



## Self-Regulated Learning Strategy and Biology Students' Achievement in Population Ecology in Senior Secondary Schools in Akwa Ibom State

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### Abstract

To investigate Self-regulated learning Strategy and Biology students' academic achievement in population ecology in senior secondary schools, in Akwa Ibom State. Two null hypotheses was formulated. A pretest posttest quasi – experimental design was adopted. A population of 8,364 and sample size of 134 (71males and 63 females) SS2 Biology students was selected for the study using simple random sampling. Biology Achievement Test (BAT) consisting of 40 questions, validated by experts was used for the study. Kuder Richardson's formula 21 ( $KR_{21}$ ) was used to estimate the internal consistency which was 0.82. Descriptive statistics and Analysis of covariance (ANCOVA) were used to answer research questions and test hypotheses respectively. The result of analysis indicated that Biology students taught using self-regulated learning strategy had a higher academic achievement than those taught using the lecture method, that gender was not a determinant of Biology students' academic achievement. Based on the findings, recommendations were made among which is the need for Biology teachers to adopt and make use of self-regulated learning strategy in teaching population ecology.

**Keywords** self-regulated learning, Academic Achievement, Gender, Biology

### Introduction

Teaching and learning Biology was meant to enhance academic achievement and application of Biological knowledge in life. Biology is the study of life. It is one of the basic sciences (Biology, chemistry, physics) that is essentially needed for a nation's technological breakthrough (Chew, 2014). To develop a sound basis for modern technology, the study of Biology which enhances understanding of nature is important. Biology is one of the science subjects in Nigerian secondary school education system and it is an important subject for science students. It is a branch of science concerned with the study of life and living organisms including their structure, functioning, growth, evolution, distribution, identification and taxonomy (Miller & Levine, 2017). Without sound knowledge and wholesome attitude towards Biology, the much needed and vouched technological breakthrough may not be achieved. Due to the importance of Biology, much emphasis has been placed on instruction especially at the secondary school level. This is to ensure the understanding of the principles and objectives of Biology education as stipulated by the Federal Republic of Nigeria (FRN, 2013). Biology is therefore a stepping stone for millions of secondary school students for successful career in some areas of science such as medicine, pharmacy, Agriculture and Engineering.

In Nigeria, the secondary school Biology curriculum is designed to prepare students to acquire adequate laboratory skills, relevant knowledge in Biology and also enable students apply scientific knowledge to everyday life in matters of personal, community, health and agriculture among others (Ado & Udoh, 2018). The content of Biology has enabled the production of food as well as the production of various materials to improve health care delivery, useful in solving problems resulting from human interactions with the environment like air and land pollution (Okorie, 2018). Institute of Biology (2013) opined that Biology is indispensable in the fields of medicine, pharmacy, agriculture, brewery, geology and nursing among others Car ew (2017) also highlighted the importance of Biology to include: helping individuals to understand the parts of the body and their functions bringing into focus the need to maintain good health; understanding and appreciating life; promoting individual choice of careers; inculcating in the individual scientific skills and attitudes in his approach to personal and societal problems. The study of Biology in senior secondary schools is expected to equip students with useful concept, principles and theories that will enable them face the challenges before and after graduation (Cakir 2017). Cakir also highlighted the importance of Biology to include: helping individuals to understand the parts of the body and their functions bringing into

focus the need to maintain good health; understanding and appreciating life; promoting individual choice of careers; inculcating in the individual scientific skills and attitudes in his approach to personal and societal problems. The study of Biology in senior secondary schools is expected to equip students with useful concept, principles and theories that will enable them face the challenges before and after graduation (Cakir 2017).

