ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26nov106

Effects of Self -Regulated Learning Strategy and Lecture Method on Biology Students Achievement and Retention in Delta Central Senatorial District

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Publication Date: 2026/11/06

Abstract: The purpose of this study was to determine the impact of self-regulated learning instructional strategy on Biology students' achievement and retention. The independent variables were Self-regulated learning instructional strategy and lecture method, while the dependent variables were achievement and retention, with sex as an intervening variable. To achieve the purpose, seven research questions were answered and seven hypotheses were formulated and tested at 0.05 level of significance. The study adopted a 2 × 2 × 3 factorial non-equivalent group quasi-experimental repeated measures design. The sample comprised 271 Senior Secondary II Biology students drawn from four co-educational secondary schools in Delta Central Senatorial District of Delta State. The instrument used for data collection was the Biology Achievement Test (BAT), which was validated and subjected to reliability testing, yielding a reliability coefficient of 0.81. Data were collected and analyzed with paired-samples t-test, independent-samples t-test, Analysis of Variance, and Analysis of Covariance. The findings revealed that (i) There was a significant difference in the achievement of students taught with self-regulated learning instructional strategy and lecture method favouring the self-regulated learning instructional group (ii)There was no significant difference in the achievement of male and female students taught with self- regulated learning instructional strategy and lecture method (iii) There was a significant difference in the retention scores of students taught with self-regulated learning instructional strategy and lecture method favouring the self-regulated learning instructional group (iv) There was no significant difference in the retention score of male and female students taught with self-regulated learning instructional strategy and lecture method (vi)There was no significant interaction effects between method and sex on achievement (vii) There was no significant interaction effects between method and sex on retention. Based on these findings, the study concluded that self-regulated learning is more effective than lecture method for teaching Biology, as it significantly enhanced students' achievement and retention. It was therefore recommended that Biology teachers should adopt and integrate SRL instructional strategy into teaching to improve students' achievement and retention in Biology.

Keywords: *Self-Regulated, Instructional strategy, Sex, Achievement and Retention.*

How to Cite: Ovuakporaye Prevailing; Osawaru Patrick Ajaja (2026) Effects of Self -Regulated Learning Strategy and Lecture Method on Biology Students Achievement and Retention in Delta Central Senatorial District. *International Journal of Innovative Science and Research Technology*, 11(11), 17-30. https://doi.org/10.38124/ijisrt/26nov106

I. INTRODUCTION

➢ *Background to the Study*

Biology is a branch of science studied at the senior secondary school level that deals with the study of living organisms, their interactions with one another and their environment. In the view of Robert (2014), it is a science that deals with the origin, history, physical characteristics, life processes and habits of living organisms. It encompasses various fields such as botany, genetics, zoology, physiology, and ecology, all of which contribute to the understanding of the complexities of life. The study of biology plays a crucial role in equipping learners with scientific skills and knowledge needed for solving real-life problems related to health, agriculture, industry, and the environment. In schools, biology education helps to promote scientific literacy, develop critical thinking, and fosters a sense of curiosity about the natural world. The biology curriculum, therefore, is designed to provide students with theoretical and practical experiences that improve comprehension of biological concepts and processes. It defines the learning objectives, content, and instructional strategies necessary to achieve meaningful learning outcomes. Through the effective implementation of the biology curriculum, students are expected to develop positive attitudes towards science, acquire problem-solving abilities, and apply biological knowledge to improve the quality of life in society (Ogbaga and Osuafor, 2022). In most secondary schools, biology is taught through a combination of theoretical explanations and

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26nov106

practical demonstrations. However, many biology teachers still rely heavily on the lecture method.

Using the lecture method approach, the teacher presents the information verbally while the students listen, take notes, and occasionally ask questions. While the lecture method allows the teacher to cover a lot of content quickly and maintain control of the class, it often puts students in a passive learning role. In the class room where lecture method is used, learners depend mainly on the teacher as the primary source of knowledge while they assume a mental information processing role. This make many students struggle to connect biological concepts to real-life situations or to remember what they have learned over time. The lecture method has a major downside: it does not consider students' individual learning differences or help them think critically and learn independently. Because of this, many students still perform below expectations in biology even though teachers and curriculum planners have made several efforts to improve how the subject is taught (Mbanefo, Ozoji, & John, 2023).

Over the years, students' performance in biology has continued to be a source of concern to educators, researchers, and curriculum planners. Although biology is an important science subject that helps students understand life and its processes, many still find it difficult to grasp key concepts or perform well in examinations. This challenge has made biology educators to look for more innovative ways of teaching that can make the learning of biology more interesting and effective. Such methods should get students actively involved in learning both through practical ("hands-on") and thoughtful ("minds-on") activities as suggested by social constructivist theorists who believe that students learn best when they interact, share ideas, and build understanding together (Ejigbo & Agbo, 2024).

