Enhancing Secondary School Students' achievement and Interest in Biology through Self-Regulated Learning Strategy

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ABSTRACT

This study focused on enhancing biology students' achievement and interest through self-regulated learning strategy in secondary schools. The study adopted the quasi-experimental pre-test, post-test control group design. Four research questions and four research hypotheses guided the study. The population of the study was all biology senior secondary school II (SS II) students in government-owned public schools in Anambra North Senatorial Zone (6,421).The study comprised 245 senior secondary form II students, randomly selected from four (4) public coeducational schools. The instruments used for data collection were the Biology Achievement Test (BAT) and Biology Interest Questionnaire (BIQ). BAT and BIQ were validated and their reliability established using Kuder-Richardson formula 21 and Cronbach respectively at 0.75 and 0.80. Data obtained were analysed using mean, standard deviation for the research questions and Analysis of Covariance (ANCOVA). The result showed that SRL strategy significantly enhanced students' achievement in biology compared to the lecture method; there was no significant difference between the mean achievement score of male and female students taught biology using SRL strategy; there was a significant difference in mean interest score of students taught using SRL strategy and those taught using lecture method; there was no significant difference between the mean interest score of male and female students taught biology using self-regulated learning strategy. Based on the findings it was concluded that self-regulated learning strategy significantly enhances students' achievements and interest in biology. It was therefore recommended that biology teachers should adopt the strategy in teaching biology at the secondary school level and that biology teachers should be trained on how to use the skills of self-regulated learning strategy effectively.

Keywords: Biology, Self Regulated Learning Strategy SRLS, Achievement and Interest

Introduction

The industrial and technological development of any nation depends to a large extent on the level of scientific education of her citizens. The central purpose of science learning is conceptualized as developing scientific literacy in students (Dani 2019). The role of science in the development of any nation cannot be overemphasized since the level of scientific attainment of a nation has always been a very important index for measuring its level of development. This, in turn, determined the country's level of socio-economic as well as industrial development. One of the major subject areas necessary for such advancement is biology.

Biology is a branch of science structured to equip students with the knowledge of relevant concepts and scientific skills (Fowler et al 2013). It also aimed at developing broadly applicable skills such as problem-solving, communication, critical thinking and objective reasoning abilities to enable students prepare to meet challenges they will face in a competitively driven world economy (Federal Ministry of Education FME, 2008). With this objective of the curriculum, students are expected to be useful and productive members of the society. In order to achieve these objectives of biology, the teaching approach should promote students to assume responsibility and control over their acquisition of knowledge and skills. Thus, students should become masters of their learning thereby controlling what, how, why and when they learn.

Self-regulated learning strategy is an active constructive process whereby learners set goals for their learning and attempt to monitor, regulate and control their cognition, motivation and contextual features in an environment (Cortney, 2022). It is an act of learning that is guided by metacognition (thinking about one's thought), strategic action (planning, monitoring and evaluating personal progress against standards) and motivation to learn to make the process of control and to evaluate one's own learning and behaviour. Unfortunately, the system of education falls short of self-regulation principles because teachers tend to emphasise theoretical presentation of biological concepts at the expense of the practical aspects which are weightier and more rewarding (Nwagbo, 2017). According Garmabi and Zarein (2017) reports that self-regulated learning significantly improved students' achievement. In another Orue and Arslen (2016) asserted that self regulated strategy significantly increases the metacognitive thinking skills and achievement of students.

Achievement is a thing done successfully with effort, skill, or courage. Yukselturk and Bulut (2019) opine that achievement studies have shown that feeling a sense of accomplishment is an important element in students developing positive wellbeing over time. Research also shows the following: People with a strong sense of purpose, persistence and accomplishment perform and achieve better at work. The authors further

assert that there is no significant difference between the mean achievement scores of male and female students taught using a self regulated learning strategy. in addition, Anyichie and Onyedike (2012) opine that male achieve significantly better than their female counterpart when taught biology in a class room setting because of the genders high interest in that area.

Interest is the feeling wanting to know or learn about some especially in science areas like biology. According to Anyichie and Onyedike (2012) interest is a powerful motivational process that energizes learning, guides academic and career trajectories, and is essential to academic success. Interest is both a psychological state of attention and affect toward a particular object or topic, and an enduring predisposition to reengage over time especially in science subjects. Ozdemir and Arlan (2016) reported that self regulated learning strategy significantly enhances students' interest in learning health science. Orue and Arslan (2016) reported that there was no significant difference between the mean interest scores of students taught using self-regulated learning strategy and lecture method in teaching some topics in selected science subjects.

