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Original Research Article

Undergraduate Science Students' Interest in Sciences in a Flipped Instructional Strategy Learning in Zamfara State, Nigeria

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Abstract: University lecturers and students are surrounded by many new technology tools, giving room to use different applications and software for their personal purposes, but using these technologies for educational purposes was very low. However, the teaching and learning processes still depend exclusively on lecture method which make science less interested. Therefore, this study employed Flipped Instructional Strategy to improve students' interest in sciences among Undergraduate University Students in Zamfara State, Nigeria. The study used Quasi-experimental design. The population of the study comprises of all undergraduate university students studying single honor courses of Biology, Chemistry and Physics for 2022/2023 session from 2 universities in Zamfara State. The sample of the study was 160 students drawn using stratified and random sampling technique. Science Students' Interest Inventory (SSII) with reliability coefficients of 0.702 was used as an instrument for data collection. The instrument was duly validated by experts. Mean and standard deviation were used to answer the research questions, while ANCOVA was used to test the hypotheses at 0.05 level of significance. The results revealed that there is significant difference in the mean interest scores of undergraduate science students taught general science courses using Flipped Instructional Strategy and those taught using enhanced lecture method. Also, it implies that there is no significant gender difference on interest scores in sciences among undergraduate science students taught general science courses using Flipped Instructional Strategy. It was recommended that science lecturers should be trained by stakeholders on effective procedures for implementing FIS to improve students' interest in sciences.
Keywords: Flipped Instructional Strategy, Interest, Sciences.

INTRODUCTION

In an attempt to encourage learning in sciences, the problems of mastery of subject matter, skills, and interest in scientific concepts could be addressed through the use of appropriate teaching method. Some of the reasons of undergraduate students' failure in utilising modern technologies to learn were attributed to the methods of teaching adopted by the lecturers in teaching sciences, which is mostly lecture method, where the lecture method is not recommended for teaching sciences (Abbas, 2023). This is because lecture method entails one way flow of communication from the teacher to the students, and it is teacher centered approach, where most of the talking is carried out by the teacher, while the students remain passive listeners which can make them loose interest in the lecture.

Interest, as an aspect of effective domain is a construct that has to do with one's readiness to like or dislike something. It could be aroused in individual by activity that tends to satisfy the individual needs. Interest according to Trumper (2014), is a term that refers to preferences to engage in some type of activities rather than others. It is a fact that a child usually performs classroom activities in order of preferences. The child take pleasure in doing what he/she is interested in. The learning that occurs after indulging in such activities, in most cases is permanent (Nwabuzeu, 2009). Interest is an important aspect in the learning process because the learner's interest is a fundamental factor in including the right knowledge, skills, values and attitudes that the curriculum seeks to attain. It helps in sustaining concentration, purpose and commitment to learn and cooperation with the teacher in the learning process (Obioma, 2006). In the opinion of Alao and Adeniyi (2009) the teacher can motivate children to develop interest to learn the following ways:

- By identifying and catering for the needs of the students
- Acknowledging their success no matter how little
- Making the classroom students friendly will always make them eager to participate in the

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classroom activities, there by learning become very interested and fun.

- Recognizing and respecting students view there by boosting and developing confidence.

When students participate actively in the learning process, the curiosity and interest of the students, according to Aydin and Cuskun (2011) manifest itself in the performance of the students. The author reiterated that, students whose interests have not been developed do not attend class regularly. Such students do not listen to the lesson carefully neither they do their homework. For the learner to be interested in class activities, appropriate learning strategy such as cooperative learning strategy should be put in place because such type of learning strategy have the tendency of developing students interest to learn thereby enhancing achievement (Deaking & Maxwell 2006).

Interest is an important aspect in the learning process because the learner's interest is a fundamental factor in including the right knowledge, skills, values and attitudes that the curriculum seeks to attain. When students are motivated, they participate actively in the learning process. The curiosity and interest of the students, according to Aydin and Cuskun (2011), manifest itself in the performance of the students. The author reiterated that, students whose interests have not been developed do not attend class regularly. Such students do not listen to the lesson carefully neither they do their homework. For the learner to be interested in class activities, appropriate learning strategy such as instructional strategy should be put in place because such type of learning strategy have the tendency of developing students interest to learn thereby enhancing achievement.

