



**IMPACT OF MIND AND CONCEPT MAPPING TECHNIQUES ON PERFORMANCE
AMONG SENIOR SECONDARY GEOGRAPHY STUDENTS IN KATSINA STATE,
NIGERIA**

By

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Abstract

The study examined the Impact of Mind and Concept Mapping Techniques on Performance Among Senior Secondary Geography Students in Katsina State, Nigeria. The study has two research objectives, answered two research questions and tested two null hypotheses at 0.05 level of significance. The research design adopted for the study was a 2x2 pretest posttest control group quasi-experimental factorial design. The two experimental groups were subjected to treatment using Mind and Concept Mapping while the control group was taught using lecture method. The population of the study consisted of 6623 SSII students from twenty one schools in Katsina Zonal Education Quality Assurance. Three co-educational public senior secondary schools were selected using Clustered sampling technique. A total number of 183 students from the sample of the study. Intact classes of SS II were used for the study. Three validated research instruments with reliability coefficient of ($r = 0.662$, $r = 0.601$) namely Geography Academic Performance Test were developed and used in data collection. Research questions were answered using descriptive statistics, while the null hypotheses were tested using ANCOVA at 0.05 level of significance. Results of the study revealed that there was a significant difference in the mean scores of performance of geography students taught map reading concept using Mind Mapping, Concept

Mapping and those exposed to lecture method. It was concluded that the use of Mind and Concept Mapping techniques is effective in enhancing students' academic performance in geography. Based on the research findings recommendations were made which include, State Ministry of education among others at all levels should provide adequate seminars, workshops and training, re-training of teachers to adopt the new teaching techniques for effective teaching and learning of geography in senior secondary schools.

Keywords: Mind Mapping Technique, Concept Mapping Technique, Lecture Method, Academic Performance, Map Reading, Geography.

Introduction

Science education is very crucial to the development of any nation that is why every nation must take it very serious in all institutions of learning towards sustainable development. Many of the developed countries achieved so much in science and technology because of development. According to Gafar (2018) Science is a powerful driver of any country for the attainment of progress and success in area of industrial, economic and social development.

It is the field that concerned with sharing the scientific content, process skills and developing efficient teaching methods affect achievement in science education. Teaching science may require special attention and efficacy of teachers in order to better attract students and teach the subjects through concrete and clear methods, through the use of individual problem-solving skills and to promote them to execute scientific examinations on their own (Taştan, Davoudi, Masalimova, Bersanov, Kurbanov, Boiarchuk, & Pavlushin 2018).

The aims and objectives of science education in Nigeria were outlined by the Federal Ministry of Education (FME, 2014) to include Basic literacy for functional living in the community, development of basic concept and principle in preparation for further studies, development of essential skills and attitudes as preparation for application of science for development and stimulation of creativity. Subject that constitutes science education in secondary schools are: Mathematics, Physics, Chemistry Biology and Geography.

According to Salisu (2019) and Mogbo, Kuta, and Tukura (2021), geography is the study of natural features and phenomena on the earth's surface and in the atmosphere. It also focuses on locations, space relations, and changes of physical phenomena on the earth's surface and is geared towards teaching the interrelationships among phenomena on the earth surface and those in the atmosphere. The main focus of geography is the physical and human or cultural phenomena on earth. It lays emphasis on peoples, places, phenomena as they occur in particular patterns and as they evolve in a process in any environment.

Geography is the study of places and the relationships between people and their environments. Geographers explore both the physical properties of Earth's surface and the human societies spread across it. Geography seeks to understand where things are found, why they are there, and how they develop and change over time. To most people, geography means knowing where places are and what they are like. Discussion of an area's geography usually refers to its topography its relief and drainage patterns and predominant vegetation, along with climate and weather patterns, together with human responses to that environment, as in agricultural, industrial, and other land uses and in settlement and urbanization patterns (Asliddin & Muhammad, 2022).

One of the problems of teaching Geography identified by Liman, Babajo and Hari (2022) is the persistent failure in senior secondary school's certificate examination (SSCE) among students. Ibrahim (2020) reported that factors identified as a bane of poor student's performance in geography is the use of faulty and inappropriate teaching method like lecture method. Salisu (2019) stated that due to its nature, common use of teacher-centered method to teaching leads to poor understanding, assimilation and application of learning, while the use of student-centered methods enhances students' achievement, thus, the need to find out whether Mind and concept mapping are learner-centered teaching/learning method, would enhance student's performance in geography.