 Thus, the lecture method of teaching which is commonly used by most biology teachers does not offer the students the opportunity for active participation, critical thinking, and executive control of their own learning. To promote self-regulated learning strategy in the classrooms the teacher must teach students the self-regulated processes that facilitate learning. This process includes goal setting, planning, self-motivation, attention, control, self-monitoring, self-evaluation, appropriate help-seeking and flexible use of learning strategies. The inability of students to apply the self-regulatory skills may also be a factor which affects their achievement and interest in Biology.

West African Examination Council (WAEC) Chief Examiners 'reports (2019) outlined a number of reasons why students performed poorly in 2019 senior secondary school certificate examinations (SSCE). Among the reasons given were: (i) inability to explain why a Rhesus negative man should not marry a Rhesus positive to avoid losing her second pregnancy (ii) poor grasp of genetics (iii) not given title to diagrams (iii) poor diagrams (iv) inability to cross the genetics questions properly (v) poor performance in questions that require application knowledge. Based on Chief Examiners' WAEC report, this study focused on Rhesus factor to examine the extent to which SRL will enhance students' understanding of Rhesus factor and its implications in families, especially as marriage and children are very important among the people of the area of this study.

According to Arsal (2019) Rhesus factor cam make individual to be unhappy in the areas of health, marriage, or even inability to have healthy children with your spouse. The author went further to opine that if an Rh-negative female marries an Rh-positive male, there is a possibility they will have an Rh-positive baby. This condition can lead to Rh isoimmunization, which means during the baby's development in the womb, baby's blood might enter mother's body. This situation can increase the possibility of producing antibodies in the mother's body. And as the baby's Rh positive blood is foreign for the mother's immune system, it can visit across the placenta and enter the baby's blood which can destroy the baby's Rh-positive red blood cells. The baby can become prone to various diseases like anemia and jaundice (Ozdemir & Arslam, 2016). According to Ozdemir and Arslam (2016) if the parents are well regulated, there is every tendency that the outcome of the baby could be averted and that is one of the numerous functions of SRL. On this note the researcher tends to investigate enhancing secondary school students' achievement and interest in biology through self-regulated learning strategy in Anambra north senatorial districts

Research Questions

1. What are the mean achievement scores of students taught biology using a self-regulated learning strategy and those taught using the lecture method?
2. What are the mean scores of male and female students taught biology using a self-regulated learning strategy?
3. What are the mean interest scores of students taught biology using a self-regulated learning strategy and those taught using the lecture method?
4. What are the mean interest scores of male and female students taught biology using a self-regulated learning strategy?

Research Hypotheses

The following hypothesis raised from the research questions were tasted at 0.05 level of significance:

1. There is no significant difference between the mean achievement scores of students taught biology using a self-regulated learning strategy and those taught using the lecture method.
2. There is no significant difference between the mean achievement scores of male and female students taught biology using a self-regulated learning strategy.
3. There is no significant difference between the mean interest scores of male and female students taught biology using self-regulated learning strategy and those taught using the lecture method.
4. There is no significant difference between the mean interest scores of male and female students taught biology using the self-regulated learning strategy.

Population

The population of the study was six thousand, four hundred and twenty-one students (6,421),
which comprised all Senior secondary form 2 biology students in senior secondary schools in Anambra North Senatorial Zone.

Methodology

The design adopted for the study was quasi– experimental research design. The sample consists of 245 SS2 biology students selected from Onitsha education zones. The purposive sampling technique was used for the selection of the four co –educational school from the zone. Two schools were used for the experimental group (self regulated learning strategy) comprising 124 students (60 male and 64 female) while the other two were used for control group (lecture method) comprises 121 students (59 male and 62 females). The criteria being that the schools must have presented candidates for West African Senior School Certificate Examination (WASSCE) for at least three times. Secondly, the school must have a qualified biology teacher with at least five years experience. The study covered a period of five weeks. First week was for familiarizing visit and training of the biology teachers in the selected schools who act as research assistants. First day of the second week was used to administer a pretest achievement test and a questionnaire to ask questions on the interest of the biology students involved in the study. Second day of the second week was used to teach the biology concept in both selected schools for experimental groups using self regulated strategy method (SRSM) and control group using lecture method (LM) for three weeks. The biology teachers were given detailed information and instructions concerning the study. Each teacher used the lesson notes prepared by the researcher for both the experimental (SRSM) and control groups (LM). At the end of the fifth week, both experiment SRSM and control group LM were post tested base on what they are taught. Equally, the same questionnaire given in pre test was given to the students before the post test but this time rearranged. Marks were awarded to each question prepared for both experiment test group and control group achievement test which constituted twenty (20) questions. If all the questions were answered correctly by the student, his entitled to hundred (100) marks. The pretest score as well as post test scores in both SRSM and LM group in each sitting had 100 marks. The pre test scores were recorded as achievement of the students grouped as well as the pre responses from interest questionnaire was recorded too to determine their means responses of the students in both groups. Post test scores were recorded as achievement of the students when taught with SRSM and LM in both groups and post responses from post questionnaire were also recorded as interest when taught with SRSM and LM in both groups using four point scale of Strongly Agree (SA) = 4, Agree (A) = 3, Disagree (D) = 2 and Strongly Disagree (SD) = 1. Data collected was used for analysis.

