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**Abstract.** *In spite of integrating HIV/AIDS education in South African curricula the prevalence of HIV in 2016 was the highest since 2002. HIV infection rate is particularly high among schoolgirls compared with boys. Using a closed-ended questionnaire, this quantitative survey research compared Biology and non-Biology schoolgirls' (n=291) behavioural intention, Health Literacy and HIV/AIDS Literacy to determine if enrolling for Biology, and subsequently learning about the scientific nature of HIV/AIDS would reduce risk behaviour among schoolgirls. Results indicate that Biology students have higher Health Literacy and HIV/AIDS Literacy than non-Biology students. The behavioural intentions of both groups were not significantly different. Health Literacy and HIV/AIDS Literacy did not correlate significantly with behavioural intention, which were indicative of risk behaviour. These findings suggest that enrolling for Biology and other science subjects and subsequently learning about HIV/AIDS may not reduce risk behaviour among schoolgirls.*

**Keywords:** *behavioural intention, biology students, health literacy, HIV/AIDS literacy, South African schoolgirls.*

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## THE RELATIONSHIP BETWEEN ENROLMENT IN BIOLOGY, HIV/AIDS KNOWLEDGE AND RELATED BEHAVIOUR AMONG SOUTH AFRICAN SCHOOLGIRLS

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### Introduction

HIV/AIDS remains one of the most devastating health challenge globally. In South Africa young people, in particular adolescent girls are most affected by HIV/AIDS. This same trend has also been reported elsewhere. For example, Saad, Subramaniam and Tan (2013, p. 196) report that "in South Asia and South-East Asia, 40% of all young people living with HIV are young women, and the rate of HIV infection among girls is rapidly outstripping the rate among boys. An estimated 6,000 young people are infected every day which translates to one person in every 14 minutes." Most developing countries like South Africa therefore have adapted their school curricula in order to use formal education to teach about HIV/AIDS. However, previous research has shown that the South African Biology curriculum, locally known as Life Sciences, is not adapted to empower students with skills and knowledge required to adopt safe behavioural practices related to HIV/AIDS (Mnguni, 2013).

The research reported in this article investigated the relationship between enrolment in Biology and behavioural intention related to HIV/AIDS among girls. The focus on girls was mainly due to the high prevalence of HIV/AIDS among adolescent girls compared to boys (e.g. Saad *et al.*, 2013). Biology was chosen as an area of interest because as a science subject it is expected to improve students' science literacy, including knowledge of HIV/AIDS. This would then allow improved decision making among students where they could critically examine and use scientific knowledge in everyday life (Bingle & Gaskell, 1994). Such an application of scientific knowledge in everyday life however would require that the curriculum adopts a social constructivist view (Bingle & Gaskell, 1994) which Mnguni (2013) argues is not the case with Biology in South Africa. Given this, the current researcher hypothesized that school Biology in South Africa does not correlate with students' behavioural intention in relation to HIV/AIDS. This hypothesis was tested in order to inform Biology curriculum development for the empowerment of schoolgirls with the intention of reducing the prevalence of HIV/AIDS.

### *Problem of Research*

At the height of the Iraqi war, Jeremy Cronin, a South African communist warned that "four hundred thousand South Africans are dying every year of AIDS. This makes the war in Iraq look like a birthday party" (Cronin, 2006). His views were based on the high HIV/AIDS prevalence in South Africa coupled



with poor literacy and poverty which exacerbated the spread of HIV. Ten years later Statistics South Africa (2016) reported that in 2016 the prevalence of HIV in South Africa was 12.7% compared to 11% in 2006. In fact, Statistics South Africa's records suggest that the prevalence of HIV in 2016 was the highest since 2002. Sadly, research shows that adolescent girls in southern Africa generally are significantly and uniquely more vulnerable to HIV/AIDS than adolescent boys (Dellar, Dlamini & Abdool Karim, 2015). This is because, young women contribute four-times the number of new infections per year compared with their male peers (Dellar *et al.*, 2015). A number of factors have been attributed to this asymmetrical spread of HIV among adolescents, including the fact that girls tend to have sexual relations with older men who are often infected with HIV (Gregson, Garnett, Nyamukapa, Hallett, Lewis, Mason, Chandiwana & Anderson, 2002). Other researchers have cited factors such as poor or lack of education, low empowerment in expressing and accessing information related to sexual matters and poverty as key factors to girls' vulnerability (Saad *et al.*, 2013). Furthermore, the spread of HIV has been attributed to behavioural factors such as peer pressure, cultural beliefs and practices, hormonal urges, gender-based violence and discrimination, stigma and discrimination, poor sexuality education, human rights violation as well as illiteracy (Dellar *et al.*, 2015; Harrison, Newell, Imrie & Hoddinott, 2010).

