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Effect of Concept Mapping on Students Achievement in Basic Technology in Junior Secondary Schools in Yenagoa Local Government Area, Bayelsa State

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Abstract

This study investigated the effect of concept mapping on students' achievement, in Basic Technology in junior secondary schools in Yenagoa local government area of Bayelsa State. Quasi-experimental research design of equivalent post-test treatment and control group was used for the study. Two research questions were posed to guide the study and two hypotheses tested at 0.05 level of significance were used. A sample size of 400 JSS11 junior secondary school Basic Technology students was selected by simple random sampling technique for the study. Research instruments titled Basic Technology Achievement Test and Basic Technology Interest Inventory Scale with reliability co-efficient index of 0.96 and 0.73 respectively were used. This was obtained using test re-test method and Pearson Product Moment Correlation. Data were analysed using mean, standard deviation and z-test. Mean and Standard Deviation were used to answer the Research questions while z-test was used to test the Hypotheses at 0.05 level of significance. The study revealed that Students taught basic technology using concept mapping teaching techniques had higher mean achievement score than those taught using lecture method. Male students achieved higher than their female counterparts in Basic Technology. It was recommended that Basic Technology teachers should incorporate this technique as one of the techniques used in teaching Basic Technology in the classroom so as to enhance the learning of Technological concepts, laws and theories. In-service training should be given to Basic Technology teachers through intensive workshops and seminars on concept mapping and co-operative learning amongst others. Curriculum developers should include the teaching of concept mapping strategies in the Basic Technology curricula of teacher education institution.

Key words: Concept Mapping, student's achievement, Basic Technology

I. INTRODUCTION

Basic Technology formerly known as introductory technology is a foundational subject taught at the junior secondary school level in Nigeria. It is a basic subject that lays the foundation for the take-off of technology related courses. Students are introduced to what technology is, different aspects of technology and its usefulness to man. Basic Technology is the type of training given to individuals to enable them imbibes technological awareness in the first three years (junior secondary school) of the six years secondary school period. Emphasis is usually placed on basic electrical/electronics, building drawing, wood work, technical drawing, concrete practice and metal work.

According to Elisha and Christopher (2017), Basic Technology is an integrated subject which consists of woodwork, metal work, building technology, auto mechanics, electrical electronics and technical drawing at their basic level. It is a subject that is offered at the junior secondary school level. Basic

Technology has been identified as a very important subject in junior secondary school and as such its importance in scientific and technological development of an individual and any nation cannot be overlooked This is why Basic Technology was separated from Basic Science and has become one of the core subjects among other science related subjects in Nigeria education system in the junior secondary school level. Its inclusion as a core subject in the junior secondary schools level of education in Nigeria calls for the need to teach it efficiently and effectively. This is because the effective teaching of Basic Technology can lead to the attainment of technological greatness both in an individual and in a nation.

Basic Technology as a subject at the junior secondary education level provides opportunities for students to explore the world of works, it is a prevocational subject This can only be achieved if Basic technology is properly taught using the most effective and efficient teaching method. This will result in higher student's achievement, increased interest in Basic technology and higher retention of knowledge and skills in technology.

Students Achievement is the measurement of the amount of academic content a student has learned in in a given subject, in a given time which has helped the student acquire knowledge and skills and also develop attitudinal changes that will enable him/her have a better understanding of related courses. Edinyang and Ubi, (2012) defines students achievement as the outcome of education which shows the extent to which a student, teacher or institution have achieved their educational goals. Students' achievement is commonly measured by examinations or continuous assessment (Abdulhamid, 2013).

Students Achievement is an important academic factor that has been recognized to be influenced by teaching method. Anderson in Essien, Akpan, and Obot, (2015), reported that interest most often is directly tied to the content or instruction, and it also directs and enhances learning. This means students 'interest in a particular subject will positively affect their academic achievement that is a higher interest in basic technology will yield a higher academic achievement in basic technology.

Lecture Method is the oldest and teacher centred method of teaching, where a lecturer comes into the class with his lecture note, stands in front of the class and reads from his lecture note and explains what he has read to the students. While students sit down passively listens and take down note where necessary. Teachers are more active and students are passive though the teacher also asks questions to keep the students attentive. Lecture method remains one of the popular methods of teaching in Nigerian secondary schools (Kenneth, 2013).He further said, most teachers of basic technology widely embrace lecture method because it provides for an effective use of time and manpower and it enables teachers to present many concepts to a large group in a relatively short period of time.

However, it is an ineffective method that eases teaching (Mohammad, 2011). According to Bimbola and Danie in Kenneth (2013), lecture method makes learners passive in the teaching/learning process. It is now being recognized that there are better ways of teaching than the traditional lecture method (Akpoghol, Samba & Asemave, 2013). Concept mapping is one of the better means of

teaching because it presents information in a less complex but interrelated manner which discredits rote learning.

