Impact of Iconic Models on Senior Secondary School Students' Academic Achievement in Physical Geography in Plateau State, Nigeria

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Abstract - *The purpose of the study is to find out the impact of iconic models on senior secondary school students' academic achievement in physical geography in Plateau State, Nigeria. Relevant literatures were reviewed on the topic. The study adopted a true experimental design. The population of the study consisted of all Senior Secondary Schools One (SSI) Students who offer geography. The samples of the study comprised of two schools and one hundred (100) geography SSI students. In line with the purpose of the study, one research question and one hypothesis were raised, answered and verified respectively. A geography achievement test was used to collect data. The test was validated and a reliability coefficient of 0.95 was obtained. The result of the test was subjected to statistical analysis using mean $(\overline{X})$ and t-test of independent samples. The analysis of the result of the test showed that the experimental group performed better than the control group which implies that there is a significant difference between the experimental and control groups. Consequently the hypothesis formulated for the study was rejected. It was concluded that iconic model is one of those instructional materials when appropriately used in teaching and learning of physical geography will improve the academic achievement of the students in the subject. Finally, teachers and students should always use iconic models in teaching and learning physical geography.*

Keywords: *Iconic Models, Students Academic Achievement and Physical Geography*

INTRODUCTION

The rapidly expanding demands for geography instruction in the nation's schools have significant and far reaching implication for the discipline. This is because most students in secondary schools have not understood the concept of geography. Geography is a science that studies physical and human processes and spatial patterns on earth in an integrated way over space and time; it examines the spatial distribution of people and their activities; physical and human made features, ecosystem and interactions between humans and the environment in a dynamic context. This means, it is concern with the study of how spatial patterns and processes affect the way people live and interact with the environment, how physical and human processes shape the environment, and how humans interrelate with the living and non-living things. Damar [1] defines geography as an applied science which seeks to apply skills and techniques, knowledge and understanding to issues and challenges in our immediate environment at a local, national, continental and global scale.

From the above definitions, three common things are identified. These are; that geography is concerned with the earth as the environment of man which influences the way he lives and organizes himself. Secondly, it is concerned with man's spatial organization and its ecological relationship to his environment. Thirdly, the distribution of resources with particular reference to planning and public policy.

Geography is categorized into two main branches. These are physical and human geography; other minor branches include regional geography, integrated geography and cartography. Physical geography studies the surface of the earth particularly the arrangement and function of natural features. Briney [2] defined physical geography as the study of natural features and processes such as geomorphology, climatology, oceanography, biogeography, landscape ecology, among others. Pradhan [3] viewed physical

geography as a natural science that deals with patterns and functioning of nature. This however deals with those aspects of nature which lie outside the human domain but can suffer serious consequences due to human intervention. These aspects include; atmosphere, climate, landforms, soil, ocean among others. The various branches of physical geography are geomorphology (concerned with the nature and origin of earth's surface features), glaciology (concerned with the study of glacier and ice sheet), biogeography (deals with the distribution of various species of plants and animals on the surface of the earth and the reasons behind the different distribution patterns), climatology (is concerned with the study of water and climate), landscape ecology (it looks at landscape as an organic whole, and is based on the idea that even minute variations in the elements may affect the land scape greatly), oceanography (study of sea and oceans of the world), environmental geography according to Pidwirny [4] is concerned with analysis of spatial aspects of interactions between humans and the natural world. Other branches are meteorology, pedology and quaternary science.

Human geography on the other hand studies people and their interaction within the earth and with their organization of space on the earths' surface. To Morais [5], human geography means the study of human race which normally involves their backgrounds, how they interact, and the perceptions that they have for various ideologies affecting things. Jonhston [6] explained that human geography is a branch of social science that deals with the world, its people and their communities and cultures by emphasizing their relations of and across space and place. The branches of human geography include economic geography which studies the influence of a region on its economic activities and vice versa, population geography (concerned with distribution, migration and growth of population in geographic areas), political geography(studies the way in which the world is divided into countries), agricultural and rural geography, urban geography among others. The other minor branches as earlier stated are Regional geography which studies the various geographical regions across the earth in an attempt to understand the uniqueness of each one. Integrated geography describes spatial aspect of interactions between humans and the natural world. The last type is cartography which is concerned with map making.