One of such constructivist approaches that supports this idea is the self-regulated learning. Self-regulated learning is an instructional strategy that involves active and constructive process in which learners set their own learning goals, monitor their cognition, motivation, and behaviours, and are directed and limited by their own goals and contextual features (Pintrich, 2000). According to Zimmerman, self-regulated learning refers to a process by which learners utilize their mental abilities to transform into academic skills through self-directed goals. The use of self-regulate learning instructional strategy is a learner-oriented method that helps learners understand themselves, become wise and determined making use of cognitive and metacognitive skills. The metacognitive skills enables them to know themselves and cognitive skills enables them to acquire knowledge and the ability to motivate themselves and manage their environment effectively. For this reason, self-regulated learning model is explained in four categories: cognitive, metacognitive, resource management, and motivational component (Pintrich & De Groot, 1990; Pintrich, 1999). Cognitive component are mental techniques used in acquisition, processing, storing, retrieving information, focusing on understanding and active engagement rather than cramming. Cognitive component are techniques that improves learners ability to process information more deeply, transfer and apply information to new situations which results in enhanced and better retention of knowledge. Examples of cognitive component includes use of Acronyms, creation of maps, self-testing, visualization and relating new information to real-life. Metacognitive component involves thinking about ones thought in order to manage learning. This includes planning, monitoring and evaluating ones understanding. Examples includes self-questioning, reflective journaling (taking note of steps used in solving problems), pre-assessment and goal setting (reviewing a topic beforehand to plan how to learn it), self-monitoring and exam wrapper (reviewing a completed exam to identify areas of mistakes). Resource management component is the intentional organization of time, study environment and support in order to achieve effective learning. While the motivational components are techniques outlined to increase student engagement, persistence and interest in learning by fostering intrinsic drive and creating a supportive, relevant and challenging environment. This can be achieved by making a connection between the curriculum and real life situations, establishing autonomy through choices, setting clear and realistic goals and providing constructive feedback in order to improve achievement.

The lecture method and self-regulated learning differ significantly in their approach to teaching and learning. While the lecture method is teacher-centered and places students in passive roles as recipients of information. Self-regulated learning is learner-centered and actively engages students in setting goals, monitoring their progress, and evaluating their learning outcome. In lecture method students depend largely for knowledge acquisition, whereas self-regulated learning encourages independence, critical thinking, and responsibility for learning differences

Also, the lecture method often pays little attention to individual learning differences while self-regulated learning allows students adopt strategies that suit their abilities and learning needs. These difference suggest that self-regulated learning may enhance students' understanding, motivation, retention, and academic achievement in Biology more effectively than the conventional lecture method. Therefore, this study seeks to investigate the effect of self-regulated on students' achievement and retention in Biology compared with lecture method.

Achievement generally refers to the level of success or proficiency students attain after learning a particular concept or subject. It reflects how well learners understand, apply, and demonstrate the knowledge and skills acquired during instruction. In the context of education, achievement is often measured through tests, assignments, or examinations that assess students' grasp of the learning objectives. High achievement indicates that learning has been effective, while low achievement may suggest gaps in understanding or ineffective teaching methods (Ogbaga and Osuafor, 2022). Self-regulated learning strategies such as goal setting, planning, self-monitoring, reflection, and motivational regulation may contribute to higher achievement in biology by enabling students to take control of their learning (Zimmerman 2001). These strategies allow learners to organize study sessions, track understanding, correct errors,

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26nov106

and maintain focus, which enhances performance in both theoretical and practical tasks. It also promotes deeper cognitive processing as students actively engage with biological concepts rather than relying on passive memorization. For instance, through self-monitoring and reflection, learners are able to detect misconceptions and revisit challenging topics, which strengthens comprehension and long-term retention. Research indicates that both male and female students benefit from Self-regulated learning strategies, though the ways they engage with these strategies may vary but the variations in approach doesn't translate into differences in achievement; (Anazifa, Limiansi, & Pratama, 2023) rather, they reflect individual preferences in strategy use. Self- regulated learning strategies support improved learning outcomes for all students in biology thereby enhancing achievement.

Retention refers to the ability of learners to remember, recall, and apply knowledge or skills over a period of time after the initial learning experience. It goes beyond short-term memorization to involve long-term understanding that allows students to connect new information with what they already know. In simple terms, retention determines how well students can keep and use what they have been taught even after classroom instruction has ended (Ibe, 2025). According to Okoye (2015) Retention is the ability of maintaining the availability of new knowledge and new meanings or some part of them. High retention indicates meaningful learning, while poor retention often shows that teaching methods were not effective enough to make knowledge stick. For teachers, assessing students' retention helps in evaluating whether their instructional strategies truly promote lasting understanding. In a subject like biology, where concepts are interconnected and build upon one another, high level of retention is essential for continued success.

An effective instructional strategy should enhance students' retention regardless of their sex. Sex is the biological classification of individuals as male and females. Studies show that male and female students may respond differently to certain teaching methods, sometimes displaying variations in confidence, engagement, or communication during lessons (Mbanefo, Ozoji, and John, 2023). Nevertheless, the purpose of understanding sex differences is not to create barriers but to equip teachers to better support diverse learners by using strategies that are sex inclusive. Sex inclusive strategies encourage active participation and meaningful interaction, enabling both male and female students to benefit equally. Evidence shows that when teaching approaches are effective, the effect of sex on academic performance becomes minimal (Ejigbo and Agbo, 2024. Determining a method that will improve students' achievement and retention irrespective of sex is a major concern for Biology Educators. Since there is a difference in the implementation of Lecture Method and self-regulated learning instructional strategy. The rationale for this study, therefore, is to investigate the effects of the self-regulated instructional strategy on biology students' achievement and retention.