Attempts have therefore been made to reduce the spread of HIV through educational programmes that include sexuality education, sexual health, life skills and resilience as well as Health Literacy and HIV/AIDS Literacy (Mnguni, Abrie & Ebersöhn, 2016). As part of these efforts, some governments have mandated the integration of Health and HIV/AIDS education in the formal school curriculum (Mnguni *et al.*, 2016). This includes Health Literacy and HIV/AIDS Literacy. Health Literacy can be defined as the basic knowledge and skills required for an individual to obtain, communicate, process, and understand basic health information and services to make appropriate health decisions (Nutbeam, 2000). Based on this definition, HIV/AIDS Literacy can be defined as HIV/AIDS-specific knowledge and skills required for an individual to obtain, communicate, process, and understand HIV/AIDS related information and services to make appropriate decisions. In the South African context, Life Orientation for instance is a compulsory school subject where students are taught the behavioural and socio-economic aspects of HIV/AIDS while in Biology they are taught the scientific nature of HIV/AIDS in relation to various body systems including the immune system and the circulatory system. Notably, Biology is an optional subject that is predominantly done by students who intend pursuing biology-related careers.

The effectiveness of educational programmes aimed at reducing the spread of HIV has been questioned. For example, Mnguni and Abrie (2012) report that adolescents are not satisfied with the content knowledge and presentation strategies used to teach about HIV/AIDS. This is because some of this knowledge is scientifically inaccurate and socially irrelevant (Mnguni & Abrie, 2012). As a result, there are reports of wide spread negative perceptions towards school programmes that teach about HIV/AIDS (Van Deventer, 2009; Rooth, 2005; Van Deventer, 2004). Other researchers (e.g. Wolff & Mnguni, 2015) report that HIV/AIDS-related content is integrated into formal curriculum as academic knowledge rather than functional knowledge. This means such knowledge is decontextualized and therefore students may not be able to transfer this knowledge into their everyday life.

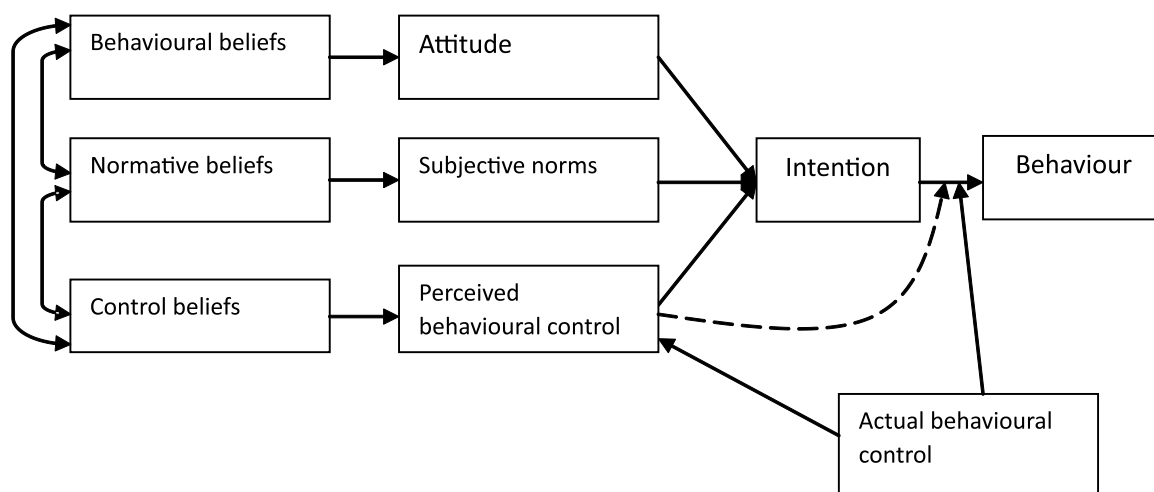
Given the complexities related to HIV/AIDS education, the current researcher explored the relationship between Health Literacy, HIV/AIDS Literacy and behavioural intention among South African schoolgirls. This is because of the increased vulnerability of girls to HIV/AIDS (Dellar *et al.*, 2015; Saad *et al.*, 2013) and the reported efforts to address this problem through formal education (Mnguni & Abrie, 2012). Of interest in this regard is whether formal education can be used to address one of the most complex socio-scientific issues among the most vulnerable.

