that HIV and AIDS education can either be integrated into a formal curriculum or non-curricula strategies can be used (Figure 7.1). With respect to curriculum-based strategies, the literature reports that there are factors that hinder the achievement of intended outcomes. These factors include negative attitudes toward HIV and AIDS education, poorly designed and implemented programmes, as well as inadequate evaluation of HIV and AIDS programmes (Figure 7.1) as well as other non-curriculum factors that have been found to affect the spread of HIV and AIDS.

The researcher found in the study that the Life Sciences curriculum (which is meant to include HIV and AIDS content) does not have a strong relationship with behaviour transformation. This is mainly because the Life Sciences curriculum statement and textbooks do not have clear objectives that relate to HIV and AIDS and behaviour framed by a suitable curriculum ideology. Based on findings behaviour transformation is not considered in the Grade 11 Life Sciences. Further research is needed in order to better understand the primary challenges of Life Sciences in relation to behaviour transformation related to HIV and AIDS. The researcher also makes recommendations for curriculum design in relation to HIV and AIDS education.

7.2 Revisiting the research subquestions with the major findings

The main findings of the study are organized according to the three research subquestions. Each finding and its implications are discussed in detail in the following subsections.

7.2.1 Addressing HIV and AIDS for behaviour transformation in the Life Sciences curriculum: research subquestion 1

The first research subquestion asked: “How does the Life Sciences curriculum address HIV and AIDS for safe behavioural preferences among students?” In the current chapter the researcher organized findings of the study in response to this question into three categories, namely the principal reason for integration of HIV and AIDS education in Life Sciences, the structure of the Life Sciences curriculum and the content of Life Sciences in relation to HIV and AIDS. These are discussed below.

7.2.1.1 The principal reason for incorporating HIV and AIDS education into Life Sciences

The researcher argued in Section 5.3.2 that the inclusion of HIV and AIDS content into the Life Sciences curriculum is a response to the epidemic of social, cultural and economic response to HIV and AIDS (Figure 7.1). In Chapter 3 the researcher pointed out that researchers indicate that HIV and AIDS education can be based on at least three foundations, namely the epidemic of HIV infection, the epidemic of AIDS, and the epidemic of social, cultural and economic response (Stein, 2003). HIV and AIDS education is then designed and administered in accordance with factors that are responsible for the targeted epidemic (Parker & Aggleton, 2003). For example if HIV and AIDS education is aimed at behaviour transformation, then the major goal is that the epidemic of HIV infection must be addressed. As also stated in Chapter 3 the epidemic of HIV infection is a scenario in which individuals become infected with HIV (Stein, 2003). Reasons for such infection may include risk behaviour (Stein, 2003). Consequently people are provided with the knowledge and skills that are necessary to transform their behaviour.

Findings of the study however point out that the Life Sciences curriculum does not spell out the necessary life skills and actionable knowledge that are required for behaviour transformation. As discussed in Chapter 3 other scholars suggest that for behaviour transformation to occur, factors that are responsible for risk behaviour, such as stigma and discrimination must be addressed (Kirby *et al*., 2007; Donovan & Ross, 2000). However the study has shown that these factors are not spelled out in the Life Sciences curriculum statement. Furthermore researchers (Francis, 2010; Kirby *et al*., 2007; Donovan & Ross, 2000) point out that behaviour transformation is only likely to occur when students are taught about the biology of HIV related to its transmission from one person to another. However the study shows that HIV transmission is one of the concepts that receive the least attention in Life Sciences. Overall the study found no evidence to indicate that Life Sciences addresses the epidemic of HIV infection.

Findings of the study also imply that Life Sciences is not concerned with the epidemic of AIDS. As indicated in Chapter 3 the epidemic of AIDS is when the adverse effects of HIV become visible (Stein, 2003). This is when infected people become ill from various opportunistic infections and some die. To address this epidemic researchers argue that people must be taught about treatment mechanisms that can be employed to counteract or reduce the effects of HIV in their bodies (Francis, 2010). The study however found virtually no attempt to provide information on opportunistic infections, multiple HIV infections, antiretroviral drugs as well as other mechanisms related to treatment of AIDS in the Life Sciences textbooks. Therefore the researcher concludes that Life Sciences does not seem to be driven by the epidemic of AIDS.