➢ *Statement of Problem*

Biology is a core science subject that demands active thinking, deep understanding, and the ability to connect scientific ideas to real-life situations. In order to achieve this, students' needs to be taught using effective teaching strategies that are not sex biased. The purpose of understanding sex differences is not to create barriers but to equip teachers to better support diverse learners by using strategies that are sex inclusive. Sex inclusive strategies encourage active participation and meaningful interaction, enabling both male and female students to benefit equally. Evidence shows that when teaching approaches are effective, the effect of sex on academic performance becomes minimal. Determining an instructional method that can improve students' academic achievement and retention irrespective of sex remains a major concern for Biology educators. Given the differences in the implementation of the Lecture Method and self-regulated learning instructional strategy in the classroom, there is a need to examine their relative effectiveness on students' learning outcomes. This study seeks to answer this questions: Will there be a difference in effects of Self-regulated learning and Lecture Method on biology students' achievement and retention? (ii) Will there be a difference in the achievement and retention of male and female biology students taught with self-regulated learning and lecture method?

➢ *Research Questions*

The following research questions were raised and were answered.

- What is the difference in the mean Biology achievement scores of students taught with self- regulated learning instructional strategy and lecture method in Delta Central Senatorial District in Delta State?
- What is the difference in the mean achievement scores of male and female Biology students taught with self-regulated learning instructional strategy and lecture method in Delta Central Senatorial District in Delta State?
- What is the difference in the mean retention scores of Biology students taught with self- regulated learning instructional strategy and lecture method in Delta Central Senatorial District in Delta State?
- What is the difference in the mean retention scores of male and female Biology students taught with self- regulated learning instructional strategy and lecture method in Delta Central Senatorial District in Delta State?
- What is the interaction effect between methods and sex on Biology students' achievement in Delta Central Senatorial District in Delta State?
- What is the interaction effect between methods and sex on Biology students' retention in Delta Central Senatorial District in Delta State?

➢ *Hypothesis*

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

- HO_1: There is no significant difference in the mean Biology achievement scores of Biology students taught

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26nov106

using the self- regulated learning instructional strategy and those taught using the lecture method in Delta Central Senatorial District in Delta State

- HO_2: There is no significant difference in the mean achievement scores of male and female Biology students taught using the self- regulated learning instructional strategy and the lecture method in Delta Central Senatorial District in Delta State
- HO_3: There is no significant difference in the mean retention scores of Biology students taught using the self-regulated learning instructional strategy and those taught using the lecture method in Delta Central Senatorial District in Delta State
- HO_4: There is no significant difference in the mean retention scores of male and female Biology students taught using the self- regulated learning instructional strategy and the lecture method in Delta Central Senatorial District in Delta State
- HO_5: There is no significant interaction effect of instructional methods and sex on Biology students' achievement in Delta Central Senatorial District in Delta State
- HO_6: There is no significant interaction effect of instructional methods and sex on Biology students' retention in Delta Central Senatorial District in Delta State

➢ *Purpose of Study*

The major purpose of the study is to determine the impact of self- regulated learning instructional strategy on Biology students' achievement and retention.

II. SCOPE AND DELIMITATION OF THE STUDY

The scope of this study is limited to investigating the effects of the self-regulated learning instructional strategy and lecture method on the achievement and retention of Biology students**.** The study will focus specifically on the Biology topic**s** (Sense Organs, Ecology Population, Balance in Nature, Reproductive System and Reproduction in Humans) as contained in the Senior Secondary School Biology curriculum. The study will be delimited to public mixed SS11 Biology students within the Delta central Senatorial District**.** It will cover four mixed senior secondary schools, where students will be exposed to the self- regulated learning instructional strategy and the lecture method for comparison.

➢ *Operational Definition of Terms*

To ensure clarity in the study, the following terms are defined operationally:

- Self-regulated learning Instructional Strategy: Self-regulated learning is an instructional strategy that involves active and constructive process in which Biology students set their own learning goals, monitor their cognition, motivation, and behaviours, and are directed and limited by their own goals.
- Lecture Method: This is a teacher-centered method of teaching where the teacher delivers information verbally while Biology students listen and take notes with minimal interaction.
- Achievement: Achievement in this study refers to the Biology students' performance scores on the Biology achievement test administered after the instructional intervention.
- Retention: scores obtained in Biology after one month of administering the post test
- Biology Students: These are SS11 students enrolled in public mixed senior secondary schools who study Biology.

➢ *Research Design*

The study adopted a 2 × 2 × 3 factorial non-equivalent group planned variation quasi-experimental repeated measure design. This design has two teaching strategies, two levels of sex(male and female), repeated testing (pre-test, post-test, and delayed post-tests). The independent variables are the Self-regulated learning instructional strategy and lecture method, the dependent variables are Biology student's achievement and retention and sex is the intervening variables. The variable matrix in shown Table 1.

Table 1 Variable Matrix of the Study.

Independent Variable	Intervening Variable	Dependent variable
Self-regulated	learning	Strategy
Lecture Method	Sex	Achievement and Retention

This design is appropriate for the study because there was no randomization of sampled subjects into groups rather intact classes were used. According to Dutra and Reis, (2016) quasi experimental design is appropriate for any experimental research that lacks randomization of subjects. Table 2 shows the design matrix for the study.

Table 2 Design Matrix of the Study.

Groups	Design
Self-regulated learning instructional strategy	O_1----------XI----------O_2----------O_3
Lecture	O_4----------X2----------O_5---------O_6

Where,

- O_1 = Pretest for Self-regulated learning instructional strategy
- O_2 = Post-test for Self-regulated learning instructional strategy
- O_3 = Delayed post-test for Self-regulated learning instructional strategy

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26nov106

- O_4 = Pre-test for lecture method
- O_5 = post-test for lecture method
- O_6 = Delayed post-test for lecture method
- X_1 = Treatment using Self-regulated learning instructional strategy.
- X_2 = Treatment using lecture method.

