IJAAR PUBLISHING®

International Journal of Research in Education and Sustainable Development | ISSN: **2782-7666**
Vol. 3, Issue 6 (June, 2023) | www.ijaar.org/ijresd

EFFECTS OF SELF-REGULATED LEARNING AND LECTURE METHOD ON PHYSICS STUDENTS' ACHIEVEMENT AND ATTITUDE IN SENIOR SECONDARY SCHOOLS IN DELTA CENTRAL SENATORIAL DISTRICT

MONEY-ENWEFAH, Omoefe Linda[1] & Prof. E. KPANGBAN[2]

[1,2]Department of Science Education, Delta State University, Abraka

ABSTRACT

This study examined the effects of self-regulated learning strategy and lecture method on academic achievement and student attitude toward physics in Delta Central Senatorial District. Six research questions and six hypotheses guided the study. The quasi-experimental design was used, the non-equivalent pre-test, post-test planned variation design. The population of the study was 19790 SSII physics students drawn from 184 public senior secondary schools in Delta Central Senatorial District of Delta State. A sample size of 220 which was randomly drawn from four secondary schools in Delta Central Senatorial District of Delta State. The instruments used for data collection were Physics Achievement Test (PAT) and Physics Attitude Questionnaire (PAQ). The reliabilities of the instruments were determined using Kuder-Richardson Formula 21 and Cronbach Alpha respectively, which yielded coefficient of internal consistencies of 0.79 and 0.83. The treatment group was assigned to the sampled schools. Data were generated through administration of the instruments. The data obtained were analyzed using mean, standard deviation, t-test and Analysis of variance (ANOVA). The following are the findings: (i) there was a significant difference between the mean achievement scores of students taught Physics using Self-Regulated learning and those taught using lecture method, in favour of students taught using Self-Regulated learning strategy; (ii) there was no significant difference between the mean achievement scores of male and female students taught Physics using Self-Regulated learning strategy; (iii) there was a significant difference between the mean attitude scores of students taught Physics using Self-Regulated learning and those taught using lecture method; (iv) there was no significant difference between the mean attitude scores of male students taught Physics using Self-Regulated learning strategy; (v) there was no significant effect of interaction between sex and teaching method on the students' mean achievement scores in Physics; and (vi) there was no significant effect of interaction between sex and teaching method on students' mean attitude scores in Physics. Based on these findings it was recommended that Physics teachers should endeavour to expose students to self-regulated learning and also use of self-regulated learning will enhance students' ability to understand and control their learning

Keywords: Self-Regulated Learning, Lecture Method, Physics Achievement, Attitude

Published *30/06/2023*

Money-Enwefah, O. L and Kpangban, E. (2023). Effects of Self-Regulated Learning and Lecture Method on Physics Students' Achievement and Attitude in Senior Secondary Schools in Delta Central Senatorial District. *International Journal of Research in Education and Sustainable Development*, 3(6), 1-24.

INTRODUCTION

Physics is a branch of natural science that focuses on the study of matter, including its basic constituents, motion, and behaviour in both space and time, as well as the associated concepts of energy and force. The major objective of physics, one of the most key scientific fields, is to comprehend how the universe functions. The study of matter, energy, and their interactions, known as physics, plays a significant role in the advancement of humanity because advances made in one field may spur the growth of other fields (IUPAP in Abamba, 2021).Physics crosses numerous interdisciplinary fields of study, including quantum chemistry and biophysics, and its borders are not clearly defined. In addition to suggesting new directions for investigation in academic fields like mathematics and philosophy, new concepts in physics frequently explain the underlying mechanisms investigated by other sciences. One needs the capacity for critical thought to pursue a job in science or engineering. Students who major in physics study a wide range of fascinating subjects, including matter, energy, and their interactions. The future development and survival of humanity depend heavily on physics, an international endeavour. Our quality of life is improved by physics because it gives us the fundamental knowledge needed to create innovative medical devices and procedures like computer tomography, magnetic resonance imaging, ultrasonic imaging, and laser surgery.

In many ways, physics is essential to the growth of any society. For instance, the development of transistors, diodes, and integrated circuits (ICs) in electronics led to the creation of radio transmitters and receivers, televisions, radio tape players, and modern medical equipment. Physics expertise was used to build devices like X-rays, which are used to take pictures of patients' internal organs and treat cancer, and ultrasound scanners, which are used to scan people's bodies for diagnoses in hospitals and other healthcare facilities. The development of solar energy is a result of the application of physics knowledge to the storage, utilisation, and preservation of sunlight for the preservation and processing of food, the production of power, and other uses. The knowledge of nuclear Physics plays a role in the preparation and processing of fuel for utilization of nuclear power, development of nuclear weapons and so on. In industries mechanics brings about new kind industries which depend on human skills and brains. Machinery also developed from mechanics helps in the development of industries. Electricity and electronics developed from the knowledge of Physics is used for the development of telephones, optics cable, phonograph fibre and internet that brings all parts of the world together. In transportation, cars, motorcycle, bicycle, ships, trains as well as aero planes are all developments from the knowledge of Physics, this is because they all used electric motors and principles of moments in their various part. Computers and satellite were also developed from Physics in the taking and receiving of messages from different parts of the world. The contributions of Physics toward making the world worth living and boosting the prestige of several nations are too numerous to mention.

The development of students' scientific literacy is conceptualised as the primary goal of science education (Dani, 2009). Mulemwa (2002) noted that due to the rapidly evolving applications of science and technology and the global reliance on its methods and outcomes across all spheres of human effort, they have become so indispensable that any civilization or nation lacking them runs the risk of being cut off from the rest of the world. A person must have completed a science course that was carefully planned, evaluated, and carried out if they are to have a solid foundation in science, of which physics is a component, and to be capable of handling the demands of daily living in their society. According to the national policy on education, science education should develop in the child well defined abilities and values such as the spirit of inquiry, creativity, objectivity, the courage to question and an aesthetic

sensibility (Federal Republic of Nigeria, 2004). The teaching and learning of physics at all levels is therefore essential. According to Adeyemo (2010), the objectives of teaching/learning physics as stated in the 1998 physics curriculum by the Federal Ministry of Education (FME) are to:

