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USING THE DELPHA TECHNIQUE, TO REFINED SCIENCE LESSONS, ACTIVITIES, AND LOCAL RESOURCES TO CREATE A SCIENCE MODULE FOR TWO FEMALE SENIOR SECONDARY STUDENTS IN NIGERIA.

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Abstract

This article outlines how topics and related activities based upon elements related to interest and anxiety for Nigerian senior secondary school two (SS II) science textbooks were identified, which was part of greater study conducted which was aimed to ascertain the elements and contents connected to interest and anxiety in science learning of the Nigerian SS II science curriculum. First, an initial list of items, topics, activities, and local materials relevant to interest and anxiety was established. Second, using this list and a framework for relevancy and not relevancy of the elements, topics, connected activities, and local materials for SS II science Curriculum and School Textbooks were analysed. Third, based on this content analysis, a possible list of 40 different topics and their related activities for the inclusion of elements related to interest and anxiety was arranged. The list of the elements, topics related activities and local materials were refined by applying two-round Expert consensus which has been considered consistent in Delphi technique. The Expert's consensus survey technique was employed to reach the level of consensus from specialists in the field of scientific education regarding the suitability of the items of the study (that is, aspects, subjects, related activities, and local materials in the SS II Nigerian science textbooks) that must be included. The results showed that of the element and 6 topics and related activities were 22 statements with options of "Yes" and "No" the higher percentages (%) of the experts responded "Yes" for round one. The results also indicated that of 24 statements for the suitability of the topics and related activities there are higher percentages (%) of "Yes". This confirmed that the themes, related activities, and local community learning materials could be incorporated into the Science Education module for Nigerian SS II female students.

Keywords: **Delphi Technique, Science Lessons, Activities, Local Resources, Female Students**

Introduction

Globally, science education found to play a critical part in people's lives, as well as the growth of science and technology for the benefit of society as a whole. The progress and achievement of science education are critical to both developed and developing countries' long-term technological development (Nwachukwu, 2012; Drury et al., 2023). According to Obomanu and Akporehwe (2012) and Muhammad, et al. (2022), science education continues to be the foundation for technological advancement. It has been stated that the success and achievement in science is a key component of the successful science, technology, engineering career pursuit (Valla & Williams, 2012; DeWitt, Siraj, & Alias 2014; Muhammad, 2023).

In recent years, there has been increased technical competitiveness in the global economy. This results in the need to assist developing countries, Nigeria included with a solid education in science and technology (Abualrob & Daniel 2013; Muindi & Guha, 2014; Fatimah, Rosidin, & Hidayat 2022; Muhammad, 2023). By strengthening science education. However, the current models for teaching and learning at the school level are ineffective in imparting the understanding of science abilities needed for students to become good future scientists (Badioze Zaman et al., 2009). As a result, students are disengaged from science activities and lack confidence and enthusiasm in practical learning, particularly female students (Skamp & Logan, 2005; Hide & Renninger, 2006). According to research, students, particularly female students, face problems in learning science, which affects their productivity. This has to do with how education is given in schools.

However, the issue of the differences against female students in studying science exist in many countries across the globe, but, is most peculiar in Nigeria (UNDP, 2001; World Bank, 2001; Muhammad, Daniel, & Abd. Rauf. 2019; Muhammad, 2023). For example, the students' enrolment of in Nigerian secondary schools in 2011, male students bear 2,410,817, whereas, the female has 1,902,347 (Federal Ministry of Education, 2005). This shows that male students have 508,470 more than the girls, particularly in scientific fields. That is why female students are facing a lot of challenges. As such, they are losing interest and having anxiety in learning science (Evans et al., 2002; Skamp & Logan, 2005; Muhammad, Yusha'u 2022). In Nigerian, this unfair treatment has been in existence for long (Erinosho, 1997). And continue to be existing at almost all levels of education particularly at secondary school level (Egun & Tibi, 2010; Abdu-Raheem, 2012; Gusau, et al., 2013; Muhammad, 2023). With regard to this, a call was made that there is the need to include culture that can suit the society in the designing of science curriculum. For instance, Nwachukwu (2012) and Muhammad (2023) recommended that, the science and technology curriculum should be selected to reflect the culture, needs, demands and the aspirations of the society based on the criterion of significance. However, the Nigerian curriculum and textbooks did not provide students with a variety of opportunities to solve real, current, societal, personal, cultural, and practical problems on a national and international scale (Awofala & Sopekan, 2013; Adeyegbe, 2004; Adikwu, 2008; Muhammad, Daniel, & Abd. Rauf. 2019; Muhammad, 2022; Muhammada et al., 2019; Muhammad, 2023).

Hence, there is the need for a change in instruction that will inculcate the interest and lessen the anxiety among female students, where female science teacher will be able to use effective strategies in their instruction to foster female students' interest and lessen their anxiety in science as well as problem-solving relevant to their interests and everyday lives (Fusco, 2001; McDonald &Dominguez, 2005; Basu, Calabrese & Barton, 2007; Nyarko 2013; DeWitt, Siraj, & Alias, 2014). Also,

they should always be updated with the recent trends in assessment practices, different strategies and practice of scientific reasoning in the teaching and learning (Sathasivam & Daniel, 2011; Ford & Forman, 2006; Muhammad, & Yusha'u 2022).

