



## Effects of Concept-mapping Teaching Strategy on Academic Performance in Biology among Senior Secondary School Students Yola Metropolis, Adamawa State, Nigeria

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### ABSTRACT

*This study investigated the effect of the Concept Mapping teaching strategy on biology students' academic achievement in secondary schools in Adamawa State, Nigeria. Two research questions and two hypotheses guided the study. Quasi-experimental research design involving pretest-posttest non-equivalent control group. The population was 24,960 SS II Biology students. From the population, two schools were randomly sampled which consist of 84 students. The instrument for data collection was the Biology Performance Test (BPT). The instrument was validated and pilot-tested using the test-retest method, and the Kuder-Richardson formula (KR-21) was used to get  $r = 0.87$ . The data collected were analyzed using Mean and Standard deviation to answer the research questions, while Analysis of Covariance (ANCOVA) was used to test the null hypotheses at 0.05 level of significance. The findings of the study showed that there was a significant difference between the mean scores of students taught biology using concept mapping teaching strategy and lecture method. It was recommended among other things that there is a need to encourage teachers to use concept map teaching strategy to improve students' academic achievement in biology.*

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### INTRODUCTION

Science Education is imperative to the socio-economic and technological advancement of developed and also developing nations such as Nigeria. This encourages developed and developing nations to invest in science courses, biology inclusive which is a pre-requisite to the attainment of scientific and technological development (Duru, 2012). Biology is an essential science subject offered at the senior secondary school level which requires suitable teaching approaches to enable the learner to acquire meaningful and relevant knowledge and apply the knowledge of biology in everyday life, it requires laboratory and field studies and a scientific attitude that are pragmatic and environment conscious (Ibe, 2013). Biology as a branch of science and prerequisite subject and Students' Academic Achievement for many fields

of learning has contributed immensely to the technological growth of a nation such as the application of biological techniques for the survival of man. Despite these, academic performance in both internal and external examinations is not encouraging (Jibrin, Abba & Mohammed, 2021). In light of this, Mohammed, Mahmoud, Yusuf and Jibrin (2023) revealed that poor performance in biology is attributed to some factors which include; the abstract nature of some concepts, large contents of the curriculum, and inappropriate instructional strategies employed by most biology teachers. The researchers further stated that the common method of instruction used by teachers is the teacher-centred approach, instead of the student-centred approach as recommended by the National Policy of Education (FME, 2013).

Teaching biology using a teacher-centred approach such as the lecture method

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makes students learn through memorization of facts leading to rote learning. Hence, the use of a teacher-centred approach makes learning some biology concepts difficult. Some of these concepts identified by the Chief Examiners' Reports of the West African Examinations Council are; the classification of living organisms, evolution, cell division, ecology and genetics among others (WAEC, 2021 & 2022). The use of the lecture method does not make learning meaningful (Jibrin, Abbas & Mohammed, 2021). Hence, Mohammed, Mahmoud, Yusuf and Jibrin (2023) suggested that biology teachers should use instructional strategies that are student-centred. Some of these instructional strategies that may enhance students' academic performance include; cooperative learning strategy, Inquiry-based learning, Project-based learning, field trip and concept-mapping instructional strategy.

Adebisi, (2011) defined Concept mapping as a method of arranging conceptual nodes, labels of nodes and links to show a relationship among multiple concepts in a domain. Concept maps are therefore tools that help organize knowledge for meaningful learning. The linking words that are used to connect concepts provide meaning for the preposition and domain of the knowledge to enrich the conceptual understanding of a concept to learn. Concept mapping-based instruction is one of the instructional strategies advocated by the Centre of Mathematical Science and Technology Education in Africa (CEMASTEA) as a learner-centred approach that helps students organize knowledge for meaningful learning.(Ali, 2015 & Makoba, 2016). In concept mapping, linking words such as prepositions and the domain of knowledge are used to connect concepts that would make students learn scientific knowledge. Therefore, this study investigated the effects of Concept-mapping teaching strategy on the academic performance of secondary school students in genetics in Yola Metropolis of Adamawa state.

### **Objective of the Study**

The purpose of the study is to determine the effect of concept mapping teaching strategy on academic achievement in genetics among senior

secondary school students in Yola Metropolis of Adamawa state, Specifically, the study sought to determine;

- 1.The effect of concept-mapping teaching strategy and lecture on Biology student's academic achievement in genetics

### **Research Question**

One research question guided the study

- 1.What is the effect of concept-mapping teaching strategy and lecture method on Biology student's academic achievement?

### **Hypothesis**

One null hypothesis was formulated and tested at a 0.05 level of significance.

H<sub>01</sub>: There is no significant difference between the mean performance scores of students taught genetics using concept-mapping teaching strategy and those taught using the lecture method.

### **METHODOLOGY**

The design employed a quasi-experimental research design. Specifically, the study was pretest, and posttest, and applied the non-equivalent control group design. The population of the study consisted of all the 7,564 senior secondary School biology students II in all the 17 secondary schools within Yola Metropolis of Adamawa State. A random sampling technique was used to select 2 secondary schools. Furthermore, simple random sampling techniques (by balloting) were used to select one intact class from each of the sampled schools and randomly assign it to experimental and control groups. The instrument used for data collection was the Genetics Performance Test (GPT) adapted from the West African Examination Council's past question papers of 2019-2022 and was pilot-tested using the test-retest method.