Despite the benefits of the subject matter, many Biology concepts in senior secondary school curriculum are perceived to be abstract and difficult to understand by students (Ekeh, 2016). West African Examination Council (WAEC) Chief Examiner's report (2019) has also revealed that students perform poorly in some biological questions. The report further enumerated candidates' weakness as lack of mastery of subject matter, misunderstanding of questions and wrong spellings of scientific terms and poor drawing skill. This poor achievement of students in Biology however, has been attributed to a number of factors by several researchers. For instance, Akpan (2018) blamed the poor performance on the state of science education enterprise in Nigerian schools. Ekeh (2016) reported that science is presented dogmatically in most schools as a series of disjointed facts and concepts which students find difficult to relate to the real world. Okorie (2018) has identified three areas of deficiency namely: Deficiency in teaching-learning process occasioned by lack of laboratory equipment and materials; deficiency inherent in the learners and deficiency associated with poor teaching of Biology or science generally. Omatade (2016) reported that most teachers lacked the knowledge of the curriculum objectives as indicated by their failure to implement them. To motivate students to learn, the teacher must make Biology real and relevant by adopting those teaching strategies in which students participate actively in lessons, using local familiar examples to illustrate scientific concepts. Omatade (2016) noted that other reasons of students' poor achievement in public examinations is that most secondary school science teachers are using conventional teaching strategy and do not make use of appropriate instructional resources and strategies but predominantly teaching without any activity based or instructional resource.

Conventional teaching strategy refers to the traditional teaching method which is teacher-centered. It is mainly authoritarian in nature whereby teaching-learning process is not based on hands-on activities. In this teaching strategy, teachers often teach the way they were taught sometimes using the same textbook and notebook they used as students. According to Etiubon & Udoh (2017), in

conventional teaching strategy, teachers are expert information providers while students learn by rote memorization, regurgitation of facts and reproduce the fact during examinations. Okorie (2018) opined that the conventional way of science teaching is based on the assumption that students are passive subject that store what they learnt as a result of repeated practice and reinforcement which may not which may not be used to teach activity based concept like population ecology.

Population ecology is a branch of Biology which studies the dynamics of species populations and how these populations interact with the environment (Michael 2019). It is the study of how the population sizes of species, changes over time and space (Orrock 2018). Population Ecology has its deepest historic roots, and its richest development in the study of population growth, regulations and dynamics or demography. It is an important aspect of Biology as it is concerned with the ecosystem as well as the interaction of species. Thus, it requires the use of appropriate instructional strategies to bring about a better understanding, reduce any form of abstraction, increase interest as well as academic achievement of students. Akpan (2018) asserted that students Achievement in sciences can be fostered through the use of appropriate teaching strategies and these strategies should be such that would enhance interest and better achievement through interaction, and bring about collaboration among students.

Self-regulated learning strategy refers to an active constructive process whereby Learners set goals for their learning and then attempt to monitor, regulate and control their cognition, motivation and behaviour. (stanikzai, 2019). It is usually guided and constrained by their goals and the contextual features in the environments. It is an interactive approach that is capable of arousing students' interest, bring about collaboration among students. Ergen (2017) conducted a research on the effect of corelationship of Self-regulated learning strategies and students academic achievement in Biology and posited that self-regulated learning strategy has effect on a academic achievement of students in Biology. Perry et.al (2018) pointed that Self-regulated learning strategy is effective in term of education responsibilities and these responsibilities are often neglected in science education because students' motivation towards and participation in lessons is usually a challenging task for in-class teaching. However, students become more enthusiastic to learn when learning takes place in a fun and interactive way. Hadwin et.al (2018) conducted a research on effect of Self-regulated learning strategy on academic achievement of students. they found out

that Self-regulated learning strategies was effective in improving the academic achievement of students. According to them, as an interactive approach it could boost active learning and motivation and also encourage teamwork. It has an important role in realizing active learning since it is both interactive and distinctive. (Butler & Cartier 2019). Self-regulated learning strategy not only make learning more brain Storming but also encourage students' in-class participation and foster their attitudes towards learning. Moreover, students who are motivated and included in the teaching process can have a more successful learning outcome, yielding a permanent body of knowledge which can later be recalled irrespective of gender. Haman and Brown (2022).

Gender in this study refers to the state of being male or female. It is the range of physical, biological, mental and behavioural characteristics pertaining to and differentiating between the feminine and masculine population (Akanwa, Ndirika & Udo 2018). The issue of gender is an important one in science education especially with increasing emphasis on ways of boosting manpower for technological development it is considered by many as having effect on the academic achievement of students in sciences (Amedu, 2015). The question of gender is a matter of grave concern especially among academic and policy formulators. Intellectuals are worried about the role of male and female in the psychological, political, social, economic, religious, scientific and technological development of a nation. (Nkok & enang 2022). For this reason, the researcher seeks to find out the effects of Self-regulated learning, lecture method and gender on students' academic achievement in population ecology in Akwa Ibom state of Nigeria.