1. to provide basic literacy in physics for functional living in the society.
2. to stimulate and enhance creativity
3. to acquire essential skills and attitudes as a preparation for technological application of physics
4. to acquire basic concept and principles of physics as preparation for further studies

If these objectives are achieved, it will prepare students to enter into the technologically progressing nations, understand their economic aspirations and be better positioned to positively contribute to the development of the nation. Despite the importance of Physics in nation building, a lot of factors have affected the teaching and learning of the subject, leading to poor achievement. Some of the factors are: the poor attitude of students which has been attributed to the perceived abstract nature of Physics and the mathematical base embedded in Physics, while the poor achievement in the subject has often been attributed to the method which the teacher employs in the teaching of the subject. Also, other factors identified are poor laboratory facilities, non-coverage of contents stipulated in the scheme amongst others (Abamba, 2002). To achieve the objectives of physics, teaching approach should promote students to assume responsibility and control over their acquisition of knowledge and skills. As a result, students should take charge of their learning by becoming masters of it and directing what, how, why, and when they learn.

Self-regulated learning is a general word that refers to how students approach their education, pursue objectives, and assess their success. Self-regulated learning is a topic that combines cognitive, metacognitive, and motivational processes. Students who engage in self-regulated learning can enhance their academic performance, recognise the value of their own learning, and remain proficient learners after they graduate. These methods can have a significant impact on students who are struggling to acquire new material, who are academically underprepared for college, or who become discouraged or unmotivated by setbacks. Students gain by learning about themselves, their strengths and weaknesses, and the best ways to organise their time and their study methods (Zimmerman, 2002). According to Zumbrunn, Tadlock, and Roberts (2011), although self-regulated learning can make the difference between academic success and failure for many students, it is an act of learning that is motivated by metacognition, which is the act of thinking about one's own thoughts, strategic action, which entails planning, monitoring, and evaluating one's progress against standards, and motivation to learn. Self-Regulated students are aware of their academic strengths and shortcomings and have a toolbox of techniques they can use to successfully complete the daily obstacles of academic work (Ejelue, 2017). Self-Regulated learning strategy has been shown in several studies to positively improve students' achievement in various subject areas. This is because it gives students an explicit plan for improving upon their achievements in science subjects and help them to understand the relationship between knowledge, skill, and motivation. The use of Self-Regulated learning strategy poses some merit over the lecture method which has been used for teaching Physics over the years.

The lecture method of teaching predominantly dominates the Nigerian classrooms. The lecture method of instruction does not give room to students to set goals for their learning or attempts to monitor, regulate, and control their cognition, motivation and behaviour guided

by their goals. Ajaja (2009) referred to the lecture method as a "talk-chalk" method. He further stated that the lecture method may be used for any class size, but it is usually used for large classes. Lecture method of teaching is a teacher directed method of teaching where students receive instruction from the teacher with little or no participation (Roediger & Mash, 2005). The students have little or no control of their learning. The adoption of the lecture method by teacher is predicated on the fact that it encourages completion of subject matter content within a limited time. Lecture method is a teacher-centred approach to teaching and learning in which the teacher is seen as an authority, dispensing knowledge to students who contribute little or nothing to the instruction. Adegoke (2011) criticizes the lecture method and concludes that all students with an exception of field dependent students benefit most from it. This may have accounted for students' poor academic performance and attitude in physics.

Academic achievement is the measurable behaviour in a standardized series of tests. It is regarded as an act of completing an action. According to Anene (2005) students' academic achievement is the performance in a school subject as designated by a score or mark obtained in a standard test. Academic achievement, according to Hattie (2009), is the measure of how well a student does in achieving particular objectives that were the focus of activities in instructional environments, particularly in school, college, and university. Academic performance is a result of learning that demonstrates how well instructional goals have been attained (Nwanze, 2016).

The academic achievement of students in a variety of subject areas has been proven in numerous studies to be greatly improved by self-regulated learning (Olakami & Gumbo, 2017). Researchers in the field of education have discovered a strong correlation between self-regulated learning and conscientiousness, willingness to study, and performance self-efficacy (Fernandez-Rio et al., 2017).Another variable that may also affect academic achievement of student is attitude. An attitude is a positive, negative, or mixed evaluation of an object expressed at some level of intensity. It is an expression of a favourable or unfavourable evaluation of a person, place, thing, or event. Attitude according to Eagly and Chaiken (2007), is a psychological tendency that is expressed by evaluating a particular entity with some degree of favour or disfavour. Attitude towards study has great contribution in academic achievement and good study pattern. Research-based evidence have shown that self-regulated learning improves students' attitude to science subjects in general.

Sex has also been identified as a factor affecting students' academic achievement. Sex issues in science education have remained a point of interest for several researchers. There is a strong argument that sex is a prediction factor on achievement (Maduabum, 2006). Literature shows mixed results on the effect of self-regulated learning on male and female students' academic achievement and attitude.

The actual state of sex difference in various fields of human endeavour remains a key issue of many research works. Solomon (2014) in his study of sex differences and students' achievement in secondary school Physics concluded that boys performed better than girls. Sex (sex difference) is a moderating variable of this study and much work has been carried out on this variable. Sex difference has been found to have influence on students' perception of the subject matter. Many researchers have observed from their various research works that boys tend to do better than girls in science subjects generally and thus they concluded by the perceived reason that girls had or showed lukewarm attitudes to science which affects their perception and performance.

It is against this background the study seeks to investigate the effects of Self-Regulated learning and lecture method on Physics students' achievement, and students' attitude towards Physics in Delta Central Senatorial District.

Statement of the Problem

A review of West African Examinations Council (WAEC) Chief Examiner's reports from 2015-2019 showed that students' performance in physics is on a continuous decline. This poor performance has been attributed to poor teaching methods among other factors. The lecture method most used in Nigerian secondary schools has made students resort to memorization of physics contents because of their passive involvement in the teaching - learning process. In lecture method students are often passive because the teacher is in charge of the teaching-learning process to a large extent and students are often dependent on the information passed down to them from the teacher and this makes the students not to actively engage intellectually with the material or to make further attempt to seek further information. Information tends to be forgotten quickly when students do not actively take part in the teaching-learning process. The students in the lecture method classroom are not given the opportunity to set goals for their learning and attempts to monitor, regulate, and control their cognition. This calls for the adoption of alternative teaching methods that is guided by metacognition (thinking one's own thoughts). When compared to the lecture technique, the self-regulated learning strategy could be a more effective teaching strategy since it allows students the chance to set learning objectives and makes an effort to monitor, regulate, and control their learning. Hence the problem which this study seeks to solve is: What will be the effect of Self-Regulated learning and lecture method on Physics Students' academic achievement and attitude in Delta Central Senatorial District?