However, a Nigerian study discovered that another issue is that parents do not always understand the value of science to their daughters (Egun & Tibi, 2010; Muhammad, et al., 2019; Muhammad & Yusha'u 2022; Muhammad, 2023). Since the attention on girls is only connected with providing the income to the family by way of being food vendors (Akinbi & Akinbi, 2015) and female students is neglected by the parents right from birth (Abbagana, 2013). Some of the parents feel disappointed if they bear a female child as they are born first. The worse is when all the children in the family are females (Uyanga,1995; Muhammad, et al., 2022; Muhammad, 2023). The sociocultural practices that discriminate against women in Nigeria, such as early marriage, domestic duties, gender-specific barriers, and religion, are among the reasons for this disappointment (Njoku, 2000; Randell & Gergel, 2010; Zakka et al., 2015; Gusau et al., 2013; Okafor & Arinze, 2012). According to Heaverlo (2011), this causes anxiety in female students and makes them disinterested in science classes, which impedes their advancement in science and technology (Nwosu et al., 2014).

However, one of the biggest obstacles has been recognized as the absence of high-quality and efficient education. For the poor output among school students, particularly female (Olson, 2008; Ogunmade, 2006; Muhammad, 2023). Therefore, there is the need for the science teachers use an effective method in their science instruction (Wasagu, 2009; Drury, et al., 2023). In general, gender prejudice against female students in science learning must be eliminated, and society—especially parents, teachers, and curriculum developers—must be made aware of the value of science (Akinsowon & Osisanwo, 2014). This is because, past research found that the losing interest by female students in learning science was established due to the lack of parental support, father's gender stereotypes, difficulty of science concepts or facts little practice in science; teaching method (Mitchell & Gilson 1997; Skamp, & Logan, 2005; DavisKean, 2007; Yang, 2010; Potvin & Hassan, 2013). Therefore, lead to boys show more interest and outscore girls in science learning (Hembree, 1990; Evans et al., 2002; Skamp &Logan, 2005; Yang, 2010; Muhammad, 2023).

Curriculum is vehicle of any nation's development, Oluniyi (2013) describes it as a dynamic, intellectual, and societal enterprise. Because it includes the planning, carrying out, and evaluating of learning experiences that schools provide to students in order to fulfill the educational goals of society, it encompasses more than just a course, topic, subject, and learning experiences (Akudolu, 2012). A body of scientific knowledge is required of students in Nigerian secondary science schools in order for them to continue their study beyond the basic level (Noun, 2015).

The situation is different in Nigeria, because scholars found that there are many inaccuracies and outdated materials in the Nigerian high school curriculum, particularly in the scientific curriculum, which has little bearing on society needs and general education (Adeyegbe, 2004; & Adikwu, 2008; Awofala & Sopekan, 2013). Also, the school textbooks recommended for use are not based on their contents and how many of the characteristics of a good science textbook they possess, but because the publishers are able to press their way through more than others (Anaduaka & Okafor, 2013; Muhammad, & Yusha'u 2022). And the curriculum is favoured on male students, because is gender bias since its contents reflect the concern of males; science careers portray masculine images in the curriculum (Okeke, 2007). As such, many students tend to be rote and find learning uninteresting

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particularly female once (Ogunmade, 2006; Nwachukwu, 2012; Muhammad, et al. 2022; Muhammad,2023). Hence, there has been a call to include religion, culture, history, in the Nigerian science curriculum, a study was carried out to design and develop teaching module to infuse elements in the SS II science curriculum in Nigeria. Thus, this article addresses a portion of the vast stated study above in connection to two objectives, which were to analyse the science curriculum and textbooks and to determine the topics, related activities and local community materials in the SS II science secondary school textbooks in Nigeria.

Method and Procedures

To achieve the above objectives of determining topics their related activities and local learning materials for the Nigerian SS II science textbooks and curriculum, three days discussion by the researchers and three science teachers from the locality where the module was implemented were made, on the relevancy and non-relevancy on which elements, topics related materials and local community learning materials should be included in designing and development of the module. The discussion was aimed to analyse the Nigerian SS II science textbooks and curriculum. Based on the outcome of this analysis, after that, the issues, elements, and materials from the local community were sent to two rounds of expert consensus utilizing survey questions for a thorough evaluation.

Delphi technique has been considered as a means of gathering data from a different expert, and found to be more reliable in as a source of data collection was not used in all the fields where consensus of the interest of different experts in the same filed are considered (Renee, & Charles, 1998; Grisham, 2008). Instead, they gave more priority to the questionnaire, which mostly administered to the group of students. Consequently, conducting an interview, using questionnaire and observation are essential elements of data collection in the field of social science research, particularly if the researcherss wants to explore his study make life as well as in-depth investigation and evaluation (Christie, & Barela, 2005).

