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College students' attitudes towards sexually themed science content: a socioscientific issues approach to resolution

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ABSTRACT

A socioscientific issues integrated instruction was used in the study to resolve college students attitude towards sexually-themed science content. Some 200 college students participated in the study as experimental and control groups. The former consisting of 98 students from one college was taught the content using the socioscientific issues integrated instruction. The later with 102 students from another college was taught the same content using a traditionally teacher dominated lectures. Both groups were taught over a period of eight weeks. Qualitative and quantitative data were obtained before and after the intervention. The quantitative data were analysed using analysis of covariance. The results revealed that there was a significant difference between the experimental and the control groups (F (1, 247) = 426.97, p = .00, partial eta squared = 0.64) where the experimental group showed a significant change in attitude towards the content studied. The qualitative data obtained some experimental group students showed a change in attitude the second interview. It was concluded that the use of the approach has significantly made the college students feel comfortable and confident to learn and teach the content.

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Socioscientific issues; college students; attitudes; sexually themed science content; socioscientific issue integrated instruction

Introduction

In recent times, Nigeria has faced some social problems which have put youths and vulnerable groups, such as children and young women, at high risk of infections to sexually transmitted infections (STIs), unwanted pregnancies and abortions. For instance, Naku (2011), USAID (2010), Odukoya, Busari, and Ateh-Abang (2006) have reported a national infection rate of HIV/AIDS at 5.8% of the population and have asserted that it was on the increase. There is need for the youths to be educated in ways to manage their lives and get some guidance to prevent these social issues and threatening diseases. Collectively, these social problems pose a huge societal impact (Eko, Osuchukwu, Osonwa, & Offiong, 2013; Francoeur, Esiet, & Esiet, 2000).

Most of the social issues can be sociologically and scientifically explained, thus science education is paramount to their understanding (Bertozzi, Padian, & Wegbreit et al., 2006;

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CDC, 2011; Evans, 2011; Hazen, 2008; OIC, 2013). In recognition of the importance of science education, the social problems mentioned have been integrated into the school science curricula by the Nigerian government as *Comprehensive Sexuality Education* with the view to reducing the problems and their effects on the economic development of the nation. However, the integration of the curriculum was resisted by traditional and religious leaders as well as by groups of students, parents and teachers simply because the content carries knowledge of sensitive sexual matters not traditionally discussed openly (Rosen, Murray, & Moreland, 2004; Shehu & Sheshi, 2012; UNESCO, 2011; USAID, 2010). The content involves knowledge and discussion of matters related to unwanted pregnancy and the use of contraceptives such as condoms for the prevention of HIV/AIDS and other STIs. Other contents include the anatomy and physiology of human reproductive organs and sexual relationships which the traditional and religious leaders found too explicit for the youths (Rosen et al., 2004; UNESCO, 2011). The opposition feared that when this knowledge was taught to youths, it would expose them to pre- and extra-marital sexual affairs and general misbehaviour while at the same time resulting in unwanted pregnancies, abortion and the manifestation of STIs (Eisenberg, Bernat, Bearinger, & Resnick, 2008; McKay, Piestrusiak, & Holowaty, 1998; Shehu & Sheshi, 2012). The opposition's resistance forced the withdrawal of the original content (Rosen et al., 2004) and was later reintroduced as family life and HIV education. It was implemented in secondary schools in the southern part of the country (UNESCO, 2011) but not in the north. This new content is currently integrated into the curriculum of post-secondary teacher training colleges as 'Family Life and Emerging Health Issues' (FLEHI) throughout the country.

The acceptance of the curriculum in the south and its rejection in the north might not be unconnected to religious, traditional background and literacy level of the people. The southern part of the country has a higher population of literate persons at 77% compared to the northern 33% (Joseph, 2012). This is because western education started in the south for more than a century by Christian missionaries before its advent in the north. This makes the acceptability of western education, culture and civilisation more easily in the south. Besides, the northern people are predominantly Muslims by faith while the southern people are predominantly Christians. These two faiths also play a very significant role in the people's cultural traditions. For instance, in the north where Hausa-Fulani tribes dominate, one can hardly differentiate between Islamic injunctions and the traditional values and norms (Bello, Booth, & Yusuf, 2000). That is to say most of the cultural 'dos' and 'don'ts' are exclusively Islamic while it is not the case in the south as said above. One example worth noting concerning the difference between southern and northern Nigeria is one of the topics of this study – the case of children born out of wedlock. In the south, such children are legitimate provided that somebody claims them. But in the north, where the study was carried out, any woman who conceives outside wedlock has brought shame to herself, her parents and relatives and the social position of her family is downgraded while at the same time the child is considered illegitimate with no right to inheritance in the event of the demise of either parent (Bello et al., 2000).

Consequently, the attitude of students and the general public towards accepting the teaching and learning of the controversial curriculum they initially opposed in the colleges remained a problem. In other words, there is a problem in teaching the learners because it is their first experience in learning such content. Another problem is how they would

handle the same content in their years as teachers should they find similar content in the school science curriculum.

It is evident from the literature that teaching and learning of science provides a platform to effectively discuss societal issues which could be scientifically explained. Scientifically grounded social issues have been integrated as socioscientific issues (SSIs) in science education (Sadler, 2009). For instance, Simonneaux and Simonneaux (2012) integrated environmental issues as SSIs. Similarly, Bottcher and Meisert (2013) reported direct and indirect instruction in the promotion of decision-making ability of SSIs on genetically modified food. Also, Ottander and Ekborg (2012) showed how six SSIs issues were developed and used in teaching and learning projects after satisfying the features that qualified them as SSIs in the Swedish national curriculum. This study is similar to these previous studies because the SSI-integrated instruction has been used in the teaching of the above mentioned sexually themed science content in Nigerian colleges of education.

In this study, an attempt has been made to make the college students feel comfortable and confident to learn and teach about these sexually themed issues, the teaching and learning of which they initially opposed, using SSI-integrated and conventional instructions. To achieve its purpose, the study used SSI-integrated instruction in the teaching and learning of the sexually themed science content. This integration is in line with the call for a need to have a teaching approach that integrates science concepts and social concerns of a problem with particular reference to their ethical, moral, traditional, spiritual, economic or political significance (Eastwood et al., 2012; Sadler, Barab, & Scott, 2007).