Flipped instructional strategy is a teaching method by which students gain exposure to new content outside of class, typically through reading, lecture videos (the videos can be those that are available from the internet, or pre- recorded by teachers themselves), or power points. The educators and students then use class time to do the more difficult work of assimilating basic knowledge and translating it into problem solving, discussion, or debates (Hunley, 2016). According to Vidor (2017), instructional strategy offers the opportunity to accommodate students learning styles for more differentiated instruction thereby providing students different avenues to learning. The additional time in the classroom provided by flipped classroom develops active learners that take control of their learning, rather than passive learners that receive information from the instructor and internalize it, while receiving no feedback.

According to Abbas and Idris (2024) one of the benefits of flipped learning is associated with the development of generic skills, for example collaboration, communication, creativity, critical thinking, information technology and digital competence, numeracy, problem-solving and self-management. Research evidence suggests that flipped learning not only stimulates higher level of thinking, problem-solving skills and self-directed learning skills, but enhances lifelong learning skills and prepares students to learn and adapt the skills once they join the working world (Shin *et al*., 2019). Besides, the interactive nature of the learning approach enables teamwork and interactions with lecturers or peers. Karanicolas *et al*., (2018) identified seven (7) steps to flipping with a framework that assists teachers to design effective flipped classes. They are as follows:

Step 1: Learning Outcomes and Key Concepts
Step 2: Plan Your Implementation Strategy
Step 3: Develop the Pre-Class Learning Activities
Step 4: Develop and Link the Class Activities
Step 5: Deliver the Flipped Class
Step 6: Link to the Post Class Activities
Step 7: Evaluate the Flipped Classroom

According to Abbas and Idris (2024) as well as Matazu and Iisma;il (2023), flipped instructional strategy improved students' academic performance irrespective of gender and therefore it should be employed as the best strategy for teaching science concepts. Thus, this research used Flipped Instructional Strategy in teaching science concepts and investigated its effect on interest in sciences.

Several studies have investigated the effectiveness of the Flipped Instructional Strategy approach in enhancing students' learning in Biology. In Nigeria, using Quasi experimental design, Matazu and Isma'il (2023) conducted a study to investigate the effect of flipped classroom instruction and enhanced lecture method on academic performance in genetics among students with VAK learning styles in Gusau, Zamfara State, Nigeria. The study found that visual learning style (40.76%) was the most preferred by the SS 3 students, followed by auditory (31.52%) and kinesthetic (27.72%) styles. The study also found that flipped classroom instruction and enhanced lecture methods improved academic performance in genetics compared to traditional lecture methods, regardless of students' VAK learning styles. In a similar trend, Abbas and Idris (2024) examined the effects of flipped classroom learning on perception in genetics concepts among secondary school students in Gusau, Zamfara State, Nigeria. The research design employed was quasi-experimental; specifically, pre-test, post test, non equivalent control group design. Results indicated that students taught using Flipped Classroom Learning possessed high level of perception in genetic concepts than those exposed to lecture method with significant difference in the mean perception scores. The findings equally indicated the insignificant difference between the perception of male and female students exposed to Flipped Classroom Learning.

