THE EFFECTS OF SOCIOSCIENTIFIC INQUIRY ON PRE-SERVICE TEACHERS' ATTITUDES, SELF-EFFICACY AND ACHIEVEMENT IN FAMILY LIFE AND EMERGING HEALTH ISSUES

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By

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FAT – FLEHIs Achievement Test

FLEIHs – family life and emerging health issues

GSE – general studies of education

HIV/AIDS – human immunodeficiency virus/acquired immunodeficiency syndrome

NCCE – national commission for colleges of education

PopFLE – population and family life education

SERC – science education research centre

SSI – socioscientific issue

SSIBI – socioscientific issue-based instruction

SSIn – socioscientific inquiry

SSIs – socioscientific issues

STIs – sexually transmitted diseases

TSES – teacher sense of efficacy scale

UNESCO – united nation education, social and cultural organisation

USAID – united states agency for international development

LISTS OF PUBLICATIONS/CONFERENCE

1. "Instructional Relationship of Socioscientific Issues-Based Instruction and Peer-Assisted Learning Strategy: An Implication for Science Instruction". *Journal of Science Education, 14* (2). 98 – 100. Accessible online at www.acefyn.org.co/rec.

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2. "The Effects of Socio-scientific Instruction on Pre-Service Teachers' Sense of Efficacy for Learning and Teaching Controversial Family Health Issues. *International Journal of Science and Mathematics Education* (**accepted in April, 2014 in press at the moment**).

3. "Understanding Socioscientific Issues in a Low Literate Society for the Achievement of the Millennium Development Goals." *International Journal of Social, Management, Economics and Business Engineering Vol: 6* No: 12, 2012 pp 692- 695. **International Science Index Vol:6, No:12, Dec., 2012** waset.org/Publication/15900

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5. "College Students' Attitudes towards Controversial Science Content: a Socioscientific Issues Approach to Resolution." *Research In Science Education*.

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KESAN INKUIRI SOSIOSAINTIFIK KE ATAS SIKAP, KEBERKESANAN DIRI DAN PENCAPAIAN DALAM ISU KEHIDUPAN KELUARGA DAN KESIHATAN YANG BARU MUNCUL DALAM KALANGAN GURU PRA-PERKHIDMATAN

ABSTRAK

Kajian ini adalah tentang kesan inkuiri sosiosaintifik ke atas sikap, keberkesanan diri dan pencapaian dalam beberapa kandungan sains yang mempunyai isu-isu bersifat sosiosaintifk dalam kalangan guru pra-perkhidmatan. Seramai 188 guru pra-perkhidmatan dari dua kolej latihan guru terlibat dalam kajian ini semuanya sebagai kumpulan eksperimen atau kawalan. Kumpulan eksperimen diajar isi kandungan menggunakan pendekatan inkuiri sosiosaintifik manakala kumpulan kawalan diajar isi kandungan yang sama menggunakan kelas didominasi guru. Tiga persoalan kajian telah dijawab dengan menggunakan data kuantitatif dan kualitatif yang diperolehi daripada tiga instrumen iaitu skala sikap guru dan keberkesanan, ujian pencapaian FLEHIs dan temu bual. Keputusan kuantitatif yang diperolehi menunjukkan bahawa terdapat perbezaan yang signifikan di antara kumpulan. Kumpulan eksperimen menunjukkan perubahan yang lebih signifikan dalam sikap (F (1,162) = 360, 55, p = .00 < .05) dan keberkesanan diri (F (1, 168) = 41.23, p = 0.00 < .05) daripada kumpulan kawalan. Kumpulan eksperimen mendapat skor yang lebih signifikan dalam skor ujian pencapaian FLEHIs (M = 26.39, SD = 4.98) daripada kumpulan kawalan (M = 21.29, SD = 6.88); t (146.03) = 8.36, p = .00 (dua ekor). Maklum balas daripada data kualitatif yang diperolehi daripada temubual juga digunakan menghurai dapatan kuantitatif. Hal ini kerana maklum balas yang diberi juga menunjukkan perubahan signifikan yang sama ke atas sikap dan keberkesanan diri memihak kepada kumpulan eksperimen. Implikasi

kajian yang berkaitan dengan pendidikan guru dibincangkan dengan batasan kajian dan sumbangan, cadangan serta cadangan untuk kajian selanjutnya.