The understanding of the concept of physical geography is possible during teaching- learning process. Teaching is the process of impacting knowledge, values, and skills from a teacher to the learners. Mang and Mankilik [7] opined that teaching can be thought of as a process that facilitates learning. Effective teaching consists of helping students to acquire and use knowledge and to learn to think and solve problems. Learning on the other hand is a relatively permanent change in an individual's interaction with the environment. Mallum and Haggai [8] viewed learning as relatively permanent change in behaviour that results from experience in the environment and is manifested in performance.

The teaching of physical geography can simply be describe as the process of impacting geographical knowledge, values and skills from a teacher to the learner. The teaching of geography at the early stage in Nigeria was based merely on memorization and mainly of description and not scientific. Damar [1] asserted that looking at the state of geography content and teaching approaches around 1950s shows that many academics were dissatisfied with the geography approach and felt that it was not scientific. The teaching of physical geography at this time was christened '"cape and Bay and Age of determinism". The cape and bay geography was concerned with memorization of the names of physical features and processes in different parts of the world while Age of determinism geography was based on "determinism and foreign regionalism". The teaching of physical geography during the post-colonial era was reviewed in consonance with the social needs of Nigerian. The teaching was more inward inclined than outward oriented as it was before. It took into consideration the potentials, resources and the immediate needs of Nigerian learners. It studies own local environment before being exposed to the study of other parts of the globe. Hence it has given birth to new approach, called local geography, fieldwork and map work. Despite the many changes that have taken place in geography over the years, the fact still remain that there exist a similarity between the subject in its early days and the subject today.

OBJECTIVES OF THE STUDY
The purpose of the study was to find out the impact of Iconic models on students' academic achievement in physical geography and to determine if there is a significant difference in the mean achievement scores of students taught with iconic

models and those taught without iconic models on the geography achievement test in physical geography. To guide the study, one research question and one hypothesis were answered and analyzed respectively.

The work was hinged on the cognitive field theory of learning (Gestalt Psychology) by Bruner (1960). Cognitive theorists believed that learning is the organization of component parts into a whole and that learning is viewed as making sense of the world (environment) by organizing the internal mental processes such as attention, imagery (icon) and insight. The basic position of cognitive theory of learning is that, learning is not simply the connection of stimuli and responds. The learner perceives, organizes and interprets the stimuli before he/she responds. This theorist believed that learning is not piecemeal or by trial and error but holistic and patterned.

The objectives of teaching geography at the senior secondary school level among others are: to develop an understanding of the role of environmental issues within geography; to promote needed basic knowledge of environmental education of students; to provide students with the opportunities to understand major global environmental problems; to develop in the students an understanding of basic concepts, principles and theories/models relating to geographical phenomena; to provide students with a body of geographical knowledge which is interesting in every life and adequate for the school certificate geography examination.

Experience over the years has shown that teachers have been depending on excessive use of words to express and convey ideas or facts in the teaching of physical geography. Today, there is a Paradigm shift in geography. The subject has gone Mathematical and scientific involving the use of models so as to explain abstract geographical phenomenon very close to the understanding of the students. Therefore, a model is a simplified representation or version of reality built in order to demonstrate certain of the properties of reality. Brunet [9] defined models as simplified version of reality, build in order to demonstrate certain of the properties of reality.

Damar [1] opined that models in geographical view point includes reasoning about the real world by means of translation in space to give spatial models or in time to give historical models. Natural environment is so complex, therefore, geographers have to simplify it in some ways in order to portray or understand it.