#### *Determining HIV/AIDS Related Behaviour: A Theoretical Framework*

HIV/AIDS-related behaviour, which could involve engaging in sexual intercourse, is rather difficult to observe without violating ethical standards of science. For this reason, the current researcher identified the theory of planned behaviour as an appropriate lens through which HIV/AIDS-related behaviour could be determined. According to Hansen, Jensen and Solgaard (2004), the theories of reasoned action and of planned behaviour could be used to predict and to understand students' motivation towards behaviours. However, while the theory of reasoned action is perceived as a good predictor of behaviour, it has been accused of failing to recognise that behaviour is not always volitional (Guo, Johnson, Unger, Lee, Xie, Chou, Palmer, Sun, Gallaher & Pentz, 2007; Kuther, 2002). Furthermore, this theory does not recognise that behaviour is also influenced by people's perceptions of their ability to perform such a behaviour (Hansen *et al.*, 2004). The theory of planned behaviour on the other hand suggests that a person's behaviour is determined by his/her behavioural intentions (see Figure 1; Ajzen, 2002, Ajzen,



1991). In this instance, the behavioural intentions can be defined as the person's attitude towards the behaviour itself and can be either for or against the behaviour in question (Kutner, 2002). Intention relates to motivational factors that influence behaviour, willingness to try as well as the amount of effort that people are willing to exert (Ajzen, 1991). Furthermore, the person's behaviour according to Ajzen (1991) is determined by subjective norms, which are other people's perceived opinions about the behaviour (Figure 1). This means behaviour will depend on facilitating factors, context of opportunity, resources and action control (Ajzen, 1991).



**Figure 1: The Theory of Planned Behaviour (adapted from Ajzen, 2002).**

The theory of planned behaviour also suggests that in addition to attitudes and subjective norms, behaviour is influenced by perceived behavioural control (Figure 1; Ajzen, 1991). This is the individual's subjective belief about whether or not they have the ability to behave in a certain way (Hansen *et al.*, 2004). Other researchers have linked the perceived behavioural controls as based on the theory of achievement motivation as well self-efficacy (Ajzen, 1991). The theory of achievement motivation defines an individual's expectancy of success as the perceived probability of succeeding at a given task (Ajzen, 1991). Self-efficacy (Bandura, 1991) refers to one's judgments on how well they can execute courses of action required to deal with prospective situations, for example, that behaviour is influenced by confidence in one's ability to perform. In essence, self-efficacy influences among other things, the choice of activities, preparation for an activity, effort expended during activity as well as thought patterns and emotional reactions (Ajzen, 1991; Bandura, 1991)

Ajzen (2002) further argues that beliefs also affect behaviour (Figure 1). For example, behavioural beliefs, which are beliefs about the likely consequence of a behaviour, have been shown to affect the attitude towards a behaviour. Furthermore, normative beliefs, that is, beliefs about the expectations of other people influence subjective norms. In addition, Ajzen (2002: 1) indicates that "control beliefs about the presence of factors that may facilitate or impede performance of the behaviour" as they affect perceived behavioural control.

Based on the above, the current researcher posits that HIV/AIDS-related behaviour in most instances is individualistic, voluntary, under control, deliberate, planned and is performed. In this way, while knowledge is important, students do decide on their behavioural patterns based on their individualistic motivation, beliefs, attitudes and intentions. However, for this to happen, the relevant knowledge and skills would have to be taught within a curriculum that is oriented towards social reconstruction ideology, which Mnguni (2013) reports is not the case in South Africa.