Research Questions

The following questions are raised to guide the study:

1. What is the difference between the mean achievement scores of students taught physics using Self-Regulated learning and those taught using lecture method?
2. What is the difference between the mean achievement scores of male and female students taught physics using Self-Regulated learning?
3. What is the difference between the mean attitude scores of students taught Physics using Self-Regulated learning and those taught using lecture method?
4. What is the difference between the mean attitude scores of male and female students taught Physics using Self-Regulated learning?
5. What is the effect of interaction of sex and teaching method on students' achievement in physics?
6. What is the effect of interaction of sex and teaching method on students' attitude towards Physics?

Hypotheses

The following hypotheses will be tested at 0.05 level of significance:

1. There is no significant difference between the mean achievement scores of students taught physics using Self-Regulated learning and those taught using lecture method?

2. There is no significant difference between the mean achievement scores of male and female students taught physics using Self-Regulated learning?
3. There is no significant difference between the mean attitude scores of students taught Physics using Self-Regulated learning and those taught using lecture method?
4. There is no significant difference between the mean attitude scores of male and female students taught Physics using Self-Regulated learning?
5. There is no significant effect of interaction of sex and teaching method on students' achievement in physics?
6. There is no significant effect of interaction of sex and teaching method on students' attitude towards Physics?

Purpose of the Study

The purpose of the research is to investigate the effects of self-regulated learning and lecture method on students' achievement and attitude in Physics. Specifically, the study will:

1. compare the mean achievement scores of students taught physics using self-regulated learning and those taught using lecture methods;
2. compare the mean achievement scores of male and female students taught physics using Self-Regulated learning;
3. compare the mean attitude scores of students taught physics using self-regulated learning strategy and those taught using lecture methods;
4. compare the mean attitude scores of male and female students taught physics using Self-Regulated learning;
5. determine if there is an effect of interaction between sex and teaching methods on students' achievement in physics; and
6. determine if there is an effect of interaction between sex and teaching methods on students' attitude in physics;

RESEARCH METHOD AND PROCEDURE

Research Design

The study adopted quasi-experimental design. Specifically, the non-equivalent pre-test post-test planned variation group design was used. Random assignment of subjects to the varied groups was not possible in order not to disrupt classroom teaching. Instead, intact classes were used. In support of this design, Harris et. al. (2006) asserts that quasi-experiment are studies that aim to evaluate interventions but that do not use randomization. Abraham and MacDonald (2011) state: "Quasi-experimental research is similar to experimental research in that there is manipulation of an independent variable. It differs from experimental research because either there is no control group, no random selection, no random assignment, and/or no active manipulation." According to Ali (2006), quasi-experimental research design can only be used when the researcher cannot randomly sample and assign subjects to groups. This design was adopted to determine the effects of Self-Regulated learning and lecture method on students' achievement and attitude. In this design, both groups were

exposed to the same physics contents. The only difference between the two groups was their instructional approaches. The experimental groups will learn with self-regulated learning formats while the varied group will learn with lecture method format. The effect of the two methods will then be compared.

The design is presented in Table 1:

Table 1: Design Matrix

Group	Pre-test	Treatment	Post-test
Self-regulated learning	O_1	X_1	O_2
Lecture method (varied)	O_3	X_2	O_4

Where,

O_1 = pre-test of self-regulated learning group.

O_2 = post-test of self-regulated learning group.

O_3 = pre-test of lecture method group.

O_4 = post-test of lecture method group.

X_1 = treatment using Self-Regulated learning

X_2 = treatment using lecture method.

Population for the Study

The population for this research comprises all public senior secondary school two (SSII) physics students in Delta Central Senatorial District. Delta central senatorial district comprises eight Local Government Areas, namely: Udu, Uvwie, Ughelli South, Ughelli North, Sapele, Okpe, Ethiope East and Ethiope West with about 184 public secondary schools, 19,790 SS2 Physics Students and 190 SS2 Physics teachers in the eight Local Government Areas in Delta Central Senatorial District.

Sampling and Sampling Techniques

Sample size of the study comprised two hundred and twenty (220) SSII physics students selected from four (4) public mixed Secondary schools in Delta Central Senatorial district. First, a simple random sampling was used to select three local government areas from the eight local Government Areas. The sampled schools for the research were selected using purposive sampling based on the following parameters: presence of well-equipped physics laboratory, trained and experienced physics teachers and school must be mixed. To this end, all the single-sex schools and schools without laboratories were eliminated from the study. Finally, simple random sampling was used to select two out of the four schools into the experimental group and the other two schools became the varied group.

Research Instrument

Two instruments used for data collection, and they are Physics Achievement Test (PAT) which will be drawn from a six-week instructional unit in physics; and Physics Attitude Questionnaire (PAQ). The physics achievement test (PAT) consists of 50 multiple choice test items constructed from the six weeks instructional unit (see Appendix 4). The physics attitude questionnaire (PAQ) consists of twenty (20) items seeking respondents' (students) answers on the effects of Self-Regulated learning on students' attitude towards physics (see Appendix 7). The responses to the physics attitude questionnaire will be framed on a 4-point scale of Strongly Agree (SA, 4), Agree (A, 3), Disagree (D,2) and Strongly Disagree (SD, 1). Both the PAT and the PAQ will be used for pre-test and post-test treatments respectively. The items in the PAT will be re-arranged before it is used for the post-test.