To overcome the problem, scholars advocate the use of innovative strategies like Mind-mapping. Ayca Kartal, Kaya Tuncer, Cennet and Ozlem Ozcakir (2015) has taking the views of teacher candidates on the implementation of the mind-mapping technique on Geography courses and at under-graduate level, is thought to be an important step to contribute to increase the applicability of the technique.

Mahmoud (2018) asserted that Mind-Map is a type of graphic organizer describe as visible drawing to what happens in the process of storing information in human brain. It is an important and a useful learning strategy as it helps learners to learn, write down their notes, and organize these notes effectively and easily retrieved as observed by Tucker, Armstrong, and Massad (2010). Similarly, Kostova and Radoynovska (2010) worked out the basic rules for successful construction of mind maps, incorporating the use of the two hemispheres – logical thinking and imagination.

On the other hand, Concept mapping can be described as a tool which helps a learner to organize their cognitive framework into more powerful integrated patterns. It is a graphical tool that organizes, connects and, synthesizes information. Concept map shows a graphical relationship between the terminologies. Visual presentation of ideas helps the students to think about a subject in a holistic sense and increases mental flexibility (Dhull & Verma 2020). Concept mapping used as a learning and teaching technique visually illustrates the relationships between concepts and ideas, often represented in circles or boxes, concepts are linked by words and phrases that explain the connection better the ideas, helping students organize and structure the thoughts to further understand information and discover new relationship. Mostly concept maps represent a hierarchical structure with the overall broad concept first with connected sub-topics, more specific concepts following (Usman & Obeka, 2017).

Statement of the Problem

The importance of Geography as a school subject is to make students understand the concepts of man-land relations which will lead them to correlate the life of man with his physical environment

and explain the interaction of human natural agencies. Geography makes individuals understand and appreciate spatial relationships as well as the differential character of the earth's surface. It also helps to gain a working knowledge of how to obtain geographic information through map reading and interpretation.

Map reading is an essential tool in the study of geography as highlighted by several researchers such as Oludaisi (2011), Olusegun (2014) and Liman, Babajo and Hari (2022). In fact, they agreed that maps are indispensable tools used by the geographers at different levels and for various purposes. Meanwhile, geographers make use of different types of maps. Topographical map is one of such maps which is an integral tool in map reading at the secondary school level in Nigeria. This map exhibits details of the physical and cultural landscapes of the area mapped with the aid of contour lines Egunjobi, (2002) in Olusegun (2014).

Reports of the students' performance in this aspect of practical geography in Senior Secondary School Certificate Examinations conducted by both West African Examinations Council (WAEC) and National Examinations Council (NECO) have not been encouraging. For instance, WAEC Chief Examiners reports (2010–2021) have highlighted poor candidates' performance in SSSCE geography map reading persistently, candidate have limited knowledge on map work, inability to draw some of the features, inappropriate scales measure, using flow lines, inability to reduce and enlarge map, misinterpretation of relief features on contour maps and computation of gradient (WAEC, 2019). Students' performance in geography external examination recently has fell short of those recent years. WAEC chief examiner reported that 2017, 2018, 2019, 2020 and 2021 WASSCE candidate have limited knowledge on map work, inability to draw some of the features, inappropriate scales measure, using flow lines, inability to reduce and enlarge map, misinterpretation of relief features on contour maps and computation of gradient (WAEC 2017, 2018, 2019).

Map reading is considered as important aspect in geography, for any students to pass in SSCE he/she must pass map reading exams, which constitutes 40% of the entire exams. Abstraction of some concepts in geography as among the science education has now become the most challenging issue despite the efforts of the stakeholders in educational institutions.

Objectives of the Study

The main purpose of the study is to examine the Impact of Mind and Concept Mapping Techniques on Skills Acquisition, Interest and Performance Among Senior Secondary Geography Students in Katsina State, Nigeria. The objectives of the study are to:

1. determine the effects of Mind and Concept Mappings on academic performance of students towards Geography in senior secondary school of Katsina Zonal Education Quality Assurance.
2. find out the effect of Mind and Concept Mappings on Academic Performance of male and female of students towards Geography in senior secondary school of Katsina Zonal Education Quality Assurance.

Research Questions

The following research questions were formulated to guide the study:

1. What is the difference between the mean scores academic performance of geography students taught map reading using mind mapping, concept mapping and their counterpart taught the same concept using lecture method in senior secondary school of Katsina Zonal Education Quality Assurance?
2. find out the effect of Mind and Concept Mappings on Academic Performance of male and female of students towards Geography in senior secondary school of Katsina Zonal Education Quality Assurance.