The third area that was explored was the epidemic of social, cultural and economic response. As indicated in Chapter 3, Parker and Aggleton (2003) define this epidemic as the explosion of HIV and AIDS awareness programmes, research and production of treatment drugs, research on curability of AIDS and factors leading to HIV infection and AIDS. Based on this definition the researcher believes that the inclusion of HIV and AIDS content in Life Sciences is another human response to HIV and AIDS which seeks to provide students with knowledge that could be used to minimize the spread and effects of HIV and AIDS (Figure 7.1). Scholars however indicate that this epidemic is influenced primarily by social contexts and culture (Luginaah *et al.*, 2005; Tobias, 2001). Therefore the researcher maintains that the inclusion of HIV and AIDS knowledge in Life Sciences is an example of the epidemic of social, cultural and economic response to HIV and AIDS (Figure 7.1).

To further understand how Life Sciences addresses HIV and AIDS for behaviour transformation among students, the researcher analysed the Life Sciences curriculum statement regarding its structure.

7.2.1.2 The structure of the Life Sciences curriculum

Findings in the study showed that there is no single apparent curriculum ideology for HIV and AIDS education in Life Sciences (Figure 7.1). In this instance the discussion in Chapter 2 indicated that curricula can be organized in different ways. The researcher also indicated that the effectiveness of a curriculum to address social issues (such as behaviour transformation) will depend on its ability to resolve some of the reported challenges in curricula in general

(Sections 2.2 and 2.5). In particular the researcher highlighted challenges that are embedded in the curriculum as most significant in ensuring that the curriculum is able to address social issues (Section 2.3.3).

Findings of the study point out that Life Sciences has a generic curriculum with basic curriculum components. These components include predetermined subject matter and a planned format of learning experiences based on recommended content. The implication of this framework however is that the curriculum will be vulnerable to other curricula challenges related to the curriculum ideology as well as content knowledge. For example Beauchamp (1981:2) indicates that the major question in curriculum development is “what shall be taught in schools.” Responding to this question may take various forms as discussed in Chapter 2 rendering the selection of content knowledge an area of much concern.

Findings indicated that with regard to content knowledge, Life Sciences adopts multiple curriculum ideologies for HIV and AIDS. Scholars indicate that it is critical that subject areas have clear founding ideologies which provide orientation for various components of the curriculum (Þórólfsson and Lárusson, 2010). Furthermore a curriculum ideology would indicate the objectives of teaching students particular content in a specific manner and sequence (Davis, 1998). The multiplicity of curriculum ideologies for HIV and AIDS education in Life Sciences means it is not clear whether students should be taught scholar academic, social efficiency, student-centred or social reconstruction knowledge. This further implies that one cannot measure the effectiveness of Life Sciences in relation to behaviour transformation against any particular curriculum objectives related to the established curriculum ideologies.

The researcher found that the Life Sciences curriculum is knowledge-oriented. As pointed out in Chapter 2 Van Manen (1978) suggests that a knowledge-oriented curriculum is not student-centred or context-specific and follows a top-down approach of teaching predetermined content and skills. A knowledge-oriented curriculum therefore is against recommendations in HIV and AIDS education that suggest that education should be informed by social, cultural and the personal contexts of students (Page *et al.*, 2006; Griessel-Roux *et al.*, 2005). Scholars argue that a knowledge-oriented HIV and AIDS education may not lead to necessary social reform through social consciousness that is needed to address behaviour transformation, stigma and discrimination, human rights violation, gender imbalances as well as sexuality challenges related to HIV and AIDS (Anderson & Beutel, 2007).

The study also found that the content of Life Sciences textbooks is not standard. As indicated in Chapter 5, the researcher does not advocate that textbooks be identical. However textbooks are regarded by many (especially in underdeveloped and developing countries) as the primary sources of information (Gregg *et al.*, 2008; Mohammed, 2007). Furthermore in some cases, access to textbooks is very limited, in that only one textbook may be available for a given subject area. Notably the textbooks used in this study were recommended by most teachers surveyed (Section 4.3.3). The consequence of having unstandardized textbooks therefore is that students from different schools and locations may be taught different content, which may be serious if textbooks do not cover all the important areas. This also means students' content understanding could differ according to the textbooks they have access to. Overall there is a great possibility that, in the case where textbooks do not present adequate content, students' understanding of the content will be limited. As suggested by researchers (and observed in the study), if students do not have adequate HIV and AIDS content knowledge, they are prone to have misconceptions of the subject (Baumgartner, 2001).