➢ *Population of the Study*

The population of the study consist of eight thousand, nine hundred and ninety (8990) senior secondary school two (SSII) Biology students in the public mix secondary schools in Delta central Senatorial District of Delta State. The class is chosen as a result of the fact that, they were not be involved in external examinations such as NECO and WASSCE.

➢ *Sample and Sampling Techniques*

The sample for the study was made up of 271senior secondary two (SSII) Biology students in four (4) public co-educational secondary schools in Delta Central Senatorial District of Delta State. A multistage sampling technique was employed in selecting the sample. This was done as follows: First, two local government areas were sampled using simple random sampling technique. Secondly, the schools in the sampled local government areas were listed and paired into different blind bags and from each stratum, two schools were selected.

➢ *Research Instrument*

The instrument used in this study for data collection for achievement and retention score for both groups of students is the Biology Achievement Test, (BAT). The Biology Achievement Test, (BAT) is made up of fifty (50) multiple choice questions with options A-D. The items were picked from the West African Senior School Certificate Examinations, WASSCE from 2021 to 2025 Biology question papers on the topics to be taught. The topics to be taught are Sense Organs, Ecology of Population, Balance in Nature and Reproductive System and Reproduction in Humans.

➢ *Validity of Research Instrument*

In order to determine the validity of the instrument, The research instrument was given to three experts for face validation: One experienced Biology teacher from Emore Grammar School Oleh Delta south, an expert in measurement and evaluation and one science educator from the Department of Science Education, Faculty of Education, Delta State University, Abraka alongside the research questions and hypotheses. The experts agreed the test items had the appropriate face validity. In scoring the section B every right answer was scored 2. The minimum score to be obtained is 0 and maximum 100

To establish the Content validity for the BAT g a table of specification based on Blooms taxonomy was developed. This is shown in Table 3.

Table 3 Table of Specification of a 50 item Biology Achievement Test

	Mental Skills						
	Lower order		**Higher Order**				
Topics (%)	Knowledge (26%)	Comprehension (16%)	Application (18%)	Analysis (22%)	Synthesis (10%)	Evaluation (8%)	Total (100%)
Sense Organs (20%)	3	2	2	2	1	1	11
Ecology Population (25%)	3	2	2	2	1	1	11
Balance in Nature (25%)	3	2	2	2	1	1	11
Reproductive System and Reproduction in Humans (30%)	4	3	3	3	2	2	17
							50

The table of specification showed that the topics were properly represented.

➢ *Reliability of the Instrument*

To determine the reliability of the BAT, the instrument was administered on fifty (50) SSII Biology students in a public School (Alaka Grammer School Ozoro, Isoko North), which is outside the sampled schools for the study. The data collected were analyze using Kuder-Richardson formula 21. Analysis of the data obtained using Kuder-Richardson formula 21 yielded a reliability of 0.81. This shows the instrument is reliable. Any research instrument was used for

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the study as it is considered reliable having a reliability coefficient of 0.70 and above (Johnson and Christenson, 2000).The choice of Kuder-Richardson formula 21 to establish the reliability coefficient of the instrument is because the instrument is multiple choice objective test items that is scored homogenous and dichotomously. According to Borg and Gall, (1979) Kuder-Richardson formula 21 is appropriate for establishing the reliability of such instrument.

➢ *Treatment Procedure*

The treatment was made up of two groups which are the Self-regulated learning instructional strategy and Lecture teaching group. The duration for treatment also was for six weeks in which for Biology teachers were be sampled from the two local government Areas and used as research assistants. To achieve the main of the study, the following steps were taken.

- *Step1: Training of Research Assistants:*

The two research assistants (Biology teachers) that used for the study were trained on how to use Self-regulated learning instructional strategy in order for them to master the techniques of its usage for two days using the teachers training manual developed by the researcher. The training manual specifically defines the steps to be followed in teaching and the specific roles teachers and students are to play. First, the research assistants were exposed to concept of Self-regulated learning instructional strategy, origin and its characteristics. For the second day, researcher we reexposed them to the steps to be taken in the implementation of Self-regulated learning instructional strategy in classroom, after which the research assistant practiced the implementation. The training came to a close when the researcher is convinced that the trained research assistant can correctly apply the teaching strategy in their respective classes.

Since the lecture method is already widely used in secondary schools, the training focused on ensuring consistency in its application rather than introducing a new approach. The training lasted for one day and were guided by a manual developed by the researcher.

During the session, the research assistants guided on how to organize their lessons, present content clearly, and maintain a consistent teaching pattern across the classes. Emphasis was placed on maintaining a teacher-centered approach, as is typical of the lecture method. They were also be briefed on the specific content to be covered and the appropriate pace of instruction to ensure uniformity. The training was conclude when the researcher is satisfied that the research assistants can apply the lecture method consistently in their respective classes.

- *Step 2: Pre-testing of both groups of Students*

Three days before the treatment with the instructional strategies, the two groups of Biology students were be pre-tested with the BAT in order to determine pre-instructional knowledge and also to establish if the students are equivalent in cognitive abilities at the point of entry.

- *Step 3: Actual treatment*

During treatment in each of the instructional groups of study, the following activities were carried out by both the research assistant (teachers) and students.

