



EFFECTS OF SELF-LEARNING AND EXPLICIT INSTRUCTIONAL STRATEGIES ON THE ACHIEVEMENT OF BIOLOGY STUDENTS IN DELTA CENTRAL SENATORIAL DISTRICT, NIGERIA

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Abstract:

This study was carried out to investigate the effects of self-learning and explicit instructional strategies on the achievement of biology students in Delta Central Senatorial District. The study adopted the pre-test post-test control group quasi-experimental design. Seven research questions and seven hypotheses were raised and formulated to guide the study, respectively. A sample of three hundred and thirty-five senior secondary II students randomly selected from six public mixed secondary schools using simple random sampling techniques was used for the study. The instrument used for data collection was the Biology Achievement Test (BAT). The reliability of the BAT was established using Kuder-Richardson formula 21 which yielded a coefficient of 0.87. The data obtained were analysed using Means, Standard Deviation, paired sample t-test, Scheffe post hoc test and Analysis of Covariance at 0.05 level of significance. The results obtained revealed that there was a significant effect of self-learning and explicit instructional strategies on biology students' achievement, compared to the lecture method; there was a significant difference in the achievement of biology students taught with self-learning and explicit instructional strategies in favour of students taught with explicit instructional strategy; there was no significant difference between the mean achievement scores of male and female students taught biology using self-learning and explicit instructional strategies; there was no significant effect of the interaction of teaching method and sex on biology students achievement. Based on the findings, it was concluded that self-learning and explicit instructional strategies are effective strategies in boosting students' achievement in biology. It was, therefore, recommended that science teachers, especially biology teachers, should expose biology students to self-learning and

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explicit instructional strategies that promote active participation and ultimately enhance achievement.

Keywords: self-learning instructional strategies: explicit instructional strategies: biology achievement; students

1. Introduction

Biology is a natural science, which entails the study of life and living organisms around us. It is a vast subject, which describes different features of living and non-living things, about the human body anatomy, which includes different types of cells, tissues, muscular system, types of teeth, types of joints, types of organs and how our organs function to keep us healthy and alive. Biology teaches us about plants and how they can be beneficial to us. It has made a great contribution to the existence of life on Earth. Therefore, the subject is introduced in all higher classes for those who are interested in studying science-related courses. This helps in building a strong foundation in the subject; build their career based on their interest and in the future. Biology serves as a core subject for many science disciplines among which are human medicine, veterinary medicine agriculture, food technology, pharmacy, anatomy, botany, zoology, genetics, biotechnology, microbiology and immunology.

Biology as a science subject is structured to equip students with the knowledge of relevant concepts and scientific skills (Onyegegbu, 2012). It also aimed at developing broadly applicable skills such as problem-solving, communication, critical thinking and objective reasoning abilities. This is to enable students to prepare for workplace self-sustainability in the world economy (Federal Ministry of Education FME, 2008). The goal of biology education is to arm students with the knowledge they need to influence or alter their environment for the betterment of themselves, their families, and their communities. In general, the importance of Biology to humanity is outlined as follows:

- The learning of Biology helps us to know how to use natural resources more efficiently in industry e.g in biotechnology, food production, building, textile and paper industries.
- The learning of Biology helps us to understand changes in the environment and the factors affecting these changes, in order to know how human needs are influenced.
- The learning of Biology is important in helping mankind to find effective ways of preventing, treating and curing diseases and home management techniques e.g., better methods of food preservation, efficient food preparation and care of the family.
- The learning of Biology is important in helping the improvement of agricultural yields through scientific innovations.

With this objective of the curriculum, students are expected to be useful and productive members of society. In order to achieve these objectives of biology, the

teaching approach applied should prompt 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. The teaching and learning situation of Biology in Nigeria has been faced with many problems as it is applicable to all science subjects in the school curriculum. Despite the importance of biology among Nigerian students, the performance of secondary school students in biology has been poor. This poor performance can be attributed to the ineffective teaching method. The West African Examination Council (WAEC) Chief Examiner's Report (2018-2019) points out that among the factors that cause low achievement of students in Biology is the poor instructional delivery approach adopted by the biology teacher. In the same vein, Obiekwe (2010) identified several factors that contribute to the level of difficulty in the teaching of science and the poor performance of students in public and internal examinations. These factors include teaching methods, lack of qualified teachers and teacher's effectiveness. The teaching method, which is one of the factors responsible for the poor performance of students in public examinations can be attributed to the lecture method because it is the predominant approach used by teachers in the teaching and learning process.