THE EFFECTS OF SOCIOSCIENTIFIC INQUIRY ON PRE-SERVICE TEACHERS' ATTITUDES, SELF-EFFICACY AND ACHIEVEMENT IN FAMILY LIFE AND EMERGING HEALTH ISSUES

ABSTRACT

The study investigated the effects of socioscientific inquiry on the pre-service teachers' attitude, self-efficacy and achievement in some science content that is characteristically socioscientific issues. Pre-service teachers numbering 188 from two teacher training colleges were involved in the study as experimental or control groups. The experimental group was taught the content using socioscientific inquiry approach while the control group was taught the same content using a teacher dominated class. Three research questions were answered using quantitative and qualitative data obtained from three instruments: attitude and teacher sense of efficacy scales, FLEHIs achievement test and interviews. The quantitative result obtained showed that there is a significant difference between the groups. The experimental group significantly showed a more change in attitude (F (1,162) = 360.55, p = .00 < .05) and self-efficacy (F (1, 168) = 41.23, p = 0.00 < .05) than the control group. Similarly, it significantly out-performed the control group in the FLEHI achievement test scores (M = 26.39, SD = 4.98) and control group (M = 21.29, SD = 6.88); t (146.03) = 8.36, p = .00 (two-tailed). The responses of the qualitative data obtained from the interviews also triangulated and elaborated on the quantitative findings. This is because the responses also indicated the same significant changes in attitude and self-efficacy in favour of the experimental group. The implication of the study with respect to teacher education has been provided with some highlights on the limitations of the study as well as contributions, recommendations and suggestions for further research.

CHAPTER ONE

INTRODUCTION

1.1 Introduction

Scientific literacy is one of the priorities of science education (Rennie and Goodrum, 2007; Tyler 2007), and schools are the main avenues of taught knowledge, skills, ideas, attitudes, and processes of science and other disciplines. However, Klosterman and Sadler (2013) are of the view that learners often lack interest and motivation in school science because they were unable to relate the knowledge learned in the classroom with their life beyond the classroom (Klosterman and Sadler). They further articulated that students try hard to make connection between what has been taught to them in the classroom and their everyday life. They also contended that science and technology have a great influence on the everyday living of the people of modern society (Hazen 2008) and the relevance of science to students is also very significant in providing the means to resolve life problems. Based on this consideration, there are some relevant social issues to learners with a very important conceptual link to science in the everyday living of the people of modern global societies. These issues are technically referred to by experts as socioscientific issues (SSIs).

One of these issues in Nigeria - Family Life and Emerging Health Issues (FLEHIs) - has been selected to be the focus of this study. This is because it is the type of education that addresses social matters and sexually transmitted diseases with HIV/AIDS in the fore front especially at the current infection rate; where 5.8% of the Nigerian population is infected and adults mortality rate is increasing by the day from the infection (Naku, 2011; USAID/Nigeria 2010; Odukoya, Busari and Ateh-Abang, 2006). In Nigeria, FLEHIs is current, sensitive and as well a controversial issue with moral, ethical,

cultural, traditional, political, economic and strong religious concern despite its scientific basis, and explanation as evidences. FLEHIs got its title from the former sexuality education curriculum that was strongly opposed by traditional and religious leaders who mobilised parents, teachers and youths as their allies (Rosen, Murray and Moreland, 2004). The titled was changed to Family Life and HIV Education (UNESCO, 2011) after removing some sensitive content. It is family life and emerging health issues – FLEHIs – as a course in colleges of federal government of Nigeria and state colleges. The course was integrated into the general studies curriculum and is given the code GSE 113.

The target group of the study who are pre-service science teachers in biology/integrated science programme undergoing teacher training are mostly (> 90%) youths that come from the northern part of the country where the said strong opposition against integrating the course originated and persisted. They are part of a society where talking about sexual matters openly is almost a taboo. Hence, their attitude (operationally defined below) towards the course and their self-efficacy (also operationally defined) in the course as future science teachers is worth finding out. This is in addition to finding out their Achievement in the course after offering it.

An instructional approach, socioscientific inquiry - SSIn - was integrated (as treatment) in teaching FLEHIs. It has varied names given to it by varied authors but all referring to the same instructional approach. For instance, it is a socioscientific issue-based instruction and referred to as SSIn by Eastwood, Sadler, Sherwood and Schlegel (2012); socioscientific instruction by Nuangchalerm and Kwuanthong (2010); Latourelle, Poplawski, Schmaefski and Musante (2012) and Tomas (2011). SSIn is an instructional strategy that integrates science content, culture and society while at the same time provides opportunities for the application of knowledge and ethical reasoning

in decision making process (Sadler, 2009; Eastwood et al 2012). In SSIn, students are given the opportunity to engage in reasoning and debating. They are also given the opportunity to interact among themselves and explore scientific ideas and real data while at the same time negotiates social aspects of the problems or issues. Barab, Sadler, Heiselt, Heikey and Zuiker (2007) describe SSIn as an instructional situation where learners use scientific approaches to explore problems that require negotiation on the scientific, ethical, moral, political, cultural, traditional, economic and spiritual concerns of an issue.

Consequently, in this study, the socioscientific inquiry - SSIn – has been integrated in the teaching and learning of FLEHIs, and the effect of such in changing the pre-service teachers' attitude (interest, perceived ability, value and commitment) to positive one was investigated. Also the effect of the use of the SSIn on the pre-service teachers' self-efficacy has been studied with specific reference to self-efficacy to influence school resources and decision making in schools, instructional and disciplinary self-efficacy as well as self-efficacy to creating a positive environment for learning. Also studied is the pre-service teachers' achievement in the content covered.