➢ *Steps to take by Biology Teachers Using Self-Regulated Learning Instructional Strategy and Lecture Method in Teaching*

- *Teaching by Biology Teachers Using Self-Regulated Learning Instructional Strategy*

✓ Step1: Introduction: Teacher introduces the Biology topic by asking students what they know about the topic.
✓ Step 2: Introduction of cognitive component: The teacher gives students an extract containing the topics to be studied and ask students to read through for 5 minutes, after that they have generated clues (eg Acronyms, maps etc.) that made to remember what they have read
✓ Step 3: Introduction of metacognitive Component: In this stage, the teacher asks students to use the clues that they have generated in step 2 to explain the concepts read to the class.
✓ Step 4: Introduction of resource management component: The teacher ask students to generate questions from the topic read, create a map that they used to explain the concept within 5minutes.
✓ Step 5: Introduction of Reinforcement component: The teacher ask students to explain the concepts using the outcome of what they have in step 4 and reward the groups that did very well
✓ Step 6: Summary /Evaluation: Teacher summaries the concepts by explaining the concept in details putting into consideration all the answers given by the students in step1-6 and also ask students questions, and give students room to ask questions.

- *Teaching of Biology by the Teachers using Lecture Method*

In teaching the concepts using lecture method, the following steps were taken for each of the concept taught.

✓ Step 1: Teacher ask questions to elicit students' knowledge about the concept to be taught
✓ Step II: Teacher explains the concepts to be taught
✓ Step III: Teacher ask students questions to find out their levels of understanding
✓ Step IV: Teacher answers students' questions
✓ Step V: Teacher summarizes the lesson.

- *Step IV: Post - testing*

At the end of the six-week teaching period, students in both groups completed a post-achievement test to evaluate their learning. After an interval of one month, the Biology Achievement Test (BAT) was re-administered to assess Student's retention. The responses from both groups were carefully scored to determine their achievement and retention levels.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26nov106

III. RESULTS

Research question One: What is the difference in the mean Biology achievement scores of students taught with self- regulated learning instructional strategy and lecture method in Delta Central Senatorial District in Delta State?

To determine the difference in the mean achievement of Biology students taught with Self-regulated Learning instructional strategy and Lecture Method, the mean of both group of students at post-test were analyzed using Mean and Standard Deviation statistics.

Table 4 Descriptive Statistics of Mean and Standard Deviation Showing the Difference in the Mean Score of Biology Students Taught with SRL and LM

Method	N	Mean	Mean. diff	S.D
SRL	217	56.18		10.45
			8.18	
LM	54	48.00		1.17

The Table shows that for the SRL group, students obtained a post-test mean score of 56.18 with the standard deviation of 10.45. For the lecture method group students obtained a posttest mean score of 48.00 with a standard deviation of 1.17, giving a mean difference of 8.18. To determine the differences in significances, hypothesis 2 was tested

Hypothesis one : There is be no significant difference in the mean Biology achievement scores of Biology students taught using the self- regulated learning instructional strategy and those taught using the lecture method in Delta Central Senatorial District in Delta State?

To determine the appropriate statistics to test hypothesis 2 the pretest score of both groups of students were analyzed using independent sample t test and this is shown in Table 5

Table 5 Independent t Test Statistics Comparing the Difference in the Mean Achievement Scores of Biology Students Taught with SRL and LM on at Pretest

Method	N	Mean	Mean. diff	S.D	df	t	sig
SRL	217	15.88		5.03			
			1.36		269	1.9233	0.006
LM	54	14.52		2.64			

With a significance of 0.06which is higher than 0.005 alpha level of significance, independent sample t-test statistics becomes the appropriate statistics to be used to test hypothesis 2

Table 6 Independent Sample t-Test Statistics Comparing the Mean Achievement of Student Taught with SRL and LM at Post Test

Method	N	Mean	Mean. diff	S.D	df	t	sig
SRL	217	56.18		10.45			
			8.18		269	5.32	0.000
LM	54	48.00		1.17			

The Table shows that there is a significance difference in the achievement score of biology students taught with SRL and lecture method because the calculated sign value of 0.00 which is less than 0.05 level of significance was obtained with this hypothesis 2 which states that there is no significant difference in the mean achievement scores of Biology students taught using the self- regulated learning instructional strategy and those taught using the lecture method was rejected

Research Question 2. What is the difference in the mean achievement scores of male and female Biology students taught with self- regulated learning instructional strategy and lecture method in Delta Central Senatorial District in Delta State?

To determine the in the mean achievement scores of male and female Biology students taught with self- regulated learning instructional strategy and lecture method the post-test of students taught with SRL & LM were analyzed using Mean and Standard Deviation statistics.

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Table 7 Descriptive Statistics of Mean and Standard Deviation Showing the Mean Scores of Male and Female Students Taught with Self- Regulated Learning Instructional Strategy and Lecture Method in Delta Central Senatorial District

Method	Sex	N	Mean	Mean diff	S.D
SRL	Male	91	53.80		10.81
				4.09	
	Female	126	57.89		9.86
LM	Male	26	47.23		7.33
				1.48	
	Female	28	48.71		9.74

For the SRL group, the Table shows that male students obtained a mean score of 53.80 with a standard deviation of 10.81, while female students obtained a mean score of 57.89 with the standard deviation of 9.86.There exist a mean difference of 4.09 in favour of the female students. For the lecture method group male students obtained a mean score of 47.23 with a standard deviation of 7.33, while female students obtained a mean score of 48.71 with a standard deviation of 1.84. To determine if the difference is significance hypothesis 3 was tested.

Hypothesis 2: There is no significant difference in the mean achievement scores of male and female Biology students taught using the self- regulated learning instructional strategy and the lecture method in Delta Central Senatorial District in Delta State.

To determine the appropriate statistics to test hypothesis 2 students independent sample t-test was used to test their pre-test data.