### Research Questions

1. What are the differences in the mean achievement scores of students taught Population Ecology using self regulated learning strategy and those students taught using the lecture method.
2. What are the differences in the mean achievement scores of male and female Biology students taught population ecology using self regulated learning strategy?

### Hypotheses

- H<sub>01</sub>. There is no significant difference in the mean achievement scores of Biology students taught Population Ecology using self regulated learning strategy and those taught using the lecture method.
- H<sub>02</sub> There is no significant difference in the mean achievement scores of male and female Biology students taught population ecology using self-regulated strategy.

### Materials and Methods

A pretest posttest quasi-experimental design was adopted and used for the study. The population for the study comprised all 8,364 SS2 Biology students of 2023/2024 academic session from the three (3) local education zones in Akwa Ibom State. A simple random sampling was used to select two schools in the study area and to assign schools to experimental and control groups. A sample size of 134 Senior Secondary two (SS2) Biology students comprising of 71 males and 63 females. With 65 Biology students in the experimental group and 69 Biology students in the control group. Biology Student in experimental group were exposed to self-regulated learning strategy while Biology students in the control group were exposed the lecture method. Topics used for this experiment where: Trophic level, species interaction, balance in nature and ecological succession. Biology Achievement Test (BAT) was the instruments used to collect data for the study. The instrument consisted of 40 objectives questions adapted from West African Examination Council (WAEC) of Nigeria. It was validated by two (2) experts. Kuder Richardson's formula 21 (KR<sub>21</sub>) was used to determine the internal consistency of the instrument which was 0.82. Each question had 4 options with only a correct answer. Each correct answer was scored two and a half marks and incorrectly answered question was scored zero mark. Before the commencement of the experimental procedure, a pretest was administered to both experimental and control group and a posttest after the experimental procedure to both experimental and control group. Mean and standard deviations were used to answer research questions while Analysis of covariance (ANCOVA) was used to test hypotheses at 0.05 level of significance. Hypothesis were rejected when the calculated *f* value was greater than the significant level and was retained if the calculated *f* value was less than the significant level.

**Results**

**Table 1: Mean and Standard Deviation of pre-test and Post test Academic scores of students taught Population ecology using self-regulated learning strategy and lecture method**

Instructional Strategy	Pre-test			Post-test		Mean Difference
	N	$\bar{X}$	SD	$\bar{X}$	SD	
Self-regulated learning	65	22.28	5.78	65.42	6.48	43.14
Lecture method	69	22.23	5.64	52.74	4.78	30.51

Results in Table 1 shows that the mean pre-test scores of students' taught population ecology as a concept using self-regulated learning strategy and lecture method are 22.28 and 22.23 respectively with standard deviation scores as 5.78 and 5.64 respectively. Their respective mean post-test scores are 65.42 and 52.74 with standard deviation scores as 6.48 and 4.78 respectively.

The table also shows that the mean difference of students scores taught using self-regulated learning strategy and lecture method are 43.14 and 30.51 respectively. It can be inferred from the result in table 1 that biology students taught with self-regulated learning strategy performed better than those taught using the lecture method.

**Table 2: Analysis of covariance (ANCOVA) of students' post-test scores classified by instructional strategies (self-regulated learning and lecture method) with pre-test scores as covariate**

Source of variation	SS	DF	MS	Fcal	P-value
Corrected model	22547.01	12	1878.92	146.27	.000
Intercept	22261.02	1	22261.0	215.41	.000
Covariate (pre-test)	3561.72	1	3561.72	277.28	.040
Main effect (instructional strategies)	521.90	2	260.95	20.32	.000
Error	6872.23	227	12.85		
Corrected total	26406.56	239			

NS = Not Significant at .05 level of significance

\* Significant at p<0.5

Results in Table 2 shows that the f-value (20.32) having a p-value (.000) of the main effects of strategies is less than the significant level (0.05), therefore, the null hypothesis one is rejected. The rejection of the null hypotheses implies that there

exist a significant difference in the mean achievement scores of Biology students taught population ecology using self-regulated learning strategy and those student taught using lecture method.