Validity of the Instrument

The face validity of the Physics Achievement Test (PAT) and Physics Attitude Questionnaire (PAQ) was carried out by a panel of three experts made up of one experienced Physics teacher, one physics educator from Delta State University and an expert in Measurement and Evaluation from Delta State University Abraka. They determined the face validity of the instruments by critically examining test items and relating them to the contents of the 6 weeks instructional unit which was developed from the first 6 weeks of SS II physics scheme of work for the first term (see Appendix 1). The experts subjected the instrument to thorough screening, by checking the suitability and clarity of the items against the research questions and hypotheses formulated for the study. The items on the instrument were checked to be sure they were in line with the objectives of the study. They concluded that items 11, 12, 24, 25 and 26 of the Physics Achievement Test (PAT) should be restructured. For Physics Attitude Questionnaire (PAQ), the panel recommended that items 2, 7 and 10 should be rephrased. Their comments, suggestions, criticism and correction were used to produce the final draft of the instruments.

Reliability of the Instrument

The reliability of the PAT was established using the Kuder-Richardson Formula 21 approach. The rationale behind the use of this method is that it is appropriate for multiple options objective test items. The instrument was administered to 40 physics students in College of Commerce in Warri South local government area of Delta State that is outside the area of coverage of the study and the data obtained were subjected to Kuder-Richardson Formula 21. On analysis, a reliability coefficient value of 0.79 was obtained (see Appendix 6). The instrument was adjudged reliable because it agrees with the recommendation by Leedy and Omrod (2005), Johnson and Christensen (2000), as cited by Ajaja (2013) that reliability has to do with accuracy and precision of a measurement procedure, a high reliability value of 0.70 or higher shows that the instrument is reliable, accurately measuring the characteristic it was designed to measure.

The reliability of the PAQ was established using the Cronbach-alpha technique. The instrument (PAQ) was administered to 40 physics students in a school in Warri

South local government area outside the area of coverage for the study. The responses of the 40 students were scored and the scores obtained were subjected to the Cronbach alpha statistic. On analysis a reliability coefficient of 0.83 was obtained (see Appendix 8). Taber (2018) stated that "Alpha values are described as excellent (0.93–0.94), strong (0.91–0.93), reliable (0.84–0.90), robust (0.81), fairly high (0.76–0.95), high (0.73–0.95), good (0.71–0.91), relatively high (0.70–0.77), slightly low (0.68), reasonable (0.67–0.87), adequate (0.64–0.85), moderate (0.61–0.65), satisfactory (0.58–0.97), acceptable (0.45–0.98), sufficient (0.45–0.96), not satisfactory (0.4–0.55)". Johnson and Christensen (2000) as cited by Akudo (2018) specified that an instrument is considered to be reliable because it meets a standard that instruments with a reliability index of 0.70 and above is reliable. From the standards mentioned above the instrument (PAQ) with the reliability coefficient of 0.83 is adjudged reliable.

Treatment Procedure

The treatment procedure adopted was used in similar studies by Ajaja (2011), Ajaja (2013) and Akudo (2018). The first step in the treatment procedure was the assignment of students into Self-Regulated learning group and lecture method group. Two intact SSII classes from the four schools selected for the study were randomly selected to make up the experimental group (Self-Regulated learning group). The two intact SSII classes from the schools that were remaining served as the lecture method group. Both groups were exposed to the same physics subject contents in their learning environment. The experimental group learned using Self-Regulated learning strategy while the planned variation group learned with the lecture method. The four teachers in the four selected schools were used as research assistants. Two of the teachers were trained on the skills of using the Self-Regulated learning strategy and the other teachers were not trained since they used the lecture method. The treatment lasted for a period of six weeks. The researcher distributed the instructional unit for both experimental and varied groups to the four research assistants a week before the start of the treatment. The instructional unit contained physics contents drawn from the first six weeks of the physics scheme of work for SSII. The distribution of instructional unit was done for two reasons:

1. to familiarize the teachers with the subject matter contents; and
2. to ensure that all the instructional presentation followed the recommended format for the designated classes.

Two days before the commencement of treatment, both the experimental and varied groups were pre-tested with the 50 items Physics Achievement Test (PAT) and Physics Attitude Questionnaire (PAQ). This was done to determine the equivalence of the groups before treatment and be sure that any change noticed later was due to the treatment. During the treatment for the lecture group, all the contents in the six-week instructional unit were presented to the students using the lecture method. The two teachers who taught the lecture groups equally presented the content materials to the students in their final forms. In the experimental classrooms, Self-Regulated learning strategy was applied. At the end of the treatment, the researcher with the help of the research assistants who are regular physics teachers in the sampled schools

administered the 20-item physics attitude questionnaire (PAQ) and the 50-item physics achievement test (PAT) as post-test to both groups. To reduce the effect of influence and familiarity, the researcher personally marked and scored the post-treatment for all the groups using the marking guides prepared by the researcher.

Method of Data Analysis

The research questions were answered using mean and standard deviation. While the hypotheses were tested using t-test and analysis of covariance (ANCOVA) at the 0.05 level of significance.

RESULTS AND DISCUSSION

This section deals with data presentation, interpretation of results and discussion of findings.

Presentation of Results
Answering of Research Questions and Testing of Hypotheses
Research Question One

What is the difference between the mean achievement scores of students taught physics using Self-Regulated learning and those taught using lecture method?

Table 2: Means and Standard Deviations (SD) Comparison of The Pretest and Post Test Mean Academic Achievement Scores of Students taught physics using Self-Regulated learning and those taught using lecture methods

Instructional methods	N	Pretest		Posttest		Mean Gain
		Mean	SD	Mean	SD	
Self-regulated learning	113	8.26	1.09	40.34	6.79	32.08
lecture method	107	8.06	.72	32.54	4.49	24.48
Mean difference		0.20		7.80		7.60
Total	220					

Table 2 shows that the self-regulated learning group pretest and posttest mean scores are 8.26 and 40.34, with standard deviation scores of 1.09 and 4.15, respectively. Also, the lecture method group had pretest and posttest mean scores of 8.06 and 32.54, with standard deviation scores of .72 and 1.52, respectively. The difference between the pretest and posttest mean achievement score for the self-regulated learning was 32.08, while the difference between the pretest and posttest mean achievement score for the control group was 24.48. The difference between the mean achievement scores of students taught physics using self-regulated learning and those taught using lecture method is 7.60.

To determine if the difference was significant, H_{01} was tested using independent t-test statistics and the summary was presented as shown in Table 3.

Ho_1: There is no significant difference between the mean achievement scores of students taught physics using Self-Regulated learning and those taught using lecture methods.

