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Effect of Problem-Solving Instructional Strategy on Students' Academic Achievement and Attitude towards Biology in Delta North Senatorial District

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Abstract: *The study looked at the effect of problem-solving instructional strategy on academic achievement and attitude of biology students in Delta North Senatorial District. The study used a quasi-experimental design. 6,453 SSII Biology students made up the study's population. There were 252 SSII Biology students in the sample. Biology Achievement Test and Biology Attitude Scale were the study's instruments. Reliability coefficients of 0.83 and 0.72, were obtained for BAT and BAS using Kuder-Richardson formula 21 and Cronbach Alpha. The findings revealed that in terms of mean achievement and attitude scores, there was a significant difference between students taught biology using problem-solving instructional strategy and lecture method, favouring problem-solving instructional strategy. The study concludes that problem-solving instructional strategy enhance student achievement and attitude toward biology more effectively than lectures. It was recommended amongst other that biology teachers should use problem-solving strategy while teaching biology to senior secondary school students.*

Keywords: Problem-Solving Instructional Strategy, Academic Achievement, Attitude

Introduction

Biology is a field of study that focuses on both plants and animals. Biology is the study of all aspects of life, including its origin, development, reproduction, structure, and behaviour. The biology curriculum has been designed to give students the scientific information and practical skills they will need to survive in the real world. Everything we currently know about living things comes from biology. Teaching of biology aimed at instilling or transferring biological knowledge to students. Educating people, particularly in Biology has long been recognized as a means of fostering economic prosperity, eradicating poverty, and establishing social welfare systems. According to the Federal Republic of Nigeria (FRN), (2013), studying biology helps students acquire a variety of skills and values, including a spirit of enquiry, creativity, objectivity, the bravery to challenge, and an aesthetic sense. The goal of biology instruction is to help students learn how to solve problems and make decisions as well as how other science disciplines are interconnected, such as how biology affects human health, agriculture, industry, and other facets of life.

However, the outcome of the review of the West African Examination Council (WAEC) Chief Examiners annual reports (2015-2019) on students' performances in the West African Senior Secondary Certificate Examination (WASSCE) over the years is disheartening. This poor achievement in Biology may be attributed to the poor teaching methods adopted by Biology teachers among others. The lecture approach is the most widely used teaching method in secondary schools in Nigeria. The lecture approach is the verbal presentation of lesson to students by the teacher. According to Ajaja (2016), the lecture approach is "talk-chalk" technique. The lecture approach may be utilised for any class size, however Ajaja (2016) went on to say that it is typically employed for large classrooms. The use of the lecture technique by teachers is based on the idea that it encourages students to finish the material in a set amount of time. A teacher-centered approach to teaching and learning known as the lecture method sees the teacher as the expert, delivering knowledge to students who have little or no input into the lesson. Adegoke (2017) attacked the lecture approach, saying that only diligent students might profit from it. In Nigeria, the lecture mode of instruction predominates in the classrooms, which discourages student involvement. Due to this observation, secondary school biology instruction should test out alternate teaching methods.

Problem-solving instructional strategy could however be a better alternative. Problem-solving instructional strategy also known as problem-based learning involves deliberately chosen and created issues that demand critical information, problem-solving ability, self-directed learning techniques, and team participation abilities from the learner (Maloney, 2004). It lessens teacher-centered instruction in which students are viewed as passive participants in classroom activities and active listeners, as in the case of the lecture style (Emerhiona, Ajaja, Nwanze, Pius & Izuegbuna, 2018). An illustration of a constructivist learning method is the problem-solving instructional strategy, which presents significant, contextualised real-world scenarios and offers learners resources, training, and support as they gain content knowledge and problem-solving abilities.

El-Shaer and Gaber (2014) stated that problem-solving teaching technique is used to get students involved in active learning. They continued by saying that it gives students a setting or challenge to apply prior information and pick up new knowledge in. It is accepted as a teaching strategy to boost motivation for learning, provide students with the tools to undertake research, put theory into practise and use their knowledge and abilities to create a workable solution to a given problem. A question with an open-ended solution is provided to each small group of students as part of the problem-solving instructional method procedure. These exercises are intended to build on past knowledge and are frequently based on real-world situations. The teacher and the other students act as scaffolds for building one's knowledge base (Schmidt, Rotgans & Yew, 2011).