The colleges where the study was carried out are teacher training institutions under the regulation of the National Commission for Colleges of Education – NCCE – in Nigeria. They operate within the guidelines of a document called NCCE Minimum Standards. The document carries the requirement of students' entry qualification, lecturers, structures, facilities etc. Students are admitted using the same entry requirement which is the standardised national examination by West African Examination Council (WAEC) and National Examination Commission (NECO). Others are National Business and Technical Examination Board (NABTEB) and some oversea

ordinary level examination like city and guilds or London General Certificate Examination (London GCE). Admission can be by Direct Entry (DE) or through a one session preparatory programme. They passed through four semesters from which they proceed to a full semester Teaching Practice (TP) exercise in which they are frequently supervised and assessed for a minimum of ten times. After successful completion of the TP, they resume for a final semester and write a project at the same time. Having satisfied all graduation requirement (passing all courses, TP and project), a candidate is awarded the Nigeria Certificate in Education – NCE - from where s/he can obtain a job or further on for bachelor's degree studies. The study used year one students who offer the course in the second semester.

1.2. Background of the Study

Nigeria, where the study was conducted is located on the southern coast of West Africa. Its 356,667 square miles makes it about twice the size of the state of California. It has a population of more than 165 million people with more than 339 tribal and ethnic groups. Benin lays to Nigeria's west, Niger to the north, Chad and Cameron to the east, and the Gulf of Guinea to the south. Politically, the country is divided into six geopolitical regions: In the south is a coastal mangrove swamp ten to sixty miles wide; in the extreme north is a semi-desert lands. In between are a tropical rain forest fifty to a hundred miles wide and a plateau of savannah and open woodland. Nigeria is currently made up of 36 states plus the Federal Capital Territory, Abuja. 19 of the 36 states and the Federal Capital Territory are situated in the northern Muslim-dominated part of the country and the other seventeen in the predominantly Christian south. There are six states in the north-east geopolitical zone of the country where the colleges of the study -

two Federal Colleges of Education - were located. The target group of the study are at the moment receiving training as future science teachers.

In Nigeria, FLEHIs is referred to as Family Life and HIV Education. It has been given different titles in different African nations and beyond. For instance, in Kenya it is called the World Starts With Me; DAKU in Indonesia; Adolescent Reproductive and Sexuality Health Curriculum in India; Human Studies in Estonia and Long Live Love in the Netherlands (UNESCO, 2011) while in the United States it is referred to as Sexuality Education. Rosen, Murray and Moreland (2004) defined it as,

> Life long process of acquiring information and attitudes, beliefs and values about identity, relationship and intimacy. It encompass sexual development, reproductive Health, interpersonal relationships, affection, intimacy, body image and gender roles. Sexuality education addresses the biological, socio-cultural, psychological and spiritual dimensions of sexuality (Rosen et al, 2004: 4).

FLEHIs, or whatever it is called, is a designed school curriculum to address the controversial issues of relationship between individuals particularly of the opposite sex. It is concerned with a healthy intimacy, affection and sexual problems which are usually not discussed openly. Parents usually remain silent on such issue despite the fact that their growing children are in need of such first-hand information for successful living as observed by Francoeur, Esiet and Esiet (2000). The education is aimed at reducing sexually transmitted infections, prevention of unwanted pregnancies and so reduction in abortions rates among the young people of the society. This is because the youths of any nation are the backbone of its development since they are the most active class of the population. Therefore their health and well-being must not be compromised.

FLEHIs have been recognised as a significant channel of improving youths' social health. For this reason, there were series of conferences and treaties to address its

political and social context in which youths make decision social situations. These conferences stressed the need for young people's information and high quality social health. They include conferences and treaties such as:

- ✓ 1989 convention on the right of children.
- ✓ 1994 international conference on population and development.
- ✓ The United Nation's world programme of action for youths to the year 2000 and beyond.
- ✓ United Nation's Assembly special session on HIV/AIDS (Rosen et al 2004).

The controversial nature of FLEHIs was as a result of strong opposition in Nigeria, Kenya, Indonesia and India (UNESCO, 2011; Rosen et al, 2004) unlike in Estonia and the Netherlands (UNESCO, 2011). In Nigeria for example, many societies and individuals recognise the social threats faced by the active youths particularly sexually transmitted infections (STIs) such as HIV/AIDS, unwanted pregnancies and high rate of abortion (Rosen et al 2004; Francoeur, et al, 2000), but still stick to traditions and beliefs of silence over such issues. In so doing, traditional and religious leaders who are well respected in the society and viewed as transmitters of faith, traditional values and beliefs are in the fore front of the opposition of the curriculum in schools and often mobilised parents, teachers and youths as their allies (Rosen et al 2004). It was generally viewed as a strategy to cut down the population in the Philippines IRIN (2010). In Thailand, politicians have negative attitudes toward the education believing it is inappropriate to teach children anything related to that (Vuttanont, 2010, UNESCO, 2011). Similarly in Malaysia, political leaders are unwilling to risk a strong and negative religious reaction by openly supporting it (Smith, Kippax and Anggleton, 2000). Another point of view is that, in Nigeria and other countries facing opposition, there is the fear that exposing the

youths to reproductive matters will make them sexually active, leading to sexual initiation and experimentation (Shehu and Sheshi, 2012) and general misbehaviour.