The lecture method of teaching is the oldest teaching method applied in most secondary schools; it is a teacher-centered method where the teacher does the talking and the students passively listens. It is commonly used by most biology teachers which does not offer the students the opportunity for active participation and does not promote meaningful learning of biology concepts. Abimbola (2013) agreed that the teacher centred methods of teaching science which is predominant in Nigerian secondary schools are not effective. Also, Olatoye & Adekoya (2010) in previous studies relating to methods of teaching science in Nigerian secondary schools also express their opinion that the conventional method of teaching science is ineffective. The lecture method of teaching does not make student to be active during the course of instruction. It is hoped that making students take responsibility for their own learning through a self-learning strategy may enhance students' academic achievement in biology. Therefore, the use of another instructional approach such as self-learning and explicit instructional strategy of teaching is employed to enable the students to be actively involved during the course of instruction and thus may help improve achievement.

Self-learning is an instructional strategy which involves using instructional materials by students. It has the following characteristics: provision for response; feedback and testing, so that students can learn either without teacher's intervention or with a minimum of teacher guidance (Akinmoyewa, 2003). Learning to regulate and assess one's own learning and behavior is a process that is motivated by metacognition, or thinking about one's own thinking, strategic action, or planning, monitoring, and assessing one's progress against standards.

Self-learning can be defined as the student's involvement in learning to the degree that the student uses his or her learning skills to learn and discover more information on his or her own (Bruner, 1961). It is also a method of teaching, where teachers provide

opportunities for students to become independent thinkers who are ready to accept responsibilities for their own learning. Self-learning may also be called self-instruction and it is a technique which involves the use of instructional materials designed for students to learn. This does not exclude working with a peer, nor having a teacher as a guide or a teacher providing the least amount of basic information in order for the student to tackle, master a learning goal, and achieve student success. A teacher using self-learning as a *modus operandi* would structure the lesson around student self-learning with minimal frontal teaching. Self-learning is a learner-centered strategy. Studies conducted by Akanbi and Kolawole (2014) showed that self-learning strategy improved students' achievement in biology.

The second strategy that allows students to participate actively in the classroom is the explicit instructional strategy. An explicit instructional strategy is a form of teacher-directed education that includes a series of practice-focused, highly organized supports. Serafini (2004) described explicit instructional strategy as a direct, systematic, structured and effective approach to teaching basic academic skills. The explicit instructional strategy involves modelling, observation, imitation or practice and corrective feedback during the course of instruction. The explicit instruction process moves systematically from massive teacher involvement and little student responsibility initially, to total student responsibility and minimal teacher involvement at the conclusion of the learning cycle.

The explicit instructional strategy involves directing students' attention toward specific learning in a highly structured environment. This instructional strategy is focused on producing specific learning outcomes. Smaller components of topics and materials are taught separately. At the same time, practice, explanation, and demonstration are all involved. Guidance and organized frameworks are given to the students. Topics are taught in a logical order and directed by the teacher. Another important characteristic of the explicit instructional strategy involves modeling skills and behaviors and modeling thinking. In doing so, the teacher must speak aloud while she solves issues and walks students through procedures. Students' focus is crucial, and successful learning depends on listening and observing others. Researchers such as Olagunju and Babayemi (2014) found that the use of explicit instructional strategy is effective in the science classroom as it enhances achievement among science students.

Another factor that could influence a student's achievement in biology is sex. Sex refers to a state of being male or female. It is the difference in the biological and physiological characteristics of males and females. The term 'sex' is a physical differentiation between the biological male and biological female. It is a trait that determines an individual function.

Sex which is the moderating variable in this study has been identified as a predicting factor which affects students' achievement. Frank (2010), in his study of sex differences in mathematics and self-learning on students' achievement in secondary school Biology, found that girls performed significantly better than boys. Studies on instructional approaches and sex performances in science show conflicting and

inconclusive findings. While some findings allege male superiority (Chun, 2015), others allege female superiority (Virtanen & Nevgi, 2010) and still others report zero effect of sex (Obi and Oghenejode, 2010).