7.2.1.3 Content knowledge taught in Life Sciences

The study found that HIV and AIDS knowledge is included in the Life Sciences curriculum as extra content organized as academic HIV and AIDS knowledge (Figure 7.1). This approach is not new as other researchers have reported on it (Van Laren, 2008). However UNESCO (2006) warns that there are various challenges associated with this approach. For example if the mother subject follows a curriculum ideology that does not address social issues (such as behaviour transformation), HIV and AIDS content could also be ineffective in that regard. The researcher also observed this in that HIV and AIDS content prescribed in Life Sciences curriculum statement and textbooks is didactic. Furthermore the researcher confirmed UNESCO's (2006) report that when added as extra content, HIV and AIDS knowledge does not receive adequate attention and some significant concepts are not covered. In this regard the researcher observed that in Life Sciences there are HIV and AIDS related concepts that are given least page volume and depth, regardless of various researchers indicating that these are crucial for improved understanding of HIV and AIDS as well as behaviour transformation.

The study found that the content knowledge presented in the Life Sciences curriculum statement and textbooks is didactic in nature. Researchers indicate that didactic knowledge is effective in providing scientifically reliable content knowledge that could be used to redress misconceptions concerning HIV and AIDS (Francis, 2010; Baumgartner, 2001). In this regard the study also found that students who have academic HIV and AIDS knowledge seem to have fewer misconceptions. However the limitation of didactic knowledge is that it must be coupled with other forms of knowledge (e.g. functional HIV and AIDS knowledge) in order to lead to behaviour transformation (Brown *et al.*, 2001). For example Brown *et al.* (2001) found that when coupled with psychological counselling, academic HIV and AIDS knowledge improves acceptance of HIV testing and also reduces post HIV test stress. This therefore means academic HIV and AIDS knowledge taught in Life Sciences may not lead to behaviour transformation unless students are also exposed to functional HIV and AIDS knowledge.

With regard to academic HIV and AIDS knowledge other researchers indicate that it is important that students are taught to use knowledge in everyday life (Cotti & Schiro, 2004). For example Klop *et al.* (2010) argue that knowledge must be coupled with good personal and social values as well as the ability to use knowledge in order to help students make informed decisions. The study however found no evidence to suggest that Life Sciences develops personal and social skills related to HIV and AIDS. This observation means enculturation of students when they develop skills and knowledge required to ensure their survival and prosperity may be limited (Kendall *et al.*, 2004; Adeyemi & Adeyinka, 2002; Hughes & More, 1997). In Chapter 2 the researcher argued that this is one of the reasons why education fails to foster socialization.

The significance of ensuring that the curriculum addresses students' needs is also discussed by Griessel-Roux *et al*. (2005) who contend that HIV and AIDS education should be tailored to specific students' needs. However the study found that Life Sciences textbooks provide predetermined content and foster development of predetermined skills. While there are no data regarding how this knowledge and skills were incorporated into the curriculum, the study did find that students' experiences and prior knowledge related to HIV and AIDS do not seem to be utilized in Life Sciences.

Overall the study was able to make inferences about the motive for including HIV and AIDS content in Life Sciences, the structure of the Life Sciences curriculum in relation to HIV and AIDS as well as the nature of HIV and AIDS content knowledge taught in Life Sciences. The conclusion derived from these findings is that Life Sciences teaches HIV and AIDS knowledge in order for students' to have knowledge of the relevant concepts. Behaviour transformation will probably not be achieved through Life Sciences because of the structure of the subject and the manner in which HIV and AIDS knowledge is incorporated.

7.2.2 HIV and AIDS knowledge and behavioural preferences of students: research subquestions 2 and 3

The second and third research subquestions asked:

"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?"

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

a) Functional HIV and AIDS knowledge?

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

In response to these subquestions the researcher argues that academic HIV and AIDS knowledge plays a significant role in influencing students' knowledge of HIV and AIDS. However this knowledge does not correlate with the behavioural preferences of students. Instead behavioural preferences seem to be influenced by other local factors (Figure 7.1). The researcher elaborates on these views below.

7.2.2.1 The significance of HIV and AIDS knowledge

The study found that HIV and AIDS content knowledge relates to students' performance. It was shown that Life Sciences students had a better knowledge of academic HIV and AIDS knowledge compared with non-Life Sciences students. As argued in Chapter 6 these observations support views by a number of researchers who believe that students use prior knowledge when constructing new knowledge as well as when they answer questions

(Maynard *et al*., 2001). The implication of this however is that those students who lack academic HIV and AIDS knowledge will not be able to answer questions related to HIV and AIDS, which will in turn affect their behavioural patterns. For example Maynard *et al*. (2001) and Pakaslahti (2000) report observing an association between concept understanding, problem-solving abilities and certain types of behaviour. Scholars indicate that when students do not understand concepts, their ability to solve problems is jeopardized leading to them displaying adverse behavioural patterns (Williams and Noyes, 2007; Pakaslahti, 2000). Consequently the researcher believes that those students, who do not have adequate academic HIV and AIDS knowledge, may display different behavioural patterns compared with those who have such knowledge.