Concept Mapping is a student-centred teaching method where the concepts in a topic are represented in maps which have circle or box or any other shapes and arrows are used to show their relationship with words or phrases linking the concepts. Concept mapping-based instruction is one of the instructional strategies propounded by CEMASTER as learner-centred approach (Makoba, 2016). Concept mapping is a teaching and learning strategy that set up a bridge between how people learn knowledge and sensible learning (Yunus in Awodun, 2017).

Agwagah and Ezeugo in Awodun (2017), stated that concept-mapping method helps to make clear to both learners and teachers the small number of key ideas they must focus on for any specific learning task. Concept learning breaks down the task to be learnt into smaller units. These smaller units serve as the key to each segment of the problem, as the learning maps each unit to the key concepts in educational settings. It was designed to support the learner's effort by externalizing concepts and propositions known to the student, making them visually patent to ease their connection with newly acquired concepts.

Statement of Problem

Basic technology is the first technology related subject the child is introduced to at the junior secondary school. This subject gives students the foundational knowledge of electrical/ electronics, building technology, technical drawing etc., the way it's being taught at this foundational level has a great impact and influence on the students' interest, retention and achievement.

Junior secondary school Basic Technology waec results from 2018 to 2020 revealed that in 2018 60% of students scored below credit in Basic Technology, in 2019 44% scored below credit and in 2020 74% scored below credit. Source: ministry of education Bayelsa State. There is a problem that needs attention if Bayelsa State must advance technologically. The poor academic achievement among basic technology students as stated above, could it be as a result of the teaching method used or what could have led to this. Lecture method remains one of the popular methods of teaching in Nigerian secondary schools (Kenneth (2013). He further said, most teachers of basic technology widely adopt lecture method because it provides for an effective use of time and manpower and it enables teachers to present many ideas to a large group in a relatively short period of time. This confirms that most times the teaching of basic technology is being dominated by the traditional lecture method which is a teacher-centred method. This has resulted to reduction in the effectiveness of learning, interest, achievement and retention of students in basic technology. Thus, leading to lack of interest and poor enrolment into technology-oriented course in the university. The goal of federal government is not being met or achieved, there is high rate of unemployment due to the fact that graduates are looking for employment into government and private Para statues rather than being self-employed and also being an employer of labour.

When an appropriate instructional method is used to teach Basic Technology students' achievement will increase in the subject and students will be influenced to choose technology related disciplines in the university and the problem of poor enrolment will be taken care off. that learning outcome is

influenced by the instructional strategy employed by teacher. It is the only factor that can easily be manoeuvre by teacher to achieve learning objectives (Eze & Bot, 2014). Hence, the study considered how effective is the use of concept mapping as an instructional strategy to enhance students' achievement, interest and retention in basic technology.

Purpose of the Study

The main purpose of this study is to investigate the effect of concept mapping on student's achievement in basic technology in junor secondary schools in Yenagoa Local Government Area, Bayelsa State.

This study sought to determine;

1. The effect of concept mapping on students' mean achievement scores in basic technology in junior secondary schools in Yenagoa local government area.
2. The influence of gender on mean achievement scores of students taught basic technology using concept mapping in junior secondary schools in Yenagoa local government area.

Research Questions

The following research questions are designed to guide the study

1. What is the effect of concept mapping and lecture method on students' mean achievement scores in basic technology in Yenagoa local government area, Bayelsa State?
2. What is the influence of gender on the mean achievement score of students taught Basic technology using concept mapping and those taught using lecture methods in Yenagoa local government area, Bayelsa State?

Null Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significance.

$H0_1$.There is no significant difference in the mean achievement scores of students taught basic technology using concept mapping and those taught using lecture method in Yenagoa local government area, Bayelsa State

$H0_2$. There is no significant difference in the mean achievement score of male and female students taught Basic technology using concept mapping in Yenagoa local government area, Bayelsa State.

II. METHODOLOGY

This study employed a quasi-experimental design. According to Alio in Igharo, Baridue, Opakirite & Daniel (2022) a survey research design is one in which a group of people or items are studied by collecting and analyzing data from only a representative of the entire population. The target Population of the study comprised of 4502 JSS1I junior secondary school Basic technology students in public schools in Yenagoa Local Government Area of Bayelsa State (source: Ministry of Education, Bayelsa State Nigeria, 2020/2021 JSS II Enrolment)The sample size consists of 400 JSSII students. A simple ramdom sampling was used chose four (4) junior secondary schools out of thirty-four (34) junior secondary schools in Yenagoa Local Government Are, Bayelsa State. Out of the four (4) secondary schools, two junior secondary intact classes were randomly chosen from each of the four-secondary school with each of the intact class consisting of fifty (50) students. The two classes were assigned Group A and B. Group A was the treatment group that was treated using concept mapping teaching method while Group B the control group, was taught using lecture method in each of the four junior secondary schools.