Considering the characteristics of self-learning and explicit instructional strategies, this study aimed at determining their effect on students' achievement. Also, the study finds out if there were variations in students' achievement as regards sex. It is against this background that this study was directed towards determining the effects of self-learning and explicit instructional strategies on the achievement of biology students in Delta Central Senatorial District.

2. Research Questions

The following research questions were raised to guide this study:

- 1) What is the effect of self-learning strategy on biology students' achievement?
- 2) What is the effect of explicit instructional strategy on biology students' achievement?
- 3) Do differences exist between the mean achievement scores of biology students taught with self-learning and explicit instructional strategy?
- 4) Do differences exist between the mean achievement scores of biology students taught with self-learning, explicit instructional strategy and lecture method?
- 5) Do differences exist between the mean achievement scores of male and female students taught biology using the self-learning strategy?
- 6) Do differences exist between the mean achievement scores of male and female students taught biology using the explicit instructional strategy?
- 7) What is the effect of the interaction between teaching method and sex on biology students' achievement?

2.1 Hypotheses

The following hypotheses were tested at a 0.05 level of significance:

- 1) There is no significant effect of self-learning strategy on biology students' achievement.
- 2) There is no significant effect of explicit instructional strategy on biology students' achievement.
- 3) There is no significant difference in the mean achievement scores of biology students taught with self-learning and explicit instructional strategy.
- 4) There is no significant difference in the mean achievement scores of biology students taught with self-learning, explicit instructional strategy and lecture method.
- 5) There is no significant difference in the mean achievement scores of male and female students taught biology using the self-learning strategy.
- 6) There is no significant difference in the mean achievement score of male and female students taught biology using explicit instructional strategy.

- 7) There is no effect of interaction between teaching method and sex on biology students' achievement.

3. Methods

This study employed the use of pre-test, post-test control group quasi-experimental research design. Three groups: the experimental group1 (exposed to self-learning), experimental group2 (exposed to explicit instruction) and control group (exposed to lecture method) were used. A pre-test and post-test were used on the three groups and thereafter, the mean achievement scores of the students in the groups were compared to determine the effects of self-learning and explicit instructional strategies on the achievement of biology students. The population consist of 19,400 senior secondary two Biology students in all public schools in Delta Central Senatorial District. The sample consists of 335 SS II biology students drawn from six mixed public Secondary Schools in Delta Central Senatorial district. The sample of the study was drawn using a simple random sampling technique. The selection of schools was done without replacement so that every school in the district will have an equal chance of being selected. The selections of schools were based on the following criteria: Schools must be mixed, availability of experienced and qualified Biology teachers with at least three years of teaching experience.

The instrument that was used to collect data for the study was the Biology Achievement Test (BAT), which was drawn from six weeks lesson plan. The BAT covered the following topics: Cell (cell organelles, similarities and differences between plant and animal cell, diffusion and osmosis) and Nutrition. The BAT consists of 50 multiple-choice test items constructed by the researcher to measure the student's level of achievement in biology. The BAT was subjected to face and content validity. The table of the specification was used to ensure that the questions covered all the contents in the six weeks instructional unit (lesson plan) in relation to the amount of time spent on each content. The face validity was done by three experts; one experienced biology teacher, one expert each in science education and measurement and evaluation department of Delta State University. These experts were asked to vet the BAT in terms of clarity of words and appropriateness to the level of students. Corrections/suggestions that were made by the experts were effected in the instrument. The expert's approval of the test items as being able to measure what it intends to measure led to the use of the instrument for the study. The reliability of BAT was established using the Kuder-Richardson formula 21 method. The Kuder-Richardson formula 21 method is most appropriate for establishing the reliability index of objective test items. The instrument was administered to 30 Utagba-Ogbe grammar school Biology students in Ndokwa West Local Government Area of Delta State which is outside the area for the study and the scores obtained were subjected to Kuder-Richardson formula 21. Kuder-Richardson formula 21 was used to analyse the test score and a reliability coefficient of 0.87 was obtained which makes it reliable. The

data were analysed with paired sample t-test, Analysis of Covariance (ANCOVA) and Scheffe post hoc test. The hypotheses were tested at a 0.05 level of significance.