Models are categorized into different types. Based on the degree of abstraction, models are grouped into symbolic, analogue and iconic models. Symbolic model is the representation of the entities of a system through symbols. This model includes Mathematical and conceptual models. Symbolic model is the most abstract among the three categories of models. Some examples of symbolic models include gravity model, cyclical model, rainfall-runoff relationship model and regression model. Analogue model is the next category of model which is the representation of entities of a system by analogue entities pertaining to the model. Analogue model can be built through two dimension visualization. For example, charts, graphs, maps and diagrams. It can also be built through three dimension visualization, for example, the flow of water in pipe to represent flow of electricity. The third category of model is the iconic model. Iconic model (scale model) is a look-alike representation of reality on a smaller scale. It is generally two or three dimensional. Some examples of iconic models include world globe, iconic models of landforms, processes and patterns. Models can also be categorized into physical models (hardware) and computer animated models (software). The hard ware models are the concrete models (iconic models) while the software models are those models that are display using computer.

The selection and use of iconic models for the teaching and learning of physical geography have to follow some basic principles. These are: select the feature/process in terms of learning goals/objectives; prepare the students for the use of the selected materials; and prepare the chosen features or processes for discussion/teaching. He has to prepare instruction before going to class.

The stages in modeling involve decompose the system into its basic entities, identify the essential relevant entities and linkages and recompose a simplified/selected version of the system with its essential/relevant entities and linkages. In another development, a striking feature of geographic change in recent years has been the increasing use of models. In recent years, geographers have been making considerable use of models in the application and development of theories and teaching of physical geography.

It is certain that geography teachers need to be resourceful in production of iconic models. Agun [10] in his research confirmed that teachers need to be resourceful in the production of instructional

materials as a way of sustaining qualitative instruction in geography. This implies that teachers should construct and use iconic models to analyze geographic processes, system and patterns. Working with iconic models involve different craft skills and tradition of practice that is, it depends on variety of philosophical understanding of science and the relationship between theory, models and the systems they purport to represent.

Models are of great uses in the teaching of physical geography. These include: models simplify the otherwise complex relationships of the geography phenomena in the real world; models provide a framework for incorporating earth system science research approaches to teaching among others. Iconic models as an example of models is very relevant in the teaching of physical geography. The relevance of the iconic model in teaching physical geography include: It is a vehicle for learning and teaching and teaching about the world. (i)   It makes learners free from abstraction of the subject; and (ii) it serves as bridge between theoretical and observable phenomena. It is use to stimulate the growth of the spirit of inquiry, training of the mind resulting in a balance intellectual approach to problem solving and seasoned capacity to analyze issues objectively.

The main task of the teacher is to impact the necessary knowledge, skills and values during the teaching-learning process for higher (improve) students' academic achievement. Academic achievement is viewed as measurable behavior in a standardized series of tests. This refers to a student's success in meeting short or long term goals in education. Annieh, sloker and Ward [11] viewed academic achievement as the outcome of education the extent to which a student, teacher or institution has achieved their educational goals. Academic achievement is commonly measured by examinations/tests. There is no general agreement on how it is best tested on which aspects are most important procedural knowledge or declarative knowledge. Therefore, students' academic achievement in geography is the outcome of their performance after attending a course in the subject over a certain period of time and for which the students are subjected to standardized examinations (SSCE/NECO). In other word, it is not just one point observation of measurable behavior of geography students that constitute their academic achievement. So many factors influence students' academic achievement. These include the environment and personal characteristics of the learner, the parent's socio-economic status, the students' parent's educational level, teachers' factors and the students learning preferences.

The general low academic achievement of students in geography in the various external examinations is a matter of national interest. There is a general fallen standard of performance in the subject in Nigeria despite the integrated and enriched nature of the present geography curriculum. WAEC chief examiner's report stated that in Kaduna State, there is an increase failure rate from 49% in 2001 to 70% in 2004 [12]. In Plateau State, the situation is similar with an increase rate of failure from 47.5% in 2005 to 69.31% in 2010 [13].