Research Hypotheses

The following Null Hypotheses were tested at 0.05 level of significance.

H₀₁: There is no significant difference between the mean academic performance scores of geography students taught map reading using mind mapping, concept mapping and their counterpart taught the same concept using lecture method.

H₀₂: There is no significant difference between the mean academic performance scores of male and female students taught using concept mapping and their counterpart taught using mind mapping.

Methodology

The study utilized pre-test post-test quasi experimental and control group design; The study consists of the three groups (two experimental and one control group) that is experimental group I (EG₁); experimental group II (EG₂) and control group (CG). Experimental group I (EG₁) were exposed to treatment (X₁) using Mind Mapping Technique; Experimental group II (EG₂) will receive treatment using Concept Mapping Technique (X₂), while control group (CG) were taught the same concept using lecture method (X₃). Pre-test (O₁) were administered to both experimental and control group to ensure careful selection of samples that are not significantly different in terms of academic performance before treatment, in other word to establish equivalence of the groups before treatment. Subject were assigned to experimental and control prior to the administration of treatment. The three groups were taught Map Reading concept for a period of six weeks. Post-test (O₂) were then be administered after treatment to determine impact of instructional methods on students' academic performance. The design was used by scholars such as Kerlinger (1975), Thomas and Isreal (2014), Salisu (2019) and Dauda (2019) and proved very effective in assessing

the impact of two or more instructional techniques on dependent variables among different groups such as one involved in the present study.

Population

The population for this study consisted of all Senior Secondary School year two (SSII) Geography students in Katsina Zonal Education Quality Assurance Katsina State, Nigeria. The schools consisted of all of public schools that offer Geography within the metropolis. There are 25 public schools out of which 21 schools are offering geography with population of 6,623. All the schools have the same characteristics in terms of Ownership, Calendar, Syllabus, Scheme of work and curriculum. The zone comprises of three Local Governments namely: Katsina, Kaita and Jibia Local Government areas. The schools consist of one (1) all boys school, two all-girls school, and eighteen (18) co-educational secondary schools that make twenty-one (21) schools in all. The number of male students was 3,765 and female students has 2,858 making a total population of 6,563. The population of Students offering geography in twenty-one (21) Senior Secondary Schools within Katsina Education Quality Assurance.

Population of the Study

Table 1. Population of the Study

SN	School	Male	Female	Total
1.	Dikko Collage	127	00	127
2.	Government College Katsina (Day wing)	242	212	454
3.	Katsina Teachers College Katsina	340	332	672
4.	Government Day Sec. Sch. K/Sauri	216	110	326
5.	Government Day Sec. Sch. K/Yandaka	339	347	686
6.	Government Day Sec. Sch. Natsinta	175	115	290
7.	Government Day Sec. Sch. K/Kaura	167	174	341
8.	Sir Usman Nagogo Col. Arabic & Isl. Katsina	805	138	943
9	Government Girls College Katsina (Senior)	00	198	198
10	Sir Emeka Efor Senior Sec. Sch. Kambarawa	200	213	413
11	Govt. Girls Sec. Sch. Unity Jibia	00	60	60
12	Government Day Sec. Sch. Yandaki	91	50	141
13	Government Day Sec. Sch. Girka	30	20	50
14	Sabitu Muhammad Yahaya Sec. Sch. Jifatu	22	20	42

15	Government Day Sec. Sch. Kaita	385	385	770
16	Government Day Sec. Sch. Dankama	98	70	168
17	Government Day Sec. Sch. Dankaba	236	75	311
18	Govt. Day. Sec. Sch. Dutsin Safe Lowcost	89	104	193
19	Govt. Day. Sec. sch. Jibia	136	136	272
20	Family Support	45	42	87
21	School for the Blind	22	57	79
TOTAL		3765	2858	6623

Source: Katsina State Ministry of Education, (2021)

Sample and Sampling Techniques

The sample of the study covered a total number of 183 SS II geography students from three coeducational schools in the study area. The choice of 183 students as a sample is in line with the recommendation of Tucker (1973), Kerlinger (1989), Sambo (2008), Salisu (2022) and central limit theorem that recommend for a number of 30 participants as viable enough to form a study sample in an experimental research. In order to ensure selection of subject with comparative abilities, the researcher analyzed the result of pre-test administered to 12 out of 21 secondary schools, using Analysis of variance.