Five primary objectives of a problem-solving instructional technique for students are outlined by Loyens, Magda and Rikers (2008): Develop a comprehensive and adaptable knowledge base, effective collaboration skills, efficient problem-solving techniques, intrinsic motivation for learning, and self-directed learning abilities. Researchers have found that students who learn using a problem-solving instructional strategy have higher levels of intrinsic motivation, more interest, independent learning, self-efficacy, better-developed meta-cognitive skills, and are more autonomous than students who do not receive such instruction. Higher levels of accomplishment may be encouraged by the development of certain strengths (Ali, Akhter, Shahzad, Sultana & Ramzan, 2011; Schmidt et al., 2011).

According to Steinmayr, Dinger and Spinath (2012), academic achievement is the results of intellectual performance in school which is indicative of students' individual and social prosperity. Academic achievement is often measured through the use of teacher-made and standardized tests. It is also the grade scores of the students which expresses the level of objectives achieved. Academic achievement is the scores of students in an achievement test. So, knowledge gained and skills acquired in Biology can be seen as academic achievement, which is determined by test results. Studies have revealed that teachers' methods of instruction have an impact on students' academic success.

The method of teaching adopted by the teacher is also believed to influence students' attitude towards a particular subject. A person's experiences shape their attitudes, which are psychological orientations that affect how they see circumstances, things, and other people and how they choose to react to them favourably or unfavourably (Mensah, Okyere & Kuranchie, 2013). Students' attitudes about biology can be either favourable or negative, and they affect the decisions they make and how they react to biology lessons. A learner can adopt a good attitude about biology by learning to link it with happy memories or occasions. It has been shown that problem-solving instructional strategy facilitates students' easy comprehension of learnt concepts thereby reducing the abstraction and difficulty attributed to Biology concepts. Determining whether the employment of problem-solving instructional strategies fosters students' development of a positive attitude toward biology more than the lecture method is another justification for this study.

Statement of the Problem

Student achievement in Biology nationwide has remained poor for years. WAEC Chief Examiners' reports of Biology students' performance in WASSCE revealed that students' performance fall short of acceptable standard. Prominent among the factors identified as the cause of the persistent poor achievement are; lack of Biology laboratory, lack of qualified Biology teachers, lack of instructional materials and poor teaching methods. As a result of their lack of or little participation during instruction, the teacher-centered lecture technique that is most frequently utilised in Nigerian secondary schools has forced students to acquire Biology ideas by rote. Neither does the lecture technique provide students a sense of freedom and independence nor does it allow them to actively engage in learning or to explore. As a result, it is necessary to develop alternate teaching strategies that give students a sense of autonomy and independence. The use of problem-solving instructional strategies could be an alternative to traditional teaching methods since they provide students the chance to explore, actively participate in lessons, and feel free and independent. By confronting real-life or real-life-like difficulties in their learning environment and determining the best solution(s), problem-solving instructional strategies assist students in preparing for upcoming or impending obstacles. In addition to ensuring that students actively participate and engage during education, problem-solving instructional strategies also give them the freedom to direct their own learning. The question that this study is trying to answer is whether or not using a problem-solving instructional strategy will help students' academic performance and attitude toward biology more than using lecture method.

Purpose of the Study

The study focused on the effect of problem-solving instructional strategy on students' academic achievement and attitudes toward biology. The study specifically aimed to find out:

1. the difference between the mean achievement scores of students taught biology using problem-solving instructional strategy and lecture method;
2. the difference between the mean attitude scores of students taught biology using problem-solving instructional strategy and lecture method.

Hypotheses

The study was directed by two hypotheses:

1. There is no significant difference in the mean achievement scores of students taught Biology using problem-solving instructional strategy and lecture method.
2. There is no significant difference in the mean attitude scores of students taught Biology using problem-solving instructional strategy and lecture method.

Methodology

The study used a quasi-experimental design. 6,453 students from 154 public secondary schools in the Delta North Senatorial District made up the study's population. 252 SSII biology students who were chosen for the sample using the purposive sampling technique. Data were gathered using Biology Achievement Test (BAT) and the Biology Attitude Scale (BAS). The Kuder-Richardson formula 21 was used to determine the BAT's reliability, and it produced a reliability coefficient value of 0.83. Cronbach Alpha was

used to determine the BAS's reliability, and 0.72 reliability value was obtained. In this study, there were two treatment groups: experimental and control groups. Biology students in the experimental group were taught using a problem-solving instructional strategy, whereas those in the control group were instructed using lectures. Before and after the treatment, pretests and posttests were given. Analysis of covariance was used to assess the scores.