Instrument

Based on the test for achievement and questionnaires for interest designed by the researchers, the two instruments were titled Biology Achievement Test (BAT) and Biology Interest Questionnaire (BIQ).

The BAT was produced base on the biology concept of skeleton, photosynthesis and reproduction and BIQ was produced base on the perceived, interest of biology students. To ensure the reliability of the instrument, the twenty (20) objective achievement questions and twenty (20) item questionnaires were administered on a group of twenty students outside the place of this study. The results were subjected to Kuder 20 Richardson and Cronbach alpha technique test to determine the reliability coefficient. A mean coefficient of 0.74 and 0.81 were obtained indicating that the instruments were reliable. In both achievement scores and interest scores in both groups, the date obtained from the pretest and post test were analyzed using mean, standard deviation for research questions and Analysis of Covariance (ANCOVA) to test the hypotheses.

Result

The result of this study was presented in line with the research questions and the hypotheses as follows.

Table 1: Mean and standard deviation of pre-test and post-test achievement scores between students taught Biology using self-regulated learning strategy and lecture method.

Group	N	Pre-test Mean	3D	Post-test Mean	SD	Mean gain
Self-regulated strategy	124	28.36	6.40	52.21	11.511	29.21
Lecture	121	28.42	7.20	46.42	9.86	20.42

Table 1 shows a mean achievement pre-test score of 28.36, with a standard deviation of 6.40 for students taught biology with self-regulated strategy while those taught with lecture method had a mean achievement score of 28.42 with a standard deviation of 7.20. As for the post-test, students taught biology using a self-regulated learning strategy had a mean achievement score of 52.21 and a standard deviation of 11.50 while their counterparts taught with lecture method had a mean score of 46.42 with a standard deviation of 9.86. From the table, students in the self-

regulated learning strategy had a higher mean gain of 29.21 while their counterparts in the lecture group had a mean gain of 20.42.

Table 2: Mean and standard deviation of pre-test and post-test achievement score of male and female students taught biology using self-regulated learning strategy.

Sex	N	Pre-test		Post-test		Mean gain
		Mean	SD	Mean	SD	
Male	60	30.60	5.60	59.50	12.51	27.82
Female	64	27.42	6.84	59.61	12.65	30.42

Table 2 shows a mean achievement pre-test score of 30.61 with a standard deviation of 5.60 for male students taught biology using a self-regulated learning strategy, while the female had 27.42 mean achievement scores with a standard deviation of 6.84. As for the post-test, male students had 59.50 mean achievement scores with a standard deviation of 12.51 while the female had a mean achievement score of 59.61 with a standard deviation of 12.65. The female students had a higher mean achievement gain of 30.42 compared to their male counterparts which had a mean achievement of 27.82.

Table 3: Mean and standard deviation of pre-test and post-test interest score between students taught biology using self-regulated learning strategy and lecture method.

Group	N	Pre-test		Post-test		Mean gain
		Mean	SD	Mean	SD	
Self-Regulated Strategy	124	21.21	8.20	52.42	6.20	32.12
Lecture	121	20.40	8.55	50.14	8.14	30.17

Table 3 shows a mean interest pre-test score of 21.21 with a standard deviation of 8.20 for students taught biology using a self-regulated learning strategy. While students taught with lecture method had a mean interest pre-test score of 20.40 with a standard deviation of 8.55. As for the post-test score, students taught with a self-regulated learning strategy had a mean interest score of 52.42 With a standard deviation of 6.20 while their counterparts taught using lecture method had a mean score of 50.14 with a standard deviation of 5.19. Students in the self-regulated learning strategy had a higher mean interest gain of 32.12 compared to their counterparts in the lecture group which had a mean interest gain of 30.17.

Table 4: Mean and standard deviation of pre-test and post-test interest score of male and female students taught biology using self-regulated learning strategy

Sex	N	Pre-test		Post-test		Mean gain
		Mean	SD	Mean	SD	
Male	60	22.64	7.24	55.26	6.20	33.25
Female	64	20.25	9.21	54.20	6.11	34.31

Table 4 shows a mean interest pre-test score of 22.64 with a standard deviation of 7.24 for male students taught biology using self-regulated learning strategy while the female counterparts had a mean interest score of 20.25 with a standard deviation of 9.21. As for the post-test, the male students had a mean interest score of 55.26 with a standard deviation of 6.20 while the female had a mean interest score of 54.20 with a standard deviation of 6.11. The female students in the self-regulated learning group had a slightly higher mean interest gain of 34.31 compared to their counterparts which had a mean interest gain of 33.25.

