

Effect of Concept Mapping Technique on Academic Performance among Secondary School Geography Students in Katsina State, Nigeria

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Abstract. This study investigated the effect of concept mapping technique on academic performance among secondary school geography students in Katsina State, Nigeria. The study adopted a quasi-experimental design. A sample of 156 (94 males and 62 females) which was randomly selected from two schools out of 25 schools with a total population of 5953 (3,317 males and 2,636 female) was used for the study. A 40-item multiple choice titled Geography Performance Test with reliability $r = 0.77$ was used to collect data. Students in the experimental group were taught using concept mapping while the control group was taught using lecture method. Research questions were answered using Mean and standard deviation. Null hypotheses were tested using independent sample t-test at 0.05 level of significance. The results of the study showed that, there is significant difference between the mean score on performance of students when taught using concept mapping and those taught using lecture methods in favor of the students taught geography using concept mapping. However, there was no significant difference between the mean score on performance of male and female students taught geography using concept mapping. It was concluded that, concept mapping strategy have significant effect on the students' performance in geography than the traditional lecture method. It was recommended that, geography teachers should expose students to concept mapping strategy so as to improve their performance in geography and both male and female students should be taught geography using concept mapping in other to equally help them learn and perform better.

Key words: Concept Mapping technique, Performance, Senior secondary students, and Geography

INTRODUCTION

The importance of education is undisputable for every individual. Every successful person is not without education. Apparently, people only become more useful and civilized with better education. In areas where citizens in that environment receive appropriate education, life cannot be as thriving and prosperous as location where there is a high standard for education (Umaru Musa Yar'adua University, 2020; Ogunode, & Ugbome 2021; Ogunode, Chijindu, & Jegede, 2022).

Secondary education is the education children receive after primary education and before the tertiary stage. Secondary education offers diversified curriculum to cater for the differences in talents and as well provides all primary school leavers with the opportunity for education of a higher level (Federal Republic of Nigeria, FRN, 2013). At the senior secondary level, many subjects are offered with some labelled as core subjects and others as electives (vocational and non-vocational subjects). Apart from the main core subjects, i.e. English Language, Mathematics and Civic Education, Geography is also one of the elective but a core subject for some options (Ogunode & Lilian, 2022; Ogunode & Usman, 2023).

Secondary school geography curriculum in Nigeria is structured to contain aspects such as map reading, physical geography, regional geography and human geography (Amosun, 2016). All these areas are well spelt out topic by topic which the geography teacher ought to teach and get the students ready for external examination. Students with interest to study geography and geography-related courses are mandated to master concepts in geography and obtain at least, a credit pass in the subject. Unfortunately, students usually experience difficulty in understanding geography lesson (Onuoha & Eze, 2013). One reason identified is the weakness the teaching method adopted by the teacher teaching the subject (Onuoha & Eze, 2013). The difficulty in learning geography result in high level of attrition of students at the senior secondary certificate examination level in Nigeria (Rilwani, Akahomen & Gbakeji, 2014). The West African Examination Council (WAEC, 2020) reported that, students' performance in geography has dropped compared to the previous years. Some of the contributing factors identified include, none coverage of syllabus as evidence in their poor performance, poor expression, mere listing of answers that require explanation, avoidance of certain vital questions, poor map works among others (WAEC, 2020).

In this recent time, there has been a paradigm shift in curriculum implementation. The significance of how learners prefer to learn is now taken into cognizance. Schools have now realized the importance of the ways students learn (Olatoye, Aderogba & Aanu, 2011; Ogunode & Atiga 2021; Ogunode, & Josiah, 2021). The constructivists proposed different theories supporting the shift of classroom instruction from teacher-centered to learner-centered. The conventional lecture method commonly adopted by teachers could also be the cause of students' poor performance. This is because, the use of lecture method entails a one-way flow of communication from the teacher to the students. Aniodoh (2011) lamented that, lecture method negates teaching as it does not give rooms for effective and meaningful learning but only enhances intellectual positivity and weariness of the learners. In Nigerian secondary schools, traditional teaching (lecture) method is most often used by Geography teachers for instruction. This kind of method may not be very effective when teaching aspect of geography like human geography. In order to foster students' learning of human

geography, certain teaching strategies that will help link the components in a holistic manner were recommended. One of such teaching strategy is concept mapping.

Concept mapping is a teaching strategy that can overtly engage students in meaningful learning processes. Concept mapping shows the relationships between a set of concepts or ideas which gives clear picture of how the concepts are related (Gimba, Daramola and Jimwan, 2015). Concept mapping promotes meaningful learning and retention of knowledge for a long period of time and helps students negotiate meaningful learning (Hyerle, 2002 in Simone (2018) describes concept mapping as a learning strategy that allows learners to externalize visual and verbal information which help them improve their understanding of learning. Concept mapping teaching strategy is therefore advantageous as it allows the learners to extract important information, relate ideas and represent them in a structured manner. It is against this background that the study investigates the effect of concept mapping technique on academic performance among Secondary School geography students in Katsina State, Nigeria.