Results

✓ There is no significant difference in the mean achievement scores of students taught Biology using problem-solving instructional strategy and lecture method.

Table 1

ANCOVA Summary of Achievement Scores of Students Taught Biology Using Problem-Solving Strategy and Lecture Method

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	7442.409[a]	2	3721.204	27.011	.000
Intercept	43250.826	1	43250.826	313.949	.000
Pretest	132.375	1	132.375	.961	.328
Methods	7272.271	1	7272.271	52.788	.000
Error	34303.242	249	137.764		
Total	796584.000	252			
Corrected Total	41745.651	251			

F(1, 249) = 52.788, P(0.000) 0.05, demonstrates a substantial difference between students taught biology utilising problem-solving strategy and lecture approach in their mean achievement posttest cores. HO_1 is terribly neglected. The mean achievement scores of students who were taught biology using problem-solving instructional approach and lecture technique differed noticeably as a result, favouring the problem-solving instructional strategy.

✓ There is no significant difference in the mean attitude scores of students taught Biology using problem-solving instructional strategy and lecture method.

Table 2

ANCOVA Summary of Attitude Scores of Students Taught Biology Using Problem-Solving Strategy and Lecture Method

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	337.265[a]	2	168.632	2.241	.109
Intercept	116225.063	1	116225.063	1544.444	.000
Pretest	1.474	1	1.474	.020	.889
Methods	333.338	1	333.338	4.430	.036
Error	18738.164	249	75.254		
Total	817432.000	252			
Corrected Total	19075.429	251			

F(1, 249) = 4.430, P(0.036) 0.05, table 2 shows a significant difference between the mean attitude posttest scores of students taught biology using problem-solving strategy and lecture approach. HO_2 is so disregarded. As a result, the mean attitude scores of biology students taught using problem-solving instructional strategies and lectures differ significantly, favouring problem-solving instructional strategy.

Discussion

The study showed that employing problem-solving strategy to learn biology resulted in much higher mean achievement scores for students than learning the subject through lectures. The difference in achievement scores between the groups could be attributed to the students' involvement during instruction. During instruction, the problem-solving group's students actively engaged in learning facts on their own with minimal teacher support. Students in the lecture group, however, only relied on the knowledge that their instructor had given to them. In other words, during instruction, the group of students using the lecture approach was passive. The low achievement results for students who were taught via the lecture approach may have been caused by this. This result is consistent with that of Emerhiona, Ajaja, Nwanze, Pius and Izuegbuna (2018) who discovered a substantial difference between students taught chemistry using problem-based teaching strategy and lecture method in terms of mean achievement scores, with the latter being more effective. This result supports Ntibi and Neji's (2018) findings showing, in physics and chemistry, guided problem-solving approach students outperformed conventional lecture method students in terms of mean scores.

The study again showed that there is a substantial difference between students taught biology using problem-solving instructional strategy and lecture method, with the students taught using the problem-solving instructional strategy displaying a more positive attitude. One possible explanation for this observation may be predicated on the fact that problem-solving instructional strategy aids development of deep meaningful knowledge by promoting critical thinking rather than mere memorization. Problem-solving instructional strategy promotes self-discovery of knowledge. Students taught Biology with the problem-solving instructional strategy discover facts on their own. Comparatively to their peers who were taught using the lecture technique, which involves imparting knowledge to the students, this may have encouraged the development of a better attitude toward biology. This result is consistent with the findings of Gok and Silay (2010), who found that students who were taught physics using a problem-solving strategy scored significantly higher on attitude tests than students who were taught using the lecture method.

Conclusions

The study concludes that problem-solving instructional strategy enhance students' achievement and attitude towards Biology more than the lecture method. Problem-solving instructional strategy enhances male and female students' achievement and attitude towards Biology equally.

Recommendations

In view of the findings of this study, the followings are recommended:

1. The adoption of problem-solving instructional strategy by Biology teachers in the teaching of Biology concepts at senior secondary school level.
2. Biology teachers should help students develop investigative skills to facilitate students' easy usage of problem-solving instructional strategy.

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