The outcome revealed significant difference, the researcher used Schiffer's Post-hoc test to determine the direction of disparity. As a result, six schools were found no significance different. In order to select the schools, Cluster sampling was used from which three schools were randomly selected from the number of schools in the area of this study through balloting. The researcher wrote the names of all the 21 public secondary schools on pieces of papers and randomly selected three schools. The first school selected represents Government Day Secondary School Natsinta (School A) experimental group I and the second school selected represents Government Day Secondary School Kaita (School B) experimental group II. While the third school selected represents Government Teachers College Katsina (School C) control group, which were randomly assigned as first and second experimental groups as well as the control group.

Sampled Schools

Table 2. Sample Distribution of the Students

S/N	School	Status	Male	Female	Total
1	School A	Experimental (E1)	24	39	63
2	School B	Experimental (E2)	27	26	53
3	School C	Control	27	40	67
	Total		78	105	183

Instrumentation

In this study one research instrument namely, Geography Academic Performance Test (GAPT) however, GAPT comprises of 40 multiple test items with five alternatives from A-E developed from the geography curriculum of SS II and adopted from previous West African Senior Secondary Certificate Examination (WASSCE), NECO and JAMB Geography past questions from 2010 to 2021.

Geography Academic Performance Test is 40 items developed by the researcher to determine the Academic Performance of students in Map Reading concept. The instrument was developed from the Map Reading concept of SS II geography curriculum. All the items in the test are objectives (multiple type) test with five alternatives (A-E). The items took into consideration all the six educational taxonomies of Bloom to ensure equal distribution over the units.

Research Findings

H₀₁: There is no significant difference between the mean academic performance scores of geography students taught map reading using mind mapping, concept mapping and their counterparts taught the same concept using lecture method.

Table 5. ANCOVA of Students Performance of Experimental I, II and Control Group

Source	Type III Sum of Squares	df	Mean Square	F	P-Value	Remark
Corrected Model	1142.007 ^a	3	380.669	8.034	.000	
Intercept	6800.473	1	6800.473	143.520	.000	
Performance-pre	770.604	1	770.604	16.263	.000	
Grouping	559.385	2	279.693	5.903	.003	*Sig
Error	8481.633	179	47.383			
Total	148265.000	183				
Corrected Total	9623.639	182				

a. R Squared = .119 (Adjusted R Squared = .104)

Table 5 presents ANCOVA of significant difference between the mean performance scores of geography students taught map reading using mind mapping, concept mapping and those taught the same concept using lecture method. From the result, sum of squares observed is 559.385, a mean square is 279.693. F-Value recorded is 5.903 and p-value obtained is 0.03. The P-Value is less than alpha value of 0.05, hence there is significant difference. Consequently, null hypothesis which stated that there is no significant difference between the mean performance scores of geography students taught map reading using mind mapping, concept mapping and those taught the same concept using lecture method is rejected. To determine the direction of disparity, the researcher run post-Hoc test using sheffer and the result is presented in Table 4.11.

Table 6. Pairwise comparison test of Direction of Differences in performance scores of Experimental and control groups.

(I) Grouping	(J) Grouping	Mean Difference (I-J)	Std. Error	Sig.	Remark
Mind Mapping	Concept mapping	2.949	1.288	.070	No Sig
	Lecture Method	4.115*	1.226	.003	*Sig
Concept mapping	Mind Mapping	-2.949	1.288	.070	No Sig
	Lecture Method	1.166	1.269	1.000	No Sig
Lecture Method	Mind Mapping	-4.115*	1.226	.003	*Sig
	Concept mapping	-1.166	1.269	1.000	No Sig

Table 6 presents Pairwise comparison test of Direction of Differences in performance scores of Experimental and control groups. From the results, p-value of 0.70 was recorded between mind mapping and concept mapping. This means that there is no significant difference between the two methods. However, p-value of 0.003 was recorded between mind mapping and lecture method. This means that there is significant difference in favour of mind mapping.

From the same results, p-value of 0.07 was recorded between concept mapping and mind mapping. This means that there is no significant difference between the two methods. However, p-value of 1.00 was recorded between concept mapping and lecture method. This means that there is no significant difference in favour of concept mapping.

Similarly, the results revealed no significant difference in favour of mind mapping and concept mapping as p-value of 0.070 was recorded in all the cases.

H₀₂: There is no significant difference between the mean academic performance scores of male and female geography students taught using concept mapping and their counterpart taught using mind mapping.