#### Research Aim and Questions

Given the complexities associated with observing HIV/AIDS behaviour, the current researcher used the theory of planned behaviour to determine the HIV/AIDS behavioural intentions of the participants as a proxy for



predicting their possible behaviour. Using the theory of planned behaviour as a theoretical framework therefore, the researcher explored the relationship between Health Literacy, HIV/AIDS Literacy and behavioural intention among South African schoolgirls. The research questions framing this research were:

- a) How do female Biology students compare with non-Biology female students in their Health Literacy, HIV/AIDS Literacy and behavioural intention?
- b) To what extent do female students' Health Literacy and HIV/AIDS Literacy correlate with their behavioural intention?

Underlying these questions was whether enrolling for Biology, and subsequently learning about the scientific nature of HIV/AIDS would reduce risk behaviour.

## Methodology of Research

### *Research Design*

To respond to the above research questions, the researcher used a comparative quantitative, non-experimental survey research design for determining Health Literacy, HIV/AIDS Literacy and as well as behavioural intention related to HIV/AIDS of the participants. The primary objective in this regard was to compare Health Literacy, HIV/AIDS Literacy and self-reported behavioural intention between biology students and non-biology students. The study was non-experimental survey because no interventions were employed. A closed-ended questionnaire was used to collect data from the participating students. Participants were girls studying in South African government schools. With the permission of the relevant authorities and participants, data were collected at the schools during school time.

### *Questionnaire Design*

Data were collected using a previously validated closed-ended questionnaire (Mnguni *et al.*, 2016) which was made up of thirty questions spread equally in three sections, namely, Health Literacy, HIV/AIDS Literacy and behavioural intention. Concerning Health Literacy, the questionnaire probed, through ten items, students' knowledge of virology, bacteriology, immunology, the circulatory system and vaccination. This knowledge is deemed in literature as essential for Health Literacy (Mnguni & Abrie, 2012) and is taught in Biology. Ten HIV/AIDS Literacy items tested the participants' knowledge of HIV Transmission, the effects of HIV in the body, the cause of AIDS, symptoms of AIDS, and the curability of HIV/AIDS. This content is primarily taught in Life Orientation for which all the participants were enrolled. This knowledge is also available in various HIV/AIDS-related youth interventions in South Africa (e.g. Kemp, Gerth-Guyette, Dube, Andrasik, & Rao, 2016; Page, Ebersöhn & Rogan, 2006). The theory of planned behaviour was used as a framework for designing ten items for probing students' behavioural intention. In this regard the items probed students' attitudes, subjective norms and perceived behavioural control towards safe and risk behavioural practices, which as discussed earlier, are determinants of actual behaviours (Ajzen, 1991).

Face and content validity of the instruments were determined through a pilot research as well as through a panel of experts (Mnguni *et al.*, 2016). Using a validation instrument (Hyrkäs, Appelqvist-Schmidlechner & Oksa, 2003; Nicholls, 2003), the panel of experts showed that the items were able to test for Health Literacy, HIV/AIDS Literacy and behavioural intentions as defined in the research and that the questionnaire was suitable for the purpose it is designed for. The pilot research showed that students in the same context as the participants were able to respond to the items effectively. The instrument satisfied reliability requirements ( $r = .71$ ).

### *Sampling and Ethical Considerations*

The participating students were selected using a non-probability convenience sampling approach from nine government schools at UMsunduzi district, Pietermaritzburg, South Africa. These participants were 291 schoolgirls aged between 15 and 18 doing Grade 11 in four inner city schools and five township schools. Grade 11s were chosen because it is in Grades 10 and 11 that scientific HIV/AIDS content knowledge is taught. Of the 291 participants, 180 were enrolled for Biology and 111 were not. In the South African education system, Biology is taught as a subject in Grades 10-12. However, students have a choice to either do Biology or not, depending on their career prospects. The Biology content taught was standard in all the schools as prescribed by the government curriculum. Ethical



clearance and consent were received from all participants, who participated voluntarily, and relevant stakeholders including the school and provincial Department of Basic Education according to the guidelines of the South African university where the research was based.