Table 3: t-Test Comparison of the Mean Academic Achievement Scores of Students taught physics using Self-Regulated learning and those taught using lecture methods**.**

	Instructional Strategy	N	Mean	Std. Deviation	df	t-cal.	t-crit.	Level of sign.	Remark
Pretest	Self-regulated learning	113	8.26	1.09	218	1.61^{ns}	1.96	0.05	Null hypothesis not rejected
	Lecture	107	8.06	0.72					
Posttest	Self-regulated learning	113	40.34	6.79	218	10.1^{s}	1.96	0.05	Null hypothesis rejected
	Lecture	107	32.54	4.49					

Table 3 reveals the t-test comparing the difference between the mean academic achievement scores of students taught Physics using self-regulated learning and those taught with lecture method. The table revealed that in the pretest, the calculated t-value of 1.61 is less than critical t-value of 1.96 at an alpha level of 0.05. This implies that the two groups were marginally equivalent before instruction (treatment) began.

However, in the post test, the mean academic achievement scores of students taught using self-regulated learning and lecture method gave a calculated t-value of 10.1 which is greater than the critical t-value of 1.96 at an alpha level of 0.05. The null hypothesis was therefore rejected. This indicates that there is a significant difference between the mean academic achievement scores of students taught Physics using self-regulated learning and those taught with lecture method.

Research Question Two

What is the difference between the mean achievement scores of male and female students taught physics using Self-Regulated learning?

Table 4: Means and Standard Deviations (SD) Comparison of the Pretest and Post Test Mean Academic Achievement Scores of Male and Female Students Taught Physics Using Self-regulated learning Instructional Strategy

Sex	N	Pretest		Post-test		Mean
		Mean	SD	Mean	SD	Difference

Males	48	8.52	0.87	39.24	6.42	32.82
Females	65	8.07	1.21	36.98	8.98	28.00
Total	113					

Table 4 shows that the pretest and posttest mean academic achievement scores of male students taught Physics using the self-regulated learning are 8.52 and 39.24, with standard deviation scores of 0.87 and 6.42 respectively. Also, the female students taught using the self-regulated learning had pretest and posttest mean scores of 8.07 and 36.98, with standard deviation scores of 1.21 and 8.98, respectively. The difference between the mean achievement scores of male and female students taught physics using self-regulated learning is 39.24 for the males, while that for the females was 36.98.

To determine if the difference is significant, Ho_2 was tested using independent t-test statistics and the summary was presented as shown in Table 5 below.

Ho_2: There is no significant difference between the mean achievement scores of male and female students taught physics using Self-Regulated learning.

Table 5: t-test Comparing the Mean Academic Achievement Scores of Male and Female Students Taught Physics Using Self-regulated learning.

	Sex	N	Mean	Std. Deviation	Df	t-cal.	t-crit.	Level of sign.	
Pretest	Male	48	8.52	0.87	111	2.29 ns	1.96	0.05	Null hypothesis rejected
	Female	65	8.07	1.21					
Posttest	Male	48	39.24	6.42	111	1.56 ns	1.96	0.05	Null hypothesis not rejected
	Female	65	36.98	8.98					

Decision: null hypotheses not rejected

Table 5 shows the independent t-test statistics comparing t-test comparing the difference between the mean academic achievement scores of male and female students taught Physics using self-regulated learning. It shows that the difference in post-test mean scores between the male students with a mean academic achievement score of 39.24 and female students with a mean academic achievement score of 36.98 as observed in Table 5 was not significant. This is because the t-value of 1.56 obtained is less than the critical t-value of 1.96 at alpha level of 0.05. With this, the null hypothesis which states that there is no significant difference in the mean academic achievement scores of male and female students taught Physics using self-

regulated learning was not rejected. This implies that there is no significant difference in the mean academic achievement scores of male and female students taught Physics using self-regulated learning instructional strategy.

Research Question Three

What is the difference between the mean attitude scores of students taught Physics using Self-Regulated learning and those taught using lecture method?

Table 6: Means and Standard Deviations (SD) Comparison ofmean attitude scores of students taught Physics using Self-Regulated learning and those taught using lecture method

Instructional methods	N	Pre-attitude		Post-attitude		Mean
		Mean	SD	Mean	SD	gain
Self-regulated learning	113	1.96	0.34	3.29	0.58	1.33
lecture method	107	1.94	0.55	1.97	0.43	0.03
Mean Difference		0.02		1.32		1.30
Total	220					

Table 6 shows that the self-regulated learning group pretest and posttest mean attitude scores are 1.96 and 3.29, with standard deviation scores of 0.34 and 0.58, respectively. Also, the lecture method group has pretest and posttest mean attitude scores of 1.94 and 1.97, with standard deviation scores of 0.55 and 0.43, respectively. The difference between the pretest and posttest mean score for the self-regulated learning was 1.33, while the difference between the pre-attitude and post-attitude rating for the varied group was 0.03. The mean difference between the mean attitude gain ratings of the self-regulated learning (experimental) and lecture method (varied) group was 1.30. The difference between the mean attitude scores of the self-regulated learning group and the lecture method group was 1.32.

To determine if the difference is significant, Ho_3 was tested using independent t-test statistics and the summary was presented as shown in Table 7 below.

Ho_3: There is no significant difference between attitude scores of students taught Physics using self-regulated learning and those taught with lecture instructional strategy.

Table 7: t-test Comparing the Attitude Scores of Students Taught Physics Using Self-regulated learning and Those Taught with Lecture Method.

	Instructional Strategies	N	Mean	Std. Deviation	df	t-cal.	t-crit.	Level of sign.	Remarks
Post-attitude score	Self-regulated learning	113	3.29	0.58	218	19.24[s]	1.96	0.05	Null hypothesis rejected
	Lecture	107	1.97	0.43					

Table 7 reveals that, in the post test, the mean attitude scores of students taught using self-regulated learning and lecture instructional strategy are 3.29 and 1.97, with standard deviation scores of 0.58 and 0.43, respectively. This gives a calculated t-value of 19.24 and a critical t-value of 1.96. The t-calculated is greater than the t-critical value of 1.96 at an alpha level of 0.05. The null hypothesis was therefore rejected. This indicates that there is a significant difference between the mean attitude scores of students taught Physics using self-regulated learning and those taught with lecture method.

