

Effect of Hands-On Learning Strategy on Senior Secondary School Students' Achievement in Topographical Map Studies in Mayo Belwa Local Government Area, Nigeria

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Abstract — This study was propelled by the poor performance of senior secondary school students' recorded in practical Geography examinations. In line with this, the study investigated the Effect of Hands-On Learning Strategy on Senior Secondary School Students' Achievement in Topographical Map Studies in Mayo Belwa Local Government Area, Nigeria. Four null hypotheses were formulated to guide the study. The study adopted a quasi-experimental non-equivalent pre-test, post test control group design comprising two groups made up of one experimental group and a control group. Four schools and two hundred and five (205) SS III Geography students made up the sample size of the study. Four intact classes (two each) were randomly selected through balloting without replacement and assigned to experimental and control groups. The instrument used for data collection in this study was Topographical Map Achievement Test (TMAT), constructed by the researcher but structured in line with WAEC and NECO standardized test items in practical Geography. The validity of this instrument was established by two experts in Geography Education and Test and Measurement. The reliability of the instrument was established using Kendall tau τ_b statistic. A reliability index of 0.78 was obtained. Hypotheses one, two and three were tested using independent samples t-test statistic. While hypothesis four was tested using Analysis of Covariance (ANCOVA). The findings of the study revealed that there was a statistically significant difference in the mean scores of students taught topographical maps using hands-on learning strategy and lecture method. There was a statistically significant difference in the retention scores of students taught topographical maps using hands-on learning strategy and lecture method. There was no significant effect of gender on the achievement of students taught topographical maps using hands-on learning strategy. There was no significant interaction effect of treatment and gender on students' achievement in topographical map studies. Based on the findings of this study, it was recommended that geography teachers should use hands-on learning strategy as an alternative strategy or incorporate this strategy with other instructional methods in order to promote effective teaching learning outcomes of students in topographical map studies.

Keywords— Achievement; Gender; Hands-On Learning Strategy; Effect of Teaching; Topographical Map Studies; Topographical Map Achievement Test.

I. INTRODUCTION

Map work, an essential and core branch of geography has been identified as one of the most difficult aspect of geography. The importance of map reading in the study of geography has been highlighted by several studies. Maps generally and in practical geography in particular are important sources of geographical knowledge. The importance of maps in geography as a course of study and to the learner cannot be overemphasized. Today without map use, it is impossible to provide students with the knowledge of events such as; the earth science, the place of the students' state, the socioeconomic activities taking place in a location and so on. Maps are not only used as communication tools, but they also assume a new role in activating the thinking process of the user. Students will be able to transfer and process data on maps, to find location using maps, to distinguish different types of maps, to make calculations using maps (e.g. length, scale, direction), to perceive spatial distribution, to interpret landform features on maps correctly, and to create sketch maps. This underscores the reason why the section that deals with the test of map reading and interpretation in practical Geography SSCE examinations (paper 1) was made compulsory for all geography students to attempt.

Maps are indispensable tools used by the geographers at different levels and for various purposes. Meanwhile, geographers make use of different types of maps. Maps could be classified into different categories. These are political maps, physical maps relief maps, climatic maps and topographical maps. Reference [1] differs slightly in the classification of maps as Atlas Maps, distribution maps, sketch maps and topographical maps. The map adopted specifically for this study is the topographical maps. Topographic map is one of such map which is an integral tool in map reading at the secondary school level in Nigeria and in Mayo Belwa Local Government Area in particular. This map represents the details of the physical and man-made features with the aid of contour lines and symbols. The reading and interpretation of topographical maps demand certain skills in the part of the students and teachers. These skills include identification of relief features on topographical maps, interpretation of landform features on the map, measurement of distance and direction, scale, inter-visibility, bearing of a place from another location, drainage pattern gradient of a slope etc. This study centers particularly on topographical maps because secondary school students in Mayo Belwa Local Government Area have problems with it. Corroborating this view, [2] indicates

