



EFFECT OF SPIDER-CONCEPT-MAPPING ON STUDENTS' MOTIVATION AND ACHIEVEMENT IN ECOLOGY IN PANKSHIN, PLATEAU STATE, NIGERIA

**NIMNAN MANZIR PETER; RAPHAEL
EMMANUEL; JENIFER MALO; MESHACH
NYINROTMWA CIRCE; AND DR. FRIDAY JOHN**

Department of Science of Technology Education,
Faculty of Education, University of Jos.

ABSTRACT

This study investigated the effects of Spider-Concept-Mapping on students' motivation and achievement in Ecology in Pankshin Plateau State, Nigeria. Quasi-experimental research design was adopted for the study. three research questions with corresponding research hypothesis were formulated. The population comprised all the

INTRODUCTION

Science education is very important to the development of any nation that is why every nation must take it very serious in all institutions of learning, Science education emphasizes the teaching and learning of science process and principles, and the goal is to: cultivate inquiry and rational mind for the conduct of good life, produce scientist for national development, and provide knowledge and understanding of the complexity of the physical world (FME, 2014). Science as a discipline has continued to play a leading role in global technological advancement and its ability to explain natural phenomenon and to solve human problem. Science education comprises of Biology, chemistry, physics and Mathematics (FME, 2014).

In Nigeria, the objective of Biology curriculum has been derived from the national policy of Education (2014) and the main objectives are to prepare students to acquire:



665 (354 males and 311 females) senior secondary school two biology students in Pankshin. The sample of 120(62 males and 58 females) students were used. Two intact classes of SS II students were involved in the study. The instruments for data collection were Students Ecology Achievement Test (SEAT) and Students Motivation Ecology Scale (SMES). Mean and standard deviation was used to answer research questions, while Analysis of Co-variance (ANCOVA) statistical tool was used to test the hypotheses at 0.05 level of significance. The results of the study showed that students taught biology using spider-concept-mapping performed better than their counterparts taught using lecture method. The experimental group performed better than the control group that is: Spider-concept-mapping affects students' achievement and motivation; and there was no gender influence on students' achievement. Based on results, it recommended among others that teachers should be encouraged to adopt the use of Spider-concept mapping instructional strategy in teaching senior school biology.

Keyword: Spider-Concept-Mapping, Motivation, Achievement, Gender and Ecology.

adequate laboratory and field skills in biology, meaningful and relevant knowledge in biology, ability to apply scientific knowledge to everyday life in matters of personal and community health and Agriculture, reasonable and functional scientific attitude. Biology is one of the science subjects that, when properly taught, will help the students to solve personal and societal problems such as human population growth through planned parenthood, increased in food production, through the application of the knowledge of genetics and plant breeding of improved varieties for human consumption.

Biology is a natural science concerned with the study of life and living organisms. Modern Biology is a vast and eclectic field composed of many specialized disciplines that study the structure, function, growth, distribution, evolution, or other features of living organism. Biology is a broad field that



offers a lot of opportunities to science students and also provides the society lots of benefits, hence there is the need for the effective teaching of Biology in our secondary schools to better harness its benefits, (Ahmed, Shittu, Yahaya, & Dada, 2021). There are different concepts in Biology. These include Physiology, Genetics, Anatomy, Evolution, and Ecology among others.

Ecology is the study of the relationship of organisms or group of organisms and their environment; or the science of the inter-relationship among living organisms and their environment. Also, Ecology is concerned with the Biology of group of organisms with functional process on land, in the ocean, and in fresh water. (Ahmad, 2014). For Ecology to be well taught and understood there has been a shift from teacher-centered to learner-centered approach in the 21st century. To this end there are so many teaching strategies, which include cooperative learning, problem solving, concept mapping, and spider concept mapping among others.

Concept map as one of the student-based activity-oriented instructional strategy is a diagram that shows the relationships between different ideas. Ibitomola, (2015) concept maps as an instructional strategy are graphical tools for organizing and representing knowledge. They include concepts, usually enclosed in circles or boxes of some types and relationships between concepts are indicated by a connecting line linking two concepts. Words on the line, referred to as linking words or linking phrases specify the relationship between two concepts. There are different types of concept mapping such as: flowchart, hierarchy, system, spider-mapping among others.