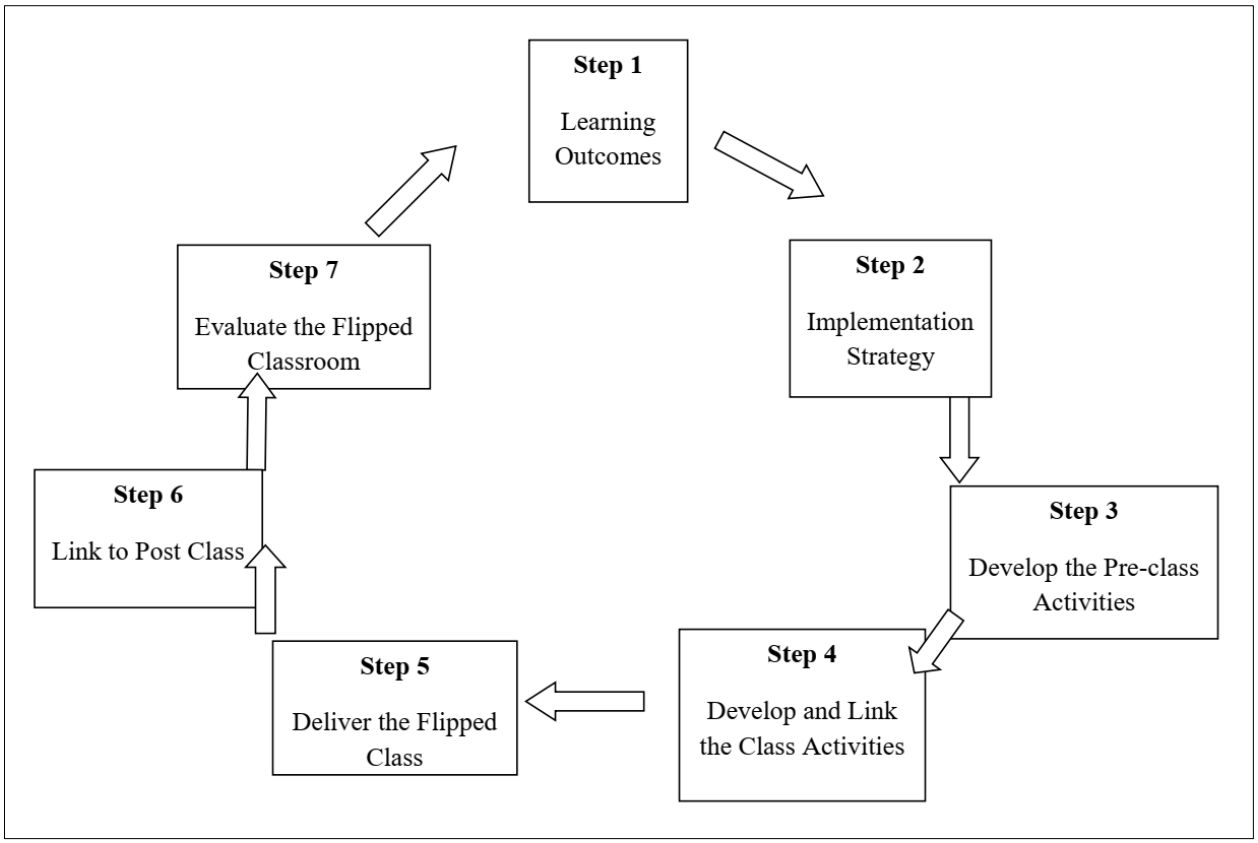

Figure 1: Steps in Developing Flipped Model (Karanicolas *et al*., 2018)

Problem Statement

The study was prompted by poor academic performance in sciences among undergraduate students in Zamfara State higher institutions of learning especially at their first year of study as shown in 2022/2023 session exam records from two (2) universities in Zamfara State. Despite the new technology tools that surround students and lecturers, for example the social networks applications are used regularly as one of the most important communication ways among the daily life of students and lecturers. However, the teaching and learning processes still depend exclusively on lecture method. According to Elian and Hamaidi (2018) lecturers use different applications and software for the personal purposes, but using these technologies for educational purposes was very low. In an attempt to encourage learning in sciences, the problems of mastery of subject matter, skills, and interest in scientific concepts could be addressed through the use of appropriate teaching method (Abbas, 2023). Therefore, there is a big gap between modern teaching methods that followed by lecturers and learning methods that their students need based on their abilities and interests which needs to be addresses timely.

Some of the reasons of undergraduate students' failure in utilising modern technologies to learn were attributed to the methods of teaching adopted by the lecturers in teaching sciences, which is mostly lecture method, where the lecture method is not recommended for teaching sciences (Abbas, 2023). This leads to find out new approaches to develop and update teaching processes which focus on the role of learner and make him/her the center of learning process. This work will therefore concern with the use of more effective approaches to enhance students' interest in sciences. One of such modern methods and strategies is the flipped instructional strategy.

Research Questions

Based on the objectives of the study, the specific questions to be addressed are:

1. What is the interest of undergraduate science students taught general science courses using Flipped Instructional Strategy and those taught using enhanced lecture method in Zamfara State higher institutions of Learning?
2. Is there any gender difference on interest in sciences among undergraduate science students taught general science courses using Flipped Instructional Strategy in Zamfara State higher institutions of Learning?

Research Hypothesis: The following null hypotheses were formulated at 0.05 alpha level of significance.

$H0_1$:

There is no significance difference in the interest of undergraduate science students taught general science courses using Flipped Instructional Strategy and those taught using enhanced lecture method in Zamfara State higher institutions of Learning.

$H0_2$:

There is no significance gender difference on interest in sciences among undergraduate science students taught general science courses using Flipped Instructional Strategy and those taught using enhanced lecture method in Zamfara State higher institutions of Learning.