The above argument is also supported by the fact that academic HIV and AIDS knowledge was found to be associated with fewer misconceptions concerning HIV and AIDS. This observation indicates that students use scientific knowledge to better understand HIV and AIDS. According to critical pedagogy (Section 2.5.3) students can use new knowledge to discuss and reflect on their life issues and modify what they already know (Baumgartner, 2001; Kegan, 2000). In this way misconceptions can be modified or eliminated.

It is accepted among researchers that academic HIV and AIDS knowledge is used by students to improve their understanding of functional HIV and AIDS knowledge (Askew *et al*., 2004). The study also found data to support this argument. However the study also found that some students who did not have academic HIV and AIDS knowledge were able to answer relevant questions. There are at least two possible explanations for this phenomenon. Firstly according to Martin (1976) students develop creative impulses through which they can answer questions correctly even if they do not have the necessary content knowledge. Martin (1976) indicates that schooling does not teach students content knowledge alone, but also the strategies and skills they need in order to pass a grade. In line with Martin's (1976) argument, one can infer that some students who do not have academic HIV and AIDS knowledge used their creative impulses to correctly guess answers. However a second possible explanation is that students used functional HIV and AIDS knowledge to respond to items testing academic HIV and AIDS knowledge. This view is the opposite of what Askew *et al*. (2004), Bhuiya *et al*. (2004), Diop *et al*. (2004), Mathur *et al*. (2004) and Frontiers in Reproductive Health (2001) reported in that academic HIV and AIDS knowledge leads to improved understanding of functional HIV and AIDS knowledge. The study showed that non-Life Sciences students who were presumed not to have studied academic HIV and AIDS knowledge as they did not enrol for Life Sciences had a pass rate that was below 50% in the academic HIV and AIDS knowledge test. However the same group scored above 50% in the functional HIV and AIDS knowledge test. Therefore it is plausible that those non-Life Sciences students who passed the academic HIV and AIDS knowledge test relied on their functional HIV and AIDS knowledge to answer items testing academic HIV and AIDS knowledge.

With regard to academic HIV and AIDS knowledge the study also found that both Life Sciences and non-Life Sciences students did not perform as well as expected. Reasons for this were beyond the scope of the study. However the researcher found that there were particular areas of concern. For Life Sciences students it was found that immunity and immune deficiency were areas of concern. Other researchers have reported that immunity is one area where learning and conceptual difficulties are mostly reported (Tibell & Rundgren, 2010). These researchers also indicated that immunity was one area in biology where the content language was distinct from students' everyday language and thus the topic presents students with conceptual difficulties (Tibell & Rundgren, 2010). In the context of the study however the implication of not understanding immunity is of much concern. The researcher believes that students who do not have knowledge of immune deficiency may have problems linking HIV and AIDS. The researcher also believes that this lack of knowledge of immunity may be responsible for students not knowing the concept of opportunistic infections. Furthermore the study shows that the lack of knowledge of immunity is related to students not knowing the concept of vaccination. While not investigated in the study, the researcher hypothesizes that knowledge of immunity could help students better understand the link between HIV and AIDS, and other opportunistic infections as well as the treatment of AIDS.

Another important finding in the context of the study is that knowledge is not significantly associated with behavioural preferences of students. Earlier in this chapter the researcher referred to scholars who report that HIV and AIDS content knowledge is directly related to safe behaviour (Lesley, 2007; Magnani *et al*., 2005; Pakaslahti, 2000; Crick & Dodge, 1994). The study however found that students' content knowledge was not significantly correlated with behavioural preferences. This finding is in line with that of various other scholars who argue that knowledge alone will not lead to adoption of safe behaviours (Ajzen, 1991). In an attempt to explain this phenomenon the researcher looked back to findings related to the Life Sciences curriculum (Chapter 5).