Spider concept mapping gets its name because it looks a lot like spider web. You will start with your core ideas at the center, and then branch outwards to sub topics in a radial pattern. Your subtopic can branch out into smaller topics (Boogaard, 2021). Despite the shift from teacher-centered to student-centered approach, some teachers still maintain the conventional method of teaching and learning process which is the lecture method.

Lecture method is a common method teacher employ in the teaching of Biology. In the course of using this method teacher dominate the class with little or no participation on the part of the learners, and the learner may be passive. According to Akpoghol, Samba, and Asemave, (2013), the lecture method involves the teacher orally presenting his ideas. The students are



passive listeners or slightly involved. In this method teacher covering a wider area within a short time and students do not gain mastering of concepts. This may cause students under achievements.

Academic achievement is the ability to demonstrate accomplishment of academic goals for which learning experience were designed. Achievement is an important academic factor that has been identified to be influence by teaching method. According to Kyado, Abah & Samba (2019). The achievement of students in Biology for more than 25 years has been persistently poor in public examinations such as WAEC. This may be as a result of poor instructional approach and motivation by Biology teachers.

Motivation is a factor that influence, trigger, and drives individual towards achieving the set goals. Motivation is used within the educational system to encourage students learning and understanding. Motivation in educational settings can either be intrinsic or extrinsic: intrinsic motivations are those that rose from within the individual, such as doing a complicated crossword, puzzle purely for the personal gratification of solving a problem. While extrinsic motivations are those that arise from outside of the individual and often involve rewards such as trophies, money, social recognition, or praise. Motivation is regarded as a force that energizes, directs, and sustains behavior (Mubeen & Reid, 2014). Student's changes in academic achievement are related to their learning motivation. The level of students' motivation in the concept of Ecology has been observed to be low due to the teaching methods, lack of instructional materials and poor knowledge of the concept by the teachers (Tom, Coetzee & Heyns, 2014). However, if students are been encourage through motivation and reinforcement it may improve their achievement irrespective of their gender.

Gender is the social/cultural constructed characteristics and roles which are associated to Males and Females which are not genetic. Males are assigned such attributes as intelligent, calculative, high retention ability among others whereas the Females are perceived to be inferior in the stated qualities. These make gender a contemporary issue of disparity in learning which affects motivation and achievement in Biology. Onyegegbu (2014) carried out a study on interaction and gender in senior secondary school science classroom and discovered that the boys clearly dominated the science lesson, and were more



active and willing than girls to comment spontaneously and make more contact with the student teachers than the girls. She also noted a little stereotypical behavior exhibited under incidence by students' teachers in favor of the boys.

STATEMENT OF THE PROBLEM

Biology contributes to the quality of life and nation building in all aspect of human endeavor. Despite the immerse contribution of Biology to the economic growth and development of the nation, the achievement of Biology students at West African Examinations Council (WAEC) is not encouraging. The Biology Chief Examiners report for 2015-2019, show students inconsistency and under achievement in Biology. In addition, research studies by Joda and Mohammed (2017) have shown that there is a persistent low achievement in SSCE Biology examinations annually. This low achievement in Biology was attributed to poor instructional delivery approaches adapted by teachers, leading to students' motivational problems, teacher's laxity toward teaching, concentration on few topics for examination purposes and student's inability to recall previously learnt materials (Umoru & Onoja, 2017). It is against this backdrop that this study is necessitated to find out the effect of spider concept mapping on senior secondary II students motivation and achievements in Ecology in Pankshin Local Government Area, Plateau State.

OBJECTIVES

The aim of this study was to find out the effect of spider concept mapping on senior secondary II students motivation and achievements in Ecology in Pankshin Local Government Area, Plateau State. Specifically, the study was guided by the following objectives:

21. To find out the if there will be difference in the achievement mean scores of the control and the experimental group.
22. To determine the difference in the motivation, mean scores of the control and experimental group.
23. To find out if there will be difference in the achievement mean scores of the male and female in the experimental group.



RESEARCH QUESTIONS

24. What is the difference in the achievement mean scores of the control and the experimental group?
25. What is the difference in the motivation mean scores of the control and experimental group?
26. What is the difference in the achievement mean scores of the male and female in the experimental group?