Besides, despite the claim that science might be unable to provide concrete solutions for these sexually themed issues, the notion that science may inform decision-making (CDC, 2011; Evans, 2011; OIC, 2013) makes the integration of these issues into teaching and learning imperative. Hence, the purpose of the study was to find out the effects of the SSI-integrated instruction in changing students' attitude towards learning and teaching the sexually themed science content. Specifically, it was aimed at finding out the effect of the integration in changing the students' interest, perceived ability, values and commitment towards learning and teaching the sexually themed science content. These four areas are the attributes of attitude that formed the constructs that were investigated.

Socioscientific issues (SSIs)

SSIs have been proposed to address complex scientific issues that are controversial and socially significant. Such problems are socially significant because they have one or more of cultural, ethical, moral, traditional, economic, political or spiritual concerns. SSIs are mainly environmental and health problems facing the people of the twenty-first century though they are not new. SSIs have been described as scientifically explained problems or issues that are conceptually linked to science (Eastwood, Sadler, Sherwood, & Schlegel, 2012; Reis & Galvao, 2009; Sadler, 2004; Sadler et al., 2007; Sadler & Zeilder, 2005a, 2004). However, despite their conceptual link, these issues are socially relevant and very much context specific; hence science was unable to provide a direct solution to address them. On the contrary, science provides informed knowledge about them, which ultimately becomes a source of reference or guidance to seek alternative ways of

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resolution. Other previous studies by Eastwood et al. (2012), Latourelle, Poplawsky, Shmaefsky, and Musante (2012), Tomas (2009) and Nuanchalerm and Kwanthong (2010) view SSIs as problem-centred (where science content is integrated with culture and society) and at the same time providing opportunities for the application of knowledge and ethical, moral, traditional and religious reasoning in the decision-making process (Eastwood et al., 2012; Sadler, 2009). They are usually found in the school science curricula but little or no attention is paid to their sensitivity; let alone engaging a special approach to their instruction.

SSIs differ from other scientific issues or problems because they involve many aspects and solutions. In other words, Sadler and Zeilder (2005a) articulated that they are open-ended, ill-structured and debatable problems or issues. They are open-ended because they do not have a direct answer or solution and are ill-structured because of the fact that they are controversial in nature in addition to having explanations from different areas. Similarly, they are said to be debatable in the sense that they are based on individuals' opinions and understanding that can be a function of ethical, political, economic, cultural, traditional and sometimes spiritual beliefs. Another distinguishing attribute of SSIs from other science issues such as science-technology-society is that while the latter focuses on the impact of science and technology on society, the former explores the moral and ethical implications that underlie the issues (Klosterman and Sadler, 2010; Sadler, 2004; Sadler & Zeidler, 2004). Sadler and Zeidler added that the SSIs movement arises from the conceptual framework that unifies the development of the morals and beliefs of learners while considering the role emotion and character can play as key factors of science pedagogy.

The teaching of SSIs content in school has taken a new dimension using SSI-based instruction or SSI-integrated instruction. For instance, Nuanchalerm and Kwanthong (2010) used this instruction in teaching 'Global Warming'. In their study, they used 24 fifth-grade students, nine lesson plans, a 20-item achievement test, a 20-item analytical thinking test, and a 10-item questionnaire on learning satisfaction. They found that SSI-integrated instruction helps students learn about nature of science in addition to promoting individuals' development in terms of both cognitive, analytical thinking and learning satisfaction.

On the other hand, Rundgren (2010) studied how background affects attitudes towards SSIs in Taiwan using three attributes of SSIs, including genetically modified food (GM food), organic food, DDT and malaria. Data were collected from 865 participants across ten populations of six different educational levels and four different vocational levels. It was found that the awareness of GM food and DDT increased with the levels of education. It was also discovered that the tendencies of the participants to buy or use GM food and their attitudes towards the three SSIs were not related to levels of education, vocation or gender, but were related to attributes of the SSIs. In a related development, Jho, Yoon, and Kim (2013) studied the relationship between science knowledge, attitude and decision-making on SSIs using the SSI-integrated instruction that focused on sustainability of nuclear power plants in Korea. Eighty-nine students attended the instruction and participated in pre- and post-questionnaires to determine their understandings of nuclear energy. Using correlation, cross-tabulation and regression analyses the results indicated that while the students' understandings of science knowledge had significantly improved throughout the instruction, they however maintained similar attitudes and

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decision-making on the issue. Moreover, the relationships between the three domains indicated that attitude showed some degree of connection to decision-making, whereas science knowledge did not show a significant relationship to decision-making.

Consequently, this study also used SSI-integrated instruction to determine its effects in improving the participants' attitudes towards the sexually themed science content that they had to study in college. The students' attitude as future science teachers is important because positive attitude has been reported to improve a greater acceptance of learning content and higher achievement (Hornstra, Denessen, Bakker, Bergh, & Voeten, 2010; Rennie and Goodrum, 2007; Wood, 1997) in addition to understanding and greater enthusiasm to communicate the content to learners.

The study was also informed by other studies which indicated that students generally have negative attitude towards learning problems that are socioscientific in nature (Dawson & Schibeci, 2003a, 2003b; Klop & Severiens, 2007; Pardo, Midden, & Miller, 2002). Besides, Ryan and Deci (2000), Pekrun, Elliot, and Maier (2006), Zeidler, Sadler, Simmons, and Howes (2005) added that learners are easily disturbed when working with complex scientific issues whose outcome is not clear, which is one of the features of SSIs. As a result, when teaching such problems, there is need for a multiphase approach like the SSI-integrated instruction to help learners overcome much, if not all, of the problems they face while learning. Learners also need help to overcome failure that affects their understanding and motivation in the formation of positive attitudes towards the sexually themed science content.

Background theory: the theory of planned behaviour

The theory that forms the basis for this study is the theory of planned behaviour (ToPB), which was initially related to the theory of reasoned action (TRA) or voluntary behaviour (Ajzen, 2002, 1991). It was developed because of the understanding that behaviour was found to be neither completely voluntary nor involuntary. Therefore, it can be influenced by some external forces. This resulted in the addition of perceived behavioural control on the earlier theory, the TRA. This new ToPB predicts deliberate behaviour because it can be deliberate and planned.

