

EFFECT OF CONCEPT MAPPING TEACHING STRATEGY ON THE ACADEMIC ACHIEVEMENT OF SENIOR SECONDARY SCHOOL STUDENTS IN GENETICS

A. G. Jibrin and S. D. Zayum
SCIENCE EDUCATION PROGRAMME,
ATBU, BAUCHI

Abstract

The study investigated the Effect of Concept Map Teaching Strategy on the Academic Achievement of Senior Secondary School Students in Genetics. The design for the study was pre-test and post-test control group design. All the 20 senior secondary schools in Dengi metropolis constituted the population for the study. Two senior secondary schools were randomly selected and made into experimental and control groups. Genetics Achievement Test (GAT) was prepared by the researchers and validated by two senior lecturers from education department, ABU, Zaria Nigeria and a reliability coefficient $r=0.70$ was arrived at after pilot testing. Genetics Achievement Test (GAT) was administered to the students by the researchers. Data collected was analysed using z- test statistics. The results indicated that students taught Genetics using concept mapped instructional strategy achieved higher than those taught using expository method. It was recommended that, teachers need to diversify their method of teaching genetics such as concept mapped teaching strategy as it will assist in higher academic achievement of learners.

Introduction

Education has been described as a vital and indispensable key to any form of development (Offiah and Achufusi, 2010). It is an instrument for economic, political and scientific development of all nations (Olarinoye, 2001 and Otuka, 2006). This could be the reason why the Federal Government of Nigeria emphasised the Teaching of Science (biology inclusive where genetics belong) in its National Policy on Education (FGN, 2008). It has been observed that the major challenges in teaching is to create experiences that involve the student and support of his own thinking, explanation, evaluation, communication and application of the scientific models needed to make sense of these experiences (Afolabi & Akinbobola 2009). In science education, there is an increasing awareness of the importance of learner-centeredness in the teaching-learning situation which has generated a lot of attention in relation to understanding how learners learn and how to help them learn about concepts in sciences (Jegede, Alaiymota & Okebukola 1990). These efforts according to Cliburn (1990) and Danjuma (2005) assisting learners to learn more effectively have led to the development of meta-cognitive strategies to enhance meaningful learning. According to Novak (1983) meta-cognitive strategies, are meta-knowledge and meta-learning which are strategies that empower a learner to take charge of his/her own learning in meaningful ways. Novak & Godwin (1984) explained further that meta-knowledge refers to knowledge that deals with the very nature of knowledge and knowing, and meta-learning refers to learning that deals with the nature of learning or learning about meaningful learning.

Malone & Dekker (1984) stated that meaningful learning means that learners can integrate new knowledge into their existing networks of concepts and propositions in their cognitive structures.

Therefore, concept mapping according to Kinchin (2005) is a strategy that help learners organise their cognitive frameworks into more powerful integrated patterns. Many researchers such as Okebukola and Jegede, (1988); Novak (1983); Bello and Abimbola (1997) have observed that concept mapped can improve meaningful learning and help learners, learn independently. Concept mapping according to Novak & Godwin (1984) is a schematic device for representing a set of concept meaning embedded in a hierarchical diagram that illustrate the interconnections between and among concepts. It can be deduced that concept map provide a visual road map showing the pathways a learner can take to construct meaning of concepts and propositions. This strategy as observed by Novak & Godwin (1984) and Novak (1990) serves as both learning tool as well as evaluation tool, which encouraged the students to use meaningful mode-learning patterns. Similarly, Chiou (2008) conducted a research on the effect of concept mapping on students' learning achievements and interest. It was concluded that those exposed to accounting using concept map performed better than those exposed to accounting using expository method.

Despite the effort of science educators such as Bello (1996); Danjuma (2005) & Jibrin and Abba (2011) towards finding a suitable instructional

strategy for effective teaching in secondary schools. There still exist some reports of poor academic performance in public examinations results such as NECO and WAEC in Biology (Lakpini, 2007; Ogbenewede, 2010; Adebayo, 2011 & WAEC, 2011). The poor performance were attributed to the use of inappropriate method of teaching; poor spelling of technical terms; shallow knowledge of the subject matter; and inability to differentiate between phenotypic and genotypic ratio in genetics among others. Also Omole (2011) was of the opinion that 75 per cent failure in mathematics and sciences is worrisome. There is the need to identify teaching methods that students can relate with share ideas and interact academically within themselves. The present study is designed to look at the effects of concept map instructional strategy on the academic achievement of senior secondary school students' in genetics.

Purpose of the Study

The main purpose of this study was to determine the academic achievement of students taught genetics using concept map teaching strategy and those taught using expository method.

Hypothesis

The following null hypothesis was formulated for testing at $\leq P 0.05$

H₀₁: There is no significance difference in the mean academic achievement of students taught genetics using concept map teaching strategy and those taught using expository method.

