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EFFECTS OF INQUIRY STRATEGY ON SENIOR SECONDARY SCHOOL STUDENTS' ACHIEVEMENT IN REFORMULATION OF KNOWLEDGE IN BIOLOGY CONCEPTS

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Abstract

This study examined the effects of inquiry strategy on senior secondary school students' achievement in reformulation of knowledge in Biology concepts (Genetics). The study adopted the non-randomized quasi experimental design. The population of the study was all the SS3 students in Egume, Anyigba Education Zone of Kogi State. The simple random sampling technique was used to sample 60 SS3 students from two schools in the study area. The instrument for data collection was 50 multiple choice styled Biology Achievement Test (BAT) which was face validated by three experts one in natural science biology department, one in measurement and evaluation and one in language education in Prince Abubakar Audu University, Anyigba. The reliability co-efficient was established using Pearson product moment correlation method which yielded 0.86. The research questions were answered using mean and standard deviation while t-test was used to test the hypothesis at 0.05 alpha level significance. The findings of the study revealed that students exposed to inquiry strategy reformulation of knowledge achieved higher than the students taught with the conventional method. Based on the findings, it was recommended among others that inquiry learning strategy reformulation of knowledge should be included in the curriculum of biology (science) studies.

Keywords: Inquiry Strategy, Reformulation of Knowledge, Achievement, Biology Concepts

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Introduction

A glance through literature reveals that there has been active research into all aspects of science in recent times. The importance of science, particularly biology as a vital school subject taught is no longer in doubt. According to Abu (2017) biology, serves as one of the core subjects for many science disciplines among which are Medicine, Agriculture, Microbiology, Science Education and Nursing among others. This is further confirmed by the requirements for admission into Nigerian Universities and other degree awarding institutions as stated in the U.M.E./De Brochure 2022/2023.Olumese (2015) said that functional and sustainable Biology is a foundation for available and solid economic prosperity of any country. Biology is therefore one of the most important science subjects for creating self-awareness in the individual as well as making the individual to contribute their quota to education more effectively and meaningfully. Biology aims at helping the child to acquire appropriate skills, abilities and competencies that would enable his to contribute to the development of the society.

In Biology, research activities are seldom teacher-centered. Often, pupils are the central focus of many research efforts aimed at diagnosing their strengths and weaknesses in the learning process According to Okey (2017), “Pupils are the patients that must be diagnosed for treatment of learning ailment.” The findings from such researches are usually used to re-direct teachers’ endeavors in the approach to teaching strategies with a view to improving pupil’ understanding of school subjects.

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Each method is communication Bending, (2014) mentioned that since the goals are premeditated and each has an important function in the learning process.

Researchers (Bajah 2014; Ogunniyi, 2016 & Ajewole,2016), have not given much credence to lecture as a potent method in improving students' achievement in biology. This method is teacher-centered, and largely characterized by the teacher talking to the class most of the time, while the students listen, take down notes and occasionally ask questions. Lecturing has had its critics over the years (Bligh, 2011; Jackson& Prosser, 2013). While many strategies abound in teaching various concepts in biology, their effectiveness vary by wide a margin as 10 – 90 percent (Adara, 2016). An important issue in this respect which this study seeks to address is the effects of inquiry strategy on senior secondary school Biology student's reformulation of knowledge on the achievement of these students in the concept of "Genetics". In reformulation of knowledge the biology student will be able to re –express ideas especially in thinking, talking out and writing to clarify their points (Clive, 2015).

Shaibu, Okunola and Ogunbowale (2020) asserts that inquiry technique is a teaching style where the learners with minimum guidance from the teachers seek to discover and create an answer ti a recognized issue or problem. While Unesco (1985) also maintains that inquiry is not the discovery of an answer that is lifted from a book, but learners themselves.

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Knowledge is cognition of reality (Tobin, 2010). Therefore, learners actively construct their own knowledge and belief as a result of their interaction with specific objects or phenomena. Yager, (2021) opined that one knows a thing only when one can explain it; such explanations are for others to understand. In line with this view Whitely (2013) stated that knowledge is not passively received but actively built up by the cognizing subject. For an individual, to be able to build up knowledge demands that he should understand and be knowledgeable. To know, according to Otuka (2013), is to understand in a certain way and in a manner, which can be shared by others. Yet, this task of understanding is compounded by the fact that we cannot transmit meaning unless that meaning can be reformulated. Von (2013) asserts that there is a heightened awareness of knowledge and this linked with the realization that each leaner has to construct or reconstruct the knowledge for himself and reorder his own thoughts when inquiry strategy and is being used as to reformulate the knowledge. Timothy (2012), explains Teachers who provide good classroom conditions, good teacher student relationship and of course apply good teaching methods may improve the academic achievement of students, thereby motivating them to score high marks. To improve one's academic achievement means understanding what is taught and being able to represent it when asked to do so.