ToPB is a model for the prediction of behavioural intention, and prediction of an individual's attitude and behaviour (Ajzen & Fishbein, 2000). The theory further stressed that if a person intends to perform a particular behaviour, it is likely that the person will do it and likewise if he/she did not intend to do it, it is likely that he/she will not do it. This means that attitude determine individuals' intention to perform a particular behaviour or otherwise.

It should be remembered that targeted participants were mainly students that come from the society that showed mixed responses towards the sexually themed science content of a course they offer in the school. It is noteworthy that it is one thing offering a course only because it is compulsory to do so using teacher-made notes, listening to lectures, read and pass examinations (Sadler, 2008), while it is another connecting effectively what has been learnt to real life situations. This significantly depends on the learners' positive attitude towards the material for making meaningful connection with real life situations, which is important and will ensure effectiveness and efficiency in their role as teachers.

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The SSI-integrated instruction here was intended to influence the participants' attitude positively towards both learning and teaching the sexually themed science content in their pre-service and service years and also to solve real life problems they might come across. Their intention is, according to this theory, the measure of their positive attitude towards teaching these types of content and using the knowledge gained in solving real life problems. The participants are members of the society whose beliefs about the sexually themed science content have been so far shown to be strongly negative (Dawson & Schibeci, 2003a, 2003b; Klop & Severiens, 2007; Pardo et al., 2002). Hence, interventions such as the SSI-integrated instruction is hoped to change their attitude to a more positive one.

Method

The study was a mixed methods research designed so that quantitative and qualitative data were obtained before and after the SSI-integrated and conventional (didactic) instructional approaches. According to Cresswell and Plano (2011), Angell and Townsend (2011), Tashakkori and Teddlie (2003), a mixed method study is one that combines the elements of qualitative and quantitative approaches. The topics that generated controversy for integrating them in the science content were designed in the form of a class activity where the target participants were grouped into two groups, experimental and control groups from two teacher training colleges in Nigeria. The experimental group in one college participated fully in the SSI-integrated instruction for eight weeks where they were deliberately allowed to take a position and argue among themselves on the problems. They debated in defence of their varied opinions on each of the topics with scientific findings as evidence to support their positions. The content was outlined and a module was formed for the eight-week activities (Appendix 1).

Participants

A total of 200 year-one college students were the research participants in the study. They were from the north eastern region and were mostly from the Hausa-Fulani tribe with a mixture of some minor tribes of the region such as Kanuri, Bolewa, Tangale and Tera who share the same culture in food, shelter, life-style and religion. The colleges were Federal Colleges of Education (FCEs), one as the experimental group and the other as the control group. The rationale behind the choice of similar colleges was to overcome any interaction effects. They are teacher training colleges, fully funded by the Nigerian federal government awarding the Nigeria Certificate in Education – NCE – in vocational, science and technical education majors for Nigerian schools (NCCE, 2009). They operate the same programme using the same curriculum designed and set by the NCCE. The teacher effect was reduced by involving teachers with the same qualification (MSc. Ed) and cognate experience taking into consideration the fulfilment of the same criteria set by the NCCE before being employed in the colleges as lecturers.

In the two colleges where the study was carried out, there are various programmes of study in science, vocational and technical education, but this research was limited to students in the programme of combined biology/integrated science major.

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The treatments

In this section, an explanation of the treatments with the experimental and the control groups were outlined. A detailed module for both the groups has been included in Appendix 1. Both groups were taught the same content in the two colleges though the approaches differ significantly as shown in Figure 1. More explanation was given in the following subsections.

Experimental group

The experimental group from one college consisting of 98 students was taught the sexually themed science content using the SSI-integrated instruction to resolve the controversy surrounding the problem. The content included the anatomy and physiology of human reproductive organs, in-vitro fertilisation, use of contraceptives, unwanted pregnancy and abortion, sexual abuse and HIV/AIDS/other STIs. A module depicting the content including the facilitator's and students' activity as well as the social concern surrounding each of the topics in the Nigerian context have been given in Appendix 1a.

For the experimental group, the facilitator would give a brief lecture to the students and the issue would be framed in a story. The students were allowed to take a position on the alternatives given in the story. For instance, on the issue of STIs, the facilitator framed the issue in a story thus:

> There is going to be a community regular meeting in a few days' time. You have been selected to make a presentation on various STIs, their effects, the microbial transmission and modes of prevention for the benefit of youths in the community. In your paper, what methods are

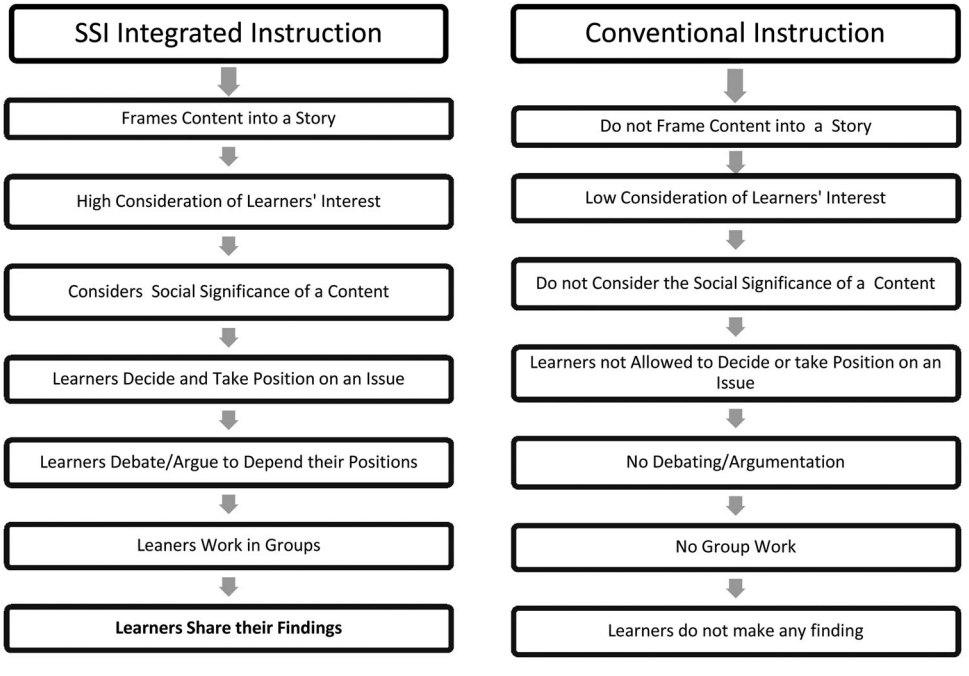

Figure 1. The difference between SSI-integrated instruction and conventional instruction.

