
EFFECTS OF MIND MAPPING INSTRUCTIONAL STRATEGY ON THE ACADEMIC
ACHIEVEMENT OF SENIOR SECONDARY SCHOOL BIOLOGY STUDENTS IN ECOLOGY

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Abstract

The study investigated the effects of mind mapping instructional strategy on the academic achievement of senior secondary school biology students in ecology. The design for the study was pretest and posttest control group design. All 20 senior secondary schools in Dengi metropolis with the total of 5,501 students constituted the population for the study. Two senior secondary schools were randomly selected and assigned into experimental and control groups. Ecology Achievement Test (EAT) was used for data collection. Data collected were analyzed using t-test statistics. The result obtained indicates that students taught ecology using mind mapping instructional strategy significantly achieved higher than those taught using lecture method. Based on the result it was recommended that, teachers need to vary their method of teaching using mind mapping teaching strategy as it improved academic achievement of students in ecology.

Introduction

Science education is a very important tool for sustainable development (Banu, 1999, Olarinoye, 2001 and Danjuma, 2005). It is due to this importance that the Federal Government of Nigeria emphasized the teaching of science and technology as contained in the National Policy on Education (FRN 2008). Also Jibrin (2009) acknowledged that science and technology education can help individuals to participate fully and intelligently in the productive sector of the economy which may lead to national development. To produce such individuals require the use of effective instructional strategy that is student rather than teacher-centered thereby involving the learners in the process of learning. Biology plays a very vital role in the development of a nation. The aims of teaching biology as contained in the biology curriculum for Senior Secondary School (FME, 2009) among others include the ability to observe, classify and interpret biological data (Scientific Skills). This is because acquisition of meaningful and relevant knowledge in biology is a pre-requisite to pursue career in Biological sciences and related disciplines. It has been reiterated in the same document that the teaching of biology like other sciences should be activity oriented. That is why professional training programmes such as workshop and seminars are conducted by the National Teachers Institute (NTI), Teacher Training Institutions such as Colleges of Educations, Faculties and Institute of Education in Nigerian Universities and Millennium Development Goals offices all over the federation for all categories of teachers in order to build capacity for effective teaching at primary and secondary schools levels.

In spite of all these efforts, the academic achievement of students in biology is not

encouraging (Lakpini 2007; Ogbenewade 2010; Chief Examiners Report WAEC, 2010; Adebayo 2011; and Jibrin and Zayum, 2012). The poor performances were attributed to inadequate instructional materials and qualified teachers (Usman, 2000), nature of some biological concepts (Chief Examiners Report WAEC, 2010), insufficient funding, unstable government policy, relying on teaching methods that are inadequate such as lecture method (Mahmud, 2009), being teacher-centered often render the students passive listeners rather than active participants (Muhammad, 2009). Unlike the activity-based that is student-centered which allow the students to take active part in the learning process. On the teaching methods Selvaratnam (1983); Nott (1987); Eze, (2001) and Ozoji (2011) observed that activity based instructional strategies such as problem-solving teaching method, concept map method, mind mapping instructional strategy and discovery method of teaching among others encourages good learning habits, contributes to clarity in thinking, logical reasoning and promotes intellectual development. Ozoji (2011) research on the effect of concept map on the academic performance of integrated science students concluded that students taught integrated science using concept map instructional strategy perform better than those taught using lecture method. Also Muhammad (2009) conducted a research on the effect of explicit problem-solving on students' achievement, retention and attitude in secondary school physics. It was concluded that students taught physics using explicit problem-solving achieved significantly higher than those using lecture method. Danjuma (2005) further observed that activity-based instructional strategy such as problem-solving instructional strategy, mind mapping, discovery method among others,

encourages logical reasoning ability, manipulative skills, and self-confidence and may enhance academic performance of learners. In a recent report of a Committee on Education in Gombe State Nigeria in 2011, reported that there were 63,992 Biology students to 116 Biology teachers which give a ratio of 1:552. This reports clearly shows that Biology teachers were highly inadequate.

Mind mapping is a teaching method which is visual and non-linear representation of ideas and their relationship (Buzan 2000) described the method is student-centered as described by Lea, Stephenson and Troy (2003) who pointed out that it allows learners to be active rather than passive listener and emphasized deep learning and understanding. Also Mind mapping has been described as one of the teaching methods that promote creative thinking, ability and high retention in learners. Mind mapping is a powerful tool that teachers can use to enhance learning as it is evident in brainstorming, note taking, problem solving, memory learning and visual thinking technique used by psychologist, educationist and other professionals (Yusuf, 2012). He further observed that problem solving teaching strategy; mind mapping enhances the development of certain skills in learners such as thinking skills, reasoning skills, and ability to make decision, taking action, information gathering and generating skills.

Types of mind maps are (1) reference mind maps which is used for keeping document (2) planning mind maps are used in making plans (3) institutions and presentation mind maps is used for training in schools. Buzan (2000) made some recommendations on how mind maps can be used in teaching. These are as follows:

- Place an image or topic in the centre at least using three colors.
- Use image symbol codes and dimension throughout your mind maps
- Select key word and print using upper or lower case letters
- Each word is alone and sitting on its line.