that 50% of the topic students considered as problematic in geography falls in the aspect of maps, particularly the aspect that deals with topographical maps. WAEC Chief Examiners, [3] reports a persistent poor trend in students' performance in practical geography SSCE examinations. Reference [4] reported that students still perform poorly in this aspect of geography. This result implies that, having problem with map reading may lead to poor performance in geography and deny students a credit pass that will qualify them to read geography and other geography related courses in higher institutions. Furthermore, this may lead to little or no expertise in professional courses like cartography, GIS, remote sensing, environmental studies, earth science, urban and regional planning and Geography as a teaching subject. Some of the likely reasons identified by the researchers as contributory factors to students' poor performance in practical geography examinations in the study area include: shortage of well qualified and experienced geography teachers, lack of well-organized fieldwork, lack of geography laboratories, overcrowded classroom, paucity or complete lack of teaching aids and suitable textbooks and poor teaching methodology. Geography students in Mayo Belwa LGA have also shown poor background in mathematics and some major geographical concepts; lack of appropriate instructional materials to illustrate and demonstrate the aspects being taught; geography not given sufficient time on the school timetable to cover the wide topics, poor drawing skills and so on as some of the reasons why they considered geography as a difficult subject and may want to run away from it. Reference [3] chief examiner's report has also confirmed some of these factors as the reasons why students performed poorly in practical Geography examinations. From this, it could be said that perhaps students in Mayo Belwa LGA regard geography as a difficult subject due to the abstract nature in which the subject is being approached, hence their poor performance in practical geography examinations. There is the urgent need to explore all avenues and bringing to the fore the use of innovative instructional strategies that could help remediate the difficulty of abstraction encountered by secondary school students in topographical map studies in the study area. This is so because, the teacher is found at the pinnacle of any curriculum implementation process and on whom the implementation of geography curriculum hinges. Therefore the instructional strategy he adopts could make or mar the teaching learning process.

Instructional strategies which promote teaching students how to access, assess and use information rather than just

directly transferring information have become a subject of discourse. Teaching methods and techniques based on a constructivist teaching approach within a student-centered learning environment have been widely accepted and advocated for. Active learning, which can be placed within the constructivist approach to student learning, has been perceived as a radical change from traditional talk and chalk approach to an all involvement of learners in the learning process so that a more meaningful learning can be achieved. Hands-on learning strategy is a student-centered instructional strategy in which students interact, solve problems and reflect on their experiences.

Hands-on learning simply means learning by doing. It is a student-centered approach to learning which provides learners with ample opportunities of taking control of their learning. It combines active learning with concrete experiences, abstract concepts and reflection in an effort to engage all learners in the classroom. When hands-on learning strategy is used, geography students and teachers learning experience of some difficult/abstract concepts in map reading would be concretized. Participating fully in the learning process is prerequisite if deep and real understanding and use of knowledge are aimed at. The process of concretising learners' learning experience in map reading using hands-on approach would enable them to have an imprint of those new, difficult/abstract concepts in topographical map studies. Having an imprint of those new, difficult or abstract concepts in topographical map studies would serve as hangers, previous knowledge or foundation for building subsequent behavioral objectives in topographical map studies. If the lessons are made learner centered, the present knowledge (entry behavior) of the students should be used as a criteria for teaching new map work concepts to them. Previous knowledge serves as hangers which link up new/difficult concepts. There is the possibility that when learners are exposed to topographical maps through practical and fieldwork (hands-on), maximum learning gains would be achieved. This may subsequently lead to improved performance of students in practical Geography examinations in the study area. Reference [5] emphasizes that learning that is activity based, develops a good understanding of the material to be learned. This is what hands-on learning strategy could do to improve the performance of students in practical geography examinations in schools of Mayo Belwa Local Government Area. Reference [6] found out that students' performance could improve when taught using hands-on learning strategies. In contrast, reports have it that the traditional lecture method adopted by most geography teachers when teaching map reading could lead to poor understanding of map concepts which may subsequently lead to low achievement in practical Geography SSCE examinations. Reference [7] observed that Geography teachers has traditionally used a wide range of teaching methods (lecture)

than many other subjects and the range has tended to expand further over the last few years. Therefore, it could be said that the poor performance of students in practical Geography examinations in secondary schools of Mayo Belwa Local Government Area may be tied to poor choice of instructional strategies by geography teachers used in teaching map reading. But this assertion is not infallible except empirical evidence is provided. This study, therefore, determines the effect of hand-on learning strategy for the achievement of secondary school students in topographical map studies.