Table 8 Independent Sample t-test Statistics Comparing the Achievement Scores of Male and Female Biology Students Taught Using the Self- Regulated Learning Instructional Strategy and the Lecture Method Pretest.

Method	Sex	N	Mean	Mean diff	S.D	tcal	df	Sig
SRL	Male	91	15.03		4.46			
				1.46		2.13	215	0.04
	Female	126	16.49		5.34			
LM	Male	26	14.54		2.44			
				0.04		0.05	52	0.96
	Female	28	14.50		2.86			

With the cal. sig value 0.04 and 0.96 which are less than 0.05 level of significance respectively, ANCOVA statistics and independent sample t-test statistics becomes the appropriate statistics to use to test hypothesis 3 for SRL and LM respectively.

Table 9a ANCOVA Statistics Comparing the Male and Female Students Taught with SRL in Delta Central Senatorial District

Source	Type lll sum of squares	df	mean square	F	sig
Corrected model	12148.957	2	6074.479	113.866	.000
Intercept	21259.670	1	21259.670	398.512	.000
Pre-achievement	11266.496	1	11266.496	110.790	.000
Sex	200.794	1	10.117	26.323	.0054
Error	11416.388	214	53.348		
Total	708340.00	217			
Corrected total	23565.346	216			

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26nov106

With the calculated sig value of 0.05 which is equal to 0.05 alpha level of significance hypothesis 3 which states that there is no significant difference in the achievement of male and female students taught with SRL was rejected. This is because there is a significant difference in the mean score of male and female students with SRL.

Table 9b Independent Sample t-Test Statistics Comparing the Mean Scores of Male and Female Students Taught with Lecture Method in Delta Central Senatorial District

Method	Sex	N	Mean	Mean Diff	S.D	df	tcal	Sig(2tail)
LM	Male	26	47.23		7.33			
				1.48		52	0.63	0.53
	Female	28	48.71		9.74			

With the calculated sig value of and 0.53 obtained for the male and female students taught with LM, which is greater than 0.05 alpha level of significance, it shows that there was no significant difference in the achievement of male and female students taught with LM leading to the non-rejection of the hypothesis which states that there is no significant difference in the mean achievement scores of male and female Biology students taught with lecture method.

Research question 3. What is the difference in the mean retention scores of Biology students taught with self-regulated learning instructional strategy and lecture method in Delta Central Senatorial District in Delta State?

To determine the difference in the mean retention scores of Biology students taught with self- regulated learning instructional strategy and lecture method the delayed post-test of students taught with SRL & LM were analyzed using Mean and Standard Deviation statistics.

Table 10 Descriptive Statistics of Mean and Standard Deviation Showing the Difference in the Mean Retention Score of Biology Students Taught with SRL and LM

Method	N	Mean	M. diff	S.D
SRL	217	49.47		9.33
			7.54	
LM	54	41.93		8.20

The Table shows that for the SRL group, students obtained a retention mean score of 49.47 with the standard deviation of 9.33. For the lecture method group, the students obtained a retention mean score of 41.93 with a standard deviation of 8.20, giving a mean difference of 7.54 in favour of the SRL group. To determine the differences in significances, hypothesis four was tested using independent sample t-test statistics.

Hypothesis 3: There is no significant difference in the mean retention scores of Biology students taught using the self- regulated learning instructional strategy and those taught using the lecture method in Delta Central Senatorial District in Delta State?

To determine if the observed difference in the mean retention scores of Biology students taught with self-regulated learning instructional strategy and lecture method is significant, the delayed post-test of students taught with SRL & LM were analyzed using independent sample t-test statistics.

Table 11 Independent Sample t-Test Statistics Comparing the Difference in the Mean Retention Score of Biology Students Taught with SRL and LM

Method	N	Mean	M. diff	S.D	df	tcal	Sig(2-tail)
SRL	217	49.47		9.33			
			7.54		269	5.44	0.00
LM	54	41.93		8.20			

With a calculated sig value of 0.00 which is less than 0.05 alpha value of significant obtained, hypothesis which states that there is no significant difference in the mean retention scores of Biology students taught using the self-regulated learning instructional strategy and those taught using the lecture method was rejected.

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Research Question 4: What is the difference in the mean retention scores of male and female Biology students taught with self- regulated learning instructional strategy and lecture method in Delta Central Senatorial District in Delta State?

To determine the difference in the mean retention scores of male and female Biology students taught with self-regulated learning instructional strategy and lecture method the delayed post-test of the male and female students taught with SRL & LM were analyzed using Mean and Standard Deviation statistics.

Table 12 Descriptive Statistics of Mean and Standard Deviation Showing the Mean Retention Scores of Male and Female Students Taught with self- Regulated Learning Instructional Strategy and Lecture Method in Delta Central Senatorial District

Method	Sex	N	Mean	Mean. diff	S.D
SRL	Male	91	47.34		9.67
				3.66	
	Female	126	51.00		8.81
LM	Male	26	41.08		7.49
				1.63	
	Female	28	42.71		8.86

For the SRL group, the Table shows that male students obtained a mean score of 47.34 with a standard deviation of 9.67, while female students obtained a mean score of 51.00 with the standard deviation of 8.81 with a mean difference of 0.12 which is in favour of the females. For the lecture method group male students obtained a mean score of 41.08 with a standard deviation of 7.49, while female students obtained a mean score of 42.71 with a standard deviation of 8.86 with a mean difference of 1.63 which is in favour of the females. To determine if the difference is significant hypothesis 5 was tested using independent sample t-test statistics.