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you going to recommend, taking into consideration total abstinence, use of condoms, vaccination, faith or beliefs in traditional herbs or religious healings? You are expected to convince your audience.

The students were allowed, based on their opinions, to support or go against the use of condoms, total abstinence and vaccination where available, or using traditional or religious beliefs in herbal medicines and destiny. Based on these, different positions were taken. For instance, some believed in traditional medicine, while some supported total abstinence and a few agreed to the use of condoms. Some believed that if you are destined to be infected, no matter the precautionary measure such as vaccination and total abstinence, you will get infected. An example proposed was innocent housewives that got infected from their 'irresponsible' husbands who were involved in extra-marital affairs with other women. They were allowed to make further investigation in groups to find out more facts from scientific and religious points of view to support their opinions taking into consideration the ethical, moral, cultural, economic, political and spiritual concerns of the issues.

In the following session, they deliberated in defence of their positions while the teacher facilitated the session which lasted for two hours. During the debate or argumentation session, a representative made a presentation while any group member could respond to questions from other supporting or opposing groups. In the end, they shared their findings and the next problem was introduced in the same way for deliberation in the following contact time.

The control group

The control group consisting of 102 students was taught the same content using a more conventional approach, that is a normal teacher-dominated class lecture. The teacher gave a lecture for two hours while pausing to answer questions from the students. For instance, he introduced the lesson by asking the students some examples of STIs where correct answers were given. He continued with listing the microbes responsible for causing the diseases. For example, gonorrhoea is caused by bacteria (Gonococcus) while HIV/AIDS is caused by viruses (human immuno-deficiency virus). He mentioned total abstinence as the most effective protection against the STIs while the alternatives were the use of condoms, vaccination where available and the use of drugs for treatment. He then gave prepared notes to the students to copy on their own. The classes that followed were the same lectures on the topics outlined in the module for two hours each until all the content was covered within eight weeks. The students were neither given a story nor allowed to provide any opinion on the use of condoms, abstinence or immunisation, to mention a few, for protection against infection. They would read the notes for test or examination purposes (Appendix 1b).

The instrument

The research instrument used for data collection was the students' attitude scale adapted from Mahoney (2010). It is a 4-point Likert scale ranging from *Most, More, Less,* to *Least.* It consists of 34 items whose reliability was considered very high (Cronbach's alpha .9) in Mahoney's study. The instrument was developed to measure students' attitude towards

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science, technology, engineering and mathematics. For this study, the developer's advice was solicited on its suitability and assured that if the attributes of attitude to be measured remained the same, the instrument could be used.

The attributes of attitude studied were interest, perceived ability, value and commitment (Appendix 3). For 'interest', it has investigated whether the participants were interested in the sexually themed science content or not. Nine items (1–8 & 34) of the instrument were designed to measure 'interest'. For the 'perceived ability', that measured the participants' self-perceived competence in learning and teaching the sexually themed science content, it was measured by 9 items (9–17). The next construct is 'value' which was measured by 8 items (18–25) that sought to find out the participants' attached importance to the content under study. Finally, the last construct was 'commitment' measured by 8 items (26–33). These items investigated the participants' readiness in applying the acquired knowledge of the sexually themed science content to practical situations.

In the study, data were obtained from the experimental and control groups using pre-intervention measurement as pre-test scores and post-intervention measurement as post-test scores. The 4-point scale of the instrument measures each item from 4 to 1 with 4 points for *Most* and 1 point for *Least*. Therefore, a higher score denotes a more positive attitude.

The dependent variable used was the post-test scores of both groups while pre-test scores for both groups were used as the covariates controlling for the former. One-way between groups ANCOVA was performed to find out the effects of the intervention in resolving the participants' attitude towards the sexually themed science content of their course. The independent variable was the two groups where the experimental group received the SSI-integrated instruction and the control group received the traditional teaching style on the same content (see Figure 1).

Preliminary checks have been performed to ensure that the assumptions of reliability, normality, linearity, homogeneity of regression slopes, homogeneity of variances and reliability of the covariates have not been violated.

Pilot test

Since the instrument had not been previously tested in Nigeria, the main purpose of this pilot study was to subject the instrument to the Nigerian context and test its reliability and content validity. The pilot study also tested language suitability for the participants. Some qualified researchers including a principal lecturer (associate professor in a university) and a chief lecturer (equivalent of professor) all with several years of teaching and research experience studied and validated the instrument. Their observations were taken into consideration and corrections were effected for content coverage and language suitability for the students at this level of their education. A group of 50 students from a different college responded to the instrument whose data were used for the pilot test. A Cronbach's alpha reliability coefficient value of $\alpha = .95$ was obtained for the overall measurement. The reliability of the constructs obtained were $\alpha = .79$ for *interest*, $\alpha = .81$ for *perceived ability*, $\alpha = .80$ for *value* and $\alpha = .77$ for *commitment* attesting to the excellent internal consistency (Cohen, 1988; Cronbach, 1951; Airasian, Gay, & Mills, 2003; Gravetter & Wallnau, 2004; Pallant, 2007; Stevens, 1996) of the instrument in the Nigerian context.

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Oral interviews

An oral face-to-face interview was conducted to obtain qualitative data to provide a deeper understanding of the quantitative data. Ten students voluntarily participated in the interviews before and immediately after the experiment. They were all from the experimental group following the pattern of Karpudewan, Ismail and Roth (2012). The first interview session was conducted during the first week of the commencement of the activities whereas the second one was conducted with the same students in the 9th week after completion of the exercise. The responses from the interviews were manually transcribed according the guide and specifications of Gillham (2005). The presentation followed the patterns of Karpudewan, Ismail, and Roth (2012) and Karpudewan (2009). The questions asked during the first and the second interviews were the same (Appendix 2).