Research Question Four

What is the difference between the mean attitude scores of male and female students taught Physics using Self-Regulated learning?

Table 8: Means and Standard Deviations (SD) Comparison of the Mean Attitude Scores of Male and Female Students Taught Physics Using Self-regulated learning

Sex	N	Pre-attitude		Post-attitude		Mean gain
		Mean	SD	Mean	SD	
Males	48	2.01	0.39	3.44	0.56	1.43
Females	65	1.92	0.30	3.24	0.55	1.32
Mean difference		0.09		0.20		0.11
Total	113					

Table 8 shows that the pretest and posttest mean attitude scores of male students taught Physics using the self-regulated learning are 2.01 and 3.44, with standard deviation scores of 0.39 and 0.56 respectively. Also, the female students taught using the self-regulated learning had pretest and posttest mean scores of 1.92 and 3.24, with standard deviation scores of 0.30 and 0.55, respectively. The difference in mean attitude score between the male and female for the pretest was 0.09, while that for the posttest was 0.20.

To determine if the difference is significant, Ho_5 was tested using independent t-test statistics and the summary was presented as shown in Table 9 below.

Ho_4: There is no significant difference in the attitude scores of male and female students taught Physics using self-regulated learning instructional strategy.

Table 9: t-test Comparing the Mean Attitude Scores of Male and Female Students Taught Physics Using Self-regulated learning.

	Sex	N	Mean	Std. Deviation	df	t-cal.	t-crit.	Level of sign.	Remarks
Post-learning attitude	Male	48	3.44	0.56	111	1.89 ns	1.96	0.05	Null hypothesis not rejected
	Female	65	3.24	0.55					

ns= not significant

Table 9 reveals the t-test comparing the difference between the mean attitude scores of male and female students taught Physics using self-regulated learning. From the table the mean attitude score of male students is 3.44 with standard deviation of 0.56, while that of female students is 3.24 with standard deviation of 0.55. This gives a calculated t-value of 1.89 and a critical t-value of 1.96. The t-calculated is less than the t-critical value of 1.96 at an alpha level of 0.05. The null hypothesis was not rejected. This indicates that there was no significant difference in the mean attitude scores of male and female students taught Physics using self-regulated learning.

Research Question Five

What is the effect of interaction of sex and teaching method on students' achievement in physics?

Table 10: Mean and standard deviation on effect of interaction of sex and teaching method on students' achievement in physics

Methods		Self-Regulated Learning			Lecture	
	N	Mean	SD	N	Mean	SD
Pretest						
Male	48	28.32	6.94	55	28.40	7.07
Female	65	30.77	5.60	52	30.73	8.15
Posttest						
Male	48	59.76	12.76	55	49.92	8.43
Female	65	59.60	12.61	52	48.27	12.25

Table 10 shows a mean achievement score of 59.76 for male students who were taught using self-regulated learning strategy (experimental group), while their female counterparts had a mean achievement score of 59.60. Male students who were taught with lecture method (varied group) had a mean achievement score of 49.92, while their female counterparts had a mean achievement score of 48.27. The results do not suggest effect of interaction between teaching method and sex on students' achievement in physics. This was because for both sexes, the mean achievement scores were higher for students in the experimental group.

Ho_5: There is no significant effect of interaction of sex and teaching method on students' achievement in Physics.

Table 11: ANOVA summary of effect of interaction of sex and teaching method on students' achievement in physics

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	7380.311[a]	6	1845.078	13.134	0.000
Intercept	41249.263	1	41249.263	293.619	0.000
Methods	6908.941	1	6908.941	49.179	0.000
Sex	40.213	1	40.213	0.286	0.593
Methods * Sex	34.179	1	34.179	0.243	0.622

Error	34700.007	214	140.486
Total	787752.000	220	
Corrected Total	42080.317	219	

Table 11 shows that there is no significant effect of interaction of sex and teaching method, as measured by the students' mean achievement scores in physics, F(1, 214) = 0.243, P = 0.622. Therefore, Ho_5 is not rejected. Which says that there is no significant effect of interaction of sex and teaching method on students' achievement in physics. This means that the students' achievement in physics in terms of teaching method is not influenced by sex. It means that variables of teaching method and sex influence the achievement of students independently.

Research Question Six

What is the effect of interaction of sex and teaching method on students' attitude towards Physics?

Table 12: Mean and standard deviation on effect of interaction of sex and teaching method on students' attitude towards physics.

Methods	Self-Regulated Learning			Lecture		
	N	Mean	SD	N	Mean	SD
Posttest						
Male	48	57.29	7.32	55	54.64	8.94
Female	65	57.57	7.16	52	55.43	8.56

Table 12 shows a mean attitude score of 57.29 for male students who were taught using Self-Regulated learning strategy while their female counterparts had a mean attitude score of 57.57. Male students who were taught with lecture method had a mean attitude score of 54.64, while their female counterparts had a mean attitude score of 55.43. Based on the result it indicates that there is no effect of interaction of teaching method and sex on students' attitude towards physics. This was because for both male and female mean achievement scores were higher for students who were taught using self-regulated learning.

Ho_6: There is no significant effect of interaction of sex and teaching method on students' attitude towards Physics.

Table 13: ANOVA summary of effect of interaction of sex and teaching method on students' attitude toward physics

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	359.384[a]	6	89.846	1.186	.318
Intercept	112023.444	1	112023.444	1478.400	.000
Methods	351.259	1	351.259	4.636	.032
Sex	17.746	1	17.746	.234	.629
Methods * Sex	5.016	1	5.016	.066	.797
Error	18716.044	214	75.773		
Total	817432.000	220			
Corrected Total	19075.429	219			

Table 13 shows that there is no significant effect of interaction of sex and teaching method, as measured by the students' mean attitude scores in physics, F(1, 214) = 0.066, P = 0.797. Therefore, the hypothesis that says there is no significant effect of interaction of sex and teaching method is retained. Thus, there is no significant effect of interaction of sex and teaching method on students' attitude towards physics. This implies that teaching methods do not collaborate with sex to influence students' attitude towards physics.