Hypothesis 4: There is significant difference in the mean retention scores of male and female Biology students taught using the self- regulated learning instructional strategy and the lecture method in Delta Central Senatorial District in Delta State?

To determine the difference in the mean retention scores of Biology students taught with self- regulated learning instructional strategy and lecture method is significant, the delayed post-test of students taught with SRL & LM were analyzed using independent sample t-test statistics.

Table 13 Independent Sample t-Test Statistics Comparing the Mean Retention Scores of Male and Female Students Taught with Self- Regulated Learning Instructional Strategy and Lecture Method in Delta Central Senatorial District

Method	Sex	N	Mean	Mean diff	S.D	df	tcal	Sig(2-tailed)
SRL	Male	91	47.34		9.67			
				3.66		215	2.90	0.004
	Female	126	51.00		8.81			
LM	Male	26	41.08		7.49			
				1.63		52	0.73	0.47
	Female	28	42.71		8.86			

With the calculated sig values of 0.004 and 0.47 which are lesser and greater than alpha value of 0.05 level obtained for male and female students taught with SRL and LM respectively, Hypothesis 5 which states there is significant difference in the mean retention scores of male and female Biology students taught using the self- regulated learning instructional strategy and the lecture method was rejected for SRL and not for LM group of students.

Research Question Six: What is the interaction effect between methods and sex on Biology students' achievement in Delta Central Senatorial District in Delta State?

To determine the interaction effect between methods and sex on achievement, Biology students' post-test scores in relation to their sex were analyzed using mean and standard deviation statistics.

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Table 14 Descriptive Statistics of Mean and Standard Deviation Showing the Interaction Effects Between Methods and Sex on Achievement

Method	Sex	N	Mean	M. dif	S.D
SRL		217	56.18		10.45
				8.18	
LM		54	48.00		1.17
SRL	Male	91	53.80		10.81
				4.09	
	Female	126	57.89		9.86
LM	Male	26	47.23		7.33
				1.48	
	Female	28	48.71		9.74

The Table shows that for the SRL group, students obtained an interaction mean score of 56.18 with the standard deviation of 10.45. For the lecture method group, the students obtained an interaction mean score of 48.00 with a standard deviation of 1.17, giving a mean difference of 9.94. Also, For the SRL group, the Table shows that male students obtained an interaction mean score of 53.80 with a standard deviation of 10.81, while female students obtained an interaction mean score of 57.89 with the standard deviation of 9.86. For the lecture method group male students obtained an interaction mean score of 47.23 with a standard deviation of 7.33, while female students obtained an interaction mean score of 48.71 with a standard deviation of 1.84.To determine the differences in significances, hypothesis six was tested with Analysis of Co-Variance statistics

Hypothesis 5: There is no significant interaction effect of instructional methods and sex on Biology students' achievement in Delta Central Senatorial District in Delta State?

To determine the interaction effect between methods and sex on achievement is significant, Biology students pre-test and post-test scores in relation to their sex were analyzed Analysis of Covariance statistics.

Table 15 Analysis of Covariance Statistics Comparing Interaction Effects Between Methods and Sex on Achievement

Source	Type lll sum of squares	df	mean square	F	sig
Corrected model	16542.888	4	4135.722	79.440	.000
Intercept	18729.956	1	18729.956	359.769	.000
Pre-achievement	12740.928	1	12740.928	244.730	.000
Sex	127.385	1	127.385	2.447	.000
Method	1538.023	1	1338.023	29.543	.119
Method*Sex	1.452	1	1.452	0.028	.867
Error	13848.286	266	52.061		
Total	836692.000	271			
Corrected total	13285.867	270			

The Table shows that there is no significant interaction effects between method and sex on retention score of biology students taught with SRL and lecture method because the calculated sign value of 0.867 which is higher than 0.05 level of significance was obtained, with this hypothesis six which states that there is no significant interaction effect of instructional methods and sex on Biology students' achievement was not rejected.

Research Question 6. What is the interaction effect between methods and sex on Biology students' retention in Delta Central Senatorial District?

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26nov106

To determine the interaction effect between methods and sex on retention, Biology students delayed post-test scores in relation to their sex were analyzed using mean and standard deviation statistics.

Table 16 Descriptive Statistics of Mean and Standard Deviation Showing the Difference in the Mean Retention Score of Biology Students Taught with SRL and LM

Method	Sex	N	Mean	M. dif	S.D
SRL		91	49.47		9.33
				7.54	
LM		54	41.93		9.51
SRL	Male	91	47.34		9.67
				3.66	
	Female	126	51.00		8.81
LM	Male	26	41.08		7.49
				1.63	
	Female	28	42.71		8.86

The Table shows that for the SRL group, students obtained a mean interaction retention score of 49.47 with the standard deviation of 9.33. For the lecture method group, the students obtained an interaction mean retention score of 41.93 with a standard deviation of 9.51, giving an interaction mean retention difference of 7.54 in favour of the SRL group. Also, For the SRL group, the Table shows that male students obtained an interaction mean retention score of 47.34 with a standard deviation of 9.67, while female students obtained an interaction mean retention score of 51.00 with the standard deviation of 8.81with an interaction mean retention difference of 3.66 which is in favour of the females. For the lecture method group male students obtained an interaction retention mean score of 41.08 with a standard deviation of 7.49, while female students obtained a an interaction mean score of 42.71 with a standard deviation of 8.86 with an interaction mean retention difference of 1.63 which is in favour of the females. To determine if the difference is significant hypothesis seven was tested using Analysis Covariance statistics.