It is at the midst of these uncertainties that Nigeria, like the Philippines, implemented the curriculum. UNESCO (2011) who reported the implementation strategy has this to say,

> The programme was first introduced in schools in 2004, and was fully scaled up in Lagos State – covering over 300 public junior secondary schools – by 2007. This rapid roll-out followed a four-year planning process that began in 1999, when the National Council on Education approved the integration of the Nigerian Sexuality Education Curriculum into all levels of the school system. The original curriculum, approved in August 2001, was ultimately changed to 'Family Life and HIV Education.' A revised curriculum was approved and implemented, and excludes discussion of condoms, contraception, and sexual behaviour, which parents, politicians and religious leaders found too explicit (UNESCO, 2011: 18).

Francoeur, Esiet and Esiet (2000) observed that despite the significance of the knowledge, it is not openly discussed and is even considered a taboo to do so. Therefore, the pre-service teachers' self-efficacy and attitude towards these issues are not going to be different from the general public's attitude towards them. Besides, available studies (Dawson and Schibeci, 2003a, 2003b, Pardo, Midden and Miller, 2002, Klop and Sevierrens 2007) showed how students generally have negative attitude towards SSIs such as genetic engineering, gene cloning, genetically modified foods and other complex SSIs. Additionally, studies (Ryan and Deci, 2000, Pekrun, Elliot and Maier 2006, Zeidler, Sadler and Simmons 2005) have also shown that students are easily distracted when working with complex scientific issues whose outcome is not clear while the need for multidimensional approach like the SSIn has been stressed. This is to help students overcome much of the ambiguity they face. To also help in overcoming failure to account for the complexity of factors that influence their cognition as well as motivation

in the formation of positive attitudes and stronger self-efficacy towards the complex scientific issues.

In a study involving SSIs, integration of SSIn resulted in an improved attitude, self-efficacy and achievement (Pedretti 1999; Tal and Kedmi 2006; Albe 2008; Eggart and Bogeholz 2009; Klosterman and Sadler 2010; Lee and Erdogan 2007; Yager, Lim and Yager 2006). Literature indicates that SSIn have been integrated in studies involving SSIs such as biodiversity lost, global warming, genetic engineering and citizenship. It shows exploration on the controversies surrounding the problems. However, Integration of SSIn in controversial issues found in courses such as FLEHIs is minimal. Thus, in the study, SSIn has been integrated into teaching and learning of FLEHIs and the effect of the integration towards pre-service science teachers' attitude, self-efficacy and achievement was investigated. In other words, the study was conducted to identify pre-service science teachers' attitudes and self-efficacy towards FLEHIs and the effect of SSIn in changing the attitude, self-efficacy was investigated. Knowledge gain as a result of SSIn was also studied as achievement of the participants.

1.3. Statement of the Problem

There have been several socioscientific issues – SSIs – in many science subjects in school science curricula that are meaningful to the life of students irrespective of faith, cultural tradition or socio-economic background. Most of these SSIs are misunderstood or are not taught the appropriate way they are supposed to (Nuangchalerm and Kwuanthong 2010; Zeidler, Sadler and Simmons 2005; Dawson and Schibeci, 2003a, 2003b; Pardo, Midden and Miller, 2002, Klop and Sevierrens 2007) for successful achievement of their objectives. They are relevant social problems with a significant conceptual link to science found in everyday living of the people (Eastwood,

Sadler, Sherwood and Schlegel 2012; Reis and Galvão, 2009; Sadler, Barab and Scott 2007; Sadler, 2004; Sadler and Zeidler, 2005, 2004). Eastwood et al particularly defines SSIs as contemporary problems that incorporate knowledge in two aspects: scientific and social knowledge. In other words, they are problems with scientific basis, process and approach to explanation. The social significance on the other hand entails the problem's ethical, moral, political, cultural, traditional, economic or spiritual concern. This qualifies SSIs as sensitive and, at the same time, controversial.

One of such SSIs found in Nigerian teacher training colleges science curricula are those contained in a course with the code GSE 113 and titled family life and emerging health issues – FLEHIs. The SSIs in the course covers topics such as unwanted pregnancy and its preventive strategies including the use of latex condom. It also contains contraception and contraceptives, use of models, charts, still pictures or motion picture for teaching human reproductive organs anatomy and physiology. It also has in its content the prevention of sexually transmitted infections (STIs) such as HIV/AIDS by the use of condom. There is a discussion of other sexually related matters such as rapes, pre-marital/extra-marital relationships that are not often discussed in the open as the tradition ruled. Moreover, because of the strong opposition against the integration of the curriculum that claim to addresses such controversial matters in Nigeria, particularly the north, they are characterised as SSIs because they have ethical, moral, cultural, traditional, political, economic or religious concern which needs serious attention.