Two instruments were used in this study. These are the Basic Technology Achievement

Test (BTAT) and Basic Technology Interest Inventory Scale (BTIIS).

BTAT is a twenty-item multiple choice objective question developed by the researcher to test the student's achievement in Properties of materials; Wood and Metals before and after treatment. These questions were developed based on the content that was taught in the lesson. Each question was made up of four options A-D. The instrument (BTAT) and (BTIIS) were face and content validated by my supervisor who is an expert in the field and three different Basic Technology teachers from different schools. These instruments were subjected to Testing and Pearson Product Moment Correlation was used to estimate the reliability co-efficient of the instrument BTAT while Cronbach alpha formula was used to estimate the reliability of the Basic Technology Interest Inventory Scale (BTIIS), The reliability test on BTAT yielded reliability co-efficient of 0.96 and 0.73 on BTIIS which indicated that the reliability is very high. Mean and Standard Deviation were used to answer the research questions while z-test was used to test the Hypotheses at 0.05 level of significance.

III. Analyses of Data and Results

Performances on the three variables are presented along the research questions and hypotheses as follows:

Research Question 1:

What is the effect of concept mapping and lecture method on students' mean achievement scores in basic technology in Yenagoa Local Government Area, Bayelsa State?

Table 1: Mean and Standard Deviation of Achievement Scores of Students Taught Basic Technology Using Concept Mapping and Those Taught Using Lecture Method.

Methods		Pre-test		Post-test		
	N	Mean	SD	Mean	SD	Mean gain
Concept Mapping	200	54.63	12.88	68.25	16.04	13.62
Lecture Method	200	47.60	11.69	57.95	11.48	10.35

Table 1 shows that the students that were taught Basic Technology using concept mapping instructional strategy obtained a higher mean achievement score of 68.25 and a standard deviation of 16.04, while those that were taught using lecture method had a lower mean achievement score of 57.95 and a standard deviation of 11.48. This gives a difference in mean achievement scores of 13.62 and 10.35 in favour of the Treatment group., which implies that the students that were exposed to concept mapping instructional strategy achieved higher than their counterparts taught using lecture method.

Research Question 2: What is the influence of gender on the mean interest score of students taught Basic technology using concept mapping in Yenagoa Local Government Area, Bayelsa State?

Table 2: Mean and standard deviation of achievement scores of male and female students taught Basic technology using concept mapping?

Gender		Pre-test		Post-test		
	N	Mean	SD	Mean	SD	Mean gain
Male	106	56.68	11.79	73.46	14.96	16.78
Female	98	52.40	13.67	62.60	15.30	10.20

Table 4.4 reveals the achievement mean scores of male and female students in Basic Technology. It shows that male students had post-test mean achievement score of 73.46 with a standard deviation of 14.96 while their female counterparts had post-test mean achievement score of 62.60 with a standard deviation of 15.30. This had indicated that male students achieved higher than their female counterparts in Basic Technology.

Hypothesis Testing

$H_{01:}$ There is no significant difference in the mean achievement scores of students taught basic technology using concept mapping and those taught using lecture method in Yenagoa Local Government Area, Bayelsa State.

Table 3. z-test analysis on the Achievement Scores of Students taught Basic Technology Using Concept Mapping and Those Taught Using Lecture Method

Groups	N	Mean	S.D.	df	z-cal	z-crit	Sig.	Rmrk
Experimental	200	68.25	16.04	398	7.385	1.96	0.000	Reject
Control	200	57.95	11.48					

Field Survey, 2021

Table 3 shows the z-test analysis on the achievement scores of students taught basic technology using concept mapping and those taught using lecture method. The analysis shows that the p-value is 0.000 which is less than the 0.05 level of significance i.e ($p< 0.05$), hence the difference in the mean scores of students taught basic technology using concept mapping and those taught using lecture method is statistically significant. The null hypothesis was rejected

H_{02}: There is no significant difference in the mean achievement score of male and female students taught Basic technology using concept mapping in Yenagoa Local Government Area, Bayelsa State.