#### *Data Collection and Analysis*

The questionnaire was administered to all students within one week at the schools. Students were not told about the questionnaire prior to administering it in order to minimize preparation through revision of the relevant work. During administration of the questionnaire teachers at the relevant schools as well as three other assistants were present and helped with the distribution of the questionnaire, invigilating and collecting the completed questionnaires afterward.

Students' responses to the Health Literacy and HIV/AIDS Literacy items in the questionnaire were scored by the researcher, as either correct (allocating a score of 1 point) or incorrect (allocating a score of 0 points) against a set of correct answers, which were prepared by the researcher. In cases where there were no responses given or where multiple answers were given, a score mark of zero was allocated. Thereafter, percentage scores were generated for each student, per school and for the two sections of the questionnaire (i.e. Health Literacy and HIV/AIDS Literacy items.) These percentage scores were then used to compare the performance of biology and non-biology students. With regards to behavioural intention items, the researcher had prepared answers that would imply safe behavioural preference, based on social norms and literature (e.g. Mnguni *et al.*, 2016). Students' responses were therefore scored against these by giving one point for a safe behavioural preference and zero for a risk behaviour.

All statistical analyses were performed using *SPSS Statistics 24.0 Ink* software. Generally, descriptive statistics were used to determine the distribution patterns of the data. Inferential statistics were then used to explore these patterns in terms of comparisons and relationships between variables. In particular, a non-parametric test (i.e. Mann Whitney u test) was used to compare behavioural intentions because the data in this regard were nominal and the independent variable consisted of two categorical, independent groups (i.e. biology and non-biology students) (Noether, 2012). Data for Health Literacy and HIV/AIDS Literacy were however interval data allowing for analysis using a parametric t-test.

#### **Results of Research**

Results showed a concerning trend regarding the participants' Health Literacy and HIV/AIDS Literacy. In this instance data for all participants combined showed that Health Literacy ( $M = 0.44$ ,  $SD = 0.25$ ) was significantly lower than their HIV/AIDS Literacy ( $M = 0.69$ ,  $SD = 0.18$ ),  $p < .001$ . In spite of this however, Health Literacy correlated significantly with HIV/AIDS Literacy ( $p = .556$ ). Given these observation, the researcher explored further to specific questions where participants showed a lack of knowledge. In the instance of Health Literacy, it emerged that 70% of the participants could not answer correctly when asked what a virus is even though 68% percent answered correctly when asked what bacteria are. However, a further 63% failed to correctly identify tuberculosis and pneumonia as examples of HIV/AIDS-related opportunistic infections. Fifty five percent (55%) also could not correctly indicate what 'contaminated blood' meant in the context of infection. Majority of the participants also could not correctly respond to questions probing knowledge of the immune system including the role of antibodies, CD4 cells as well as the meaning of immune deficiency. Notably, participants showed better understanding of HIV/AIDS Literacy. In this regard participants gave correct responses to items probing knowledge of the causes of AIDS, HIV transmission mechanisms (i.e. 83% in both instances) as well as HIV infection and the role of antiretroviral drugs (i.e. 78% in both cases). However, participants could not correctly respond to a question probing their understanding of the different strains of HIV.

Data also revealed that there was no significant difference in the behavioural intention of participants from inner city schools and township schools (Table 1). This in spite of significant differences in Health Literacy and HIV/AIDS Literacy ( $p < .001$  in both cases). The mean score for Health Literacy in township schools was 0.4 and 0.52 for inner city school. Similarly, the mean score for HIV/AIDS Literacy in township schools was 0.66 and 0.76 for inner city school. This clearly shows that students from inner city students had higher knowledge of HIV/AIDS than their township peers. However, the results suggest that the schooling environment has negligible effect on student behavioural intention.