Table 4.14: ANCOVA Analysis of Post-test Academic Performance Mean Scores of male and female in Experimental groups

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Remark
Corrected Model	1420.691 ^a	4	355.173	7.280	.000	
Intercept	2261.320	1	2261.320	46.349	.000	
Performance-pre	1267.918	1	1267.918	25.988	.000	
Gender	338.761	3	112.920	2.314	.080	Not Sig
Error	5122.809	105	48.789			
Total	95891.000	110				
Corrected Total	6543.500	109				

a. R Squared = .217 (Adjusted R Squared = .187)

Table 4.14 presents ANCOVA Analysis of significant difference posttest mean interest scores of male and female students in the experimental groups I and II taught map reading using mind mapping, concept mapping and those taught the same concept using lecture method. From the result, sum of squares observed is 338.761, a mean square is 112.920. F-Value recorded is 2.314 and p-value obtained is 0.08. The P-Value is greater than alpha value of 0.05, hence there is no significant difference. Consequently, the null hypothesis which stated that there is no significant difference between the mean performance scores of geography students taught map reading using mind mapping, concept mapping and those taught the same concept using lecture method is rejected.

Discussions

The study investigated the Impact of Mind and Concept Mapping Techniques on Performance Among Senior Secondary Geography Students in Katsina State, Nigeria.

In Mind Mapping and Concept Mapping students form themselves as cooperative groups in which they perceive that they can reach their learning goals if and only other group members also reach

their goal. So, it helps the students develop note by themselves and burst critical thinking to students as well as expanding the horizon of the brain hemisphere which are logical thinking and reasoning. The use of Mind Mapping and Concept Mapping removes the barriers associated with teacher centered instructional methods and offers a very unique learning situation in which learners are given opportunities to actively seek for information, analyzed it and construct knowledge by themselves.

Finding number one indicates significant difference in the mean academic performance of scores of geography students of secondary schools taught map reading concept using Mind Mapping and Concept Mapping and those exposed to lecture method. This finding is supported by Okeke, (2018) who stated that planning by means of mind map had positive effects on the use of self-regulation strategies and their motivation. Marashi and Kangani (2018) said that the use of concept mapping was therefore, more successful than tutorial sheets. Arulselvi (2017) added that the impressive advantage of a Mind Map is that it literally “maps” the way a person’s brain sees and creates connections; once mastered, it brings incredible clarity and ease to decision-making process, using all of the ways the brain processes information – word, image, logic, number, rhyme, colour and spatial awareness, so that the person is literally thinking with his or her whole brain. Zhao (2020) states that because of these benefits, the use of Mind Mapping holds promises as a technique to aid students learning. Under the subtle guidance of teachers, students will consciously draw mind map to help them understand and analyzed geographical problems and they will naturally develop a good map reading habit (Zhao, 2020).

The study revealed that, gender effect does not impede students’ Academic performance of geography concepts when Mind Mapping and Concept Mapping are used. However, reports from various academic sources have it that geography as a subject or course of study is gender sensitive. This is in line with the idea of Mao, Cai, He, Chen & Fan (2021) states that male show more positive attitudes toward science than female. Salisu (2019) asserted that gender is a significant

factor in students' performance in environmental education concepts of geography with male students performed better than female counterparts.

The study finally revealed that, there is significant interaction effect of treatment (Mind Mapping and Concept Mapping) and gender on students' Academic performance in geography. This study is in line with Abdulraheem (2014) states that male achieved better than female in mathematics, sciences and social science while females also did better than males in Arts except in Yaruba. Reports from various academic sources have it that geography as a subject or course of study is gender sensitive. Furthermore, Academic performance and gender are variable in this study for determining whether Mind Mapping and Concept Mapping are gender stereotype.

Conclusion

Based on the findings of this research, it can be concluded that the use of Mind Mapping and Concept Mapping techniques is effective in enhancing students' academic performance in geography, in other words employment of Mind Mapping and Concept Mapping strategies have the potential of enhancing academic performance in geography.

Recommendations

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

1. The use of Mind Mapping and Concept Mapping improved the academic performance ability of students in the present study. As such therefore, teachers and students of geography should be encouraged to use the two strategies as alternative or innovative teaching strategy in order to improve teaching and learning of geography.
2. The government and STAN, ANG, NERDC should inculcate the habit of adopting new teaching strategies that will enable both teachers and students interact and actively involved in the lesson, however, publishers should learn the skills of adopting new strategies such as Mind Mapping into their textbooks. This will enable the students and the reader to develop interest and skills acquisition ability also will improve.

3. State Ministry of education among others at all levels should provide adequate seminars, workshops and training of teachers to adopt the new teaching strategies for effective classroom delivery.

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