RESEARCH HYPOTHESES

- H₀₁:** there is no significant difference between the achievement mean scores of the control and the experimental group.
- H₀₂:** there is no significant difference between the motivation mean scores of the control and experimental group
- H₀₃:** there is no significant difference between the achievement mean scores of the male and female in the experimental group.

METHODOLOGY

The study adopted a quasi-experimental design of non-equivalent pretest-posttest control group design, where intact classes were used. The population of this study comprises of all the public senior secondary two students studying Biology as a subject in Pankshin Local Government Area of Plateau State, during the 2021/2022 academic session. The sample of the study consists of 120 (62 males and 58 females) senior secondary two Biology students. Purposive sampling technique was employed to select two schools that offer Biology. After which sample random technique was used to select one arm of class from each school as sample for the study. The Researchers used Student's Ecology Achievement test (SEAT) and Student's motivation Ecology Scale (SMES) to collect data. The SEAT and SMES were used to measure student's achievement and motivation in Ecology (Basic Ecological concept (Habitat), Pollution, Association, Adaptations to environmental factors, and Conservation of natural resources) as concept taught during the study period.

The students in both the experimental and control groups were tested using the SEAT and SMES before the commencement of the four weeks' treatment, in order to determine the equivalence of the groups in knowledge and ability.



The concept Ecology was taught for four weeks using spider-concept mapping for experimental group while lecture method for control group. The post-test (SEAT and SMES) were administered to both the groups after the four weeks of treatment to determine the effectiveness of the spider concept mapping and motivation. The scores obtained were analyzed, Mean and standard deviation were used to answered research questions and the hypotheses was tested at 0.05 level of significance

RESULTS AND DISCUSSION

Research Question One: What is the difference in the achievement mean scores of the control and the experimental group?

To answer research question one, the scores of student's for SEAT in the control and experimental groups were subjected to descriptive statistics in form of Means and Standard Deviations. This is presented in Table 1

Table 1: Analysis of Post-test Means and Standard Deviations Scores for SEAT of the Control Experimental Group

GROUP BET		N	Mean	Std. Deviation	Std. Error Mean	Mean Difference
SEATPOST	Experimental	67	59.67	15.572	1.902	14.62
	Control	53	45.06	15.887	2.182	

Table 1 indicated that that the post-test means and standard deviations of students for SEAT scores for experimental group were 59.67 and 15.572 while that of control group were 45.06 and 15.887. The post-test mean difference was 14.61 in favour of experimental group.

Research Question Two: What is the difference in the mean motivation scores of the control and experimental group?

To answer research question two, the scores of students for SMEAS in the control and experimental groups were subjected to descriptive statistics in form of Means and Standard Deviations. This was presented in Table 2



Table 2: Analysis of Means and Standard Deviations Scoresfor SMES of the Control Experimental Group

	GROUP	N	Mean	Std. Deviation	Std. Error Mean	Mean Difference
SMES	Experimental	67	65.31	6.265	.765	9.80
	Control	53	55.51	5.052	.694	

Table 2 indicated that the post-test means and standard deviations of students for SMES scores for experimental group were 65.31and 6.265 while that of control group was 55.51 and5.052. The post-test mean difference was 9.80 in favour of experimental group.

Research Question Three: What is the difference in the mean achievementscores of the male and female in the experimental group?

To answer research question three, the scores of studentsfor SEAT in the experimental group of male and female students were subjected to descriptive statistics in form of Means and Standard Deviations. This was presented in Table 3

Table 3: Analysis of Means and Standard Deviations Scoresfor SEAT in the Experimental Group of Male and Female Students

	GROUP GENDER	N	Mean	Std. Deviation	Std. Error Mean	Mean Difference
SEAT	Male	35	48.00	18.433	3.116	8.75
Gender	Female	32	56.75	13.714	2.424	

Table 3 revealed that that the means and standard deviations of students for SEAT scores in the experimental group for male students were 48.00and 18.433 while that of female students were 56.75and13.714. The mean difference was 8.75 in favour of female students.



Testing of Hypotheses

Hypothesis One

H_{01} : there is no significant difference between the mean achievement scores of the control and the experimental group.

To test hypothesis one, the scores of experimental and control group were subjected to Analysis of Covariance (ANCOVA). The result was presented in table 4.