The present study was carried out to look at the effect of mind map instructional strategy on the academic achievement of senior secondary school biology students in ecology in Dengi Metropolis.

Purpose of the Study

The main purpose of the study is to determine the mean academic achievement of Senior Secondary School biology students taught ecology using mind map and those taught using lecture methods of teaching.

Research Question

The study will answer the following research questions: what is the mean academic achievement of Senior Secondary School biology students taught

ecology using mind map and those using lecture methods of teaching?

Research Hypothesis

The following research hypothesis was formulated in null form and was tested at P 0.05 level of significance: There was no significant difference in the mean academic achievement of Senior Secondary School biology students taught ecology using mind mapping and those taught using lecture method.

Methodology

The research design for this study was Quasi-experimental that employed pretest posttest control group design. Pretest was administered to subjects before the treatment to determine the equivalence of the subjects in their academic ability level. Posttest was administered after the treatment to determine the effect of the treatment (mind mapping instructional strategy) on subjects' achievement. This was done using the same instrument (Ecology Achievement Test). Experimental group received treatment which was mind mapping instructional strategy while the Control group was taught using lecture method.

The population of the study was all the Twenty (20) Senior Secondary Schools that were located in Dengi Metropolis with a total of 5,501 Senior Secondary School II Biology Students. Two (2) Senior Secondary Schools were randomly selected by 'balloting technique for the study. In each school selected, intact class of Senior Secondary II biology Students was used, one of the schools was randomly assigned experimental while the other served as control group. The experimental school has 42 subjects and the control school has 40 subjects. This is in line with Tuckman (1975) who stated that sample size of minimum of 30 subjects is viable for experimental study of this nature.

Instrument for Data Collection

A thirty multiple items Ecology Achievement Test (EAT) developed by the researchers was employed for data collection. Items in the instrument were constructed on topics identified to be difficult (Sale, Nasiru, Chinade, Yanga and Usman, 2012). The topics are Territorialism, Food Chain, Feeding Relationship and Ecological Concepts.

Validation of the Instrument

The instrument Ecology Achievement Test (EAT) was validated by two PhD holders and Senior lecturers from the Department of Science Education, Ahmadu Bello University, Zaria and two B.Ed degree in Biology Education. They made same recommendations on the areas of content and appropriateness of the language and the instrument was corrected and used for this study.

Reliability of the Instrument

To pilot test the instrument, Govt. Secondary School Gagdi, in Gagdi Metropolis of Plateau State which is outside the study area was used. The subjects in the school are of equivalent standard with research subjects. A test retest method was adopted in which the test was re-administered to the same respondents after two weeks as recommended by Tuckman (1975). The results of

the test were correlated using Pearson Product Moment Correlation Coefficient (PPMC) which gave a reliability coefficient $r = 0.87$ and was suitable for use. This was based on recommendation by Sambo (2005) who pointed out that instrument of reliability coefficient (r) of at least 0.55 is reliable for the study of this nature.

Procedure for Data Analysis

The Data collected from both the experimental and control groups were subjected to t-test statistics at $P > 0.05$ level of significance.

Result and Discussions

Table: 1: t- test Analysis of Experimental and Control Groups.

Groups	N	X	Sd	Df	t-value	t-critical	Remark
Experimental	42	21.53	1.94	78	33.67	1.99	Rejected
Control	40	8.7	0.76				

Table 1 shows the t-value of 33.67 with the t-critical of 1.99. This indicates that the t-value is higher than the t-critical at $P = 0.05$ level of significance set for the study. Therefore, the null hypothesis that state there is no significant difference in the mean academic achievement of senior secondary school biology students taught ecology using mind mapping and those taught using lecture method is rejected. Results of research question shows that subjects who received instruction using mind mapping significantly achieved better than those taught using lecture method. According to Danjuma (2005); Bashir (2011) and Jibrin & Zayum (2012), learning is better facilitated if learners are fully involved in the learning process. Mind mapping is one of the ways of involving learners in the learning process. Mind mapping has assisted the learners to present learning inform of a diagram which has assisted them to achieve higher in ecology. Mind mapping as one of the activity-based instructional strategy has been reported (Danjuma, 2005) to promote creative thinking ability and high retention in learners as shown in this study. The result is in agreement with a related work of (Bashir, 2011) who reported that secondary school students taught Chemistry using concept mapping achieved higher than those using lecture method. Also Jibrin & Zayum (2012) reported that secondary school students taught biology using peer tutoring instructional strategy achieved significantly higher than those using lecture method.

Conclusion

From the study, it was concluded that mind mapping instructional strategy has improved the academic achievement of senior secondary school biology students in ecology. It was shown that mind mapping instructional strategy has the potentiality of improving the academic achievement of students.

Recommendations

Based on the result of the study, it is recommended that:-

- 1, Secondary School Teachers should be encouraged to use mind mapping instructional strategy in teaching biology.
2. Federal, State, Local Government and NGOS should come to the aid of the schools through funding and provision of instructional materials for better teaching and learning biology.

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