Data analysis

The study was conducted to ascertain the attitude of college students towards some sexually themed science content in the course that they offered. Using the recommendation of Shadish, Cook, and Campbell (2002), a quasi-experimental research design was used with the two groups assigned to experimental and control groups. According to them, where there is a control group, the use of pre-test scores as covariates would improve internal and external validity of the study. Therefore, in this study, pre-test scores of both groups were used as covariates in the analysis of covariance (ANCOVA). Besides, because of the measurement of four distinct constructs of the attitude, a Bonferroni adjustment of $\alpha_{adj} = \alpha/n$, (Napierala, 2012; Price, 2000) was employed where n is the total number of tests conducted in the study (α_{adj} = .0125) to keep the alpha level for the total experiment at $\alpha_{exp} = .05$.

Research results

Quantitative findings

Table 1 gives the descriptive statistics of the data collected where all the mean scores of the participants were given alongside the estimated marginal means at 95% confidence intervals. When the data were analysed using one-way between groups ANCOVA and after adjusting for the covariate scores, there was a statistically significant difference between the two groups on their post-test scores F (1, 247) = 426.97, p = .00, partial eta squared = 0.64. There was a strong difference between the pre-test and post-test scores of the instrument as indicated by a partial eta squared value of .64 (see Table 2). This showed a difference in attitudinal change among the groups with the experimental group

Table 1. Descriptive statistics.

	Mean scores		95% Confidence interval			
			Expt group		Ctrl group	
Attitude constructs	*Expt group*	*Ctrl group*	Upper	Lower	Upper	Lower
Interest	3.37	2.47	3.28	3.45	2.40	2.30
Perceived ability	3.20	2.40	3.27	3.13	2.46	2.30
Value	3.60	2.61	3.69	3.51	2.68	2.54
Commitment	3.47	2.51	3.56	3.39	2.58	2.44
Overall	3.41	2.52	3.47	3.34	2.57	2.47

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Table 2. Quantitative results summary.

	Mean scores					
Attitude constructs	*Expt group*	*Ctrl group*	*F*	*t*	*P*[a]	*PES*[b]
Interest	3.37	2.47	(1, 247)	274.52	.00	.53
Perceived ability	3.20	2.40	(1, 247)	295.56	.00	.55
Value	3.60	2.61	(1, 247)	307.87	.00	.55
Commitment	3.47	2.51	(1, 247)	290.50	.00	.54
Overall	3.41	2.52	(1, 247)	426.97	.00	.63

[a]Sig. $p < .013$ (After Bonferroni Adjustment).
[b]Partial Eta Squared.

showing a more positive attitude towards the content while they initially had a negative attitude towards them.

However, an individual construct analyses was conducted to ascertain the strength of the significant difference obtained in the overall analysis to check whether or not the objectives of the research had been achieved. The same one-way between groups ANCOVA was used in the analyses using the pre-test scores as the covariates. It can be seen from Table 2, that for *interest* there was a significant difference between the experimental and control groups on their post-test scores F (1, 247) = 274.52, p = .00, partial eta squared = .53. The mean difference calculated was given in Table 1.

For the *perceived ability*, the results obtained were F (1, 247) = 295.56, p = .00, partial eta squared = .55. The means difference was given on Tables 1 and 2.

The calculated scores of *value* obtained was F (1, 247) = 307.87, p = .00, partial eta squared = .55. The last construct, which is *commitment*, was calculated as F (1, 247) = 290.50, p = 00, partial eta squared = .54. When the results in Table 2 are considered, there is a significant difference between the experimental and control groups' attitude towards the content. It is noteworthy that the control group's mean scores have also increased, while that of the experimental group is significantly higher. Therefore, according to the findings of this study, the students' attitude has significantly improved (or is positively affected) for the experimental group after using the SSI-integrated instruction in the teaching and learning of the socially significant science content that is unique to the northern Nigerian society. This indicated that it is significantly more effective than the traditional/conventional approach in improving the participants' attitude towards the sexually themed science content.

Qualitative findings

When the responses of the interviewees are considered in general (Table 3), it can be understood that all pre-intervention responses show that most of the participants exhibited a relatively negative attitude towards the sexually themed science content of the course that they offered. For instance, to find out about their interest, the participants were asked if they liked to know more about the sexually themed science content, for instance from TV shows or offering courses of that nature. Eight respondents showed low interest while only two showed a moderate interest in the first instance. However, almost all showed a shift and showed more interest during the second interview. The following was the response of respondent 2 in the first and the second interviews as an example:

> **Pre-intervention**: Sometimes these TV shows have nothing valuable and I think the course is enough.

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Table 3. Qualitative results summary.

Constructs/ themes	Questions	1st Interview	2nd Interview
Interest	1	8: expressed low interest 2: expressed moderate interest	0: expressed low interest 10: expressed high interest
Perceived ability	2	8: are reluctant 2: are willing	3: are reluctant 7: are willing
Value	3	9: did not give value 1: do value	2: do not value 8: do value
Commitment	4	9: shows less commitment 1: shows more commitment	1: shows less commitment 9: shows more commitment
	5	9: shows no commitment 1: shows commitment	1: shows no commitment 9: shows more commitment
		Figures in 1st & 2nd interviews	*Represent respondents*

Post-intervention: In fact I can offer more courses to know more about these social problems of health and so on. TV programmes or documentaries can also help and it is a good thing if we give time for these.

It can be understood here how low the interviewee's interest was in the first interview and a change had occurred in the second. After devaluing TV shows on matters that have to do with some of the sexually themed science content of their course in the first instance, he readily recognised it and attached some significance to it while at the same time showed willingness to give time for it. All responses of the participant are given in Appendix 2.

For the 'perceived ability', seven students showed a more attitudinal change when asked how they could go about doing an assignment or project involving the sexually themed science content that they had studied (Table 3). The excerpt from respondent 3 is as follows:

Pre-intervention: I will do assignments as usual like in other courses.
Post-intervention: Projects or assignments involving controversial science content are going to be interesting to me. I will go with the work no matter how difficult it can be because in the end of it something valuable will surely be learnt.

The respondent showed how he would go about doing an assignment or project in the first interview showing no additional effort, indicating lower self-perceived ability. But in the second interview he was ready to go about it by putting much effort to finding a solution irrespective of its difficulty. Here, a more self-perceived ability has been expressed in anticipation of gaining something valuable in the end. This also indicates an attitudinal change from negative to a more positive one after the experimentation.