Statement of Problem

One of the objectives of education in Nigeria is to enhance science and technology which would enable the nation tackle her economic, social and technological problems. Geography is one of the subjects taught in secondary schools which aim at inculcating skills and relevant attitude in students so that, they can face challenges created by population explosion, environmental pollution, regional socio-economic inequality, resource depletion etc. Secondary school leavers are expected to obtain at least a credit pass in the subject before they can be given admission to study any geography-related course. Unfortunately, students are reported to have encounter difficulty in learning the subject (Onuoha & Eze, 2013) and this eventually result in high level of attrition of students at the Senior Secondary Certificate Examination Level in Nigeria (Rilwani, Akahomen & Gbakeji, 2014). The causes of this poor performance is attributed, but not limited to, none coverage of syllabus, poor expression, mere listing of answers that require explanation, avoidance of certain vital questions, poor map works, and use of irrelevant teaching methods among others (WAEC, 2016-2022). Research evidence abound that highlight a number of factors responsible for low academic performance in geography, among the several factors enumerated to account poor teaching method seem to be a major contributory factor. The neglect of activity-oriented method of teaching has led to abstractness which makes the students less active (passive learners) and more prone to rote memorization. Based on this, many researchers advocate the use of self-learning strategies such as concept mapping, as a way of enhancing students' performance and promoting good attitude to geography. As far as the researcher is concerned, no empirical evidence is available to back this claim especially in Katsina State where this study is taking place. It is on this note that the study seeks to investigate the effect of Concept Mapping Technique on Academic Performance among Secondary School Geography Students in Katsina State, Nigeria.

Objectives of the Study

The objectives of this study were to:

1. Investigate the effect of concept mapping technique on students' academic performance in geography in senior secondary schools of Katsina.

2. Investigate the effect of concept mapping technique on male and female students' academic performance in geography in senior secondary schools of Katsina.

Research Questions

The following research questions were addressed in this study:

1. What is the difference between the mean academic performance scores of Geography students taught using concept mapping and those taught the same concept using lecture method in senior secondary school in Katsina state, Nigeria?
2. What is the difference between the mean academic performance scores of male and female students taught Geography using concept mapping?

Hypotheses

H0₁: There is no significant difference between the mean academic performance score of geography students taught using concept mapping and those taught the same concept using lecture method in secondary schools of Katsina state.

H0₂: There is no significant difference between the mean academic performance scores of male and female students taught Geography using concept mapping in senior secondary schools of Katsina state.

Literature Review

There are many investigation on mapping in educational institutions. For instance, Cheema and Mirza (2013) analyzed the effect of concept mapping, a constructivism based learning strategy, on academic performance of 7th grade students in the subject of general science. They also discovered that male students taught through concept mapping performed significantly better than the female students. The reviewed work used general science while the current work narrows the scope to geography students. This is a gap that this current research filled. Another study was carried out by Otor (2013) who investigated the effects of concept mapping strategy on secondary school students' achievement on difficult chemistry concepts in Benue state. He found out that students taught using concept mapping strategy achieved higher and significantly better than those taught using conventional method. There was also a better performance in favour of female students compared to their male counterparts using this method. The study compared the achievement of students in difficult areas in chemistry using concept mapping and conventional method only while the current study is on academic performance in geography.

Effectiveness of concept mapping as a teaching strategy to undergraduate students taking introductory physics course was investigated by Luchembe, Chinyama and Jumbe (2014) and the study disclosed that the mean score for the experimental group's posttest was higher than the mean score of the control group. This showed that concept mapping was more effective than the tutorial sheet strategy. The findings also revealed that students had a positive attitude towards the use of concept mapping. The study compared the performance of undergraduate students in physics using concept mapping but the current study compares the effects of concept mapping and conventional method on Academic performance among geography students in senior secondary schools. Ogbonna (2014) investigated effect of concept mapping on students' achievement and interest in selected

concepts from organic chemistry in Federal Capital Territory. It also examined the achievement and interest on both male and female students. The results from the study among others showed that: Concept mapping methods have statistically significant effect on students Achievement in Organic Chemistry and as well as significant effect on Students' interest in Organic Chemistry. The study compared the achievement of students in organic chemistry using concept mapping and interest while the current study is on academic performance in geography.