METHODOLOGY

This study employed quasi-experimental research design (pre-test and post-test experimental control group design). The experimental groups were taught using Flipped Instructional Strategy while the control groups were taught using enhanced lecture method of teaching. The population of this study consisted of all first-year undergraduate sciences students offering single honour courses of Biology, Chemistry and Physics from two universities in Zamfara State i.e. Federal University Gusau and Zamfara State University Talata Mafara. The sample size of the study consisted of one hundred and sixty (160) UG I sciences students which comprised of eighty (80) males and eighty (80) females selected through stratified and simple random sampling techniques and assigned into experimental and control group.

The treatment for the study was teaching of general sciences courses of Biology, Chemistry and Physics for UG I. The experimental group were taught these general courses using FIS guided by the Lesson Plan designed by the researchers for a period of four weeks. In delivering the actual experiment, a flow chart of the steps involved in FIS as designed by Karanicolas *et al*., (2018) as indicated in Fig. 1 above was strictly adhered to. The students in the control group were taught the same concepts using enhanced lecture method of teaching which involved lecture-based instruction with the use of diagrams and illustrations related to concepts being treated to enhance participants' engagement and participation. The researchers ensured that the lesson plan designed for this purpose was strictly followed and lecture notes were given by the researchers.

Science Students' Interest Inventory (SSII) with reliability coefficients of 0.702 was used as an instrument for data collection. The instrument was duly validated by experts. Mean and standard deviation were used in answering the research question, while analysis of covariance (ANCOVA) was used for testing the hypotheses at 0.05 level of significance using statistical product and services solution (SPSS) version 20.0.

RESULTS

Research Question 1:

What is the interest of undergraduate science students taught general science courses using Flipped Instructional Strategy and those taught using enhanced lecture method in Zamfara State higher institutions of Learning?

To answer this research question, mean and standard deviation were used. The result obtained from interest score of FIS and enhanced lecture method was used. The mean and standard deviation were computed and presented in Table 1.

Table 1: Mean and Standard Deviation of Students Interest in the Experimental and Control Groups

Groups	N	Mean	SD	Mean Diff.
Experimental	80	85.5500	9.78361	5.65
Control	80	79.9000	9.41531	

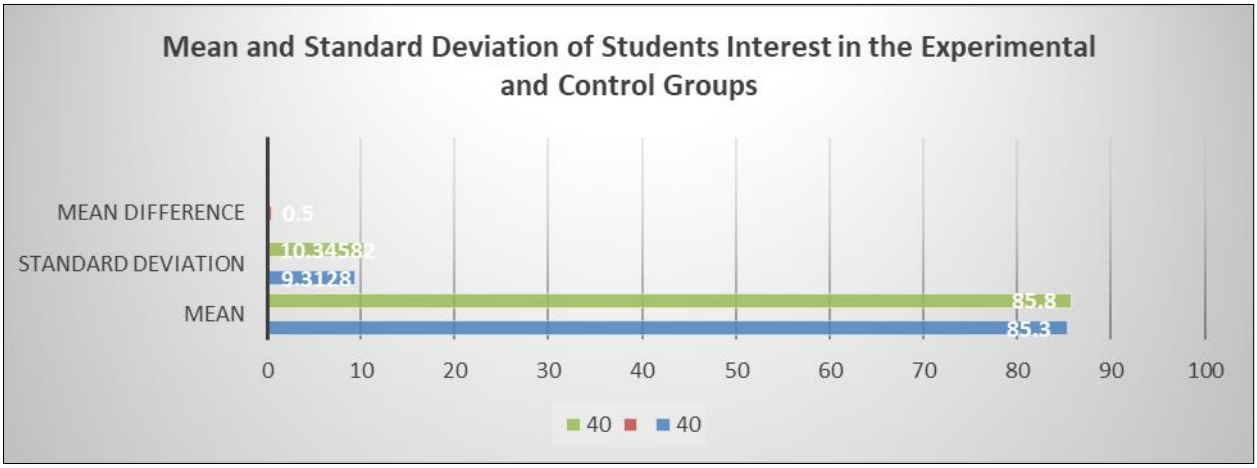

Fig. 1

Table 1 shows that the means and standard deviations of experimental group were 85.55 and 9.78 and that of control group were 79.90 and 9.41 respectively. The mean difference in the interest scores was found to be 5.65 in favour of the experimental group. This shows that the experimental group had high interest

scores of general science courses as a result of exposure to flipped instructional strategy. To find out if the difference in mean was statistically significant, the corresponding hypothesis was tested.