The next example was from one of the eight respondents who exhibited a change of attitude in favour of a positive one for the construct of 'value' as can be seen in Table 3. This was when they were asked whether or not they saw something important in the content and whether or not there was need for it. The following response in the first and the second interviews from respondent 1 is representative of the views of the rest:

Pre-intervention: Every course is important and the one with controversial science content cannot be singled out.
Post-intervention: Considering the health and environmental issues nowadays, it is very useful. There is need to reduce premarital sex and unwanted pregnancies and abortions.

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The respondent wondered why importance could be attached to one course, indicating that it is of low value to her in the pre-intervention instance. A noticeable shift occurred after the intervention where high value has been attached to the content especially in present day health, environmental and other social problems facing humanity, particularly the immediate society. A qualitative shift in attitude can be said has manifested here.

Furthermore, nine respondents also showed a more positive attitude in the second instance on the last construct, commitment, as shown in Table 3. They were asked two questions: one was their readiness in taking up a career or more studies on the same or similar content while the second was whether there is a life situation in which such knowledge can be useful. One example from a married woman who is respondent 7 given here is worth noting:

> **Pre-intervention**: My husband may not allow me to take a job there.
> **Post-intervention**: For me to be important to myself and society at large, I am ready to learn more and work with these issues, which means I am out to help others.
> **Pre-intervention**: Not only the controversial science content, all what we learn here can be put to use in life.
> **Post-intervention**: In the society that we live, the controversial science content has a useful role to play because many things that we don't know we now know and believe me, I will also help others with what I learn.

The respondent cautioned that her husband may not allow her to take a job if offered but set him aside in the second interview in response to the first question. While responding to the second question in the first interview, she said all what was learnt can be put to use in life, not only the sexually themed science content but contradicts herself in the second interview and confessed that she now knew a lot after participating in the activities of the treatment. She admitted to being helpful to herself and people of her society. She now understands that what has been learnt in school can be put to solving life problems. This is very essential for a learner to be able to connect the material learnt in school to solving not only personal problems but helping others as well. This is a change in attitude in favour of a positive one.

Summary

All the pre-intervention responses of the participants in general showed negative attitudes towards the sexually themed science content. However, there was a more qualitative attitudinal change to a positive one after the eight weeks of the intervention activities. This change could be the consequence of the intervention though none of the control group members was interviewed either prior to or after the intervention. Yet the result further strengthens the quantitative findings obtained, which showed also a shift from negative to positive attitudes. The quantitative findings of the study have thus supported the qualitative findings.

Discussion

It is important to improve the college students' attitude towards these socially significant issues. This is because of the fact that they are in teacher training institutions receiving training to be future Nigerian teachers. It is necessary that they use the acquired knowledge, ideas, skills, attitudes and experiences and make connections with their life-styles and career. When the teaching and learning of this and other similar sexually themed science content is left to continue in the traditional way of teacher dominated classroom

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lectures and notes taking, the tendency of offering a course, write examinations and merely pass would manifest which is far from the objectives of the teacher training programme. The findings of this study have shown how the SSI-integrated instruction has significantly affected the students' negative attitudes.

Teachers were considered the transmitters of knowledge, ideas, skills, attitudes and experiences to their learners. They are role models in the society whose life-style, attitude and aptitudes are emulated by young learners who may tend to ignore or pay little attention to some of the content particularly the socially significant ones.

This research has indicated that the attitude of the college students can be improved or changed to a more positive one when a more proactive approach to instruction was put into use, particularly when using the SSI-integrated instruction. This is because the learners were allowed to take a position on a particular problem and negotiate it with their peers thus sharing ideas and knowledge. This approach is similar to that of the Sadler and Zeidler (2004) qualitative studies where students used a decision-making strategy in situations that are controversial and scientific in nature. They showed how students negotiated and resolved genetic engineering problems. In their study, 30 participating students were involved in a semi-structured interview to find out their patterns of informal reasoning and the role of morality in these processes. The research found that the students showed evidence of rationalistic, emotive and intuitive forms of informal reasoning where they relied on two or more of these reasoning patterns in resolving individual socioscientific scenarios. The researchers also cautioned on the need to ensure that science classroom environment values intuition and emotion in addition to reasoning.

Another similar study was that of Eastwood, Sadler, Sherwood, and Schlegel (2012). They studied two groups of participants to find out how the SSIs-based learning affected their epistemological understanding of scientific inquiry. They found that both groups of the participants have similar responses but only differed in five subthemes out of the 60 subthemes used. In their method, they too used an interview schedule with some of the students to validate and triangulate the quantitative data. Likewise in this study, the same SSIs-based learning was used with one group of students to find out its effectiveness in affecting the participants' attitude towards the sexually themed science content. Also interviews were used to substantiate the understanding of the quantitative data obtained.

Conclusion

Positive attitudes of teachers towards teaching sexually themed science content are very significant for achieving the desired objectives of the learnt content. The attitude theory has linked a positive attitude to performance and behaviour. That is behavioural intention to performing a task depends on one's attitude towards it. This study has found the significance of the SSI-integrated instruction in resolving controversies surrounding some sexually themed science content. From the initial stage, the literature has shown how the general public including students and teachers showed a mixed response to the teaching of some this content intended to address some of the social problems worrying Nigerian society. However, after the SSI-integrated instruction, a significant shift to positive attitude towards the content manifested.

The findings of the study therefore showed that with new instructional method or approach of this type, where students were deliberately involved and given the chance

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to make their opinions known, and were allowed to defend it using scientific and even religious quotations to support their position, a significant change in favour of a positive attitude resulted.

In the colleges studied, the SSI-integrated instruction was found to have a positive effect on the participants' attitude towards the sexually themed content that they had studied. This system of instruction has been found to be effective in the teaching and learning of what initially appeared to be a social taboo in the society. It is therefore recommended that this system of instruction be tested in other colleges found in northern Nigeria where opposition was shown to have persisted.