The data collected were subjected to the Pearson Product Moment Correlation Coefficient to establish the reliability coefficient of  $r = 0.87$ . Before the treatment procedure, the researchers trained the regular biology teachers of the sampled schools for two weeks to serve as

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research assistants. The research assistants were trained on how to teach genetics using concept-mapping teaching and lecture methods. The experimental group was taught using a concept-mapping teaching strategy while the control group was taught using a conventional (lecture) method. The exercise lasted for six weeks after which both the experimental and the control groups were post-tested using GPT. The scripts were collected, marked and recorded to form the data for the study. The data collected was analyzed using mean and standard deviation to answer the research question and Analysis of Covariance

(ANCOVA) was used to test the hypothesis at 0.05 level of significance.

## RESULTS

The research question was answered using descriptive statistics of Mean and Standard Deviation, while the hypothesis was tested using ANCOVA at a 0.05 level of significance.

### Research Question

What are the mean achievement scores of students taught genetics using concept-mapping teaching strategy and those taught using the lecture method?

**Table 1:** Mean and Standard Deviation of Pretest and Posttest Scores of students taught genetics using concept-mapping teaching strategy and those taught using lecture method

| Group        | N  | Pretest |      | Posttest |       | Mean Gain |
|--------------|----|---------|------|----------|-------|-----------|
|              |    | Mean    | SD   | Mean     | SD    |           |
| Experimental | 51 | 8.57    | 4.56 | 26.31    | 9.67  | 17.74     |
| Control      | 53 | 8.45    | 4.65 | 19.45    | 10.36 | 11.00     |
| Total        | 84 |         |      |          |       |           |

The descriptive statistics in Table 1 revealed that the concept mapping instruction group have 51 students who have a pretest mean score of 8.57 and a standard deviation of 4.56. In the posttest, concept mapping has the highest mean score of 26.31 with a standard deviation of 9.67. The lecture method group has 53 students with a mean score of 8.45 and a standard deviation of 4.65 at the pretest level and a mean score of 19.45 with a standard deviation of 10.36. A mean gain of 17.74 and 11.00 was achieved

indicating that those taught using concept mapping achieved better than those taught using lecture method. Hence, the level of the difference in the mean scores was tested statistically.

### Hypothesis Testing

**HO<sub>1</sub>.** There is no significant difference in the mean achievement scores of students taught genetics using concept-mapping teaching strategy and those taught using the lecture method.

**Table 2:** Analysis of Covariance of the pretest and posttest mean scores of students taught genetics using concept mapping and those taught using lecture method

| Source              | Type III Sum of Squares | DF  | Mean Square | F       | Sig. | Partial Eta Squared |
|---------------------|-------------------------|-----|-------------|---------|------|---------------------|
| Corrected Model     | 1825.472 <sup>a</sup>   | 3   | 608.491     | 5.590   | .001 | .094                |
| Intercept           | 23265.133               | 1   | 23265.133   | 213.731 | .000 | .570                |
| PRETEST             | 6.169                   | 1   | 6.169       | .057    | .812 | .000                |
| TEACHING_STRATEGIES | 1818.791                | 2   | 909.395     | 8.354   | .000 | .094                |
| Error               | 17525.255               | 161 | 108.853     |         |      |                     |
| Total               | 116563.000              | 165 |             |         |      |                     |
| Corrected Total     | 19350.727               | 164 |             |         |      |                     |

a. R Squared = .094 (Adjusted R Squared = .077)

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The results of the analysis in Table 2 show that there is a significant difference between the concept mapping strategy and lecture method on students' academic achievement in genetics  $F = 8.35$  (df 1, 164),  $P = 0.00$ . Since the computed p-value (0.00) is less than 0.05 level of significance, therefore, the null hypothesis which states that there is no significant difference between concept mapping instructional strategy and lecture method on students' academic achievement in genetics is rejected.

### DISCUSSION OF FINDING

The result of the study indicated that there was a significant difference in the mean scores of students taught genetics using concept-mapping instructional strategy and those taught using the lecture method. The findings of Sakiyo and Waziri (2015) are in agreement with this particular work. Sakiyo and Waziri (2015) conducted research on the effect of the concept map teaching method on secondary school student's academic achievement in genetics and found that concept map and lecture methods enhanced students' achievement in biology in general. Similarly, the study of Jibrin, Mohammed and Zayum (2020) indicated that students' academic performance in genetics and other concepts in biology is enhanced when taught using a student-centred approach, usually concept-mapping or cooperative learning strategies.

### CONCLUSION

The result of this study indicated that learning biology at secondary school is better if students are exposed to learning through a student-centred approach, such as the concept-mapping instructional strategy. The use of concept mapping has proved to be effective in learning genetics. This indicated that if biology teachers use appropriate teaching strategies students would learn meaningfully.

### RECOMMENDATIONS

Based on the findings of this study, the following recommendations were made;

1. Biology teachers and science teacher educators should adopt concept mapping instructional methods when teaching to enhance students' achievement in biology.
  2. Teachers need to diversify their method of teaching biology such as concept mapping teaching strategy as it will assist in higher academic achievement in biology.
  3. The state government and professional bodies like STAN should organize workshops, conferences and seminars for training and re-training of biology teachers on the use of innovative teaching strategies that are student-centred like concept mapping.
  4. Curriculum planners should design a biology curriculum with an emphasis on student-centered instructional strategy
- Based on the findings of this study the following could be recommended;

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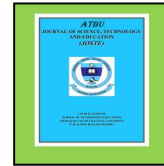
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