$H0_1$:

There is no significance difference in the interest of undergraduate science students taught general science courses using Flipped Instructional Strategy and those taught using enhanced lecture method in Zamfara State higher institutions of Learning.

To test this hypothesis, the post-test of the students' interest in the experimental group were compared with that of the control group using ANCOVA statistical tool as shown in Table 2.

Table 2: ANCOVA Analysis on the Mean Interest Score of Experimental and Control Groups

Interest	Sum of Squares	Df	Mean Square	F	Sig.	Decision
Between Groups	1276.900	1	1276.900	13.852	.000	Rejected
Within Groups	14565.000	158	92.184			
Total	15841.900	159				

* Significant, $P \leq 0.05$

The results presented in Table 2 shows that the significant (2-tailed) value is 0.000 which is less than $P \leq 0.05$. Therefore, there is significant difference in the mean scores of experimental and control group. This implies that there is significant difference in the mean interest scores of undergraduate science students taught general science courses using Flipped Instructional Strategy and those taught using enhanced lecture method in Zamfara State higher institutions of Learning.

Research Question 2:

Is there any gender difference on interest in sciences among undergraduate science students taught general science courses using Flipped Instructional Strategy and those taught using enhanced lecture method in Zamfara State higher institutions of Learning?

To answer this research question, mean and standard deviation were used. Data on interest of male and female students taught using Flipped Instructional Strategy were subjected to descriptive statistics based on gender (i.e. male and female). Mean and standard deviation were computed and presented in Table 3.

Table 3: Mean and Standard Deviation of Interest for Male and Female students taught using Flipped Instructional Strategy

Group	N	Mean	Standard Deviation	Mean Difference
Male	40	85.3000	9.31280	0.5
Female	40	85.8000	10.34582	

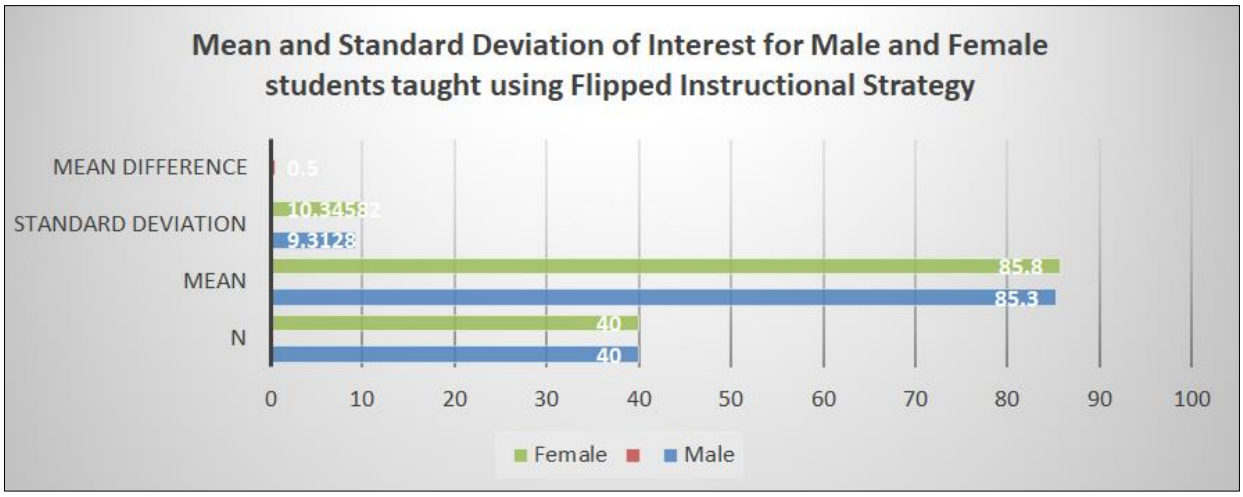

Fig. 2

Table 3 shows that the means and standard deviations of male students in the experimental group were 85.30 and 9.31 and that of female students were 85.80 and 10.35 respectively. The mean difference in the interest scores was found to be 0.5 in favour of female. This shows that there is slight difference of male and female interest scores when taught using flipped classroom learning strategy. To find out if the difference in mean is statistically significant, the corresponding hypothesis (HO_2) was therefore tested.

$H0_2$:

There is no significance gender difference on interest in sciences among undergraduate science students taught general science courses using Flipped Instructional Strategy in Zamfara State higher institutions of Learning.

To test this hypothesis, mean interest scores of the male and female students in the experimental group were compared. Data on interest of male and female students taught Flipped Instructional Strategy was tested using ANCOVA.