Moreover, apart from the sexually themed science content studied here, there are similar scientifically defined issues that are also socially significant that need to be further studied. These areas includes but are not limited to (i) the effect of chemicals in agricultural practices, (ii) destruction of biodiversity as a result of human activities such as deforestation and desert encroachment and (iii) sewage disposal practices and pollution. It is also recommended that the use of the instrument by Topcu (2010) that was specifically developed to measure attitudes towards SSIs be administered to pre-service teachers.

One of the limitations of the study is the small number of participants used for the interview from the experimental group. Furthermore, interviews with some of the control group participants would have elaborated more on the quantitative findings that had been obtained by providing a more in-depth understanding of the control group's qualitative outcomes after the intervention. Another limitation is that the participants' gender and background were not considered as factors that could possibly determine the change in attitude despite the significant role that they could play particularly in the society where the research was conducted.

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Appendices

Appendix 1a A Module for the SSIs approach *(experimental group)*

Science content	Social concern of the content	Facilitator's activity	Learners' activity	Duration
Male and Female Reproductive Anatomy and Physiology	Use of teaching materials such as posters , models, charts and motion pictures that shows human sex organs	Gives lecture and some notes in slides or in papers Moderates debates	To take a position on the need to use the said teaching materials in classroom considering the social concern of doing so. In class argumentation is allowed	1week
In-vitro fertilisation	Use of sperm donations to solve childless problem	Same as above	Taking position on the need to accept or not accept sperm to solve childless problem	1week
HIV/AIDS	Use of Condom or total abstinence	Same as above	Take a position on how to prevent infection e.g. use of condom	1 week
Use of contraceptives and Contraception	Premarital, marital and extra-marital sexual relationship and prevention of pregnancy by the use of condom and contraceptive	Same as above	Argument based on opinions for the prevention of pregnancy in each relationship considering the social concern of doing so.	1 week
Unwanted pregnancy and Abortion	Safe delivery of out-of-wedlock-child or abortion?	Same as above	Take a position and explore the social significance of the safe delivery of out-of-wedlock-child or abortion	2 weeks
Sexual abuse	Rape and premarital sex	Same as above	The results of rape and how to handle rape victim and culprit	1 week
Other STIs	Preventive measure like the use of condom	Same as above	Total abstinence of use of preventive measure? Take position for argumentation	1 week

Appendix 1b A Module for the conventional approach (control group)

Science content	Facilitator's activity	Learners' activity	Duration
Male and Female Reproductive Anatomy and Physiology	Gives lecture and some notes in slides or in papers. Respond to questions	Listen to the teacher and sometimes ask questions. Take readymade notes from the teacher.	1 week
In-vitro fertilisation	Same as above	Same as above	1 week
HIV/AIDS	Same as above	Same as above	1 week
Use of contraceptives and Contraception	Same as above	Same as above	1 week
Unwanted pregnancy and Abortion	Same as above	Same as above	2 weeks
Sexual abuse	Same as above	Same as above	1 week
Other STIs	Same as above	Same as above	1 week

Appendix 2. Interview Questions and Responses

Q1: Dou you like to know more about sexually themed content like in TV shows or offering courses of that nature?

Respondents	*Pre-test*	*Post-test*
1	*The course is compulsory for every student and programme involving it may help understanding*	*Yes. I am ready to offer more courses to know much about these socially scientific problems. TV would help a great deal for many people*
2	*Sometimes these TV shows have nothing valuable and I think the course is enough*	*In fact I can offer more courses to know more about these social problems of health and so on. TV programmes or documentaries can also help and it is good thing if we give time for it*
3	*No. I don't like too much work load*	It will be interesting to see on TV what is taught in school. I have to stay and watch it. Also more as courses of sexually themed content type is quite needed for the development of our backward people. We will be teachers to teach and we need more knowledge because we cannot teach what we don't know
4	I know this course only here in the school and what is in the course need to be understood first	It is interesting to see what we know I mean the happenings in the society are part of a course for us to learn. Yes it will be useful to know more by any means not only on TV or offering more courses
5	The course is okay	In fact, there is need for special programme in TV for more enlightenment of the society. Courses only benefit those who come to school but TV programme is for all
6	Knowing more by any means is my hobby and I will like to know more about anything because it will be important	Truly videos and movies on TV which relates to sexually themed content can be useful and knowledge increasing means. Even if one offer course to have more ideas, TV movies can also help. It is good if people devote some time to watch them
7	I don't want to offer more courses	I will for better understanding and more knowledge
8	I have many things to do every day. This may coincide with examination period or some other things. It will not be easy	I think because of the importance of sexually themed content I am ready to know more about it in whatever way
9	It depends on the TV programme and the type of sexually themed content course. I think I should think before doing that	This sexually themed content we are doing now has many topics common to the people and their problems in love, marriage, or other relationship. I agree to watch TV shows with these kinds of problem because they can be way out of your problem. This can help person a lot
10	What we have in this one I think is enough to us	Yes it can be useful

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Q2: How would you go about an assignment or project involving sexually themed content?

Respondents	*Pre-test*	*Post-test*
1	*I will try my best*	*I need to study and understand the question or the objective of the work before swinging into action. Using references in books and the internet can be effective*
2	It is good thing for one to do his assignment always	The project may be specifically for me to know something by doing. I will do my best
3	*I will do assignments as usual like in other courses*	Projects or assignments in sexually themed content are going to be interesting to me. I will go with the work no matter how difficult it can be because in the end of it something valuable will surely be learnt
4	*Though some students may copy assignment from others, I will do mine as I always do*	Assignment or project can be solved with the help of others like medical doctor I mentioned. With their assistance it can be simply finished
5	*As usual*	Consultations to seek expert's knowledge will help so much. I can try as much as possible to do it myself
6	*Library has books and some internet connections. I can go about my assignments there*	I think you mean challenging project or assignment. The agencies I mentioned can be of great assistance in performing the activities
7	*Like I do in other courses*	Many topics show what happens in the society. I will use this knowledge and ask from the people to do the assignment or project
8	*Yes I would do it as usual*	In fact I will work extra harder to score higher
9	Assignment and project are students' activities. I can go about it like my colleagues	In workshop I mention, I can get materials and lectures from qualified facilitators that can help in assignment and project, I can get materials and lectures from qualified facilitators that can help in assignment and project you mention
10	Like I do always	I will solve them by consultations of books, internet and even other lecturers

Q3: Do you believe that sexually themed content is important and that there is need for it?