The researcher believes that academic HIV and AIDS knowledge tested in the study is not correlated with safe behavioural preferences of students because of the principal reason for incorporating HIV and AIDS education into Life Sciences (Section 7.2.1.1), the structure of Life Sciences (Section 7.2.1.2) and content knowledge taught in Life Sciences (Section 7.2.1.3). For example the study found that Life Sciences students are not taught to apply academic HIV and AIDS knowledge in their daily lives. Therefore even if these students have the necessary knowledge that could lead to behaviour transformation, if they do not have the necessary skills, this will not occur. Furthermore if Life Sciences knowledge is didactic, students will require special skills to translate such knowledge to actionable knowledge. Therefore the fact that academic HIV and AIDS knowledge did not correlate with students' behavioural patterns may not necessarily mean knowledge cannot lead to behaviour transformation. Instead the researcher concludes that academic HIV and AIDS knowledge taught in Life Sciences is not compiled and administered in a manner that would lead to behaviour transformation.

7.2.2.2 Students' behavioural preferences

Given the finding that knowledge is not related to students' behavioural preferences, the question then is what informs students' behaviour? The study shows that students' behaviours are context-specific suggesting that the hidden curriculum has a greater influence than the formal curriculum. In Chapter 6 the researcher referred to the fact that students' behavioural preferences are generally similar even though in isolated cases they varied from school to school. This finding suggests that HIV and AIDS education should be tailor-made to address specific issues in society. Donovan and Ross (2000) indicated that HIV and AIDS education should not follow an individualistic approach because behaviours are not individualistic but collective and social. Findings of the study support this view but highlight the need to explore social factors within each context so that HIV and AIDS education is driven toward these factors.

In Chapter 3 the researcher reported on five factors that have been identified (by other scholars) as influencing the spread of HIV and AIDS, namely risk behaviour, stigma and discrimination, poor sexuality education, as well as violation of human rights. The researcher also indicated that health education (such as HIV and AIDS education) may fail because of factors such as negative attitudes towards health education, poor design and implementation of interventions and evaluation strategies employed. However the study provided another possible reason why HIV and AIDS continue to spread. Findings of the study indicate that some of the students do not view themselves as being at risk of contracting HIV even though they engage in risk behaviour. Data in this regard showed that some students view society and other students as being at risk of HIV infection. For example these students point out that others do not protect themselves from infection. However data also showed that the same students report risk behaviour that puts them at risk of infection. Some students in this regard indicated that they would have unprotected sexual intercourse. This finding suggests that some students do not take ownership and responsibility for their own behaviour and their contribution to society through a social reconstruction approach. Therefore the fact that students lack responsibility and instead point fingers may increase their risk of HIV infection.

7.3 Recommendations for further research

While the findings of the study are important the researcher believes that further research is needed to better understand the relationship between education and social factors such as behaviour transformation in the context of HIV and AIDS. Some possible research areas are discussed below.

Firstly, there is a need to investigate how the Life Sciences as a subject could be used to foster behaviour transformation. The study showed that Life Sciences lacks a clear curriculum ideology that could foster behaviour transformation. However it remains imperative that Life Sciences contributes to student development and empowerment. Therefore it is critical that research be conducted to determine how Life Sciences could be transformed into a social reconstruction subject, without losing its rigour as a science subject that fosters concept understanding. This means there is a need to explore the possibility of integrating a scholar academic ideology with the social reconstruction ideology so that Life Sciences can teach content knowledge by developing skills that students need to reconstruct social norms and values that are perpetuating the spread of HIV and AIDS.

Secondly, the study showed that there are some HIV and AIDS concepts, for example immunity, that are not well understood by students. The impact of individual concepts (rather than academic or functional HIV and AIDS knowledge as a whole) on behavioural preferences however was not explored. With that there is also a need to investigate how students' knowledge of concept related to HIV and AIDS could be improved. In this regard research is needed to determine some effective teaching and learning strategies that could be employed in Life Sciences to ensure that students have a better understanding of HIV and AIDS related concepts.

Thirdly, the study showed that the content of the two Life Sciences textbooks was not standard. There is therefore a need to investigate the impact of this variation on students' concept understanding, especially in schools where there are textbook shortages. To this end research may extend to compare South African textbooks with other international textbooks in Life Sciences to determine if the standard in South Africa is comparable with that of other countries. This could also help determine which concepts should be covered in the textbooks and which ones should be optional.

Fourthly, the study found that there may be local (school-specific) factors related to the formal curriculum that seem to affect students' behaviours. These factors were however not identified. Given their apparent impact on students' behaviours, the researcher believes that research is needed to identify these factors and also to determine the extent to which they inform students' behaviours. This will ensure that HIV and AIDS education is able to address the specific needs of students.