Table 4: ANCOVA Analysis on the Interest Scores of Male and Female Students taught using Flipped Instructional Strategy

	Sum of Squares	Df	Mean Square	F	Sig.	Decision
Between Groups	5.000	1	5.000	.052	.821	
Within Groups	7556.800	78	96.882			Accepted
Total	7561.800	79				

** Not Significant at P ≤ .05

Results presented in Table 4 shows that the significant (2-tailed) value is 0.82 which was more than P ≤0.05. Therefore, there is no significant difference in the mean scores of male and female students. This implies that there is no significant gender difference on interest scores in sciences among undergraduate science students taught general science courses using Flipped Instructional Strategy in Zamfara State higher institutions of Learning.

DISCUSSION OF THE FINDINGS

The study investigated the Effects of Flipped Instructional Strategy on Academic Interest in Sciences among Undergraduate University Students in Zamfara State, Nigeria. To achieve this, two research questions were answered and four hypotheses were tested at 0.05 level of significance. The results from the analysis were presented in line with the stated research questions.

The result of Research Question 1 and Research Hypothesis 1 in Table 1 and 2 shows that, the means and standard deviations of experimental group were 85.55 and 9.78 and that of control group were 79.90 and 9.41 respectively. The mean difference in the interest scores was found to be 5.65 in favour of the experimental group. This shows that the experimental group had high interest scores of general science courses as a result of exposure to flipped instructional strategy. To find out if the difference in mean was statistically significant, the corresponding hypothesis was tested and rejected. This implies that there is significant difference in the mean interest scores of students taught sciences using FIS and enhanced lecture method. The finding is in line with that of Yusif *et al*., (2024) who revealed that interest of the concepts is one of the most important factors of students' understanding of scientific inquiry and the nature of science. The finding also supports Abbas (2023) whose findings revealed that, the way students perceive influence their academic achievement and interest. On the other hand, the study is not in line with that of Achor and Agbidye (2014) who revealed that students' interest has no significant effect on their academic achievement.

The result of Research Question 2 and Research Hypothesis 2 in Table 3 and 4 shows that, there is no significant difference in the mean interest scores of male and female students taught sciences using FIS. This implies that gender was not a determinant factor in sciences students' interest. The means and standard deviations of male students in the experimental group were 85.30 and 9.31 and that of female students were 85.80 and 10.35 respectively. The mean difference in the interest scores was found to be 0.5 in favour of female. This shows that there is slight difference of male and female interest scores when taught using FIS. To find out if the difference in mean is statistically significant, the corresponding hypothesis (HO_2) was therefore tested and accepted. This finding is in conformity with many findings reported by researchers such as Mukhtar and Yusifa (2024) who revealed that there is no significant difference in the interest of male and female students on science concepts. The finding is also supported by Yusifa (2023) who found that there is no significant difference in the mean scores of male and female students' interest in science concepts. The results showed that students exposed to FIS had better academic performance and that gender has no significant influence on their interest. However, the influence of gender on the interest of science concepts was observed by Vlckova, Kubiatko and Usak (2019), the correlation among was analysed and females had more positive attitudes toward than males.

CONCLUSIONS

The findings of the study concludes that students exposed to FIS are more interested in sciences than those taught sciences concepts by means of enhanced lecture method. This implies that FIS enhanced interest in learning science concepts and therefore should be use the main teaching strategy in order to improve the teaching and learning of sciences in tertiary institutions. The results also show that there is no significant difference between the interest of male and female students who learnt sciences by means of FIS; hence gender does not affect interest when students are taught using FIS. Therefore, science lecturers should use FIS in teaching both males and female students.

Recommendations

The following recommendations are made:

1. The use of FIS improved the interest of students in the present study. Therefore, science lecturers should be encouraged by the stakeholders to use FIS as the main teaching strategy in order to improve the teaching and learning of sciences in tertiary institutions.
2. Science lecturers should be trained by stakeholders on effective procedures for implementing FIS in their lecture rooms by organizing extensive seminars and workshops. This is because FIS helps in improving students' interest positively.
3. Undergraduate students should be encouraged by the lecturers to use FIS as they can achieve high academically regardless of gender. And science lecturers should use FIS in teaching both male and female students.
4. The federal and state government through ministry of education and other educational agencies should provide universities with learning materials based on modern technologies that meet the students' requirements. This is because FIS improved students' interest positively of both male and female students.

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