Another factor that may affect the achievement of students in Mayo Belwa Local Government Area is gender. Reports from various academic sources have indicated that geography as a course of study is gender sensitive [8]. Inputs from girls during geography classes in the study area were observed to be considerably lower. While boys are likely to ask more questions and engage the teacher during geography classes (active), the girls will rather choose to remain quiet, even when they know (passive). Based on this observation, it could be inferred that male students in the study area may likely perform better than female students when hands-on learning strategy is used. However, this assertion is still subject to investigation. Researches on gender and students' academic achievement have been widely reported. However, it is pertinent to note that these findings are inconclusive. Some studies [9] have shown that male and female students would not differ significantly in mean achievement scores when exposed to treatment. While others are of the view that male and female students would differ significantly in their academic achievement when exposed to treatment [10], [11]. On whether male and female students would or would not differ significantly when exposed to topographical maps using hands-on learning strategy in secondary schools of Mayo Belwa LGA? Still remains an unanswered question. Therefore, this study will find out how male and female students would perform when taught topographical maps using Hands-On Learning Strategy.

The theoretical framework of this study hinged on the Kolb's Experiential Learning Theory [12]. This theory was rooted in the experiential works of John Dewey, David Lewin and Jean Piaget. Kolb sees learning as a process in which knowledge is constructed through the transformation of experience. The experiential learning theory sees studying in four phases. These four phases are concrete experience, reflective observation, abstract conceptualization and active experimentation. It is expected that the teaching of topographic maps in this study would enable learners to pass through these stages so that their learning experience would be concretized. On the basis of the Kolb's Experiential Learning Theory, one could infer that secondary school students in Mayo Belwa Local Government Area learning topographical maps through the lecture method may experience some difficulties.

Based on the foregoing, it could be realized that while it's true that studies have been carried out in other localities and subject area related to the efficacy of hand-on learning strategies in promoting effective teaching learning outcomes of students [13], [14]. It is also true and pertinent to note that empirical evidence are lacking related to the efficacy of hands-on learning approaches in promoting effective teaching and learning outcomes of students in topographical map studies in Mayo Belwa Local Government Area. Therefore, the basic assumption underlying this study is that hands-on learning strategy if used to teach topographical maps, students learning outcomes may improve. It is against this background that the study delved into the use of hands-on learning strategy in teaching and learning of topographical maps in secondary schools of Mayo Belwa Local Government Area, Nigeria with the intention that this would remediate students' difficulty of abstraction in order to improve performance.

A. Statement of the Problem

Studies have shown that the traditional lecture method adopted by most geography teachers in teaching map reading and interpretation (which is a compulsory section in practical geography examinations) has led to poor understanding of the concept among secondary school students [4], [13]. 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) has not been encouraging [3], [4]. Sequel to these reports, the performance of senior secondary school students in practical geography examinations in Mayo Belwa Local Government Area in the years observed by WAEC and now has not been encouraging. One of the key factors identified as the reason for the poor performance of students in practical Geography examinations is the teacher's instructional strategy. Several studies conducted by [13], [15] and [16] agreed that most geography teachers usually employ a conventional method (talk and chalk method) to teach the students map reading. Geography teachers teaching in secondary schools in Mayo Belwa LGA may or may not be entirely 'caught in the web' of these studies, but until one provides an empirical evidence to substantiate this claim, this existing gap will always remain unfilled. Therefore, the need to remediate the difficulties of abstraction encountered by secondary school students in topographical map studies in Mayo Belwa Local Government Area using hands-on learning strategy (practical and fieldwork) informed this research. It is against this backdrop that the study was designed to find out the Effect of Hands-On Learning Strategy on Senior Secondary School Students' Achievement in Topographical Map Studies in Mayo Belwa Local Government Area, Adamawa State, Nigeria.

B. Purpose of the Study

The purpose of the study was to determine the Effect of Hands-On Learning Strategy on Senior Secondary School Students' Achievement in Topographical Map Studies in Mayo Belwa Local Government Area, Nigeria. Specifically, the objectives of the study were to:

- (i). Determine the achievements of students taught topographical maps using Hands-On Learning Strategy and Lecture Method;
- (ii). Determine the retention rates of students taught topographical maps using Hands-On Learning Strategy and Lecture Method;
- (iii). Find out the influence of gender on achievement of students taught topographical maps using Hands-On Learning Strategy;
- (iv). Determine the interaction effect of treatment and gender on students' achievements in topographical map studies.

C. Hypotheses

The following research hypotheses were formulated to guide the study:

H₀₁: There is no significant difference in the mean scores of students taught topographical maps using Hands-On Learning Strategy and Lecture Method.