Youths in the north where the strong opposition persisted were mobilised as allies by the opposition who are traditional and religious leaders (Rosen, Murray and Moreland, 2004). The study was carried out in this part of the country, the north, from where almost all the participants of the study (pre-service science teachers) came. As

students in a teacher training institution and future science teachers, they would offer the course – FLEHIs – which has in its content the SSIs mentioned above. Being active members of the society that opposed the integration of the curriculum, this is their first experience, as college students, to offer a course of this nature. The students' negative attitude and weaker self-efficacy towards the curriculum would not differ from that of the society in general (UNESCO, 2011; USAID 2010; Shehu and Sheshi, 2012, Odukoya, Busari and Ateh-Abang, 2006, Rosen, Murray and Moreland, 2004, Francoeur, Esiet and Esiet, 2000) and was investigated for the training of effective science teachers for the society.

Similarly, studies have shown how students have negative attitudes and weaker self-efficacy towards SSIs in general (Dawson and Schibeci, 2003a, 2003b, Pardo, Midden and Miller, 2002, Klop and Sevierrens 2007) which affect their achievement negatively. The participants of the study could not be exception in addition to being members of the society whose cultural tradition dictates silence on sexually related matters and even considers it a taboo to do so. This means there is a problem bearing in mind that it is their first experience of offering a course containing such SSIs in its content. Furthermore, for problems of this nature in a course, there is the need for a more advanced multidimensional instructional approach to address its controversial issues. Socioscientific inquiry – SSIn - has been reported by Ryan and Deci, (2000), Pekrun, Elliot and Maier (2006), Zeidler, Sadler and Simmons (2005) as being in the fore front for its effectiveness and efficiency in SSIs instruction.

It is noteworthy at this juncture that over the years the teaching and learning of the SSIs that are controversial and socially significant to the students' and human's life by large remained the conventional teacher dominated lecture and very little or no

discussion methods (Hassan 2001, Greenwald, Hedges and Laine 1996, Klosteman and Sadler, in press) which is not suitable. This is because available literature (Nuangchalerm and Kwuanthong 2010; Latourelle, Poplawski, Schmaefski and Musante, 2012; Tomas, 2011; Sadler, Barab and Scott, 2007; Radcliffe and Marcus 2003; Schwartz, Lederman and Lederman, 2008) have indicated that controversial content of a course like this should not be only restricted to the acquisition of scientific concepts alone for the purpose of passing examination *only*, as is the case over the years. It should engage students in discussion and dialogue about the scientific, societal, ethical, moral, cultural, traditional, political, economic and even religious aspects of the issues or problems as well as their personal and societal implications to the learners (National Committee on Science Education Standards and Assessment, 1996; Qualification and Curriculum Authority, 1999; Seethaler and Linn,2004; Eggert and Bögeholz 2009; Sadler and Zeidler, 2004; Sadler, 2004). This means that a diversion from the common practice of the teaching that do not change learners' thinking and feeling (i.e. attitude) towards the course; the one that do not change their sense of power to make a decision about the course (i.e. self-efficacy) is strongly sought for. A method that provide rich contexts for the exploration of important content is strongly needed so that experiences, knowledge, skills, ideas and attitudes learnt can be connected to life experience which is the main objective of the course. Moreover, a new approach is sought for that can generate learners' interest and at the same time motivating to make learners understand the relevance of the controversial scientific problems in their everyday life.

This justify the integration of SSIn in the study which is shown to have positive effects in socioscientific issues instruction (Sadler, Barab and Scott, 2007; Sadler and Zeidler 2005; Zeidler and Keefer, 2003). It is a system of instruction similar to case-based and problem-based instruction in the aspect of framing science content within a story (Sadler, Barab and Scott, 2007). But it slightly differs from the two because it has no direct answer to issue or problem; rather, learners are given an opportunity to explore the controversy around the issue with scientific facts and explanation. They are also challenged to come out with a position supported with the scientific facts as evidences. Klosterman and Sadler (2013) have shown that using SSIn in teaching and learning improves students' critical thinking power. It was also shown to influence positively, students' interest in science and give motivation as well as higher order thinking skills (Latourelle, Poplawsky, Shmaefsky and Musante, 2012) in addition to increasing the learners' understanding of science. Latourelle et al also articulates that socioscientific issues–based teaching and learning makes students investigate a wide range of subject areas and their branches in science, society, politics, economy and any other reality that affect the everyday life of the learner.