The purpose of survey method has been identified by scholars in the field of social science research. It was considered as the process of data collection about asking a group of people to describe their responses or opinions on issue or issues, which ranges from questionnaires, interviews and document review (Todd, 1979; Denscobe, 2005; Neuman, 2005; Muhammad, 2023). It was found to be a valid method of making results more comprehensive (Todd, 1979; Christie, & Barela, 2005; Grisham, 2008). Thus, in this study survey questions were used in finalising the consensus of the experts in determining the elements, topics, connected activities, and local community materials for the development of Science Education Module for Nigerian SS II Female Students. More so, On the process of reaching the consensus among the experts in the field of science education a survey questions statement round one which consisted of 24 different Items submitted to 23 experts, with statement were asked to respondent to 'Yes' or ''No'. Also, three options were provided; one is where the experts should respond on 'YES', the second is 'No 'option and the third option is where the experts were asked to make comments, observations and any necessary input for making the design and development of the module more valid and better. Subsequently, the format was used for the Experts' consensus round two but, this round the items were reduced to 22 items and submitted to another group of 35 science educators.

Preparation of the Elements, Topics, Activities, and Local Materials In Relation To interest and anxiety Analysis of the Elements Related to Interest and Anxiety in Nigerian SS II Science Curriculum/Textbooks

The science textbooks (Biology, Chemistry and Physics) and Curriculum (Biology, Chemistry and Physics) were analysed by the researchers and three experienced science teachers, see Table 1. The textbooks are in accordance with the Nigerian curriculum, and the ones using in instructing secondary school pupils in the district where this study was carried out, both male and female. According to the reviewed literature, if female students are familiar with the examples and activities linked to the concepts they are being taught, and if the teacher teaches these concepts is also a female teacher, then interest can be increased and anxiety can be reduced. For example, science education experts have discovered that children's attention can be piqued and their anxiety reduced by engaging in engaging science activities and receiving high-quality instruction that incorporates scientific concepts from their immediate surroundings (Oloruntegbe, Ikpe et al., 2010; Fusco, 2001; Mc Donald & Domogues, 2005 & Barton, 2007; Muhammad, 2023).

Nevertheless, the activities in the Nigerian curriculum and textbooks were found to be formal, not feminist and not localised to suit the culture and the nature of a Nigerian community particularly where this research will be conducted. A localise means making something limited to a place, while, localised materials are the materials which restricted to a settings or community. If the activities are carried out using localised materials could increase pupils' enthusiasm in science and lessen their fear of it. The localised materials are the materials found in the place in the northern Nigerian settings local materials includes Locally made pot, locally made spoon and cup from the clay or wood, locally made sieve. These materials could be used instead of the formal materials in the laboratory and believed to enhance interest and lessen the anxiety in learning science. In this study, the activities were found not using local materials available in the Nigerian settings particularly where this research will be carried out. Thus, the researchers feel it important to use local materials in the activities so that the female students' interest will be enhanced, and anxiety be lessened. Also, from the analysis of the curriculum and textbooks and results of a focus group interview, that this could be the cause of fear and lack of enthusiasm for studying science.

Moreover, the rationale for making the above decision is that firstly, after going through the whole topics, activities and evaluation guide in the curriculum and the text books. Initially, 40 different topics and related activities were fished out from the science curriculum and text books by the researchers and put forward to discuss with the experienced science teachers so that they can decide and choose the relevant ones that is functional and suitable in the community.

The discussion last for a period of two weeks. Part of the discussion includes: The researchers put forward all the topics and related activities and asked the 3 science teachers some questions like: *Based on your experience in teaching science what are the local materials do you think can be used in these topics and related activities? Do you think that the topics and activities can fit the level of SS II students? What are the topics and related activities you think that it can arose the interest and lessen the anxiety of female students in learning science? What are the activities you think female students can easily apply scientific concepts learnt to construct some projects in their homes? Is the science curriculum and textbooks using for both male and female students? Did the activities suit the culture and nature of Nigerian community? All the science teachers responded "No". This could be the cause of lack of interest and anxiety in learning science.*

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The discussion continues, the researchers asked can we pick these topics and activities. The topics and related activities which 3 science teachers respond suggested the research accepted them and ticked them "√", but the topics and related activities that only 1 science teacher suggested where rejected and marked "x". The researchers and experienced science teachers reached a consensus on which activities are functional and suitable that could be included in the development of the module.

Secondly, the answers from the focus group interviews given by female students. an interview with a focus group on 14th Feb. 2017 with 14 SS II female students indicates that the female students are having anxiety and less interested in learning science. Some of the responses from the students are: because the way teachers present the lessons; the topics are very abstract; feel nervous and fear during the lesson; the topics are taught by male teacher; not related to my culture and religion. the lessons and practical are difficult. Others includes: I want to get married after my secondary; practical not frequently; laboratory is not well equipped and arranged lessons are not interesting; Lessons are not culturally and religiously related to my life; apparatus are not adequate we do share them; the topics are not important to myself and my community; We do practical once in a week, some weeks we don't do the practical; lessons are not interested and *are not related to our life settings.* Conclusively, the female students show that They are anxious and uninterested in learning science because the lessons and activities are being taught by the male teacher and not related to their culture, religion and health benefit to themselves and their community. Thus, based on these evidences and the experience of the researchers and three3 science teachers in teaching science subjects and their awareness on the norms, culture, and values of the community in which these researchers will work. The five elements were agreed upon by the researchers and three seasoned scientific teachers. They are: The module's creation should incorporate local resources and a female teacher role model, as well as stories of notable women scientists and prophets, as well as activities linked to culture, religion, health, and seven other areas. The description of the analysed SS II science curriculum is in Table 1 and 2 below.