H₀₂: There is no significant difference in the retention scores of students taught topographical maps using Hands-On Learning Strategy and Lecture Method.

H₀₃: There is no significant difference in the mean scores of male and female students taught topographical maps using Hands-On Learning Strategy.

H₀₄: There is no significant interaction effect of treatment and gender on students' achievements in topographical map studies.

II. MATERIALS AND METHOD

The study employed a quasi-experimental non randomized pre-test, post-test control group design where four intact classes were used. The present study compared the Effect of the independent variables of the study (Hands-on Learning Strategy used in the Experimental group and a traditional approach--Lecture Method used in the Control group) and gender (Male and Female) on the dependent variable (student achievement). The research design layout is thus represented as follows:

O ₁	X ₁	O ₂
O ₃	X ₂	O ₄

where:

O₁ and O₃ are Pre-test Observations for the two groups.
 O₂ and O₄ are Post Test Observations for the two groups.
 X₁ = Experimental treatment using Hands-On Learning Strategy.
 X₂ = Placebo (Control) treatment using the Lecture Method.

A. Sample and Sampling Technique

The population of this study consists of all the 3,957 geography students spread in the nineteen Government Senior Secondary Schools in Mayo Belwa LGA, Nigeria. The Multi-stage sampling technique at three levels was used in the study. The simple random sampling technique involving the use of balloting with replacement was used in selecting four out of nineteen public Senior Secondary Schools offering geography in Mayo Belwa Local Government Area of Adamawa State. One intact class was further selected in each school by simple random sampling technique. Schools were selected far away from each other in order to prevent contamination that may result from interaction between the samples. A total of 205 (110 Male and 95 Female) students made up the sample for the study. Students in two of the intact classes were clustered into one and assigned to the Experimental group (n = 107; Male = 58, Female = 49) while students in the other two intact classes were merged and assigned to the Control group (n = 98; Male = 52, Female = 46). The SS III geography students were used specifically for the study because they were preparing to sit for their final examinations (WAEC/NECO); hence the need for the practical knowledge of map reading. The Experimental Group was taught concepts in map reading theoretically and exposed to topographic maps through practical and fieldwork and the Control group was taught concepts in map reading theoretically with no hands-on experience of topographic maps and fieldwork.

B. Research Instrument

The instrument used for data collection was a 40-item Topographical Map Achievement Test (TMAT). The TMAT was constructed using a table of specifications of objectives based on the Senior Secondary Geography Curriculum and SSCE practical Geography questions; and in line with WAEC and NECO standardized test items in practical Geography. The table of specifications was employed in drawing the items so that each content area is given its appropriate proportion of items based on the number of period(s) spent to teach it and the behavioral objectives for lesson delivery. The TMAT had two sections, A and B. Section A consisted of 33 objective items (33 marks) while Section B contained 7 essay items (67 marks), to be answered within the span of 2 hours 30 minutes. All questions were made compulsory for students to answer because this is the standard observed in WAEC and NECO practical Geography examinations. The instrument covered the following topics as spelt out in Nigeria's Geography Curriculum for Senior Secondary School. The topics are: basic concepts in map reading, measurement of distance, direction and bearing, map reduction and enlargement, drainage patterns on the map and the gradient of the slope. The TMAT was administered to the students in the experimental and control groups at the pre-treatment stage (pre-test, to determine their entry behavior) and at the post treatment stage (post test). In order to reduce the effect of the pre-test on the post test, the study was conducted over a period of six weeks and the items on the instrument reshuffled. Two lesson plans were used in the study. The lesson plan designed for the application of hands-on learning strategy in teaching concepts in topographical maps and the lesson plan designed for the application of lecture method in teaching topographical maps. Students in the experimental and control groups were treated using these lesson plans. The following table (Table I) represents the item specification for the instrument measuring five cognitive domains in the Blooms taxonomy of behavioral objectives, namely: knowledge, comprehension, application, analyses and syntheses.