**Table 1. Comparison of behaviour intention of inner city and township school participants.**

	Ranks				Test Statistics	
	School Type	N	Mean Rank	Sum of Ranks	Mann-Whitney U	8716.500
Behavioural intention	Township schools	206	145.81	30037.50	Wilcoxon W	300037.500
	Inner city schools	85	146.45	12448.50	Z	-.141
	Total	291			Asymp. Sig. (2-tailed)	.888

The researcher then explored the data to determine if taking Biology as a subject had an effect on the participants' ability to correctly respond to the relevant items. Results showed that Biology students have a significantly higher Health Literacy ( $M = 0.54$ ,  $SD = 0.20$ ) than non-Biology students ( $M = 0.27$ ,  $SD = 0.23$ ),  $p < .001$ . It was also found that the HIV/AIDS Literacy among Biology students ( $M = 0.74$ ,  $SD = 0.16$ ) was significantly higher than that of non-Biology students ( $M = 0.62$ ,  $SD = 0.19$ ),  $p < .001$ . Interestingly, a similar pattern was observed when students were grouped according to whether or not they were doing Physics as a subject. Participants who were enrolled for Physics had a significantly higher Health Literacy ( $p < .001$ ) and HIV/AIDS Literacy ( $p = .034$ ) than non-Physics students. However, one could argue that, except in a few instances, participants enrolled for Biology usually also enrolled for Physics as well. As a result, participants were also compared according to enrolment in Mathematics since Mathematics is not always associated with Biology. For example, in the South African curriculum, students doing business studies (i.e. Economics and Accounting) are given an option of taking Mathematics even though they do not take Biology. Students who do neither sciences (Biology and Physics) nor business studies (e.g. Accounting and Economics) are not expected to do any mathematics. In the current research, 82% of the participants were enrolled for Mathematics. Data analysis then revealed that participants who were enrolled for Mathematics performed significantly better than those who did not on both Health Literacy ( $p < .001$ ) and HIV/AIDS Literacy ( $p < .001$ ). Data also showed that enrolment in science subjects correlated significantly with Health Literacy and HIV/AIDS Literacy (Table 2). However, enrolment in Accounting, Geography, History, and Life Orientation did not correlate with Health Literacy and HIV/AIDS Literacy. This in spite of the fact that Life Orientation is supposed to teach about the behavioural and socio-economic aspects of HIV/AIDS and was taken by all participants. The most plausible explanation of these results is that in Biology students are taught scientific knowledge of HIV/AIDS, and Biology is taken by most participants taking Physics and Mathematics. Consequently, students taking Biology, Physics and Mathematics showed a higher Health Literacy and HIV/AIDS Literacy.

**Table 2. Correlation between selected school subjects and HIV/AIDS-related knowledge among students (n = 291).**

		Health Literacy	HIV/AIDS Literacy
HIV/AIDS Literacy	Pearson Correlation	.556**	
	Sig. (2-tailed)	.001	
Accounting	Pearson Correlation	-.099	-.028
	Sig. (2-tailed)	.093	.630
Business Economics	Pearson Correlation	-.176**	-.040
	Sig. (2-tailed)	.003	.499
Economics	Pearson Correlation	-.327**	-.149*
	Sig. (2-tailed)	.001	.011
Geography	Pearson Correlation	-.012	-.104
	Sig. (2-tailed)	.839	.077
History	Pearson Correlation	-.027	.061
	Sig. (2-tailed)	.648	.301
Life Orientation	Pearson Correlation	.108	.047
	Sig. (2-tailed)	.067	.422
Biology	Pearson Correlation	.525**	.317**
	Sig. (2-tailed)	.001	.001



		Health Literacy	HIV/AIDS Literacy
Mathematics	Pearson Correlation	.388**	.266**
	Sig. (2-tailed)	<.001	.001
Physics	Pearson Correlation	.456**	.251**
	Sig. (2-tailed)	.001	.001

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

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

Further analysis of the data showed a significant correlation between Health Literacy and HIV/AIDS Literacy between groups (i.e. Biology and non-Biology students). However, both Health Literacy and HIV/AIDS Literacy did not correlate significantly with behavioural intention. In this instance results showed that the distribution of responses of Biology and non-Biology students for behavioural intention were not significantly different (Table 3). Data also revealed that in some instances both groups reported tendency towards risk behaviour particularly in relation to multiple sexual partners and unprotected sex.