However, until now, little or no study that this researcher is aware of that has been able to find out specially whether biology student will achieve better if they are given the opportunity to reformulate knowledge in cognitive achievement in Biology concept when exposed to inquiry and Reformulation

of knowledge (SRK). Akanya and Unwaha (2019) argues that methods of teaching currently in use have failed to nurture the diverse experiences of learners. There is no doubt that the needs of the 21st century students are different from the needs of the students of the last century (Bedir, 2019).

Siregar, Franziath and Marmanto (2020) agree by saying that current methodologies of teaching should therefore focus both developing both the skills and knowledge that will make the students to be successful in the globalized world. To this end it is imperative that teachers of biology reconsider their pedagogical approaches to catch up with today's realities.

This study is therefore aimed at investigating the effects of inquiry strategy on senior secondary school biology students' reformulation of knowledge on achievement in biology achievement in biology concept. One research question and one null hypothesis guided the study these are;

Research Question

What is the difference in the mean achievement score of students exposed to inquiry strategy on students reformulation of knowledge and those taught with conventional method

Hypothesis

H0: There is no significant mean difference in the mean achievement score of students exposed to inquiry strategy on student's reformulation of knowledge and those taught with the conventional method.

Methods

The design for this study is the non-randomized quasi-experimental design. The population of the study is all the 605 SS3 students in the 6 public secondary schools in Egume, Anyigba educational zone of Kogi State. The balloting procedure was employed to draw two schools from the population of the study. Two intact classes in each of the sampled schools were then randomly assigned to treatment

A total sample of 60 senior secondary school biology students constituted two groups (30 experimental and 30 control) from Egume educational area of Kogi State. The decision as to which of the subjects will receive treatment was made on a random basis. A coin was flipped. The tail was slated for the control group while the head was for the experimental group. Based on the results, senior secondary school Biology students in one of the government public secondary became the experimental group and while the senior secondary school in the same state (Kogi) became the control. The biology students in each group were randomly selected. The Experimental and control groups were in their final year course leading to the award of senior secondary school certificate 2020/2021 academic year. The students mean age of the experimental and control groups were 17.2 and 18 3.years respectively. The study used quasi – experimental design and adopted a pre –test – post – test to achieve this.

The instrument for this study titled Biology Achievement Test (BAT) was developed by the

researcher on the concept ‘’GENETICS’’. It consisted of 50 multiple choice objective test items for the experimental and control groups. These items were subjected to a two- part validation procedure. First, the content validity was established by having the items evaluated by a panel of judges made up of one university biology expert and two other biology educators as well as a specialist in test construction.

Secondly, the panel of judges was also asked to evaluate the suitability of the test for the target population with regard to reading and language levels. This is necessary because, according to Ehindero (2014), language of instruction can affect cognitive achievement in science. Following the inputs from the judges, 50 out of the initial pool of 75 items were selected. The materials were revised in line with the corrections and recommendations made before they were used on the students. The vetting sequence suggested by Campell and Mine (2015) was used for validating the pre/post test questions that constituted the assessment instrument. Content validity was established by comparing the objectives of the biology syllabus with the contents of the assessment instrument. The achievement test was pilot – tested to establish its reliability. The reliability co- efficient was computed using Pearson product moment correlation method. This gave r=0.96.

Before the commencement of the main treatment, the pre- test achievement test administered to both groups of subjects in the experimental and control groups. The achievement test questions were based on the teaching topic selected for the experiment and was designed to test for one hour. The

purpose of the pre- test was to determine students' initial knowledge of the material they would later learn. It was also used to determine the comparability of the two groups with respect to their achievements on the pre-test scores. Immediately after the pre- test, they were exposed to instructional treatments; the experimental group, to the inquiry and SRK. As the investigation continued, students were given the opportunity to reformulate knowledge about genetics for themselves.