Table 4. z-test analysis on the Achievement Score of Male and Female Students Taught Basic Technology Using Concept Mapping

Groups	N	Mean	S.D.	Df	z-cal	z-crit	Sig.	Rmrk
Male	106	73.46	14.96	202	5.124	1.96	0.000	Reject
Female	98	62.60	15.30					

Field Survey, 2021

Table 4.10 shows the z-test analysis on the mean achievement score of male and female students taught Basic technology using concept mapping. The analysis showed that the f-value is 5.124, p-value is 0.000 is less than the 0.05 level of significance i.e ($p< 0.05$). This implies that the null hypothesis which states that there is no significant

difference in the mean achievement score of male and female students taught Basic technology using concept mapping is thus rejected.

The findings of the study revealed that the students taught basic technology with concept mapping instructional strategy achieved higher than their counterparts taught with the lecture method. And a further test of significance at 0.05 level shows that there is a significant difference between the main achievement score of Basic Technology students taught with concept mapping and those taught with lecture method in Yenagoa Local Government Area in Bayelsa state in favour of concept mapping.

Discussion of the findings

The findings of the study revealed that the students taught basic technology with concept mapping instructional strategy achieved higher than their counterparts taught with the lecture method. And a further test of significance at 0.05 level shows that there is a significant difference between the main achievement score of Basic Technology students taught with concept mapping and those taught with lecture method in Yenagoa Local Government Area in Bayelsa state in favour of concept mapping.The finding of this study is in line with that of Jaya (2015) who reported that students exposed to the concept mapping instructional strategy in a particular subject achieved more than those who were taught with the traditional method. The findings also agree with Kell, Lubinski and Benbow, (2013), that teaching method influences students' achievement in a subject. The findings of Offor, (2011) that the experiment group (i.e. those taught with concept mapping) outperform those taught with lecture method i.e.(control group)accords perfectly with this study. Ukpai, Okafor, Abonyi and Ugama (2016), also revealed that the students taught basic science with concept mapping performed significantly better than the students taught with conventional method. In other words, the difference between the adjusted mean achievement of the experimental group was significant in favour of the experimental group.

The consistencies in the result of this study and the previous studies could be due to the effectiveness in teaching when concept mapping strategies is used. This implies that concept mapping method has a positive effect on the students' achievement in basic technology. Hypotheses testing relating to this research question confirms that there is significant difference in the mean achievement scores of students taught basic technology using concept mapping and those taught using lecture method.

Moreover, according to Afuwape cited by Awoduni (2017), concept mapping promotes the development of critical thinking skills which are embedded in creativity that can be used to ensure meaningful learning for enhancing academic achievement.

The findings of this study indicated that male students achieved higher than their female counterparts in Basic Technology. This difference was further tested for significance at 0.05 level and it confirms that there is a significant difference in the main achievement score of male students and those of the female students taught Basic Technology using concept mapping in Yenagoa Local Government Area in Bayelsa state in favour of concept mapping.

The result of this study corroborates previous findings that gender influence student's achievement in basic technology when concept mapping instructional strategy is used. For instance, Ahmad and Munawar (2013) found that Concept mapping as a teaching learning tool is more effective for the

male students than female students with respect to achievement in science,

Ukozor (2011) also reported that boys achieved better than girls in sciences. Nuhu, Suleiman and Dauda (2017) also affirmed that Male students were found to perform better than their female counterparts in the concept mapping method. However, the difference in the performance of male and female students in the concept mapping method was not significant at 5% level of significance. Hence gender has moderating role in defining the effect of concept mapping on academic achievement in the subject of science.

Although, Ugwuanyin Ezeudui (2013) reported that girls did better than boys in students' conceptual understanding of force and motion. On the contrary Nzewi in Ezeudu (2031) showed that gender has insignificant effect on student's achievement.

However, from the result of the hypothesis testing relating to this research question, there is significant difference in the mean achievement score of male and female students taught Basic technology using concept mapping.

IV. CONCLUSION

Based on the findings and discussion of the study, the following conclusion was made;

There is significant difference ($p< 0.05$) between the mean achievement score of students exposed to concept mapping approach and those exposed to lecture method in basic technology, in favour of concept mapping instructional strategy.

There is significant effect of gender ($p>0.05$) on the achievement of students taught basic technology using concept mapping and those taught using lecture method.

V. RECOMMENDATIONS

Based on the proceeding results of this study, the following recommendations are considered appropriate

i. Since the study reveals that the use of concept mapping enhances students' achievement, interest and retention in Basic Technology, it is recommended that Basic Technology teachers should incorporate this technique as one of the techniques used in teaching Basic Technology in the classroom so as to enhance the learning of Technological concepts, laws and theories.

ii. In-service training should be given to Technology through intensive workshops and seminars on modern teaching techniques such as concept mapping and co-operative learning amongst others. This will help to enhance their competence especially in the choice and use of the various innovative teaching strategies.

iii. Curriculum developers should include the teaching of concept mapping strategies in the Basic Technology curricula of teacher education institution.

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