4. Results

Research Question 1: What is the effect of self-learning strategy on biology students' achievement?

Hypothesis 1: There is no significant effect of self-learning strategy on biology students' achievement.

Table 1: t-test comparison of Pre-test and Post-test Achievement Scores of Students Taught Biology Using Self-Learning Strategy

Testing	N	\bar{X}	SD	Df	t-cal	sig. (2-tailed)	Remark
Pretest	93	24.27	8.75	92	30.941	0.000	Ho ₁ is rejected
Posttest		60.00	13.62				

Table 1 indicates a significant effect of the self-learning strategy on achievement, $t = 30.041$, $P(0.00) < 0.05$. With this result, Ho₁ was rejected. Thus, there is a significant effect of self-learning strategy on biology students' achievement.

Research Question 2: What is the effect of explicit instructional strategy on biology students' achievement?

Hypothesis 2: There is no significant effect of explicit instructional strategy on biology students' achievement.

Table 2: t-test comparison of Pre-test and Post-test Achievement Scores of Students Taught Biology Using Explicit Instructional Strategy

Testing	N	\bar{X}	SD	Df	t-cal	sig. (2-tailed)	Remark
Pretest	107	21.60	7.92	106	33.149	0.000	Ho ₂ is rejected
Posttest		61.93	12.77				

Table 2 indicates a significant effect of explicit instructional strategy on achievement, $t = 33.149$, $P(0.00) < 0.05$. With this result, Ho₂ was rejected. Thus, there is a significant effect of explicit instructional strategy on biology students' achievement.

Research Question 3: Do differences exist between the mean achievement scores of biology students taught with self-learning and explicit instructional strategies?

Hypothesis 3: There is no significant difference in the mean achievement scores of biology students taught with self-learning and explicit instructional strategies.

Table 3: ANCOVA Comparison of Mean Achievement Scores of Students Taught Biology Using Self-Learning and Explicit Instructional Strategies

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	7372.451 ^a	2	3686.225	26.742	.000
Intercept	45298.943	1	45298.943	328.623	.000
Pre	7188.032	1	7188.032	52.146	.000
Methods	722.560	1	722.560	5.242	.023
Error	27155.369	197	137.845		
Total	779460.000	200			
Corrected Total	34527.820	199			

Table 3 indicates that there is a significant difference in the mean achievement scores of students taught biology using self-learning and explicit instructional strategies, $F(1, 197) = 5.242$, $P(0.023) < 0.05$. Therefore, the null hypothesis three is rejected. Implying that there is a significant difference in the achievement of biology students taught with self-learning and explicit instructional strategies, in favour of students taught with explicit instructional strategy.

Research Question 4: Do differences exist between the mean achievement scores of biology students taught with self-learning strategy, explicit instructional strategy and lecture method?

Hypothesis 4: There is no significant difference in the mean achievement scores of biology students taught with self-learning, explicit instructional strategy and lecture method.

Table 4: ANCOVA Comparison of Post-test Mean Achievement Scores of Students Taught Biology Using Self-Learning Strategy, Explicit Instructional Strategy and Lecture Method

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	17178.459 ^a	3	5726.153	39.721	.000
Intercept	72282.627	1	72282.627	501.407	.000
Pretest	8313.262	1	8313.262	57.667	.000
Method	10684.683	2	5342.341	37.059	.000
Error	47716.777	331	144.159		
Total	1147504.000	335			
Corrected Total	64895.236	334			

Table 4 indicates that there is a significant difference in the mean achievement scores of students taught biology using self-learning strategy, explicit instructional strategy and lecture method, $F(2, 331) = 37.059$, $P(0.000) < 0.05$. Therefore, the null hypothesis is rejected. However, in order to determine the direction of the difference among the three instructional strategies (self-learning, explicit and lecture), Scheffe's post-hoc test was performed as shown in Table 5.