Table I. Table Of Specification Of Learning Objectives Of Topics In Topographical Map Achievement Test Instrument (TMAT)

Topic	Knowledge (25%)	Cognitive Comprehension (25%)	Objectives Application (25%)	Analyses (12.5%)	Syntheses (12.5%)	Total (100%)
Basic Concepts in Map Reading	2	2	2	1	1	8
Map Distances, Direction and Bearing	2	2	2	1	1	8
Map Reduction and Enlargement	2	2	2	1	1	8
Drainage Patterns on the Map	2	2	2	1	1	8
Gradient of the Slope	2	2	2	1	1	8
Total	10	10	10	5	5	40

Table I show that 25% of the 40 items would test knowledge (2 items), 20% would test comprehension (2 items), 25% would test application (2 items), 15% would test analyses (1 item) and 15% would test syntheses (1 item). The table also shows that 8 of the 40 items would be on basic concepts in map reading, 8 on map distances, direction and bearing, 8 on map reduction and enlargement, 8 items on drainage patterns on the map and 8 items on the gradient of the slope.

Thus, the formula for computing items at cognitive level is:

$$\frac{\text{Percentage of Cognitive Objective}}{100} \times \text{ROW TOTAL}$$

(i.e. Knowledge = $25/100 \times 8 = 2$).

C. Validation of the Instrument

Face and content validity of the Topographical Map Achievement Test (TMAT) items was established by two experts in Geography Education and in Test and Measurement in the Department of Science Education, Adamawa State University, Mubi. This was done to ensure adequate representation of each content area and the appropriateness of items in terms of comprehensiveness and clarity of language. The experts also determined the appropriateness of the TMAT for teaching the chosen topics/units, suitability for the level of the students, the extent to which the contents cover the topics/units they are meant to cover, possible errors in suggested answers and the structuring of the TMAT. The validators offered suggestions for some items in the instrument to be restructured in line with Blooms taxonomy of behavioral objectives. The validators also suggested that the essay items be reduced from sixteen items to seven items and the objective items be

increased from twenty four to thirty three. Their suggestions, corrections and criticisms guided the production of the final draft of the items in the instrument.

D. Reliability of the Instrument

To establish the reliability of the instrument, a pilot test was carried out using sixty four students in two Senior Secondary Schools who were not part of the population of the study. The reliability co-efficient of the internal consistency of the TMAT was established using Kendall tau b statistic. The statistic produced a reliability index of 0.78. This reliability index suggests that the internal consistency of the instrument was adequate for the study.

E. Method of Data Analysis

The four hypotheses (H_{01} , H_{02} , H_{03} and H_{04}) in the study were tested using different statistical tools. Hypotheses one, two and three were tested using independent samples t-test statistic while Hypotheses four was tested using Analysis of Covariance (ANCOVA). All tests were done at 0.05 level of significance. The tests determined whether there was a significant difference between the means of the variables under consideration.

III. RESULTS

In order to determine the students' entry behavior at the onset of the treatment, an independent samples t-test analysis was conducted using students' pre-test scores in the experimental and control groups. The result is presented in Table II.

Table II. Summary Of T-Test Analysis Of Students' Pre-Test Scores In Hands-On Learning Strategy And Lecture Method

Source	N	Mean	Mean Difference	SD	df	t	Sig. (2-tailed)
Hands-On Learning Strategy	107	17.084	-0.396	11.915	203	-0.225	.822
Lecture Method	98	17.480		13.923			

Not Significant; $p > .05$.

Table II shows that there is no statistically significant difference in students' achievements taught topographical maps at the onset of the treatment ($t = -0.225$; $df = 203$, $p > 0.05$). This indicates that the students were having equivalent entry behavior prior to treatment. There was no significant difference in the levels of academic achievement between students taught topographical maps by hands-on

learning strategy and lecture method at the onset of the treatment.

A. Hypothesis Testing

1. Hypothesis One

There is no significant difference in the mean scores of students taught topographical maps using Hands-On Learning Strategy and Lecture Method.

To test hypothesis one, the post test scores of students in the experimental and control groups were subjected to

inferential analysis using independent samples t-test statistic. The result is hereby presented in Table III.

Table III. Summary Of T-Test Analysis Of Students' Post Test Scores In The Hands-On Learning Strategy And Lecture Method

Source	N	Mean	Mean Difference	SD	df	t	Sig. (2-tailed)
Hands-On Learning Strategy	107	50.879	27.634	19.764	203	11.595	.000*
Lecture Method	98	23.245		13.459			

*Significant; $p < .05$.

Table III shows the t-test analysis of students mean scores in the experimental and control groups. It could be deduced from the table that there is a statistically significant difference in the mean scores of students taught topographic maps using hands-on learning strategy and lecture method ($t = 11.595$; $df = 203$, $p < 0.05$). This difference implies that students in the experimental group performed significant in topographical map studies compared to their counterpart in the control group.