Table 4: ANCOVA Analysis of the Post-Test Mean Scores for SEAT of the Experimental and Control Groups

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	22554.626 ^a	2	11277.313	102.316	.000
Intercept	4323.355	1	4323.355	39.225	.000
BETPR	16233.866	1	16233.866	147.286	.000
GROUP	3294.027	1	3294.027	29.886	.000
Error	12895.740	117	110.220		
Total	375292.000	120			
Corrected Total	35450.367	119			

4. R Squared = .636 (Adjusted R Squared = .630)

Table 4 revealed that the F-value computed was 147.29; adjusted R Squared observed was 0.63 and the p-value of 0.000 was observed. Since the obtained p-value of 0.000 is less than the alpha value of 0.05, based on the decision rule, this study rejected the hypothesis one that says there is no significant difference between the post-test mean achievement scores of the control and experimental group after exposure to spider-concept mapping. The decision implies that, there is a significant difference between the post-test mean achievement scores of the control and experimental group after exposure to spider-concept mapping. It can be stated that treatment has effect on students' achievement in ecology ($F(1, 117) = 147.29, P = 0.00$).



H_{02} : there is no significant difference between the motivation mean scores of the control and experimental group

To test hypothesis two, the scores of experimental and control group for SMES were subjected to Analysis of Covariance (ANCOVA). The result was presented in table 5.

Table 5: ANCOVA Analysis of the Mean Scores for SEMS of the Experimental and Control Groups

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	4203.830 ^a	2	2101.915	96.134	.000
Intercept	3078.368	1	3078.368	140.793	.000
SMEPR	1359.526	1	1359.526	62.180	.000
GROUP1	720.809	1	720.809	32.967	.000
Error	2558.137	117	21.864		
Total	453038.000	120			
Corrected Total	6761.967	119			

R Squared = .622 (Adjusted R Squared = .615)

Table 5 revealed that the F-value computed was 62.18; adjusted R Squared observed was 0.615 and the p-value of 0.000 was observed. Since the obtained p-value of 0.000 is less than the alpha value of 0.05, based on the decision rule, this study rejected the null hypothesis two (2) that says there is no significant difference between the post-test motivation mean scores of students in the control and experimental group. The decision implies that, there is a significant difference between the post-test motivation mean scores of students in the control and experimental group. It can be stated that treatment has effect on students' motivation ($F(1, 117) = 62.18, P = 0.00$).

H_{03} : there is no significant difference between the mean achievement scores of the male and female in the experimental group.



To test hypothesis three, the scores of experimental group for SMES of male and female students were subjected to Analysis of Covariance (ANCOVA). The result is presented table 6. below:

Table 6: ANCOVA analysis of the Mean Scores for SEAT in the Experimental Group for Male and Female Students

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	12625.416 ^a	2	6312.708	66.929	.000
Intercept	2738.398	1	2738.398	29.033	.000
BETGPR	11345.566	1	11345.566	120.289	.000
GROUP3	1331.273	1	1331.273	14.115	.000
Error	6036.434	64	94.319		
Total	201080.000	67			
Corrected Total	18661.851	66			

R Squared = .677 (Adjusted R Squared = .666)

Table 6 revealed that the F-value computed was 14.12; adjusted R Squared observed was 0.666 and the p-value of 0.000 was observed. Since the obtained p-value of 0.000 is less than the alpha value of 0.05, based on the decision rule, this study rejected the null hypothesis three that says there is no significant difference between the mean achievement scores of the male and female in the experimental group. The decision implies that, there is a significant difference between the mean achievement scores of the male and female in the experimental group. It can be stated that treatment has effect on students' achievement in ecology with gender ($F(1, 67) = 14.12, P = 0.00$).

SUMMARY OF FINDINGS

The finding indicated that there is a significant difference between the achievements means scores of the control and the experimental group. This finding agreed with that of Usman and Mankilik, (2019) who carried out a study to investigate the Effect of Concept Mapping Strategy on Secondary School



Physics Students' Achievement. Based on the data analysis, it was seen that concept mapping strategy improves student's achievement in Physics; it was also found that concept mapping strategy was effective in enhancing students learning.

In addition, the finding indicated that there is significant difference between the achievement mean score of the male and female in the experimental group. The finding agreed with that of Nnamani and Oyibe (2016) who conducted a research on gender and academic achievement of secondary school student in Social Studies in Ebonyi State. Based on the data analysis the result indicated that there is a significant difference in the mean achievement of secondary school students in Social Studies based on gender.