Bright, Alex and Peter (2015) examined the effect of concept mapping approach on students' achievement in Mathematics in Secondary School in Ngor Okpala Local Government Area of Imo State. The result of the study showed that, concept mapping approach improved students achievement in mathematics, the method removed gender inequality. Based on the result of the study it was recommended that, concept mapping approach should be used by teachers in teaching mathematics in secondary schools to improve students' achievement. The reviewed work has similar objectives like the present study. While the reviewed work was in mathematics the present study in the basic science and technology. The reviewed study deal with only achievement while the present study is on both attitudes and achievement. The reviewed work was carried out in Imo state while the present work is in FCT where many ethnic groups in Nigeria are mostly represented.

Nubagbi, Jamabo and Igwe (2018) investigated the effects of cooperative and concept mapping instructional strategies on student's achievement in chemistry. Results obtained show that there is a significant difference in academic achievement of students taught with cooperative and concept mapping strategies in respect to gender, location and retention. The male students had better performance in their respective categories. Based on the results, it was concluded that Cooperative Instructional Strategy (CIS) and Concept Mapping Instructional Strategy (CMIS) are effective instructional methods for teaching. Kipkemoi (2019) investigated effect of Collaborative Concept Mapping teaching strategy on students' attitudes towards mathematics in secondary schools in Kenya. The results revealed that there were statistically significant difference attitudes towards mathematics in favour of CCM between students exposed to Collaborative Concept Mapping teaching strategy and those taught using Conventional Method of Instruction. From the findings it can be concluded that the attitude towards mathematics is marked higher when the students are taught using the Collaborative Concept Mapping Teaching Strategy than when the conventional method is employed.

Methodology

The design employed for this study is Quasi-experimental design. The populations of this study comprises of all Geography Senior Secondary Two (SSII) Students in the twenty- five (n = 5953) secondary schools across Katsina Zonal Education Quality Assurance. Private secondary schools were excluded from the population in order to work with schools with same characteristics in terms of space, laboratory equipment and teachers' qualification so as to reduce disparities between control and experimental groups. A total number of one hundred and fifty-six (156) SS II Geography students from two secondary schools namely Government College Katsina (Daywing) and Government Senior Secondary School Yandaka served as a sample of the study. The choice in the

selection of 156 students as a sample is in line with the Central Limit theory advocated by Kerlinger (1974) and Tuckman (1975) who stated that in an experimental research, 30 samples is viable and adequate enough to represent the entire population of the study. Students from both schools were randomly assigned into experimental and control group.

The instrument for collecting data for the study was Geography Performance Test (GPT). GPT is 40 multiple items contains Five alternatives lettered A-E, meant to measure the students' academic performance in geography concepts across six levels of cognitive learning domains (knowledge, comprehension, application synthesis, analysis and evaluation, Understand and Apply) in accordance to the Revised Bloom's taxonomy (see Table 3.3). GPT is a 40-item multiple choice questions which was adopted from previous questions of the West African Senior School Certificate Examination in Geography. The items were drawn using the following curriculum unit in the senior secondary school geography curriculum (1) Agriculture (2) Industries and (3) Transportation. Each item on GPT was scored two points, making a maximum obtainable score of 80 marks and a minimum of zero. the research questions were answered by using Mean and Standard Deviation. The hypotheses were tested at 0.05 alpha level using SPSS Package Version 23.0.

Results and Discussions

Research Question One: What is the difference between the mean academic performance scores of geography students taught using concept mapping and those taught without using concept mapping?

Table 1: Mean and Standard deviation of academic performance of senior secondary school students taught geography using concept map and those taught using lecture method

Group	N	Mean	Standard Deviation	Standard Error of Mean	
				Standard Error	Mean Difference
Concept Mapping	77	46.05	10.692	1.218	29.67
Lecture	79	16.38	5.034	.566	

The Table 1 shows that students taught using concept map had a mean score of 46.05 and Standard Deviation of 10.69 while the students taught using lecture method had a mean of 16.38 and standard deviation of 5.03 with a mean difference of 29.67. The mean score of students taught geography using concept map is greater than the mean of the group taught geography using lecture method. This answered the research question number two which sought to establish difference between the mean academic performance of students taught geography using concept map and those taught using traditional method. Students taught using concept map has the highest mean score than the control group.

Research Question Two: What is the difference between the mean academic performance scores of male and female students taught Geography using concept mapping?

Table 2: Mean and Standard deviation of academic performance of senior secondary school male and female students taught geography using concept map

Group	N	Mean	Standard Deviation	Standard Error of Mean	Mean Difference
Male	44	46.23	11.29	1.702	0.41
Female	33	45.82	10.01	1.742	

The Table 2 shows that the male students taught using concept map had a mean performance score of 46.23 and Standard Deviation of 11.29 while their female counterpart had a mean performance score of 45.82 and standard deviation of 10.01 with a mean difference of 0.41. The mean performance score of male students is slightly greater than the mean performance score of their female counterpart. This answered the research question number five which sought to establish difference between the mean performance score of male and female students taught geography using concept map. The male students taught using concept map has the highest mean score than their female counterpart.