Consequently, because SSIn has been shown to be in the fore front as a model for teaching socioscientific issues (Tomas, 2011, Zeidler et al, 2005; Sadler, 2010; Sadler, 2007; Sadler and Zeidler, 2005; Latourelle, Poplawsky, Shmaefsky and Musante, 2012 Klosterman and Sadler, 2010; Marcus, 2010; Liu, Lin and Tsai 2010); this study therefore has integrated it in teaching and learning the controversial issues of the SSIs in FLEHIs. It has found out its effects on the achievement, attitude and self-efficacy of the pre-service science teachers in two Federal Colleges of Education Nigeria. This was informed courtesy of limited availability of literature that shows similar studies

specifically with such participants. It is worthy of note that course registering, reading and passing examination only for the sake of satisfying graduation requirement contradicts the objectives of offering a course. This and question students particularly the participants in their status as future science teachers. The notion should give way because it creates problem considering them as the society's future science teachers. The SSIn is meant to increase their instructional and subject matter knowledge gains, positively affect their attitude and self-efficacy towards the course so that their position in the society as models and transmitters of knowledge, ideas, attitudes, skills and experience can be very effective.

1.4. Objectives of the Study

This study was intended to achieve the following objectives:

i. To determine the pre-service teachers' experimental and control groups' attitude towards FLEHIs before and after integration of SSIn.

ii. To determine the pre-service teachers' experimental and control groups' self-efficacy in FLEHIs before and after integration of SSIn.

iii. To determine the pre-service teachers' experimental and control groups' achievement in FLEHIs after integration of SSIn.

1.5. Research Questions and Hypotheses

1.5.1. Research Questions

The following research questions were answered in the conduct of this study:

i) Is there any significant mean difference between pre-service teachers' experimental and control groups' attitude towards FLEHIs before and after SSIn?

ii) Is there any significant mean difference between pre-service teachers' experimental and control groups' self-efficacy in FLEHIs before and after SSIn?

iii) Is there any significant mean difference between pre-service teachers' experimental and control groups' achievement in FLEHIs after SSIn?

Relative to the above research questions, the following Null Hypotheses were tested:

i) There is no significant mean difference between pre-service teachers' experimental and control groups' attitude towards FLEHIs before and after SSIn. ($H_{O1}: \mu_1 = \mu_2$)

ii) There is no significant mean difference between pre-service teachers' experimental and control groups self-efficacy in FLEHIs before and after SSIn. ($H_{O2}: \mu_3 = \mu_4$)

iii) There is no significant mean difference between pre-service teachers' experimental and control groups achievement in FLEHIs.

($H_{O3}: \mu_5 = \mu_6$)

1.6. Significance of the Study

The study would be very important as outlined below:

Presently, socioscientific issues and Socioscientific Issue-Based Instruction are receiving attention in science education and researchers are extensively carrying out studies to find out the effectiveness of the Socioscientific Issue-Based Instruction in the improvement of achievement, informal thinking, decision making, scientific literacy etc. (Pedretti, 1999; Tal and Kedmi, 2006; Albe, 2008; Eggart & Bogeholz, 2009) for successful livelihood. Likewise, this research is also going to strengthen or refute the effectiveness of the method in the improvement of learners' achievement, attitude and self-efficacy to Socioscientific Issues.

Researchers who are interested in the area of Socioscientific Issues can find the study and its results as a rich and recent reference material to enrich their findings and justify their purpose and objectives.

The result would also be an evidence for the introduction of a new and most recent approach to the teaching and learning of science which is simpler on the part of the teacher and more engaging to the learners.

It is going to be important to curriculum designers and planners in planning science curriculum that contains Socioscientific Issues.

It will draw the attention of education policy makers in the Ministry of Education in consideration of Socioscientific Issues and the necessary support it require for effective implementation so that resources and personnel energy would not be wasted.

The research would also be important to serving science teachers in the understanding and identification of other Socioscientific Issues in their science subjects and know how to go about the new instructional approach using the modular approach (lesson plan) designed in the study.

This research is also going to be of great significance to traditional and religious leaders in understanding the nature of Socioscientific Issues and its relevance to real life situation thereby removing misconception of the subject matter.

The findings would also be an important document for National Commission for Colleges of Education chief executive and principal officers charged with the responsibilities of overseeing the operation of colleges of education, establishment of new science education programme by exposing the current strategy in handling aspects of science courses having Socioscientific Issues.

As it was successfully carried out, the outcome of the study will contribute an important knowledge of the effectiveness or otherwise of SSIn (Latourelle, Poplawsky, Shmaefsky and Musante, 2012; Zeidler and Keefer, 2003; Sadler and Zeidler, 2005; Sadler, Barab and Scott, 2007; Klosterman and Sadler, in press) in the teaching and learning of SSIs particularly with regard to pre-service science teachers' attitude, self-efficacy and achievement which has not been done before. This will also provide grounds for further investigations in other areas of interest.

1.7 Delimitation of the Study

This study investigates the attitude, self-efficacy and achievement in biology/integrated science teachers undergoing training in teacher training colleges. The colleges are Federal Colleges of Education in Nigeria operating the same curriculum, the same mode of admission, graduation and supervised as well as accredited by one body – the national commission for colleges of education (NCCE).