Table 5: Scheffe's Post-hoc Test Comparison of Mean Achievement Scores of Students Taught Biology Using Self-Learning Strategy, Explicit Instructional Strategy and Lecture Method

(I) Teaching strategy	(J) Teaching strategy	Mean Difference (I-J)	Std. Error	Sig. ^b	95% Confidence Interval for Difference ^b	
					Lower Bound	Upper Bound
Explicit strategy	Self-learning	3.513*	1.715	.041	.139	6.887
	Lecture	12.886*	1.569	.000	9.801	15.972
Self-learning	Explicit strategy	-3.513*	1.715	.041	-6.887	-.139
	Lecture	9.373*	1.618	.000	6.190	12.556
Lecture	Explicit strategy	-12.886*	1.569	.000	-15.972	-9.801
	Self-learning	-9.373*	1.618	.000	-12.556	-6.190

As indicated in Table 5, Scheffe's post-hoc test shows that there is a significant difference in the mean achievement scores of students taught biology using the self-learning strategy and those taught using explicit instructional strategy, in favour of explicit instructional strategy; there is a significant difference in the mean achievement scores of students taught biology using self-learning and those taught using lecture, in favour of self-learning strategy. Table 5 again shows that there is a significant difference in the mean achievement scores of students taught biology using explicit instructional strategy and those taught using lecture, in favour of explicit instructional strategy. As indicated in Table 4, among the three instructional strategies, the explicit instructional strategy proved most effective followed by the self-learning strategy and the lecture method came last.

Research Question 5: Do differences exist between the mean achievement scores of male and female students taught biology using the self-learning strategy?

Hypothesis 5: There is no significant difference in the mean achievement scores of male and female students taught biology using the self-learning strategy.

Table 6: ANCOVA Comparison of Mean Achievement Scores of Male and Female Students Taught Biology Using Self-Learning Strategy

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	5963.485 ^a	2	2981.742	24.158	.000
Intercept	15592.198	1	15592.198	126.326	.000
Pre-test	5889.698	1	5889.698	47.718	.000
Post-test	233.395	1	233.395	1.891	.173
Error	11108.515	90	123.428		
Total	351872.000	93			
Corrected Total	17072.000	92			

Table 6 indicates that there is no significant difference in the mean achievement scores of male and female students taught biology using the self-learning strategy, $F(1, 90) = 1.891$, $P(0.173) > 0.05$. Therefore, the null hypothesis five is not rejected. Therefore, there is no

significant difference in the mean achievement scores between male and female students taught biology using the self-learning strategy.

Research Question 6: Do differences exist between the mean achievement scores of male and female students taught biology using the explicit instructional strategy?

Hypothesis 6: There is no significant difference in the mean achievement scores of male and female students taught biology using explicit instructional strategy.

Table 7: ANCOVA Comparison of Mean Achievement Scores of Male and Female Students Taught Biology Using Explicit Instructional Strategy

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	1922.647 ^a	2	961.323	6.514	.002
Intercept	31207.750	1	31207.750	211.457	.000
Pre test	1868.799	1	1868.799	12.663	.001
Post test	8.915	1	8.915	.060	.806
Error	15348.755	104	147.584		
Total	427588.000	107			
Corrected Total	17271.402	106			

Table 7 indicates that there is no significant difference in the mean achievement scores of male and female students taught biology using explicit instructional strategy, $F(1, 104) = 0.060$, $P(0.806) > 0.05$. Therefore, the null hypothesis six is not rejected. Therefore, there is no significant difference in the mean achievement scores between male and female students taught biology using explicit instructional strategy.

Research Question 7: What is the effect of the interaction between teaching method and sex on biology students' achievement?

Hypothesis 7: There is no significant effect of the interaction of teaching method and sex on biology students' achievement.

Table 8: ANCOVA Summary on Effect of Interaction of Teaching Method and Sex on Biology Achievement

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	17437.404 ^a	6	2906.234	20.086	.000
Intercept	71780.833	1	71780.833	496.106	.000
Pre test	8385.732	1	8385.732	57.957	.000
Method	10849.473	2	5424.737	37.493	.000
Sex	28.115	1	28.115	.194	.660
Method * Sex	255.341	2	127.671	.882	.415
Error	47457.832	328	144.689		
Total	1147504.000	335			
Corrected Total	64895.236	334			

Table 8 shows that there is no significant effect of the interaction of teaching method and sex as measured by students' mean achievement scores in biology, $F(2, 328) = 0.882, P(0.415) > 0.05$. Therefore, H_0 is not rejected. Thus, there is no significant effect of the interaction of teaching method and sex on biology students' achievement. This implies that students' achievement scores in biology relative to the teaching method are not influenced by students' sex.