2. Hypothesis Two

There is no significant difference in the retention scores of students taught topographical maps using Hands-On Learning Strategy and Lecture Method.

To test the second hypothesis, the retention scores of students in knowledge and comprehension items exposed to topographic maps by hands-on learning strategy and lecture method was analyzed using unpaired samples t-test statistic. The result of the analysis is as follows:

Table IV. Summary Of T-Test Analysis Of Students' Retention Scores In The Hands-On Learning Strategy And Lecture Method

Source	N	Mean	Mean Difference	SD	df	t	Sig. (2-tailed)
Hands-On Learning Strategy	107	34.617	11.607	13.581	203	6.190	.000*
Lecture Method	98	23.010		13.223			

*Significant; $p < .05$.

The result presented in Table IV shows a statistically significant difference in the retention scores of students taught topographical maps by hands-on learning approach and those taught by the lecture method ($t = 6.190$; $df = 203$, $p < 0.05$). This result indicates that students in the experimental group achieved greater material retention than the students in the control group.

3. Hypothesis Three

There is no significant difference in the mean scores of Male and Female students taught topographical maps using Hands-On Learning Strategy.

To test this hypothesis, the post test scores of male and female students in the experimental group was subjected to inferential analysis using independent samples t-test statistic. The result is hereby presented in Table V.

Table V. Summary Of T-Test Analysis Of Male And Female Students' Post Test Scores In The Hands-On Learning Strategy

Source	N	Mean	Mean Difference	SD	df	t	Sig. (2-tailed)
Male	58	49.276	-3.5	21.268	105	-0.912	.364
Female	49	52.776		17.852			

Not Significant; $p > .05$.

It could be observed from the analysis in Table V that there is no significant difference in the mean scores of students taught topographic maps by hands-on learning strategy based on gender ($t = -0.912$, $df = 105$, $p = > 0.05$). This implies that male and female students in the experimental group did not differ significantly in mean achievement scores in topographical map studies.

4. Hypothesis Four

There is no significant interaction effect of treatment and gender on students' achievements in topographical map studies.

Analysis of covariance was carried out to test this hypothesis, in which the post-test scores of the students were the dependent variables, treatment and gender the independent variables while pre-test scores were the covariates. The result is hereby presented in Table VI.

Table VI. Summary Of Analysis Of Covariance Of Interaction Effect Of Treatment And Gender On Students' Achievements In Topographical Map Studies

Source	Type III Sum of Squares	df	Mean Square	F	Sig. (2-tailed)
Corrected Model	198.596 ^a	2	99.298	.596	.552
Intercept	18224.735	1	18224.735	109.298	.000
Pre-test	159.898	1	159.898	.959	.329
Treatment*Gender	51.994	1	51.994	.312	.577
Error	33682.156	202	166.743		
Total	95391.000	205			
Corrected Total	33880.751	204			

Not Significant; $p > 0.05$.

Table VI shows no significant interaction effect of treatment and gender on students' achievement in topographical map studies. The facts emerging from the table show that there exists no significant interaction between treatment and gender on student academic achievement ($F(1, 202) = 0.312$, $p > 0.05$). This implies that students' gender was not sensitive to the treatment administered that was why interaction did manifest.

IV. DISCUSSION

The discussion of the findings of this study centers on the four hypotheses that were tested in the study. Hands-on learning is increasingly becoming popular as an effective instructional strategy used in the field of science and education in particular. The pre-test results of the students in the experimental and control groups provides the grounds in which it could be reasonably assumed that the students had equivalent entry behavior prior to treatment. The result indicates that there was no significant difference in the mean scores of students in topographical map studies prior to the treatment ($t = -0.225$; $df = 203$, $p > 0.05$).

A. Finding on the Effect of Hands-On Learning Strategy and Lecture Method on Students' Achievements in Topographical Map Studies

From the statistical analysis of the Hypothesis one, the result revealed that there was a significant difference in the mean scores of students taught topographical maps using hands-on learning strategy and lecture method. The students taught using hands-on learning strategy achieved significantly results than those taught using a lecture method ($t = 11.595$; $df = 203$, $p < 0.05$). This is in consonance with

the submission of [17] who found out that students who built the hands-on water purification system had a deeper understanding of the concepts than the students who had lecture-based lessons. The finding also buttresses that [6] which showed that students exposed to topographical maps by the hands-on approach performed significant than the students taught by conventional method. Furthermore, this finding concurs with that of [13], who investigated the effect of tutorial mode of Computer-Assisted Instruction (CAI) on students' academic performance in practical geography in Nigeria and found out that there was a significant difference in students' performance exposed to topographical maps through computer assisted instruction (Hands-On) and those exposed through conventional method-Talk and Chalk.