Although there are many programmes of teacher training in the school of sciences of the colleges, the biology/integrated science programme was selected because it is the most relevant programme to the socioscientific issue under investigation, which is *FLEHIs*. Programmes such as chemistry/integrated science, physics/integrated science are not within the coverage of this study, despite the fact that they are in the school of sciences too, mainly because the majors of such programme is chemistry and physics respectively.

Furthermore, the method (s) of teaching employed by the teachers, how well students perform in their courses and their entry qualifications into the programme are

not within the coverage of this study. Lastly, out of the coverage of this study is the perception of students towards their teachers, teacher's attitudes towards their learners and the effect of such on the students' performance.

1.8 Operational Definitions of Terms

Achievement: Performance of the participants in FLEHIs after the 8-week activities.

Attitude: looks into four attributes as the constructs for the study. They are the pre-service teachers' Interest, Perceived Ability, Value and Commitment towards the controversial content of the study.

FLEHIs: family life and HIV education, whereas it is given the title family life and emerging health issues in Nigerian colleges of education general studies curriculum.

Pre-service teachers: are participants of the study. They are youths training at the moment as science teachers in the teacher-training college of the study. They are the target group of the research.

Self-Efficacy: is the pre-service teachers' sense of confidence in having the power or capacity to act or make a decision, based on four areas as the constructs for the study. They are efficacy to influence school resources and decision making; disciplinary and instructional self-efficacy and the efficacy to create a positive school climate.

Socioscientific Issues - SSIs: a controversial real life problem found in FLEHIs which is socially relevant to the pre-service teachers' life and the society and having a scientific basis or explanation.

Socioscientific Inquiry – SSIn: The teaching strategies for socioscientific issues where learners are allowed to explore the controversy around the issue come out with an opinion supported by scientific facts and findings as evidence.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter is concerned with the review of writings, views, research reports and or opinion of authors and researchers or great personalities in relation to the problem under investigation. It also consists of the theoretical framework that highlights the psychological theories on which the study was grounded and justified. However, for the sake of clarity and straight forwardness, the review focuses on the following subheadings:

2.1. Socioscientific Issues (SSIs).

2.2. Socioscientific Inquiry (SSIn).

2.3. FLEHIs as SSIs and the controversies surrounding it.

2.4. Theoretical frameworks

2.5. Teachers' attitudes and its effect on students'/learners' achievement.

2.6. The effect of teachers' achievement on the academic achievement in learners.

2.7. The effects of teachers' self-efficacy to learners' achievement.

2.1 Socioscientific Issues

2.1.1. The Socioscientific Issues - SSIs

Scientific literacy in the 21st century appears to be part and parcel of successful living. There are many reasons as observed by different researchers (Hazen 2008; Rennie and Goodrum, 2007; Tyler 2007) for the general individual's need of science knowledge. The need ranges from making informed decision on choice to enjoyment of scientific news which includes news on new discoveries or development on existing

knowledge. With the current development in world's science and technology, one cannot disagree with the direct influence science and technology has on the lives of the people of the modern society. In other words, in this modern time, scientific knowledge, ideas, skills, attitudes and experiences play a key role in the everyday living of the people. This therefore makes science very relevant to human life and a means to solving some immediate life problems.

Hence, scientific literacy for all is one of the priorities of science education (Rennie and Goodrum, 2007; Tyler 2007), and schools are the main formal organisation charged with the responsibility of taught knowledge, skills, ideas, attitudes, and processes of science and other disciplines. But Klosterman and Sadler (2013) are of the view that learners often lost interest in school science and motivation to it which makes it very hard for them to make connection between what has been taught to them in the classroom and their everyday life. This risk the significance of science and technology to the students, the people and the society, they added. Several vital issues that formed the science content are thus missed or given negligible attentions.

One of such issues present in the school science content is the issue or problem that is originally scientific but has some social significance to the students and the people of the general society. They are relevant social problems with a very significant conceptual link to science that exists in the everyday living of the people. These issues are technically referred to as socioscientific issues – SSIs – (Eastwood, Sadler, Sherwood and Schlegel 2012; Reis and Galvão, 2009; Sadler, Barab and Scott 2007; Sadler, 2004; Sadler and Zeidler, 2005, 2004). They are in the news because the media frequently confront people with news about scientific issues with controversial perspective (Reis and Galvão, 2009). Eastwood et al particularly defines SSIs as

contemporary problems that incorporate knowledge in two aspects: scientific knowledge and social knowledge and concerns. In other words, they are problems with scientific base in conception, process and approach. The social significance and or concern, on the other hand, mean the problem's ethical, moral, political, economic or religious concern. This qualifies SSIs as very sensitive and at the same time controversial.

Indeed, socioscientific issues – SSIs - are real life global issues that are socially controversial and have a scientific explanation. Sadler (2004) holds the view that characterises SSIs or problems with two necessary elements: the first one is the issues' or the problems' conceptual or procedural connection to science on one hand and secondly, on the other hand, is its social significance. This clearly indicates that for any issue or problem to be identified as socioscientific, it must satisfy the criteria of having a scientific basis both in terms of explanation and approach or process to explaining it. It must be also socially relevant and controversial drawing attention morally, ethically, politically, economically or religiously to itself. These problems or issues are mostly environmental problems, health problems or complex interdisciplinary scientific problems on which students need to be empowered (Eastwood et al, 2012) to understand, explore and be able to solve them for their own and the societal benefits under the guidance of a qualified teacher in a formal school system.