Furthermore, the result indicated that there is a significant difference between the motivation mean scores of the control and experimental group. The result is in line with that Amos (2014) Carried out a study on the Effects of motivation on students' Academic Performance in biology in some selected senior secondary schools in zaria L.G.A of Kaduna state. The results of the findings showed that motivated Biology students in all its ramifications performed far better than unmotivated Biology students.

CONCLUSION AND RECOMMENDATION

Based on the findings of this study, it can be concluded that, Spider-concept mapping enhances student's achievement in ecology better than the conventional lecture method. The study therefore recommended that Biology teachers should use Spider-concept mapping strategy to teach aspect of Ecology.

REFERENCES

- Ahmad, Y. (2014). *Effects of field trip on retention and academic achievement in ecology among secondary school students in Zaria, Nigeria*. Theses submitted to the school of post graduate studies Ahmadu Bello University, Zaria.
- Ahmed, M., Shittu, F., Yahaya, L., & Dada, A. (2021). Effects of concept-mapping instructional strategy on senior school students' achievement in biology, Lagos state, *Nigeria Malaysian Online Journal of Educational Sciences*. 9(1), 14-23
- Ibitomola. M. (2015). *Effect of concept mapping and experimental techniques in teaching biology in secondary schools in Federal capital territory Abuja, Nigeria*. Abuja: Macmillan Press.
- Onyejekwe, C.A., Uchendu, C. G. & Nmomo T. (2018). Effect of Concept Mapping on Students' Performance in Genetics, in Selected Public Schools in Obio/Akpor, *International Institute of Academic Research and Development, International Journal of Education and Evaluation*, 4(1), 54-60.



- Akpoghol, T, Samba, R.&Asemave, K. (2013). Effect of Problem-Solving Strategy on Students' Achievement and Retention in Secondary School Chemistry in Makurdi metropolis. *Research Journal in Curriculum & Teaching*, 7(1), 529-537.
- Boggaard, K (2021). What is Concept mapping. Retrieved October 26, 2021 from <https://micro.com/blog/what-is-concept-map>.
- Kyado, J., Abah, C., & Samba, R. (2019). Effect of collaborative concept mapping instructional strategy on secondary students' achievement in Difficult Biology concept. *American Journal of Social Sciences and Humanities*, 4(3), 434-447.
- Mubeen, S., & Reid, N. (2014). The measurement of motivation with science students: *European Journal of Science Education Research*, 3(3), 129-144.
- Opara J.C. (2011). Inquiry Method and Student Academic Achievement in Biology: *American-Eurasian Journal of Scientific Research* 6 (1), 28-31.
- Tom, F. Coetzee, & Heyns, T. (2014). Factors influencing academic performance in Biological sciences among students in nursing education institution. *African Journal for Physical Health Education, Recreation and Dance*, 2(1), 3-7.
- Onyegebu, N (2014). Provision of facilities in Biology classroom: new direction and challenges. *International Journal of education*, 5(1), 70-75.
- Umaru, E., & Onoja A. (2017). *Comparative effects of instructional approach on students' academic achievement in Biology; implication for curriculum review*. *Journal of curriculum*. Unpublished Med thesis. University of Calabar, Nigeria.
- Joda, F.M., & Mohammed, A.A. (2017). Effects of guided inquiry teaching methods on senior secondary school Biology students' academic achievement and retention in Yola education zone, Adamawa state, Nigeria. *Multidisciplinary Journal of Science, Technology and Vocational Education*, 5(1), 89-96.
- Usman, I., & Mankilik, M. (2019). Effects of Concept Mapping Strategy on Secondary School Physics Students' Achievement in Jos, Plateau State, Nigeria. *KIU Journal of Humanities*. Kampala International University ISSN: 2415-0843; 4(3), 117-126.
- Nnamani, S., & Oyibe, O. (2016). Gender and Academic Achievement of secondary school students in social studies in Abakiliki urban of Ebonyi state. *British Journal of Education*, 4(8), 84-95.
- Amos, M. (2014). Effects of motivation on students' Academic Performance in biology in some selected senior secondary schools in Zaria L.G.A of Kaduna state. *Journal of Vocational Studies (abujovs)* 8(1), 183.
- Federal Ministry of Education FME (2014). National Policy on Education. Abuja: NERDC Press.