**Table 3: Mean and Standard Deviation of male and female biology students pre-test and Post test scores taught Population ecology using self-regulated learning strategy**

Instructional Strategy	Gender	Pre-test			Post-test		Mean Difference
		N	$\bar{X}$	SD	$\bar{X}$	SD	
Self-regulated learning	Male	32	22.35	5.54	64.54	6.66	42.19
	Female	33	22.30	6.36	67.78	7.04	45.48

As shown on Table 3, male students taught population ecology using self regulated learning strategy had a pretest mean score of 22.35 and a posttest mean score of 64.54 with standard deviation 5.54 and 6.66 respectively while their female counterpart had a pretest mean score of 22.30 and a posttest mean score of 67.78. with standard deviation 6.36 and 7.04

respectively .mean difference achievement scores of male students taught population ecology using self-regulated learning strategy is 42.19 and their female counterpart is 45.48. It can be inferred in the table that female students taught population ecology using self-regulated learning strategy achieved higher than their



male counterparts when taught using self regulated learning strategy as well.

This indicates that self-regulated learning strategy proved to be more effective in improving the

mean achievement scores of female students in population ecology than their male counterparts.

**Table 4: Analysis of covariance of academic achievement of students taught population ecology using self-regulated learning strategy based on gender**

Source of variation	SS	DF	MS	F-value	P-value
Corrected model	19534.34	12	1627.86	53.77	.00
Covariate (pre-test)	270.99	1	63.59	8.95	.13
Main effect (instructional strategies)	9571.86	2	4785.93	158.09	.06
Gender	549.63	1	549.63	18.16	.08
Error	26406.56	27	30.27		
Corrected total	26406.56	239			

NS = Not Significant at .05 level of significance

\* Significant at  $p < 0.5$

As shown in Table 4, the f-value (.08) is greater than the alpha level (.05). Therefore, the null hypothesis two is not rejected. This implies that there exists no significant difference between the academic achievement of male and female biology students taught population ecology using self-regulated learning strategy

### Discussion

Students taught population ecology using self regulated strategy had a mean gain of 43.14 compared to students taught population ecology using the lecture method with a mean gain of 30.51. This indicates that students taught population ecology using Self regulated learning strategy achieved better. This implies that there was a significant difference in the academic achievement of students in the experimental and control groups. The result of this study revealed that students taught population ecology using self regulated learning strategy achieved higher than students taught using the lecture method. This result is in tandem with Ergen 2017 whose study on the influence of self regulated learning strategies on students academic achievement, conceptual understanding and motivation in Biology, was found to be effective. From the study it was revealed that self regulated learning strategy has a large effect on academic achievement of Biology students. The reason behind the superlative achievement of this study could be as a result of the fact that Biology conceptualization was enabled through self regulated learning strategy.

Furthermore, male and female students had a mean difference of 42.19 and 45.48 respectively. This indicates that female students had a higher mean than their male counterpart but from analysis, the main effect of gender and interaction effect with learning strategies were not significant. This means that using

self regulated learning strategy was sensitive to overcoming gender bias. This is in agreement with Godspower and Ihenko 2017 and Stanikzai 2019 who examine the influence of gender on academic achievement in Biology students and reported that gender has no significant influence on academic achievement of male and female students in Biology. Stanikzai 2019 further stated that self regulated learning strategy considers the need of male and female students during the teaching and learning process and consequently closes gender gap. This is in contrast with Amedu, 2015 who observed that male students outperformed their female counterpart in terms of academic achievement in Biology.

### Conclusion

This study investigated the effects of self-regulated learning strategy and lecture method on Biology students' academic achievement in senior secondary schools in Akwa Ibom state. From the result self-regulated learning strategy was seen to enhance significantly students' academic achievement in Biology than the lecture method. Therefore, the strategy should be used in the teaching and learning process to enhance academic achievement. Gender was found to be non significant from the result. Therefore this study has provided grounds to dislodge gender stereotype since academic achievement in Biology was not susceptible to gender.

### Recommendations

The following recommendations were made:

1. Biology teachers should intensively make use of self-regulated learning strategy since it was found to enhance academic achievement devoid of gender.

2. Government should organize seminars and workshop to sensitize Biology teachers on the use of innovative and interactive strategies such as self-regulated learning in teaching Biology in the classroom.

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