Table 5: ANCOVA comparison of post-test achievement score of students taught biology using self-regulated learning strategy and lecture method.

	Sum of squares	Df	Mean square	F	Sig
Between groups	6351.334	1	6351.334	52.310	.000
Within groups	22416.984	244	139.194		
Total	34029.117	245			

Table 2 shows that there is a significant difference between the mean achievement post-test score of students taught biology using a self-regulated learning strategy and those taught using a lecture method in favour of students taught using a self-regulated learning strategy.

Table 6: ANCOVA comparison of post-test achievement score of male and female students taught biology using self-regulated learning strategy.

Source	Type III sum of square	Df	Mean square	F	Sig
Corrected model	66.121	2	34.065	.211	810
Intercept	21127.762	1	21127.762	136.879	.000
Pre	65.244	1	65.244	.416	.000
Sex	317	1	.317	.003	.960
Error	20223.369	243	151.624		
Total	36604.000	245			
Corrected total	20291.500	245			

From the table, a non-significant difference was found between the mean achievement post-test score of male and female students taught biology using self-regulated learning strategy.

Table 7: ANCOVA comparison of post-test interest score of students taught biology using self-regulated learning strategy and lecture method.

	Sum of square	Df	Mean square	F	Sig
Between group	315.461	1	315.461	3,460	.035
Within group	15217.424	244	63.725		
Total	17075.271	245			

Table 7 shows a significant difference between the mean interest post-test score of students taught biology using self-regulated learning strategy and those taught with the use of lecture method in favour of students taught with the use of lecture method in favour of students taught using self-regulated learning strategy.

Table 8: ANCOVA comparison of post-test attitude score of male and female students taught biology using self-regulated 'learning strategy.

	Sum of squares	Df	Mean square	F	Sig
Between group	2.267	1	2.267	.045	.832
Within group	5617.129	244	50.291		
Total	5617.129	245			

Table 8 shows a non-significant difference between the mean interest post-test score of male and female students taught biology using a self-regulated learning strategy.

Discussion of Results

The result of this study has indicated that there is a significant difference between the mean achievement scores of students taught biology using a self-regulated learning strategy and those taught using a lecture method in favour of students taught using a self-regulated learning strategy. The finding was in agreement with Olakanmi and Gumbo (2017) who reported that self-regulated learning significantly improved student achievement. This was also in line with Orue and Arslan (2016) who reported that self-regulated learning strategy significantly increases the metacognitive thinking skills and achievement of students. This positive outcome in favour of self-regulated learning strategy was the fact that the strategy has the capacity to arouse and sustain students' motivation and interest as well as helping students to develop learning skills.

The study also showed a non-significant difference between the mean achievement scores of male and female students taught biology using a self-regulated learning strategy. This indicates that the strategy is not gender bias, which was in conformity with Yukselturk and Bulut (2019). However, there are contradictions with views of Anyichie and Onyedike (2012) who reported that males performed significantly better than their female counterparts.

Another finding revealed that there is a significant difference between the mean interest score of students taught biology using self-regulated learning strategy and those taught using the lecture method in favour of students taught using the self-regulated learning strategy. These findings are in agreement with Ozdemir and Arslan (2016) who reported that self-regulated learning strategy significantly enhances students' interests which was contested by Orue and Arslan (2016) who reported that there was no significant difference between the mean interest scores of students taught using self-regulated learning strategy and lecture method.

The study finally showed a non-significant difference between the mean achievement score of male and female students taught biology using a self-regulated learning strategy. This was in agreement with Garmabi and Zarein (2016) and Rahman (2011) who reported a non-significant difference in the interest score of male and female students taught biology using a self-regulated learning strategy.

Conclusion

Based on the discussion and findings of the study, it can be concluded that a self-regulated learning strategy significantly improves students' achievements in biology compared to the lecture method as well as enhancing students' interest towards biology. There is, therefore, the need to acknowledge that self-regulated learning strategy plays a significant role in the study of biology. And should be adopted. Biology teachers, therefore, need to be groomed on the requisite skills needed for effective implementation.

Recommendations

1. Biology teachers should adopt the self-regulated learning strategy in teaching biology at the secondary school level
2. Biology teachers should be trained on how to effectively use self-regulated learning strategy skills and also to acquaint them with the importance of the strategy.
3. The government should provide an enriched learning environment in schools to facilitate the use of the strategy.

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