Research Design

The design for this research is Quasi-experimental that employed pre test post-test non equivalent control group design. Pre-test was administered before the treatment by the researcher. This was to determine the equivalents in their academic ability. Post-test was administered after the treatment to determine the effect of treatment (concept map teaching strategy) on the subjects. This was done using the same instrument (Genetics Achievement Test). Experimental group received treatment using concept map teaching strategy while Control group was taught using lecture method.

Population of the Study

The population of the study was all the twenty (20) Senior Secondary Schools II that were located in Dengi Metropolis with total of 15,500 Senior Secondary School Biology Students from public schools.

Sample and Sampling Procedure

Two (2) Senior Secondary Schools were randomly selected using 'balloting method' from the area of the study. In each school selected intact class of Senior Secondary II Students was used. And the two schools were divided into experimental and control groups using 'odd and even' number method where the odd number school becomes the control group while the even number the experimental school.

Instrument for data collection

A twenty (20) multiple choice items Genetics Achievement Test (GAT) developed by the researchers was employed for data collection. The topics in Genetics covered by the students used in this study are:

- i. Transmission and expression of characters in organisms and Definition of genetics Terms.
- ii. Chromosomes the basis of heredity
- iii. Variation in population.
- iv. Application of principles of heredity to agriculture and medicine, and
- v. Probability in genetics

Validity of the Instrument

The instrument (Genetics Achievement Test) was validated by two (2) PhD holders and Senior lecturers from Department of Education, ABU, Zaria Nigeria and two (2) B.Ed holders teaching biology at Senior Secondary Schools. They made same recommendations on the areas of content and appropriateness of the language and the instrument was corrected before been used for this study.

Reliability of the Instrument

To determine the reliability of the instrument a pilot test was conducted at Government Secondary School Amper Plateau State which is outside the study area to ensure that the instrument was consistent. A test retest method was employed within two weeks interval in line with Tuckman (1975) recommendation. The results of the test were correlated using Pearson Product Movement Correlation Coefficient (PPMC), the reliability coefficient (r) was found to be 0.70 which shows that the instrument is reliable and was used for data collection in the study.

Method of Data Collection

Since there are two (2) groups for the study that is the experimental and control groups, respectively. Lesson plan was developed by the researchers for experimental group using concept mapped teaching strategy and control group using lecture method for the period of six (6) weeks. Pre-test was administered

to the groups to determine the equivalent of the ability level of the sample subjects.

The researchers then administered the posttest Genetics Achievement Test (GAT) to the students using the same instrument and marking scheme. The instrument was reshuffled after the pretest to avoid test wiseness. The scripts were collected and marked. The scores were subjected to statistical analysis.

Method of Data Analysis

The Data collected from both the experimental and control groups in the pretest and posttest were subjected to z-test statistics at $P \leq 0.05$.

Results and Discussion

The null hypothesis states that there is no significance difference in the mean academic achievement of students taught genetics using concept map teaching strategy and those taught using expository method.

Table 1; z-test analysis between the mean academic achievement of the experimental and the control groups

Group	N	\bar{X}	S.D	df	t_{cal}	t_{crit}	Remark
Experimental	30	54.8	14.5	79	2.08	0.98	Sig.
Control	50	48.3	11.9				

Table 1 show that, at 0.05 level of significance for z-tests the t_{cal} 2.08 is greater than the t_{crit} 0.98 with mean scores of 54.8 for experimental and 48.3 for control group at df 79. Therefore, the null hypothesis is rejected. Hence a significant different exist between the experimental and control groups in favour of the experimental group.

Discussions

The results revealed that there was significant difference in the mean academic achievement of students who were taught genetics using concept mapped instructional strategy and those taught to using expository method. The result is in agreement with that of Chiou, (2008) who reported that students' exposed to accounting using concept mapped performed better than those exposed to accounting using expository method. This might be possible because the students are directly involved in the learning process. It has been suggested earlier by Abdullahi (1982) & Danjuma (2005) that since students were actively involved in learning process and were able to found out some information for themselves through activity-based instructional strategy such as discovery method, problem-solving and concept map teaching method learning is better facilitated.

Conclusion

From the study it was concluded that concept map teaching method is one of the effective methods of teaching genetics at the Senior Secondary School Level, since it shows potentiality of improving student's academic achievement.

Recommendation

Based on the findings of the study, the following recommendations were made:-

1. Teachers need to use concept mapped teaching method so as to improve the academic achievement of students in genetics.
2. There is the need for training of biology teachers on the effective use of concept mapped teaching method in teaching genetics.
3. Facilities should be provided by the Federal and State governments as well as PTAs and NGOs for effective use of concept mapped teaching method for teaching in senior secondary schools
4. Biology education researchers may replicate and improve this study at a different location and at other education levels in the country.

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