**Table 3. A comparison of the behavioural intentions of Biology and non-Biology students.**

	Ranks				Test Statistics	
	School subjects taken	N	Mean Rank	Sum of Ranks	Mann-Whitney U	9677.500
Behavioural intention	Non-biology	111	143.18	15893.50	Wilcoxon W	15893.500
	Biology	180	147.74	26592.50	Z	-1.074
	Total	291			Asymp. Sig. (2-tailed)	.283

Concerning risk behaviours, data revealed that participants reported a generally safe attitude (Table 4). However, it emerged that as few as 39% of the participants thought it was ok to use sterilised needles for injections while 54% thought otherwise. It was also found that 77% of the participants report that most students dislike condoms. While this does not imply that they do not use condoms, the fact that such a high number reported a negative subjective norm may be indicative of the possibility of students who may not use condoms. This deduction is further supported by the fact that 53% of the participants reported that young people in their community do not protect themselves from HIV infection. Furthermore, 16% of the participants reported that they would have unprotected sexual intercourse, e.g. without a condom with their boy/girlfriend.

**Table 4. Behavioural intention of the participants (n = 291).**

Classification	Item	Yes (%)	No (%)
Attitude	It is okay for unmarried people to have unprotected sexual intercourse.	08	90
	It is okay for people to have many sexual partners.	03	97
	It is okay to use sterilized needles for injections.	39	54
	It is okay to share one razor blade without sterilizing it before use.	02	95
Subjective norm	In my community, it is okay for people to have multiple sexual partners.	06	90
	Most students in my school like condoms.	17	77
	Young people in my community protect themselves from HIV infection.	42	53
Perceived behavioural control	I would have sexual intercourse with someone whose sexual activities I do not really know.	07	90
	I would have unprotected sexual intercourse, e.g. without a condom with my boy/girlfriend.	16	82
	I am at risk of getting HIV.	30	68



## Discussion

In responding to the research questions, this research was able to determine the Health Literacy and HIV/AIDS Literacy of the participants. The theory of planned behaviour was also successfully used to determine the behavioural intentions. These findings could be used to further our understanding of the prevalence of HIV/AIDS among girls.

### Key Findings

A significant finding of this research is that among the participating girls, Health Literacy was lower than their HIV/AIDS Literacy. This could be explained by the fact that general HIV/AIDS specific knowledge is taught to all students through a number of media for a variety of outcomes (e.g. Harrison *et al.*, 2010; Ebersöhn, 2008). What is interesting however is that Biology students had significantly higher level of both Healthy Literacy and HIV/AIDS Literacy. This finding echoes Mnguni *et al.* (2016) who also found that Biology students have a significantly higher HIV/AIDS knowledge than non-Biology students. What is also significant is that schoolgirls doing science subjects (including Mathematics and Physics students) have a significantly higher HIV/AIDS knowledge than schoolgirls who do not do science subjects. This is a critical finding in the global fight against HIV/AIDS because it may imply that increased access to science may improve the understanding of HIV/AIDS among students. This is critical in light of previous research, which has suggested that poor or lack of education including health and sexuality education increase the vulnerability of girls to HIV infection (e.g. Dellar *et al.*, 2015). The researcher therefore believes that health and sexuality education should include aspects of science education. Urgent in this regard however, is further research to determine why science subjects correlate positively with Health Literacy and HIV/AIDS Literacy. This particularly in light of the fact that Health Literacy and HIV/AIDS Literacy knowledge did not have a significant correlation with enrolment in non-science subjects such as History and Life Orientation. This finding suggests therefore that enrolment in science subjects could be important for improved understanding of HIV/AIDS.

While HIV/AIDS knowledge was related to enrolment in science subjects, it was interesting to find that neither Health Literacy nor HIV/AIDS Literacy correlates with safe behavioural intentions. Using the Theory of Planned Behaviour, the current research has demonstrated that the attitude and perceived behavioural control of 'self' were generally positive towards safe HIV/AIDS behaviour. However, when asked about the 'other' rather than the 'self', participants reported negative behavioural patterns. For example, the students reported that most 'other' students do not like condoms and that young people do not protect themselves from HIV infection. This finding is critical because as suggested in literature, people are more honest when talking about the 'other' and tend to be defensive when talking about themselves (Ajzen, 1991). While the participants may not have tangible evidence to support their claims about the 'other', they may actually be reflecting on their own experiences and behaviours.