Hypothesis 6: There is no significant interaction effect of instructional methods and sex on Biology students' retention in Delta Central Senatorial District in Delta State?

To determine the interaction effect between methods and sex on retention, Biology students delayed post-test scores in relation to their sex were analyzed using Analysis of Variance statistics.

Table 17 Analysis of Variance Statistics Comparing Interaction Effects Between Methods and Sex on Retention

Method	Sex	N	Mean	M. dif	S.D
SRL		91	49.47		9.33
				7.54	
LM		54	41.93		9.51
SRL	Male	91	47.34		9.67
				3.66	
	Female	126	51.00		8.81
LM	Male	26	41.08		7.49
				1.63	
	Female	28	42.71		8.86

The Table shows that there is no significant effect of interaction between method and sex on retention is since a calculated sign value of 0.462 which is higher than 0.05 level of significance was obtained with this hypothesis seven which states that there is no significant interaction effect of instructional methods and sex on Biology students' retention was not rejected.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26nov106

IV. DISCUSSION OF FINDING

- *Section A: Effects of Self-Regulated Learning on Biology Students Achievement*

The first finding of the study indicated a significant difference in the achievement of students taught with self-regulated learning instructional strategy and lecture method favouring the self-regulated learning instructional group.The students in the self-regulated learning instructional group outscored those with the lecture method group with a mean difference of 8.18 as shown in Table 1. This was however found to be significant in Table 3. This significant difference found is as a result of the self-regulated activities that the students taught with self -regulated learning instructional strategy were engaged in. In using these strategy, students engage in constructive process by setting their own learning goals, they monitor their cognition, motivation, and behaviours and are directed and limited by their own goals and contextual features. The process of monitoring their cognition enables them to discover their academic strength and weakness and also give them the room to improve in their learning in the area of their weakness. This finding is in line with that of study by Achufusi-Aka & Offiah (2010) who found significant difference in the achievement of students taught with self-regulated learning and lecture method.

The second finding of the study showed no significant difference in the achievement of male and female students taught with lecture method but there was a significance in the male and female students taught with SRL. In Table 4 shows that the males in the SRL group perform higher than their female counterparts with a mean difference of 3.66 while the in the lecture method group, the female students performed better than male counterparts with a mean difference of 1.48. This however was found to be significant in Table 6a and not significant in Table 6a. This is an indication that the male and female students enjoyed the learning activities that they were exposed to when the strategy and the method were used and this made them acquire knowledge almost at the same level. This findings agrees with that of Achufusi (2015) whose findings indicated a significant difference in the achievement of male and female students for LM but disagrees with that of SRL

Also, the fifth finding of the study showed no significant interaction effects between method and sex on achievement (Table 12). This findings shows that learning acquired by the students when self-regulated learning and lecture method were used was not in combination with the influence of sex. This finding supports that of Akudo (2018) whose study showed no significant interaction effects between methods and sex on achievement.

- *Sections B: Effects of Self-Regulated Learning on Biology Students Retention*

The third finding of the study indicated a significant difference in the retention scores of students taught with self-regulated learning instructional strategy and lecture method favouring the self-regulated learning instructional group. The students in the self-regulated learning instructional group outscored those with the lecture method group with a mean difference of 7.54 as shown in Table 7. This was however found to be significant in Table 8. This significant difference in retention score found, is as a result of the self-regulated activities that the students taught with self -regulated learning instructional strategy were engaged in. In using these strategy, students engage in constructive process by setting their own learning goals, they monitor their cognition, motivation, and behaviours and are directed and limited by their own goals and contextual features. The process of monitoring their cognition enables them to discover their academic strength and weakness and also give them the room to improve in their learning in the area of their weakness and also move knowledge to their long term memory. This finding is in line with that of study by Schunk (2012) and Azevedo (2014) who found students who set specific, achievable goals and monitored their progress retained more information than those who did not engage in such practices.

The fourth finding of the study showed no significant difference in the retention score of male and female students taught with self-regulated learning instructional strategy and lecture method. Table 9 shows that the females in the SRL group performed higher than their male counterparts with a mean retention score difference of 3.66, while the in the lecture method group, the female students performed better than male counterparts with a mean retention score difference of 1.63. This however was found not to be significant in Table 10 for LM but significant for SRL. This is an indication that the male and female students enjoyed the learning activities that they were exposed to when the strategy and the method were used and this made them retained acquire knowledge almost at the same level in the LM group but at different levels in SRL. This findings agrees with that of Achufusi (2015) whose findings indicated a significant difference in the achievement of male and female students for LM but disagrees for SRL

Also, the sixth finding of the study showed no significant interaction effects between method and sex on retention (Table 13) . This findings shows that learning retained by the students when self-regulated learning and lecture method were used was not in combination with the influence of sex. This finding supports that of Akudo (2018) whose study showed no significant interaction effects between methods and sex on achievement.

V. CONCLUSION

Based on the findings of the study it was concluded that self -regulated learning is a more effective strategy for teaching Biology with regards to improving students achievement and retention and that both strategies do not interact with sex to influence students' achievement and retention since the sixth and seventh findings showed no significant interaction effects between method and sex on achievement and retention.

RECOMMENDATION

In line with the findings of the study, the following recommendation that Curriculum planners and policy-makers

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26nov106

should incorporate Self -regulated learning instructional strategy into the curriculum of Teachers training programme so that the pre-service teachers can acquire the skills for its usage upon graduation and school administrators should organize training and workshop for in service teachers so that they can acquire the skills for its usage and encouraged to use it.

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