Fifthly, the study showed that students' subjective norms were of greater concern than their attitudes and perceived behavioural control in relation to behaviour transformation. This is in the context of the theory planned behaviour (Guo *et al.*, 2007; Ajzen, 1991). However the study could not quantify the significance of subjective norms in relation to the other factors in determining students' behaviour. Therefore research is needed in this regard to determine the definite role that subjective norms would play in influencing behaviour.

7.4 Recommendations for Life Sciences curriculum development and HIV and AIDS education

The study attempted to provide an examination of the impact of Life Sciences on behaviour transformation. While new knowledge was generated, the challenge was that the Life Sciences curriculum does not fall within any one curriculum ideologies explored in Chapter 2. As indicated in Chapter 5 Life Sciences was found to overlap between various curriculum ideologies. However as argued in the same chapter, this overlap limits the subject's ability to be rigorous and thorough in meeting its ideological objectives particularly in relation to HIV and AIDS. The researcher therefore recommends that Life Sciences should adopt a clear curriculum ideology that will inform the integration and presentation of HIV and AIDS related content. Such an ideology must provide clear and attainable objectives for HIV and AIDS related behaviour transformation. Furthermore content knowledge, the instructional process and assessment strategies must be informed by such a curriculum ideology. Furthermore HIV and AIDS experts must be consulted so that suitable content is correctly integrated. The researcher also recommends that thorough present-situation analysis and target-situation analysis should be conducted in order to ensure that HIV and AIDS content knowledge integrated into Life Sciences responds to the needs of students and relevant societies (Kırkgöz, 2009; Songhori, 2008; Long & Crookes, 1992).

With respect to HIV and AIDS education, the researcher recommends that each programme should respond to a specific epidemic in relation to the epidemic of HIV infection, the epidemic of AIDS, and the epidemic of social, cultural and economic response. This means factors that affect each epidemic must be addressed concisely.

7.5 Conclusion: there is a need for social reconstruction

The researcher believes that there is a need for social reconstruction through education. As stated in the previous section it appears that students, who themselves are at risk of contracting HIV do not take ownership of their risk of infection. Instead they view their societies and fellow students as being at risk of HIV infection. Findings also indicate that there may be a lack of critical knowledge regarding HIV and AIDS among students since such knowledge is not presented in the textbooks even though recommended in the curriculum statement. All of the above are some of the reported factors that are responsible for the spread of HIV and AIDS in South Africa (Francis, 2010; Parker & Aggleton, 2003; Stein, 2003). By inference therefore the researcher believes that both students (irrespective of whether they are Life Sciences or non-Life Sciences students) and their communities remain at risk of HIV infection and consequently there is a need to reconstruct social norms that are facilitating the spread of HIV and AIDS.

Because of the HIV risk reported in literature, the researcher believes that the survival of society remains threatened by unsafe behavioural preferences that put members of the society at risk of contracting HIV. Furthermore the study has shown that Life Sciences, a mechanism developed by the society to provide knowledge regarding HIV and AIDS (Schiro, 2008), is not effective in achieving this goal. Therefore a different strategy that is informed by the current findings is required.

As stated in Chapters 1 and 2 social reconstructionists believe that education and learning are a process of interpreting the past, present social situations and envisioning the future (Schiro, 2008). The study however shows that Life Sciences is not able to do this effectively. Therefore there is a need to adapt Life Sciences so that undesirable aspects of social culture, norms, attitudes and beliefs that are responsible for the current behavioural preferences can be eliminated. In other words if behaviour transformation is the objective, then Life Sciences should follow a social reconstruction ideology. This means Life Sciences should prepare students to confront social norms in a reflective manner so that students could understand that they are part of an unhealthy society that needs to transform its behaviour by reconstructing values, norms, attitudes and beliefs using knowledge. The researcher also agrees with Shimbira *et al.* (2007) that students should be trained to become agents of change who will take ownership of their reconstruction role in society.

In conclusion the researcher agrees with Barak Obama[20] that “change will not come if we wait for some other person or some other time. We are the ones we've been waiting for. We are the change that we seek. It is time to fundamentally change the way that we do business in [education]. To help build a new foundation for the 21st century, we need to reform our

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

[curriculum] so that it is more efficient and more creative. That will demand new thinking and a new sense of responsibility." To this end, the researcher believes that education should be used to address the challenges faced by humanity today.