Respondents	Pre-test	Post-test
1	Every course is important and sexually themed content cannot be singled out	Considering the health and environmental issues nowadays, it is very useful. There is need for it even to reduce premarital sex and unwanted pregnancies and abortions
2	Sexually themed content is a course in GSE and without it one cannot graduate	No one doubts the importance of the knowledge of this course in the life of people
3	Sexually themed content is for every college student. They know its use that is why they put it for us to register and pass	Surely I believe it is very I important and every college student need it at this age
4	I don't think it is necessary. It is an additional load to too many courses we are made to offer before graduation	All categories of students whether married or single would find the course important in their life. There is need for it of course
5	Yes	Considering the current youth life and what is happening, there is a need for it because it can be useful
6	Yes, I believe	It is very important. There is need for it by students and the teachers. The people of the society also need it
7	When we study it we will know the importance	There is need for sexually themed content for every member of the society
8	Sexually themed content and other GSE courses need to be reviewed because they add more credit units to our semester courses	There is need for it for successful and healthy living

(*Continued*)

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Continued.

Respondents	Pre-test	Post-test
9	It depends on the situation one find himself. I mean for somebody it can be important and not for others	I said it. It is important to people with problem in love, marriage and other relationships. Here sexually themed content knowledge can be important and I believe there is need for it
10	I think it will be important	There is need for it especially for the youths

Q 4: What is your readiness in taking a career and more studies to learn more about sexually themed content?

Respondents	Pre-test	Post-test
1	I have to think very much before doing such	When there is a vacancy, it is good for me to take the offer because there will be much contribution I can do to help others
2	I better remain a teacher	With more knowledge as a result of offering courses of sexually themed content nature, I can contribute more to people with problem
3	Like in state action committee on AIDS? Well it depends on the vacancy available there. You know the situation of employment	Although vacancies are very difficult to exist, I am sure to take a job there. I will be happy to know more so that I can perform my job very well satisfactorily
4	I may not perform well there	. Yes I will
5	Vacancies rarely exist	at least one can help those in problem that include friends, relatives, neighbours, etc. working in one of the agencies I mentioned can also help very much
6	As I said must know sexually themed content before all these	I will
7	My husband may not allow me to take a job there	For me to be important to myself and the larger society, I am ready to learn more and job in these issues means you are out to help others
8	I don't want more courses that add more credit loads	I can work in sexually themed content related office and this will require me to learn more about it
9	It depends on the problem and the type of job offered. I have to think before accepting	Yes, I will take the job
10	This one is enough and I may not fit into career involving it	I think I can take the career to be guiding our youths of today who are misbehaving. Then I would like more studies to be effective

Q5: Do you think there would be situations in life where sexually themed content knowledge would be important?

Respondents	Pre-test	Post-test
1	It is knowledge and no knowledge is a waste	Presently it is very important because of the problems of the youths both males and females. One can understand how he can solve his immediate life problem without leaking his secret to anybody
2	It may be possible	In life, I can encounter one problem or the other and some topics in sexually themed content are useful to overtake the problems despite their controversy
3	There are so many problems in life and different courses can contribute to that	This course is different from other courses because it is concerned with family life. It is important not only to married men and women. It is useful for youths to plan ahead in their life since everybody is going to get married one day

(*Continued*)

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Respondents	Pre-test	Post-test
4	I think there can be but I am not sure	Yes. There are situations in everybody's life where sexually themed content knowledge can be useful. Everybody come across one kind of problem or the other which can be solved by using what we learn in sexually themed content. We can help others who don't come to school to learn
5	Yes. I think there would be in this life we have many problems	If there would be no situations in life for its use, I think they cannot put it among the courses we register. If you consider our society, we surely need the knowledge because of its importance. Women will know how to live with their husbands in good health and peaceful. Youths would be careful from now. No more misbehaving, no more mental love and sexual harassment
6	If we study it we will know	
7	Not only sexually themed content, all what we learn here can be put to use in life	In the society we live, sexually themed content has a useful role to play because many things that we don't know we now know and believe me not only me, I will also help others with what I learn
8	It can be possible	We are in a situation already which sexually themed content knowledge will be very useful
9	I will repeat it depends on the problem	Yes. Even in my life, I can confess, I learn something that can help me. It is very important
10	There are many social problems in life and sexually themed content alone cannot solve them	In love among youth both males and females, and in married people is an example of life situations where sexually themed content knowledge can be important. There are many more

Appendix 3.

Table of Specification for the Attitude Scale (Mahoney, 2010)

Attitude constructs	Number of questions	%	The Respective Questions in the Questionnaire
Interest	9 questions	26	1. I like to read about controversial science content 2. My school offers courses in controversial science content 3 My school does not offer after-school programmes in controversial science content 4. I enjoy watching TV shows involving controversial science content 5. I do not want to learn more about controversial science content 6. I do not enjoy taking courses with controversial science content 7. Courses in controversial science content are available to me 8. I dislike the challenge of controversial science content 34. I like controversial science content
Perceived Ability	9 questions	26	9. I am good at projects involving controversial science content 10. Controversial science content are difficult for me 11. I perform well in controversial science content courses 12. I cannot handle advanced courses in controversial science content 13. Controversial science content is simple 14. I do not worry about taking tests in controversial science content 15. I struggle in controversial science content courses 16. I do not understand controversial science content 17. Homework in controversial science content is easy

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Attitude constructs	Number of questions	%	The Respective Questions in the Questionnaire
Value	8 questions	24	18. Controversial science content is important 19. What I learn in controversial science content has no value to me 20. I believe there is a need for controversial science content 21. I need controversial science content 22. Learning controversial science content will not help me 23. Controversial science content is good 24. I care about developments in controversial science content 25. Controversial science content are not worth my time to understand
Commitment	8 questions	24	26. I would dislike more/advanced courses in controversial science content 27. I would like to participate in more after-school programmes in controversial science content 28. I am curious about a career involving controversial science content 29. I am interested in advanced programmes involving controversial science content 30. I have no interest in discovering new ways to apply controversial science content 31. Controversial science content is not a vital part of my perceived future 32. I intend to further develop my abilities in controversial science content 33. I will continue to enjoy the challenge of controversial science content

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