There are three critical notes related to lack of correlation between Health Literacy and HIV/AIDS Literacy with safe behavioural intentions. Firstly, if the participants are correct in reporting the 'other' students as being at risk of infection, then one may argue that the Health Literacy and HIV/AIDS Literacy of the 'other' students are not known; and hence their knowledge of HIV/AIDS cannot be regarded as a factor for their vulnerability. This argument however could suggest that the theory of planned behaviour as used in the current study was not successful in determining the behavioural intention of the 'self'. Secondly, and in line with other researchers, this finding suggests that behaviour is not always related to knowledge (e.g. Mnguni *et al.*, 2016, Guo *et al.* 2007; Page *et al.*, 2006; Hansen *et al.*, Shortell, Weist, Sow, Foster & Tahir, 2004; Ajzen, 1991). Thirdly, the lack of correlation between Health Literacy and HIV/AIDS Literacy with safe behavioural intentions may be due to misalignment between curriculum and everyday life (e.g. Mnguni, 2013). To this Hodson (2004, p. 2) contends that "regrettably, science is often regarded as a body of knowledge that can be transmitted by teachers, memorized by students, and reproduced on demand in examinations. Regrettably, too, science is often portrayed as the de-personalized and disinterested pursuit of objective truth, independent of the society in which it is practised and untouched by ordinary human emotions, values, and conventions." The current researcher therefore suggests that perhaps the lack of correlation between knowledge of HIV/AIDS and behavioural intention among the youth could be because of education's failure to resolve the dualism between the school and society (Zuga, 1992), a duality which renders school irrelevant to everyday societal issues. Instead, there may be other factors that inform behaviour. Further research is required to explore these arguments in detail.





### *Limitations and Areas Requiring Further Research*

The major limitation of the research was its inability to determine if behaviour of the participants is individualistic, voluntary, under control, deliberate, planned and is performed requiring scrutiny. This could be because of the inductive approach used instead of the deductive approach. For example, instead of using closed-ended pre-determined determinants of HIV/AIDS related behaviour using the theory of planned behaviour, the researcher could have asked open-ended questions. Thereafter methods such as the Delphi method could have been used to allow the data to reveal factors informing risk behaviour, other than those listed in the theory of planned behaviour. Such a method could probably provide a more realistic prediction of the participants' vulnerability to HIV/AIDS.

Furthermore, research must be done to determine what informs risk behavioural intentions among youths in South Africa, since knowledge seems not to. Ajzen (1991) suggests that it is beliefs, attitudes, subjective norms and behavioural control. The question however is, within the context of HIV/AIDS, what informs beliefs, attitudes, subjective norms and behavioural control, seeing for instance that enrolment in some school subjects does not? While it was important to explore the subject within the context of girls, in the future it might be necessary to compare girls and boys since social pressures may be affecting them both equally. While the findings of the current researcher are important, the researcher believes that a wider and more in-depth study is required to explore the relationship between scientific HIV/AIDS knowledge and behavioural intention in South Africa and globally. This recommendation is made in the light of a number of reports that scientific literacy improves lives.

### **Conclusions**

Given the high prevalence of HIV/AIDS in South Africa, it is encouraging to note the various efforts to increase knowledge and awareness. The high Health Literacy and HIV/AIDS Literacy among students is a critical finding. More important is that these literacies are associated with enrolment in science subjects. Flowing from this, the researcher believes that efforts must be made to ensure that these literacies are not 'exclusive' to science students but to all students. This could be done by adapting other subjects, where it is not the case currently, to integrate socio-scientific issues such as HIV/AIDS.

Additionally, based on the reported findings that show a lack of correlation between knowledge and behavioural intentions, the researcher is of the view that it is not enough to teach about HIV/AIDS. As reported in literature, what may be more important is to ensure that such knowledge is contextualized and actionable. Therefore, efforts may need to be taken to adapt the curriculum to address everyday life issues that students go through.

The researcher also believes that researchers must consider grounded theory methods when exploring factors that affect HIV/AIDS behaviour. This is based on the observation that the theory of planned behaviour may not have been the best framework for determining behavioural intentions of the participants in the current research.

In responding to the research questions, the researcher concludes that female Biology students have a higher Health Literacy, HIV/AIDS Literacy than non-Biology students even though the behavioural intentions are not significantly different. Finally, the students Health Literacy and HIV/AIDS Literacy do not always correlate with their behavioural intention.

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