Discussion

In view of the research questions answered and hypotheses tested, findings from the study were discussed as follows:

Academic Achievement Scores of Students Taught Physics Using Self-regulated learning and Those Taught with Lecture Method

The first finding shows that there was a significant difference between the mean academic achievement scores of students taught Physics using self-regulated learning strategy and those taught with lecture instructional strategy. The finding might be explained by the different instructional strategies used in each group. The students in the experimental group may have participated more actively in the learning process than those in the lecture group, which may have contributed to their higher achievement scores, as evidenced by the fact that students taught Physics using a self-regulated learning outperformed those taught using the lecture method. This finding is in line with the views of Nwafor, Obodo and Okafor (2015),

who reported that self-regulated learning strategy engendered higher students' achievement in Basic Science than the lecture method. This finding also gives credence to that by Oruc and Arslan (2016) and Yigzaw and Fentle (2013) who reported that Self-Regulated learning strategy significantly increased the reading comprehension and metacognitive thinking skills of students. Nwafor, Obodo and Okafor (2015) further states that self-regulated learning significantly improves students' achievement in Physics.

Academic Achievement Scores of Male and Female Students Taught Physics Using Self-regulated learning

The testing of hypothesis two revealed that there is no significant difference in the mean academic achievement scores of male and female students taught Physics using self-regulated learning. The finding maybe due to the fact that the use of self-regulated learning enhances the achievement of both male and female students as the method provided equal opportunity for all the students to participate actively in the learning process. This finding corroborates that of Yusuf (2014) who found that there was no significant difference in achievement between male and female students taught using self-regulated learning strategies. The finding agreed with Sani (2015) who found "no-significant" difference in performance between male and female students in the self-regulated learning group. This finding confirms that by Yukselturk and Bulut (2009) who reported that there were not statistically significant mean differences among motivational beliefs, self-regulated learning variables and achievement in programming with respect to gender. This finding disagrees with the views of Sardareh, Saad and Boromand (2012) who found a significant difference in the mean achievement scores of learners exposed to self-regulated learning, based on sex.

Attitude Scores of Students Taught Physics Using Self-regulated learning and Those Taught with Lecture Method

Testing of hypothesis three showed that there is a significant difference between the learning attitude scores of students taught Physics using self-regulated learning and those taught with lecture method. This finding may be due to the fact the used of self-regulated learning inculcate positive learning behavior into the student than the use of lecture method. This finding is in line with Igboanugo (2013) who reported that self-regulated learning instructional strategy is more efficacious in improving students' learning attitude and interest as well as improving their academic achievement than the lecture method. The study also aligned with Sugano and Mamolo (2021) who revealed that self-regulated learning showed a significantly greater effect than the traditional teaching method in promoting positive learning attitude and the motivation and interest of the students towards learning physics. This finding further gives credence to that of Ozdemir and Arslan (2016) who observed that self-regulated Jigsaw IV significantly enhanced students' attitude towards English Language, compared to the lecture method. The finding is also in line with Shekari (2012) who demonstrated that attitude learning methods have a greater influence on

the development of positive learning attitudes in students compared to traditional teaching methods.

Learning Attitude Scores of Male and Female Students Taught Physics Using Self-regulated learning

Data analysis for hypothesis four indicates that there was no significant difference in the mean learning attitude scores of male and female students taught Physics using self-regulated learning. The explanation for this finding could be that learning activities in attitude classrooms are equally shared among group members irrespective of sex, thereby motivating all students to actively participate in the learning process. This finding is in line with Affhalter (2010) revealed that in attitude learning environments, male and female students share equally in the group task, hence there is no significant difference in their learning attitude. This finding is consistence with that of Rahman (2011); Garmabi and Zarein (2016) who reported a non-significant difference in the attitude scores of male and female students exposed to self-regulated learning strategy This finding contradicts that of Mohammadjani and Tonkaboni (2015) who revealed that female students had higher learning levels in attitude towards teaching methods than male students did.

Effect of Interaction between Sex and Teaching Method on Physics Achievement

The study further revealed a non-significant effect of interaction between sex and teaching method on students' achievement in Physics. This finding confirms the views of Banarjee and Humar (2014) who reported a non-significant effect of interaction between sex and teaching method on students' achievement in science. This find also agreed with Mberekpe (2013) whose finding suggests there is no interaction effect between method of teaching and gender on students' achievement in biology. The finding also disagreed with Akpochimora (2018) who also showed that there was a significant effect of interaction among sex and teaching method on achievement.

Effect of Interaction Between Sex and Teaching Method on Attitude Towards physics

The study also found that there is no significant effect of interaction between sex and teaching method on students' attitude towards physics. This finding is in agreement with that by Oruc and Arslan (2016), who found a non-significant effect of interaction between sex and teaching method on students' attitude towards reading comprehension. This finding also gives credence to that of Ozdemir and Arslan (2016) who observed that there was no significant effect of interaction between sex and teaching method on students' attitude towards English. However, the finding aligns with the finding by Jana and Patra (2017) who revealed that gender and teaching method had significant effect of interaction on students' attitude scores in Geography.

Conclusion

From the findings, the academic achievement and students' attitude towards physics was higher using self-regulated learning instructional strategy than using the lecture method. It was therefore concluded that the use of self-regulated learning enhances the academic achievement and student learning attitude towards physics better than the lecture method.

Recommendations

The following recommendations are made, based on the findings of this study:

I. Physics teachers should endeavour to expose students to self-regulated learning. The use of self-regulated learning strategy will enhance students' ability to understand and control their learning.
II. Curriculum planners should ensure that they incorporate self-regulated learning in physics curriculum, as it will help to promote students' academic achievement and learning attitude in the subject.
III. Teachers should ensure active participation of both male and female students during the teaching and learning of Physics using self-regulated learning.
IV. Apart from the fact that self-regulated learning is more effective in teaching and learning physics it also enhances student's academic achievement and their learning attitude, hence the Ministries of Education should ensure that textbook authors incorporate self-regulated learning in the instructional methods for senior secondary schools.
V. Regular workshops, seminars and symposia on topics/concepts should be organized to expose teachers to the procedures of applying self-regulated learning instructional strategy in teaching physics,

REFERENCES

Abamba, E. I. (2021). The effects of school location on students' academic achievement in senior secondary physics based on the 5E learning Cycle in Delta State Nigeria. LUMAT: *International Journal on Math, Science and Technology Education*, 9(1), 56-76.