This group was able to think over things, investigate through talking about things, and writing them to clarify their own understanding of the concept of genetics learnt, and in this way re- expressing the ideas they gained from the learning of the concept. The control group was exposed only to the conventional approach. They were not given the opportunity to re-express their thoughts in any way before the test. At the end of the main treatment a similar test used as pre- test was administered as post- test for each group. To minimize the possibility of students remembering items in the pre- test, the researcher first administered the pre- test, then gave the treatment in three lessons for three weeks in each group, allowed two weeks before administering the post – test on the two groups. The data collected through the test for both experimental and control groups were scored. For analysis, the two study groups' scores were computed in order to compare group's differences using t test for two independent groups.

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Results

Table 1: t test results of the mean achievement scores of the experimental groups

Group	N	X	Sdt-value	F	
Experimental	30	10.75	8.64	0.64	0.000
Control	30	10.78	8.71		

*Not significant at P< 0.5

There is no significant difference between experimental and control group score Between experimental and control group scores in pre=test, t- value of 0.64 is not significant at P <0.05. From Table 1 , the result suggests that the experimental and control groups were similar because the calculated t – value of 0.46 was less than the critical t- value of 1.99 at 0.5 alpha level of significance.

It can be seen from table 1 that the mean of 10.75 with the standard deviation of 8.64 for the experimental group was close to the mean of 10.78 with the standard deviation of 8.71 of the control group. Therefore, the two groups may be described as coming from similar characteristic parent populations for all practical purposes.

Table 2. T- test Analysis of Post – Test Scores

Group	N	X	SD	t-value	P
Experimental Inquiry + SRK	30	24	2.3	8.75	0.000
Control	30	16	2.78		

* Significant at P< 0.05

In Table 2, the result indicates a statically significant difference between the experimental group that used inquiry and SRK Approach and the control group who were taught with conventional Approach alone. This is significant because the calculated t- value of 8.75 is greater than the critical t – value of 1.99 at P <0.05. It can be seen from Table 2 that mean of 24 for experimental group that used inquiry and SRK is higher than the mean score of 16 for the control group that use conventional and SRK but conventional approach alone. It can be concluded that there is a significant difference between the groups exposed to inquiry and SRK Approach in their achievements in biology.

Discussion of Findings

From the findings of the study, it was proved that the students (experimental) taught using inquiry plus Student Reformulation of Knowledge (SRK) were significantly better in performance than the students (control group) using only conventional Approach. The difference between the two groups as shown in Table 2 was significant at the chosen probability level favoring the experimental group taught with inquiry and SRK.

In effect the inquiry and SRK proved a better approach in teaching biology. From the findings of the study, it is evident that student reformulation of knowledge in biology teaching does in fact help more students to learn better, enables them master instructional outcomes at some higher level of performance. In other words, the inquiry and SRK were a more effective approach in teaching biology than the conventional approach alone.

The findings have led to the rejection of the hypothesis stated in the study. Also the use of inquiry and SRK involved the use of several sense organs. Psychological researchers have shown that learning is enhanced when more than one sense organ is involved during the learning process (Blair and Stone (2011). The finding tallies with the studies by Von (2009) which showed that knowledge reformulation is more easily recalled and more easily used in daily living or when solving a problem in some other fields of thought.

Conclusion

From the findings of the study, it could be seen that inquiry strategy reformation of knowledge is an indispensable tool for teaching Biology. It is more effective than the conventional lecture method. The findings also revealed that inquiry strategy and students' reformation of knowledge showed a significant difference in favour of experimental group.

Recommendations

On the basis of the above findings, the following recommendations made;

1. Since the inquiry and student reformulation (SRK) has been found to be more effective than the conventional approach alone and has enhanced performance, there is need to emphasize its use in secondary schools especially in teaching biology.
2. Teacher trainers should themselves try to emphasize the use of inquiry and SRK in training the education teachers to be, so that they can transfer same into their regular classroom practices.

Print ISSN 2992 – 5649 Online ISSN 3026 – 9318

3. There is need to employ the services of experts in inquiry and SRK Approach for the training of Nigerian science teachers.
4. It is also recommended that curriculum planners in Science Education in Nigeria should emphasize Inquiry and SRK Approach in curriculum of primary, Junior Secondary School (JSS), Senior Secondary School (SSS) and even the tertiary institutions of learning.

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