H0₁: There is no significant difference between the mean academic performance score of geography students taught using concept mapping and those taught using lecture method in secondary schools of Katsina state.

Table 3: t-test analysis of Posttest students' Geography performance in Experimental and Control Groups

Group	N	Mean	Standard Deviation	Mean Difference	t-value	Df	p-value	Remark
Concept mapping	7	46.05	10.692	29.67	22.2	15	.010	Sign.
Lecture Method	7	16.38	5.034		66	4		

Significant at P<0.05

The Table 3 presented t-test analysis of Posttest students' performance in Experimental and Control Groups. Result shows that the t-value calculated was found to be 22.67 and p-value obtained was 0.00 which is less than 0.05. Therefore, there is significant difference in the mean academic performance of students after treatment. This established significant difference in the mean academic performance scores of students taught geography using concept mapping and those taught with traditional method, in favour of the experimental group. The hypothesis is rejected.

H0₂: There is no significant difference between the mean academic performance scores of male and female students taught geography using concept mapping in senior secondary schools of Katsina

state.

Table 4: t-test analysis of male and female students' Geography academic performance taught using concept mapping

Gender	N	Mean	Standard Deviation	Mean Difference	t-value	df	p-value	Remark
Male	4	46.23	11.291	0.41	0.165	75	.869	Not Sign.
Female	3	45.82	10.005					

***Not Significant at $P < 0.05$**

The Table 4 presented t-test analysis of male and female students' academic performance in Experimental Group. Result shows that the t-value calculated was found to be 0.165 and p-value obtained was 0.869 which is greater than 0.05. Therefore, there is no significant difference in the performance scores of male and female students when concept mapping was used to teach students geography. This means that, concept mapping has equal effect on students irrespective of their gender. The hypothesis is therefore retained.

Discussion of Findings

The study investigated the effect of concept mapping technique on academic performance among secondary school geography students. The study revealed that, there is significant difference between the mean academic performance score of geography students taught using concept mapping and those taught using lecture methods with the concept mapping group having significant higher performance. The implication of this finding is that the concept mapping is more effective than the conventional method. The finding is in line with the finding of Ogbonna (2014) that concept mapping methods have statistically significant effect on students' achievement in Organic Chemistry than conventional method. This is possible because concept mapping has been found to facilitate meaningful learning as well as mastering of concepts. This is why students taught using concept mapping performed better than the control group.

The study also discovered that there was no significant difference between the mean scores on performance of male and female students taught geography using concept mapping. That is, concept mapping improves students' academic performance irrespective of their gender. These findings confirm the work of Bright, Alex and Peter (2015) which showed that concept mapping approach improved students achievement in mathematics, the method removed gender inequality as both the students performed equally. The reasons for the non-significant difference in the male and female students exposed to concept mapping technique may be due to the fact that both sexes collaborated very well in the process of learning and no gender dominated the class. Another reason could be that all the members of the group worked together as a team to achieve the common goal which had reflected in their performance. However, the finding contradicts that of Cheema and Mirza (2013) who found that male students taught through concept mapping performed significantly better

than the female students. The finding also contradicts that of Otor (2013) that there was also a better performance in favour of female students compared to their male counterparts taught chemistry using concept mapping.

Conclusion

The population of students registering geography in final examinations in secondary schools has not been encouraging despite geography is known to be a bridge subject between science and social science. The major cause of the poor enrolment and performance in the subject has been linked to the use of inappropriate instructional strategies adopted by the geography teachers. However, this study provides an empirical evidence to support the efficiency of concept mapping strategy in teaching. Concept mapping strategy was found to make students explore a wider variety of ideas needed to boost students' learning outcomes. It enhances understanding of content, creative and critical thinking, expression of ideas and information using visual form and making connection in learning geography. Also there was no significant difference in academic performance of male and female in geography taught with the concept mapping technique. Through this instructional strategy, students were able to develop more positive attitude towards learning.

Recommendations

Based on the findings of this study, the following are hereby recommended:

1. Geography teachers should always use concept mapping strategy to teach geography concepts so as to help students perform well in the subject.
2. Both male and female students should be taught geography using concept mapping in order to equally help them learn and perform better.
3. Seminars, workshops and conferences should be organized to train teachers in human capacity building to popularize the application of concept mapping strategy, given the fact that this among the recent innovative strategy for teaching and learning in senior secondary schools in Nigeria.
4. Teachers should try to avoid conventional strategy in the teaching learning at this level, since the present study has proved it to be inhibitive to learning outcomes.

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