SSIs - are different from other scientific issues in that they are of many aspects and solutions. This means that they are open-ended, ill-structured and arguable problems or issues (Sadler and Zeidler, 2005a). 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 explanation from different areas. On the other hand, they are said to be debatable in the sense that they are based on individual's

or group of individuals' opinion and understanding taking into consideration ethical, political, economic, cultural and sometimes even religious concern. Furthermore, while science-technology-society (STS) focuses on the impact of science and technology on the society, SSIs explore the moral and ethical implications that underlie these issues (Sadler and Zeidler, 2004; Sadler, 2004). Sadler and Zeidler added that SSIs movement began from the conceptual framework that combines the development of ethical, moral and beliefs knowledge of students and consider the role played by emotion and character as essential components of science instruction (Sadler, 2005). That is to say science instruction, according to the proponents of SSIs, should take in to consideration learners' beliefs and values and allow them to judge science content according to what they believe is right or wrong.

SSIs must be understood as real world issues that, apart from being controversial, are meaningful to the students because they are informed by science (Sadler, Barab and Scott, 2007). In fact, many of the socioscientific problems are facing people of the modern society that is why Marcus (2010) considers them as those not only having scientific base but also have a potentially high impact on the society. She does not hesitate to give some examples in form of debatable questions as one of the features of SSIs as follows in her words:

- How do we handle an imminent bird's flu pandemic?
- Is genetic modification the future of medicines and global food supply?
- Is climate change really as big a threat to humanity as scientists tell us?
- How conclusive is DNA evidence in a murder trial?
- Should we consider building a new generation of nuclear power stations?

All these and other similar controversial issues have ethical, moral, political, economic or religious concerns. For instance, in handling bird's flu pandemic, a mega

poultry farm with about twenty five thousand (25,000) layer-birds was infected and was marked for destruction! This would really bring about political, economic, moral or ethical concern. This is because the owner will surely ask for compensation from government; many employees are losing their jobs; there may be a need for political influence to enhance the payment and amount of money for the compensation. What will be the perception of the owner and the general public if the farm belongs to a member of the opposition to the ruling party? That is why such kind of issue is called SSIs! Characteristically, they do not have direct answer because making a decision on such issues or problems involve a difficult compromise between many conflicting values as Marcus (2010) observed. This further explains the multifaceted nature of SSIs, though they have some common features. Palmer (1998) testified this when he tried a description of the content of SSIs on environmental issues as a knowledge base having a

> highly value – laden content, and one person's solution may be another's catastrophe. It is a content that incorporates aesthetic, spiritual, social, political and economic dimensions alongside (not separate from) the purely scientific (Palmer 1998: 267).

This is an additional indication of how current, real world problems are SSIs yet very controversial and at the same time socially significant. Additionally, Marcus positioned that though SSIs are naturally multidisciplinary, they do share some common attributes. She said in her words that they have a basis in science frequently as the frontiers of scientific knowledge, they:

- Contain an element of controversy;
- Involve framing opinions and making choices at personal or societal level;
- Are frequently media reported with attendant issue of presentation based on the purposes of the communicator;
- Deals with complete information because of conflicting/incomplete scientific evidence and evidently incomplete reporting;

- Address local, national and global dimensions with attendant political and societal framework;
- Involve some cost-benefit analysis in which risk interacts with values;
- May involve consideration of suitable development;
- May require some understanding of probability and risk;
- Are frequently topical with transient life (Radcliffe and Marcus 2003 in Marcus 2010: 2-3).

These are the attributes of SSIs that distinguished them from other scientific problems. The author noted however, that the issues are scientifically based and have an element of controversy surrounding them. The problems also call for opinion formation in support or against the problem as a process of arriving at a resolution of the controversy surrounding the issue. Besides, they are always in the media reports as news on local, national or international dimensions because of their concerns of politics, ethics, morality, religion and in fact the general society. In forming a position about SSIs mentioned above, moral and ethical values are key players though consideration of sustainable development is also significant.

Furthermore, Zeidler and Sadler (2007) argued that SSIs are issues representing complex, ill-structured problems and tend to emerge from the areas of new and advanced researches in science education (Kolstø, 2001). They contended that SSIs are real world problems facing not only scientists, but science educators and the general public. They added one distinct feature of SSIs which is lacking a direct answer or solution. SSIs hence remain undetermined and are not normally presented for discussion in a classroom situation. Moreover, nobody doubts their genuineness as debatable topics, therefore, ideal for argument-based instruction since they provide rich context for the exploration of important science achievement (Klosterman and Sadler, 2013). Being an argument-based instruction where students explore more, SSIs enable learners to