Table 1. Description of Analysed SS II Science Textbooks in Nigeria

S/N	The textbook's title	The total number of pages	The total number of chapters	The total number of topics	The overall count of the subtopics	The total number of activities
1	Third Edition of Modern Biology for Senior Secondary Schools (2006) AFP African First Publisher Limited, Ramalingam, S.T.	566	25	25	66	117
2	Third Edition of New School Chemistry for Senior Secondary School O.Y. Abiabio, AFP African First Publisher Limited, 2006.	608	32	32	166	89
3	For Senior Secondary Schools, New School Physics. M.W. Anyakoha, AFP African First Publisher Limited, 2000	505	37	37	197	58

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Table 2. **Examined the Nigerian Secondary School Science Curriculum Framework**

Title of Curriculum	Objectives of the Curriculum	Curriculum Frame work
Federal Ministry of Education Senior Secondary Education Curriculum (2009) Objectives	- Adequate Laboratory and field skills in Science Subjects	- Theme - Topic - Performance
Forms 4-6 Published by NERDC, the Nigerian Council for Educational Research and Development		
Form 4-6 Published Nigerian NERDC Educational Research and Development Council (NERDC)	- Meaningful and relevant knowledge in Science - Ability to apply scientific knowledge to every day life - Reasonable and Functional Scientific Attitude	- Content - Activities- Teacher and Students - Teaching and Learning Materials - Evaluation Guide

Validation of the Elements, Topics, Projects/Activities and Local Materials Learning Resources

There have been various studies in the literature in term of employing validity particularly in Delphi method which validate the contents of different programs (Christie, & Barela, 2005; Landeta 2006; Grisham, 2008; DeWitt, 2014, et al., Thanabalan, et al., 2015). However, their contents and outcome are contrary to the present study and in particular science lessons. In this study, the researchers considered the relevant contents to be submitted to group of experts for validation. A group of professionals in science education were considered significant in validating the contents (Elements, Topics, Projects/Activities and Local Materials/Community Learning Resources). This is because of their experience in the field. The experts used in validating the items consist of 23 members (Table 3) for round one, the panel was selected using purposive sample technique because they have teaching experience in science. The researchers selected the experts from a group of professors, doctors, science inspectors, science curriculum officers and science teachers in the field of science education. On another hand, a panel consisted of 35 different experts which consisted of the professors, doctors, science inspectors, science curriculum officers and science teachers in the field of science education.

Table 3. **Experts Involved in Round one Experts' Consensus Survey Technique**

Experts	Frequency	Percent	Valid Percent	Cumulative Percent
Prof. in Sci. Edu.	2	8.7	8.7	8.7
PhD in Sci. Edu.	4	17.4	17.4	26.1

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Sci. curriculum Officer	4	17.4	17.4	43.5	
Science Inspector	4	17.4	17.4	100.0	
Science Teacher	9	39.1	39.1	82.0	
Total	23	100.0	100.0		

The researchers forwarded 35 items together with the frame work of the module to the group of experts for validation and an option where they are required to make comments on the improvement of the module was also provided. The group of experts (23) who participated the round one survey have at least 10 years working experience in the field of science education (Table 4).

Table 4. Working Experience for Round One Experts' Consensus Survey Technique

Experience	Frequency	Percent	Valid	Cumulative Percent
10 Years	1	4.3	43	4.3
15 Years	22	95.7	95.7	100.0
Total	23	100.0	100.0	

The experts are from different schools and organisation and are also, from different regions. The schools and science board under the Ministry of science education involved in this round are in Table 5 below:

Table 5. Schools' Description Involved in Round one Experts' Consensus Survey Technique

Schools and their Locations for the Round One Experts' Consensus Survey Technique

S/N	Name	Location
1.	Usman Danfodio University	Sokoto State
2.	Federal University Gusau	Zamfara State
3.	Kebbi State University of Science. Technology	Kebbi State
4.	Female Education Board	Zamfara State
5.	Government Secondary Schools	Zamfara State

Expert Consensus Round One (24 Items 23 Experts)

There are 24 different statements on the design of the module in relation to interest and anxiety as well as level of students and religion, cultural and parental relation in the context of the

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study, were prepared and presented to a panel of twenty-three professionals in science education, the experts consisted of Professors, Doctors, Science Teachers, Science Curriculum Officers and Science Inspectors in Table 6. The aim was to reach a consensus and validity on the items for its inclusion in the module. The outcome of the expert's responses shaws that Table 6 shows that 93% of the experts responded "Yes" that the module can help female students studying science at the SS 2 level become more interested in the subject and feel less anxious. Furthermore, the study's subjects, associated activities, and components pertaining to interest and anxiety are suitable and can be connected to the community's culture and religious beliefs. Table 6 is shown below.