Efforts have been made to tackle the problem of low students' achievement in the subject through the review of geography curriculum in order to remove some irrelevant topics and to improve on the methodology and use of instructional aids. This was done in the geography curriculum review of 1985. The inclusion of ICT through computer assisted learning, remote sensing and GIS (geography information system) are recent development to the subject. With all these developmental efforts, the problem of low students' achievement in the subject still persists. This prompted the researchers' develop iconic models and experimented in the teaching of physical geography in senior secondary schools in Plateau State, to see if it can remedy the situation. Other ways of solving this problem is for government to focus more attention to the production of instructional materials particularly iconic models.

The teaching of physical geography at the secondary school level does not seem to be achieving its objectives as expected due mainly to its abstract nature. Consequently to this is the students poor academic achievement and to some extent students refusal to offer and register it. The implication of this may be the number of geography students would drastically reduce. However, when iconic models are use, the problem of abstractness of the subject may be tackled.

In an attempt to solve the frequent low students' academic achievement in both external and internal examinations, the researchers used iconic models to find out if it can be used to improve the level of students' academic achievement in physical geography in both external and internal examination. This is because iconic models have not been properly used in improving students' academic achievement in

physical geography. The justification for researching on physical geography as a major area of problem was based on WAEC chief examiner reports of 2005, 2010[20], 2013 and *2014* which stated that students' low achievement in both external and internal examinations for the years under review was attributed to students' low achievement in physical geography.

Apart from using iconic models to improve the teaching and learning of physical geography, other strategies that could be used in teaching and learning physical geography which will subsequently improve students' academic achievement are application of strategies that enhance learning and better understanding of the subject such as innovation and introduction of new teaching and learning methods that are conscious of the students' interest, use of ICT. Practical involvement and individualized learning process and consideration of students learning preferences. With the low students' academic achievement in physical geography, the researchers ask "can iconic models be used to improve the academic achievement- of senior secondary school students in physical geography?

METHOD

A true experimental research design was used in this study. All senior secondary school students in Plateau State who offer geography were considered as the population. Two schools were randomly sampled for the administration of the test. The schools were Government Girls College Bokkos and Government secondary school Daffo. A total number of one hundred senior secondary one geography students from the two schools were considered as sample.

Simple random sampling technique was used in getting the schools and selection of students. In getting the schools to be considered as experimental and control groups, two sets of coloured papers (Pink and blue) were folded and kept in a bag. Letter 'E' was written on the pink paper to represent experimental group while letter 'C was written on the blue paper to represent control group. The researchers employed the service of two people to represent the two schools in picking the papers. The first person represented Government Girls College Bokkos picked the pink colour paper while the other was picked by the second person representing GSS Daffo. The first fifty (50) students from each of the two schools who picked papers written "Sample" on it were considered for the research.

Geography achievement test (GAT) was used. There were two different test administered pre-test and post-test. Both tests have twenty objective questions and two essay questions which tested students on different aspects of physical geography. Each objective test item carries 2½ marks given a total of 50 marks while the essay questions carry 50 marks. After marking the test scripts, the results of the pre-test for the two schools were compared and also that of the post-test for the two schools were compared. The procedure adopted in developing the instrument was by using senior secondary school geography curriculum to teach during the experiment. The researchers taught both groups of schools for a period of four weeks with two lessons per week in each school starting from February 23rd, 2015 to March 25th, 2015. In developing the research items, the researchers used JAMB, SSCE and NECO question papers to compare the standard of the GAT.

Two experts from Faculty of Education University of Jos validated the instrument. The researchers used internal consistency method (split half method) to determine the reliability. The reliability of the instrument was 0.95. This shows high positive correlation coefficient and hence the instrument was considered to have high reliability. GAT was personally conducted by the researchers to students in SS 1 in the sampled schools. The instrument was into pre-test and post-test. The results of the tests were compared. First the result of the pre-test for experimental and control groups and secondly that of the post-test for both experimental and control groups. One hundred GAT papers were administered and all collected back. The statistical techniques employed were the use of mean ($\bar{X}$) and t - test for independence samples.