Abraham, I.& MacDonald, K. (2011) Encyclopedia of nursing research: Quasi-Experimental Research. Springer Publishing Company. Available at: http://0-search.credoreference.com.brum.beds.ac.uk/content/entry/spennurres/quasi_experimental_research/0

Adegoke, B. A. (2011). Effect of multimedia instruction on senior secondary school students' achievement in physics. *European Journal of Educational Studies*, 3(3), 537-541.

Adeyemo, S.A (2010). The Curriculum Transformation: Issues Problem and Prospects. *International Journal for Education Research Technology (IJERT)*. Vol (1), 99-111

Affhalter, M. G. (2010). Effects of Gender and Role Selection in Cooperative Learning Groups on Science Inquiry Achievement. All NMU Master's Theses. 342. https://commons.nmu.edu/theses/342

Ajaja, O. P. (2009). *Teaching methods across disciplines*. Ibadan: Bomn Prints.

Akpochimora, F. (2018). Effects of cooperative learning strategy and sex on students' academic achievement in chemistry in Delta central senatorial district. A Masters dissertation submitted to the Department of Science Education, Delta State University, Nigeria. November 2018.

Anene, G. U. (2005). Home economics and the academic performance of a child. *Journal of Home Economics Research*, 6(1), 99-103.

Banarjee, P. & Humar, K. (2014). A study on self-regulated learning and academic achievement among the science graduate students. *International Journal of Multidisciplinary Approach and Studies*, 1(6), 329.

Dani, D. (2009). Scientific literacy and purpose for Teaching Science: A case study of Lebanese private school teachers. *International Journal of Environmental and Science Education*, 4(3), 289-299

Eagly, A. H. & Chaiken, S. (2007). The advantages of an inclusive definition of attitude. *Social Cognition*, 25(5), 582-602.

Federal Republic of Nigeria (FRN), (2004). *National Policy on Education*. Lagos: NERDC Press

Fernandez-Rio, J., Cecchini, J. A., Méndez-Gimenez, A., Mendez-Alonso, D., and Prieto, J. A. (2017). Self-regulation, cooperative learning, and academic self-efficacy: Interactions to prevent school failure.*Journal of Frontiers in Psychology*.8:22.

Gamabi, H. & Zarein, G. (2016). EPL teachers' attitude towards the effectiveness of metacognitive strategies used by high school students. International Journal of Learning and Development, 6(1), 61-75

Hattie, J. (2009). Visible learning. Hattie rankings: 195 influences and effects sizes related to student achievement. University of South Australia, ACER.

Igboanugo, B. I. (2013). Effects of peer-teaching on students' achievement and interest in senior secondary school difficult chemistry concepts. International Journal of educational research, 12(2), 61-71.

Jana, A. K., & Patra, A. (2017). Attitude and Achievement in geography: A study on Bengali Medium Students. International Journal of Education and Psychologic Research (IJEPR), 6(2), 75-77.

Mberekpe, A. C. (2013). Effect Of Students Improvised Instructional Materials On Senior Secondary School Students‟ Achievement In Biology. An M. Ed (Doctoral dissertation, Thesis submitted to the Department of Science Education, university of Nigeria, Nsuka).

Mohammadjani, F., & Tonkaboni, F. (2015). A Comparison between the Effect of Cooperative Learning Teaching Method and Lecture Teaching Method on Students' Learning and Satisfaction Level. International Education Studies, 8(9), 107-112.

Mulenwa, J. N. (2002). A triangular framework for improving girls' participation in SMTE at the school level in Africa. An invited Discussion Paper to the FEMSA/AFCLIST Workshop on Developing a Systematic Framework for Gender Interventions within the Education System in Africa. Kenya: Nairobi.

Nwafor, C. E., Obodo, A. C. & Okafor, G. (2015). Effect of self-regulated learning approach on junior secondary school students' achievement in basic science. *Journal of Education and Practice*, 6(5), 78-92.

Nwanze, A. C. (2016). Effect of multimedia synchronized instructional strategy on students' achievement and retention in secondary school chemistry in Onitsha education zone. Unpublished M.Ed. Dissertation submitted to Department of Science Education, Nnamdi Azikiwe University, Awka.

Olakanmi, E. E., & Gumbo, M. T. (2017). The effects of self-regulated learning training on students' metacognition and achievement in chemistry. Open Journal Systems, 25(2), 161-170.

Oruc, A. & Arslan, A. (2016). The impact of self-regulated learning on reading comprehension and attitude towards Turkish course and metacognitive thinking. *Educational Research and Reviews*, 11(8), 523-529.

Ozdemir, E. & Arslan, A. (2016). The effect of self-regulated jigsaw iv on university students' academic achievements and attitudes towards English course. Journal of Education and Training Studies, 4(5).

Rahman, F. (2011). Effects of some students related factors on their metacognitive awareness Language Journal, 11(4), 76-85.

Roediger, H. L., & Marsh, E. J. (2005). The positive and negative consequences of multiple-choice testing. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 31, 1155-1159.

Sani, S. (2015). The importance of intercultural education in developmental age. Procedia-Social and Behavioral Sciences, 197, 1148-1151.

Sugano, S. G. C., & Mamolo, L. A. (2021). The Effects of Teaching Methodologies on Students' Attitude and Motivation: A Meta-Analysis. International Journal of Instruction, 14(3), 827-846.

Yigzaw, A. & Fentle, A. (2013). The impact of students' self-regulated language learning on their reading achievement in Ethiopian high schools: grade 9 in focus. *Journal of Media and Communication Studies*, 5(5), 44-51.

Yukselturk, E., & Bulut, S. (2009). Gender differences in self-regulated online learning environment. Journal of Educational Technology & Society, 12(3), 12-22.

Yusuf, H. O. (2014). Assessment of the implementation of the reading component of the English language curriculum for basic education in Nigeria. Advances in Language and Literary Studies, 5(2), 96-102.

Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview.*Theory into Practice*, 41(2), 64-70.

Zumbrunn, S., Tadlock, J., & Roberts, E. D. (2011). *Encouraging self-regulated learning in the classroom: A review of the literature*. Metropolitan Educational Research Consortium (MERC).