Table 6. Percentages (%) of Experts' Consensus Round One

Item	Statement	Yes	No	No Answer	Total
1	The module's subjects and associated activities are sufficient for preparing female form 5 students to acquire the requisite science material.	23	0	0	23
2	The module's topics and associated activities can help female Form 5 pupils feel less anxious and more interested in the study, which is the study's goal.	22	1	0	23
3	The module's subjects and associated exercises are appropriate for the students' level.	23	0	0	23
4	The activities are pertinent to society and parenting.	21	0	2	23
5	Parents' unfavorable opinions about the value of learning science may be changed by the module's topics and associated activities.	21	2	0	23
6	The topics and related activities are relevant to the culture of the community.	18	4	1	23
7	The module's activities would make science less challenging for female pupils to study.	21	2	0	23
8	The module's subjects and associated activities may help female students feel less anxious when studying science.	23	0	0	23
9	The module's associated activities are applicable to the daily lives of the female students.	21	0	0	23

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10	Parents may be motivated to enroll more of their daughters in scientific classes by the module's content and accompanying activities.	21	1	1	23
11	Students may get more interested in studying science as a result of the module's relevant activities.	22	1	0	23
12	It would not be difficult for the female students to apply the science concepts to the tasks they would be performing at home.	22	1	1	23
13	Both sides will be pleased if the female students do the tasks in front of their parents.	23	0	0	23
14	When their parents are around, female pupils won't be overly excited to participate in the activities.	17	4	2	23
15	The module's activities will boost the confidence of female pupils in scientific classes.	22	0	1	23
16	The module's topics and associated activities would inspire female students to pursue science education more strongly.	21	0	2	23
17	The female science teacher with experience can readily incorporate the themes and activities.	21	2	0	23
18	Students can use available local materials to complete the activities in their community.	20	3	0	23
19	The children can do the activities in their neighbourhood using local resources.	22	1	0	23
20	The module's contents are pertinent to the standards and beliefs of the community where this study will be conducted.	22	1	0	23
21	The module's contents are pertinent to the values and customs of the community where this study will be conducted.	21	1	1	23
22	The community's faith may have something to do with the activities.	22	1	0	23

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23	The presentation of the subjects and associated activities respects the community's religious views, which may pique the interest of female students in science education.	22	1	0	23
24	The presentation of the subjects and associated activities respects the community's religious views, which may help female students feel less anxious when studying science.	22	0	1	23
	Total	513	26	12	552
	Percentage (%)	93%	5%	2%	100%

Moreover, the experts suggested that, The module's design ought to prioritize child-centered learning. stated. A child centred learning is where part of the concern in the instruction will be on the child and will be fully involved through either drama or a play role activity; Form five students should be changed to SS II students, because is current title used in the Nigerian educational system; one topic with its related activity (Reproduction, dissection of male and female vertebrate should be removed because the female students may feel shy in explaining the reproductive organs in the presence of their parents and all the topics and related activities are from biology and chemistry. Thus, topic like: The module must cover the use of lenses and plane mirrors together with their associated activity (building a telescope). Additionally, they suggested that all of the claims made about the components, themes, and associated activities used to create this module be satisfactory and highly effective, with the activities having relevance for both parents and society." If fully implemented. This was what gave the researchers chance to move further to the next round (Experts Consensus Round Two) for the second validation. In this round the contents of the module were redesigned base on the experts' responses and input. 22 items consisted of 22 statements with one example of the lesson from the lessons in the module were prepared and submitted Table 7.

Table 7. Percentages (%) of Experts' Consensus Round Two

Item	Statement	Yes	No	No Answer	Total
1	For SS II female students to learn the required science content, the module's subjects and related activities are sufficient.t.	32	3	0	35
2	The module's topics and associated activities can help female SS II students become more interested in the study and feel less anxious, which is the study's goal.	33	2	0	35

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3	The module's subjects and associated exercises are appropriate for the students' level.	35	0	0	35
4	The activities are pertinent to society and parenting.	30	4	1	35
5	Parents' unfavourable opinions about the value of learning science may be changed by the module's topics and associated activities.	35	0	0	35
6	The subjects and associated activities are pertinent to the community's culture.	31	3	1	35
7	The module's activities would make science less challenging for female pupils to study.	34	1	0	35
8	The module's subjects and associated activities may help female students feel less anxious when studying science.	33	2	0	35
9	The module's associated activities are applicable to the daily lives of the female students.	34	1	0	35
10	The module's subjects and associated activities may persuade parents to encourage more of their daughters to enroll in scientific classes.	34	1	0	35
11	It would not be difficult for the female students to apply the science concepts to the tasks they would be performing at home.	34	1	0	35
12	Both sides will be pleased if the female students do the tasks in front of their parents.	35	0	0	35
13	The female pupils won't feel anxious about participating in	32	2	0	35

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	the events when their parents are there.				
14	The module's activities will boost the confidence of female pupils in scientific classes.	35	0	0	35
15	The module's topics and associated activities would inspire female students to pursue science education more strongly.	35	0	0	35
16	The female teacher of science has training and experience, so she can readily execute the themes and exercises.	34	1	0	35
17	Students can use locally accessible items to complete the activities in their community..	34	1	0	35
18	The module's components are pertinent to the subjects and tasks.	32	3	0	35
20	The module's contents are pertinent to the values and customs of the community where this study will be conducted..	33	2	0	35
21	The community's faith may have something to do with the activities.	31	4	0	35
22	Because the subjects and associated activities are given in accordance with the community's religious values, female pupils may be more interested in studying science.	22	5	0	35
	Total	**731**	**36**	**2**	**769**
	Percentage (%)	**95%**	**4.00%**	**1%**	**100%**