B. Finding on the Effect of Hands-On Learning Strategy and Lecture Method on Students' Retention in Topographical Map Studies

The result of this study showed that students taught topographical maps using hands-on learning strategy achieved greater material retention than those taught using lecture-based approach ($t = 6.190$; $df = 203$, $p < 0.05$). The use of hands-on approach in teaching topographical maps provided the students with a greater mastery of concepts taught which reflected on their retention scores. This finding is in consonance with that of [18] and [5]. According to these researchers, students who practice what they're learning in a hands-on environment can often retain three and half times as much as opposed to just sitting in a lecture room and listening intently. The finding is also in agreement with that of [19] who found out that students taught chemistry using active learning approach achieved greater

retention of concepts than those taught using lecture method.

C. Male and Female Students' Achievements in Topographical Map Studies

Result of this study shows that hands-on learning strategy has no effect on gender. The result revealed that the male and female students taught topographical maps using hands-on learning strategy achieved equal results ($t = -0.912$, $df = 105$, $p = > 0.05$). This finding is in consonance with that of [19] who found no significant difference in the achievement of male and female students in chemistry. The finding also concurs with that of [20], [21] and [22] who found out that male and female students would not differ significantly in their performance scores when exposed to treatment. This result is not in agreement with [10], [11], [23] and [24] who reported that boys achieved better than girls and vice versa respectively. Thus, it can be deduced that the use of hands-on learning strategy enhanced the performance of both male and female students.

D. Finding on the Interaction Effect of Treatment and Gender on Students' Achievement in Topographical Map Studies

The finding of this study revealed that there was no significant interaction effect of treatment and gender on students' achievements in topographical map studies ($F(1, 202) = 0.312$, $p > 0.05$). This result is in agreement with the findings of [25] [26] and [27] who found no significant treatment-gender interaction effect on students' achievement. The result is in disagreement with the findings of [28], [19] and [29] who found a significant treatment-gender interaction effect on students' achievement. This goes to show that the gender of the students was not sensitive to the treatment administered using hands-on learning strategies and traditional lecture method.

V. CONCLUSION

The study had shown that hands-on learning strategy had a significant effect on the students' academic achievement in topographical map studies. The hands-on learning strategy appeared to be outstandingly more effective than the lecture method. Students taught topographical maps through hands-on approach achieved better results than those taught using lecture approach. The study also found out that hands-on learning strategy could promote greater material retention of concepts in topographical map studies. This is so because students exposed to topographical maps by hands-on learning approach achieved greater material retention than those exposed through lecture method. The influence of gender on academic achievement taught topographical maps by hands-on learning strategy was not significant. Similarly, the results of this study provide empirical evidence that students' academic achievement in topographical map studies depends on the method of instruction adopted and not influenced by gender. The study

has shown that gender (male/female) had no significant effect on students' achievement. It can therefore be concluded that gender of students whether male or female, does not seem to have any influence on the effectiveness of any of the treatments employed in the study. This is an indication that if both treatment/strategies are used effectively for male and female they are likely to produce similar results. Therefore, hands-on learning strategy could be employed by geography teachers in teaching topographical maps in secondary schools in order to remediate the difficulty of abstraction experienced by students.

VI. RECOMMENDATIONS

Based on the educational implications of the results of this study, the following recommendations are made:

Since the use of hands-on learning strategy in teaching topographical maps has been found to enhance the quality of achievement in topographical map studies, geography teachers should be encouraged to employ it more in the teaching of the subject. By so doing, the achievement of students in the practical geography examinations could improve.

Enlightenment campaign, workshops and seminars should be organized for geography teachers by Education Authorities. These authorities include: Federal and State Ministries of Education, institutes and Colleges of Education etc. This could be done in order to create awareness among geography teachers on the efficacy of the strategies/methods and then sensitize them on the adoption of the methods/strategies in teaching topographical maps. The geography laboratory which serves as the 'engine room' for conducting practical works is very essential in topographical map studies. Therefore, Nigerian public schools should be equipped with the necessary facilities and the relevant instructional materials for conducting practical work sessions.

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