5. Discussion

The study revealed that there is a significant effect of self-learning strategy on biology students' achievement. This is evident in the significant increase in the post-test mean achievement score compared to the pre-test mean achievement score of students taught biology using the self-learning strategy. All things being equal, the increase in the post-test is as a result of treatment with the use of the self-learning strategy. The study again revealed that there is a significant effect of explicit instructional strategy on biology students' achievement. This also may be attributed to the significant increase in the post-test mean achievement score of the students as a result of treatment with the use of explicit instructional strategy. Therefore, it can be concluded that self-learning and explicit instructional strategies improve biology students' achievement. This finding agrees with the views of Akanbi and Kolawole (2014) and Agu and Samuel (2020) who reported that self-learning and explicit instructional strategies improve students' achievement.

Furthermore, the study revealed that there is a significant difference in the performance of biology students taught with self-learning and explicit instructional strategies, in favour of students taught with explicit instructional strategy. This implies that explicit instructional strategy is more effective in boosting students' achievement in biology than self-learning instructional strategy. A possible explanation for this finding may be attributed to the fact that explicit instructional strategy allows for partnership between teachers and students during the instructional procedure. The teacher models the steps and presents the objectives of the lesson, demonstrate clarity and enthusiasm while the students participate actively through guided practice sessions, independent practice sessions and corrective feedback. Explicit instruction includes continuous modelling by teachers followed by more limited teacher involvement as students begin to master the material. But this is not the case for the self-learning strategy. Students in the self-learning strategy learned at their own pace without the help of the teacher. This could have resulted in the higher achievement scores of students taught biology using explicit instructional strategy over those taught using self-learning instructional strategy.

The study also revealed that there is a significant difference in the mean achievement scores of students taught biology using self-learning strategy, explicit instructional strategy and lecture method, in favour of explicit instructional strategy followed by self-learning instructional strategy. This implies that self-learning and explicit instructional strategies enhance students' academic achievement in biology more

than the lecture method. The higher achievement scores of students taught biology using self-learning and explicit instructional strategies may be attributed to the fact that the students were more active in the learning process and thus aided their comprehension of biology concepts than those in the lecture group. The students in the lecture may have been passive since the teachers pass on their knowledge to their students in the final form. However, students taught using self-learning and explicit instructional strategy discovered knowledge for themselves with little or no assistance from the teachers. This finding confirms that of Oyovwi (2019) who reported that the self-regulated learning strategy significantly enhanced students' academic achievement in biology compared to the lecture method. This finding also concurs with that of Oka and Abba (2020) who reported that there was a significant difference in the mean achievement scores of students exposed to explicit learning strategy and conventional method. Students in the explicit learning strategy achieved more than the Control group.

Another finding of the study revealed that there is no significant difference in the mean achievement scores between male and female students taught biology using the self-learning strategy. This implies that the self-learning strategy equally facilitates the achievement of male and female students. The explanation for this finding is that both male and female students taught biology using the self-learning instructional strategy and actively participated during the teaching and learning process. Equal participation may be responsible for the non-significant difference in the mean achievement scores of both sexes. This finding confirms the view of Jirga (2019) that there was no significant difference in the mean achievement scores of male and female students taught basic science using the self-learning strategy.

The study further revealed that there is no significant difference in the mean achievement scores between male and female students taught biology using explicit instructional strategy. This finding could as well be attributed to the equal involvement and participation of male and female students during instruction as a result of using explicit instructional strategy. This finding is in agreement with that Oguejiofor (2020) who reported that there was no significant effect of sex on the achievement and attitude of students towards basic science.

The last finding of the study revealed that there is no significant effect of the interaction of teaching method and sex on biology students' achievement. This implies that the teaching methods (self-learning strategy, explicit instructional strategy and lecture method) do not interact with sex to influence students' achievement in biology. This finding agrees with the views of Obi and Oghenejode (2010) who reported that neither sex nor its interaction with the self-learning strategy has any significant effect on achievement. This finding further corroborates the views of Olagunju and Babayemi (2014) that the two-way interaction effect of explicit instructional strategy and sex had no significant effect on achievement and attitude.