Expert Consensus Round Two (22 Items 35 Experts)

Int the second round of the experts' consensus, there are 22 different statements on the design of the module in relation to interest and anxiety as well as level of students and religion, cultural and parental

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relation in the context of the study, were written and presented to a panel of thirty-five specialists in the field of scientific education, the experts consisted of Professors, Doctors, Science Teachers, Science Curriculum Officers and Science Inspectors. The aim was to reach a consensus and validity on the items for its inclusion in the module. The following is the outcome of the expert's responses. The above table shows that 95% of the experts responded "Yes" demonstrated the module can meet the study's goals of increasing female students' interest in and lowering their anxiety levels when learning science at the SS II level. Furthermore, the study's subjects, associated activities, and components pertaining to interest and anxiety are suitable and can be connected to the community's culture and religious beliefs.

Additionally, they thought that the suggested local resources were readily available, that the module could be simply taught by a female teacher, and that, should it be done well, it might inspire parents to see the value of science. However, only 4.7% responded "No", while only 0.3% did not responded to some items. This signifies that majority of the experts agreed on the items for their development of the module related to interest and anxiety in learning science. In addition, the comments made by the experts for the development of module include: the design of the module should be stated (child centred design). Throughout the class, the instructor should focus on a child-centered approach in which the student is the primary focus and will be actively involved; Form five students should be renamed SS II students because that is the current title used in the Nigerian educational system; all of the topics and related activities should be from biology and chemistry; one topic with an activity (Reproduction, dissection of male and female vertebrates) should be removed because female students might feel uncomfortable explaining their reproductive organs in front of their parents.. As a result, the module must include subjects like the use of lenses and plane mirrors together with their associated activities (building a telescope). Additionally, they suggested that all of the assertions made about the components, themes, and associated activities used to create this module be satisfactory and highly effective, and that, if fully executed, the activities would be pertinent to parents and society. This demonstrates the content's validity (Grisham, 2008).

Experts' Consensus Round Two Survey

Experts' Consensus Round Two: Refining Topics, Related Activities, and Community Local Materials in Nigerian SS II Science Textbooks

Considering the greater "YES" percentages and the round one expert opinion the researchers finalised and considered all the comments and refined topics its related activities and elements and rearrange the frame work of the module, for round two Survey technique from another group of experts in different institution and location to refine it again. After collecting all the responses, the science experts' feedback on the module's design includes the following: Every lesson should be light-hearted (Play manner technique); Students who will be performing the activities should have tags attached to them that indicate their roles; The courses and activities in the module should take the average age of the pupils into consideration. The instructor who is going to teach the module needs to be qualified and experienced; There are two nearly identical activities: (i.e. activity a and b). Consequently, as a mathematical topic is not covered in the module, recommending that a certain topic be dropped or substituted with another from mathematics; The curriculum of the module's courses and activities must include the name of the school.

Other remarks from the experts include the following: the module's lessons and activities should include a certain number of students; the study's objectives should be clearly specified in the

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module; Local materials should be changed to community learning resources, because local materials are a general term while, community learning resources is specific; Problem solving, inquiry and role play methods should the instructional approach in the module; The names of the enzymes responsible in the digestion of food in the mouth and stomach should be mention; Item 2 (Learning objectives) should be corrected. Verbs such as describe, explain, list should use instead of knowing and the meaning of digestion should come first before the alimentary canal. This is in line with the Delphi technique's consensus of different experts in the same field (Christie, & Barela, 2005; Grisham, 2008).

The experts concurred that the subjects, associated activities, and components pertaining to interest and anxiety are suitable and have potential connections to the community's culture and religious beliefs where the study will be conducted. Additionally, they thought that the suggested local resources were readily available, that the module could be simply taught by a female teacher, and that, should it be done well, it might inspire parents to see the value of science. Tables 8, 9, and 10 include descriptions of the experts, accordingly.

Table 8. Description of experts involved in experts' consensus round two experts involved in round two Experts' Consensus

Expert	Frequency	Percent	Valid Percent	Cumulative Percent
Professor in Sci. Edu.	1	2.9	2.9	2.9
PhD in Sci. Edu.	6	17.1	17.1	20.0
Curriculum Officer	4	11.4	11.4	31.4
Science Inspector	7	20.0	20.0	100.0
Science Teacher	1	7	48.6	48.6	80.0
Total	35	100.0	100.0	

Table 9. Experts' experience involved in round two

Experience	Frequency	Percent	Valid Percent	Cumulative Percent
5 Years	4	11.4	11.4	11.4
10 Years	9	25.7	25.7	37.1
15 Years	22	62.9	62.9	100.0
Total	35	100.0	100.0	

Table 10. Description of Schools Involved in the Experts' Consensus Round Two

Name	Location
Usman Danfodio University	Sokoto State
Federal University Gusau	Zamfara State

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Bayaro University Kano	Kano Sate
Federal College of Education Technical	Zamfara State
Zonal Inspectorate Head Quarters Gusau	Zamfara State
Different Government Secondary Schools	Zamfara State

Moreover, Table 11. above shows the descriptive statistics (simple percentage %) in the experts' consensus round two consensus from the experts in round one and two after having compiled the expert's responses on the design of the module, it was found most of the experts in both round 1 and 2 have agreed on the statements for the development of the module. Then their comments and observation were used in designing the final draft of the module that was used during the development process. Table 2 contains the remaining components, subjects, associated activities, and resources for community learning.