RESULTS

Table 1: Pre-test mean scores of experimental and control groups.

Variable	Mean
Experimental group	38.52
Control group	38.51
($\bar{X}$) difference	0.01

From table 1, the pre-test mean scores for both experimental and control groups were 38.52 and 38.51. This simply means that the two groups possessed closely the same entry level with regard to academic achievement on the topics to be taught in physical geography. However, the result showed that

significant difference existed in the result of both control and experimental groups in relation to the students' academic achievement in geography.

Table 2: Post-Test mean scores for experimental and control groups.

Variable	Mean
Experimental group	60.6
Control group	43.44
$(\bar{X})$ difference	17.0

From table 2, it is obvious that the experimental group performed better than the control group. The experimental group has a mean score of 60.6 while the control group has 43.44. This showed a mean $(\bar{X})$ difference of 17.0. This empirically shows that iconic models have significant impact on the academic achievement of SS 1 geography students.

Hypothesis 2: There is no significant mean difference in the mean achievement scores of the experimental and control groups in geography achievement test. It means that the use of iconic model have significant impacts on the student performance in geography.

Table 3: Post-Test achievement results for the experimental and control groups (n=50)

Variable	$(\bar{X})$	S^2	SD	T-cal
Experimental Group (n=50)	60.6	455.1	21.0	4.79
Control Group (n=50)	43.44	184.9	13.6	

Significant at 0.05; df=98; t-critical: 1.98

From table 3, the calculated t-value (4.79) is greater than the critical t-value (1.98). This shows a statistically significant difference between the mean scores of the experimental group (60.6) and the mean score of the control group (43.44) at 0.05 significant level (t =4.79, d.f = 98, P< 0.05) thus HO is rejected and concluded that there is a significant difference in the mean scores of students taught physical geography with iconic models (experimental) and the other group taught physical geography without the models (control group).

DISCUSSION

From the research question, it revealed that the post-test mean scores of the experimental group was greater than the mean score of the control group. This shows that iconic models have significant impact on the academic achievement of S.S.I geography students. This was supported by the research conducted by Dyoshak [14] where he use iconic models to find out if it has significant impact on academic achievement of geography students in Shendam Local Government Area. He concluded that the experimental group performed better than the control group in the GAT. The experimental group performed better because they were exposed to the models by modeling and using some of the models. This made the learning more concrete and developed their sensory organs. Pestalozzi in Sanda [15] stated that the child be allow to coordinate his sensory organs which involve the cognitive, affective and psychomotor aspects of bloom taxonomy. This simply means that learning is best when students are allowed to fully participate in learning to discover things when manipulating the available resources. Onasanya and Omosewo [16] report shows that students need to be encouraged to learn not only through their eyes or ears but should be able to use their hands to manipulate apparatus to ensure better academic performance.

The second finding from the analysis of the hypothesis revealed that the calculated value (4.79) is greater than the critical t-value of 1.98. This shows a mean difference in favor of the experimental group. With this result, the hypothesis was rejected and concluded that there is a significant difference in the mean achievement scores of the experimental and control group. This means the experimental group performed better than the control group. This assertion is supported by research conducted by Daniel and Sati [17], Momoh [18] and Moronfola [19]. Dyoshak [14] asserted that the most appropriate instructional material in teaching physical geography is Iconic models. Ema and Ajayi (2001) in Damar and Gosele (2006) opined that instructional materials have become synonymous with every form of success in education. Therefore, it is advisable for geography teachers to use iconic models.

CONCLUSION AND RECOMMENDATION

Based on the finding of the study, interrelationship could be developed between use of Iconic models and students' academic achievement in physical geography. It could be concluded that iconic model is one of those instructional materials that improve the academic achievement of students in

physical geography. Other variables may intervene on students' level of intelligent, method of teaching, students' interest among others.

It is recommended that the application of iconic models should be emphasized in teaching and learning of physical geography. Geography teachers should incorporate other varieties of instructional materials alongside iconic models in teaching physical geography.

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