6. Conclusion and Recommendations

The following conclusions were reached based on the findings of this study: Self-learning and explicit instructional strategies are effective strategies in boosting students' achievement in Biology. An explicit instructional strategy is more effective than a self-learning strategy in enhancing students' achievement in biology. Self-learning and explicit instructional strategies boost the biology mean achievement scores of male and female students equally. Self-learning and explicit instructional strategies do not interact with sex to influence students' achievement in biology.

In view of the findings of this study, the following recommendations were made:

- 1) Science teachers should expose biology students to self-learning and explicit instructional strategies that promote active participation and ultimately enhance achievement.
- 2) Stakeholders in the education sector should encourage and enforce the use of self-learning and explicit instructional strategies in the teaching and learning of biology and science in general.
- 3) Government should organise seminars and workshops to train science teachers on how to use the skills of self-learning and explicit instructional strategies effectively.

Conflict of Interest Statement

The authors declare no conflicts of interest.

About the Authors

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References

- Abimbola, I. O. (2013). The misunderstood word in science towards a technology of perfect understanding of all. In 123rd inaugural lecture of university of Ilorin (p.22-31) Unilorin Press.
- Agu, P. A. & Samuel, R. I. (2020). Effect of explicit and scaffolding instructional strategies on basic science and technology students' interest and achievement. *International Journal of Innovative Education Research*, 6(2), 19-26.
- Akanbi, A. A. & Kolawole, C. B. (2014). Effect of guided discovery and self-learning strategy on biology student achievement. *Journal of Education and Leadership Development*, 6(1), 19-42.
- Akinmoyewa, J. O. (2003). Effects of cooperative, competitive and individualistic use of self-instructional package on learners' achievement in Biology. *Journal of Education and Society*, 1(2), 133-141.
- Bruner, J. S. (1960). *Toward a Theory of Instruction*. Cambridge, MA: Harvard University Press.
- Chun, L. (2015). Sex and ethnicity differences manifested in chemistry achievement and self-regulated learning. *International Education Studies*, 8(8), 1-12.
- Federal Ministry of Education (FME) (2008). National Curriculum for science secondary school biology. Lagos: Government Press.
- Frank, I. (2010). *Sex differences in mathematics performance and in self-regulated learning (SRL)*. ISSN:2040-7149, 1(29), 4-23.
- Obi, C. C. & Oghenejode, M. C. (2010). Effect of gender differences and instruction in self-monitoring strategy on students' achievement in selected science concepts. *Nigerian Journal of Research and Production*, 16(1), 1-7.
- Obiekwe, C. (2010). Effects of constructivist instructional approach in student's achievement in basic ecological concepts in biology. *Journal of STAN*, 26-35.
- Oguejiofor, C. (2020). Effect of explicit instruction on students' achievement and attitude towards basic science. *Nigerian Online Journal of Educational Sciences and Technology*, 1.(2), 19-34.

- Olagunju, A. M., & Babayemi, J. O. (2014). Effects of enhanced teaching (explicit teaching + peer-tutoring) strategy and sex on students' attitude to basic science. *Journal of Education and Leadership Development*, 6(2), 150-165.
- Olagunju, A. M., & Babayemi, J. O. (2014). Effects of enhanced teaching (explicit teaching + peer-tutoring) strategy and sex on students' attitude to basic science. *Journal of Education and Leadership Development*, 6(2), 150-165.
- Olatoye, R. O., & Adekoya, Y. M. (2010). Effect of project based, demonstration and lecture teaching strategies on senior secondary students in an aspect of agricultural science. *International Journal of Educational Research and Technology*, 1(1), 19-20.
- Onyegegbu, N. (2012). Provision of facilities in biology classroom: New direction and challenges, *Journal of Education Research* 4, 70-75
- Oyovwi E. O. (2019). Enhancing biology students' academic achievement and attitude through self-regulated learning strategy in secondary schools. *Journal of educational and social research*, 9(4), 149.
- Serafini, F. (2004). *Lessons in comprehension: Explicit instruction in reading workshop*. Heinemann Portsmouth NH.
- Virtanen, O. & Nevgi, G. (2010). Enhancing biology students' academic achievement and attitude through self-regulated learning strategy in secondary schools. *An international Journal of experimental educational psychology*. 30, 323-34.

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