Table 11. Following the two rounds of expert consensus, Nigerian SS II science textbooks now include refined topics, their related activities, and community-sourced materials.

Element	Topic	Activity	Local materials
Stories of the famous historical women scientists, female teachers, and historical women around the prophets Religion, Culture, and Health.	The nutrient cycle (water cycle) in nature	To conduct an experiment on the water's rotation through phases (Water is a unique present.)	Globes created locally in pairs, large and small clay pots made locally, hot water, ice blocks, salt, spoons made locally, white nylon, and rags.
Stories of the famous historical women scientists, female teachers, and historical women around the prophets Religion, Culture, and Health.	Water pollution is one type of pollution.	to conduct an experiment using tainted water. (Avoid tampering with water)	Local firewood, sands, ground nut oil, clay plate, pure water, and cup
Stories of the famous historical women scientists, female teachers, and historical women around the prophets Religion, Culture, and Health.	Both untreated and treated water	making river water fit for human consumption. (I adore my neighbourhood	Large handcrafted pot, tiny handcrafted pot, locally made plate, locally grown cotton, handcrafted wooden cup, and sunflower
Stories of the famous historical women scientists, female teachers, and historical women around the prophets Religion, Culture, and Health.	Water (water hardness)	To distinguish between different water's hardness levels, use soap. (Control your soap).	locally produced soap, distilled water, a sample of rainwater, a river, a well, and a wooden tube.

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Female teacher model, stories of the great past women scientists, stories of the past women around the prophets Culture, Religion, Health.	Application of lenses and plane mirror	constructing a telescope out of various local resources. (Observing anything from a distance).	Cartoon with an empty stomach, scissors, and a knife. Arabic gum, a clean white plane cloth, lenses, and a knife
Female teacher model, stories of the great past women scientists, stories of the past women around the prophets Culture, Religion, Health.	Alimentary canal and digestion of food in Humans	Making a telescope using some local materials. (Looking an object from far distance).	Wood, clay, natural colors, wood screws, sugar-cane brush, water, natural clay container, empty bottle, and tubes.

Development and E valuation of Science Education Module for SS II Nigerian Female Students

After having a frame work of the designed module, from the previous stage (i.e., Design stage). A three days' work shop was conducted for the development of the module. Initially, a letter from the principal of the schools where the course was held was also received, as was approval to conduct the program for three days from the Female Education Board under the Ministry of Education. A total of sixteen seasoned science instructors representing various scientific disciplines and schools were chosen to participate in the workshop. These educators consented to act as parents as well. This is because they are married and bears both male and female children who are schooling. The venue for the workshop was Government Girls Arabic Secondary School Gusau, Zamfara state Nigeria.

The essence of the workshop was informed to the participant that it was aimed: to look and fish out the features of the module ; to deliberate and finalised on the topics, related activities with the community learning resources that will be considered in the module; to discuss and finalise on the kind of suitable teaching strategy and type of evaluation that the module requires; to deliberate on the guidelines for parents' involvement/role in the activities that will be used in the module; and to endorsed the final draft of the module.

The first day of the workshop the researchers make a formal introduction, after which the purpose of the workshop, grouping and arrangement of roles were stated. The teachers who are also served as the parents were grouped in to three grouped, the group members were asked to choose a group leader among them. The participants were divided into 4 groups as follows**:** group 1 will look and fish out the features of the module; group 2 will deliberate and finalised on the topics, related activities with the community learning resources that will be considered in the module; group 3 will discuss and Group 4 will discuss the criteria for parents' involvement/role in the activities that will be used in the module as they finalize the sort of acceptable instructional strategy and kind of evaluation required in the module.

In the second day, the long discussion, arguments and suggestions among the group members continues, while the researchers were going around answering some questions and giving more light on the contents and features of the module. The work of each group were exchanged to cross check

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and ensure the validity of each group and to see if there are other observations suggestions or input they could make. The last day, (day three) was the time when the groups compiled their work and endorsed the final draft of the module. After the three days' workshop, the researchers rearranged the module and considered all necessary During the workshop, the science professors offered suggestions and remarks. In addition to the module's structure being changed and grammar errors being fixed, some of the comments are as follows: the user manual for the module should be included; each lesson's heading should be included; the duration of the module's assignments and activities should not be specified; the researchers should adhere strictly to the module's developed content without bias; parents' interests should be taken into consideration when choosing them; the teacher implementing the module should receive sufficient training. The schools that participated in the workshop were listed in Table 12 along with their locations.

Table 12. Schools that Involved During the Workshop and their Location

Name	Location
Govt. Girls' Day Sec. Sch.	Shinkafi
Govt. Sci. Sec. Sch.	Shinkafi
Govt. Girls' Arabic Sec. Sch.	Gusau
Govt. Girls' Day Sec. Sch.	Tudun Wada
Govt. Girls' Day Sec. Sch.	Birnin Ruwa
Govt. Girls' Day Sec. Sch.	Samaru, Gusau
School for Continue Education	Gusau

During the conduct of workshop, the 16 science teachers from different schools who have practical experience in teaching biology, chemistry and physics subjects were participated see Table 13. The make their own contributions and observations for the success of the implementation and evaluation of the module.

Table 13. Science Teachers Involved in the Development of the Module and their Schools

S/N	Qualification	School
1.		G.S.S.S. Shinkafi
2.		G.G.D.S.S. Shinkafi
3.		G.G.D.S.S. Shinkafi
4.		G.G.D.S.S. Shinkafi
5.		G.G.D.S.S. Samaru
6.		S.C.E. Gusau
7.		G.G.D.S.S. T/Wada
8.		G.G.D.S.S. T/Wada
9.		G.G.D.S.S. T/Wada

However, some of the comments made and considered during the workshop includes: the grammatical corrections were corrected; availability of the community learning resources for the home projects/activities should be provided; intensive training of the female The period of the home

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projects and activities shouldn't be set, and the instructor who will administer the module should be chosen because the projects and activities are not formal; module should not be implemented during the school normal lessons; training should be giving to the female students who are going to construct or carry out the home projects and activities; instructional guide for the female teacher who will implement of the module should be included; the table of contents should contain the header of each topic and the activities that are related to it. Finally, the final version of the module was developed.

Characterisation of the Features in the Developed Science Education Module

The developed science education module is a teaching module which it's designed was based on the two round experts' consensus in the field of science education. Additionally, the module's lesson plans were created utilizing Gagne's Nine Events of Instruction structure. The contents of the components of the module are in Table 14 below.

Table 14. Characterisation of Features of the Developed Science Education Module

Features	Characterisation of the features
Overview of the contents	All pertinent information from the whole module, together with reference page numbers, is included in the table of contents. It is set up so that the contents are easily accessible.
Module title	The title module provided a concise overview of the module, which was created using the existing research, needs analysis, professional judgment, and advice from science teachers.
Background	The context and goal of the module are provided by its background. The background was created using requirements analysis and research about female students' interest in and worry about learning science.
Objectives of the study	The overall study's objective was to increase female students' interest in and reduce their concern about learning science, which is where the study's objectivity was found.
Objective of the module	This aimed at achieving the main objective of the module and it was built on this. One important thing in the objective is that it was indicated that the developed module could be used to review the existing science curriculum, because the curriculum and textbooks were found inadequate.
Teachers' Instructional Guide	It was indicated what a female teacher's role is. In other words, she should function as a facilitator, giving the kids instructions on the lessons and assisting them with play-role exercises where they will participate in the lesson.
Topics related activities and community	Using tools for community learning, six subjects and associated activities were chosen based on the community's everyday activities. Resources for community learning will be made available. These are not part of what the students typically do in class.
Units	This is an additional module component that included the six distinct lessons and the exercises that went along with them. There are six units, each of which represents a distinct unit and topic.

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Home project/activity	In this section of the module, a group of chosen female students created and explained to their parents at-home projects or activities that they engaged in utilizing resources for community learning that were made available to them. The goal was to alter the parents' perceptions about women's education in science so that more women may be enrolled in science programs.
Teachers'Instructional Guide	It was indicated what a female teacher's role is. In other words, she should function as a facilitator, giving the pupils instructions on the lessons and assisting them with play-role activities where they will participate in the lesson.
Activity guide	will serve as the students' manual with instructions on how to create and carry out the projects and activities.
Parents Involvement Guide	The parents will learn about their expected participation in the project/activities in this section of the program.
Instructional guide	The nine instruction-related events—Grab attention, notify learners of objectives, stimulate recall of earlier learning, present the information, offer "learning guidance," elicit performance (practice), provide feedback, and assess performance—will be found appropriate while creating the module's lessons.
Resources and Materials	The resources and materials will be available in the stings of the community. Are the materials used during the development of the module
Appendices	This is he section at the end of the module. Where the parents' roles and the resources used are placed
References	This is another section and the last in the module in which all the sources of the information were acknowledged and listed.

Conclusion

Conclusively, this study consisted of the larger part in the design and development of a science education module for enhancing female pupils' enthusiasm in studying science at the secondary school level and lowering their fear. The study revealed many elements related to interest and anxiety in learning science which were found missing in the Nigerian science secondary school SS II textbooks and curriculum. These gave reasons to determined elements, topics related activities, which were one of the sections of the module, these can be use by the ministries, curriculum designers and developers in reviewing and restructuring the science secondary school textbooks and curriculum which were found literature and document analysis inadequate in enhancing the enthusiasm and decreasing worry of female Students from Nigeria pursuing science. Additionally, the study's components, lesson-related activities, and community learning resources may be able to alter female students' levels of interest and anxiety in order to improve their exam. Moreover, the contents in this design stage of the module could make female students to realise the relevance of learning science in relation to their culture, religion daily life problems, this could make them to perform better in their examination as male counterpart. Therefore, the community learning resources and at-home projects identified in this study may help parents rethink the significance of their daughter's acquiring science in secondary

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school. This may prompt them to enrol more of their daughters in secondary scientific programs in Nigeria.

Recommendations

From this study it has been recommended that a module or model should be developed so as to address the issues found during the Delphi survey. Also, the module or model should incorporate elements, home projects and role play activities. It has been recommended that home projects using local materials should also be included in the module or model.

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