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THE USE OF GIS TECHNIQUES IN TEACHING STUDENTS OF SENIOR SECONDARY SCHOOL THE ART OF MAP READING AND INTERPRETATION IN SOME SELECTED SCHOOLS OF KATSINA STATE

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ABSTRACT

The availability of geographic applications and geographical information systems (GIS) has created many interesting possibilities for the analysis, interpretation, and production of geographic information (GI). GIS has been used extensively to teach students map reading in many countries. However, Nigeria seems to be left behind in this. Using a quasi-experimental approach, this study investigated the Use of GIS Techniques in teaching Students of Senior Secondary Schools the art of Map Reading and Interpretation in Some selected

INTRODUCTION

Geography is one of the oldest earth sciences and its roots date back to the works of early Greek scholars. The Greek scholar Eratosthenes first used the word' geography' in the third century B.C. The words Geo means "Earth" and Graphy "to describe" the literal meaning of geography is to describe the earth's surfaces. In other words, "Geography is largely the study of the interaction of all physical and human phenomena and landscapes created by such interactions." It is about how, why, and where human and natural activities occur and how these activities are interconnected. (Balasubramanian, 2016)

Geographic Information Systems" deals with the storage and analysis of information about the Earth for automatic retrieval by a computer in an accurate manner. In addition to other sub-disciplines of geography, GIS specialists must understand computer science and database systems study. Maps have traditionally been used to explore the Earth and to exploit its resources (Elsheikh, 2022). GIS technology is an expansion of Cartographic science that enhanced the efficiency and analytic power of traditional mapping (Shamle, 2019). Now, as the scientific community recognizes the environmental consequences of human activities, GIS technology is becoming an essential tool in the effort to understand the process of global change. Various map and satellite information sources can be utilized in such a way that, recreate the interactions of complex natural systems. Such visualization can help to predict what will happen to an area if it is repeatedly floated or what changes are expected if a particular

schools of Katsina State. The multistage sampling method is used to select the sample. The use of the GIS technique was evaluated both before and six weeks after the training. The data were obtained in 3 phases. Phase one is the pretest when both the control and experimental groups answer WAEC 2022 questions on map reading. The researcher scores the answers based on the WAEC marking guide. The second phase is the training phase where respondents in the experimental group only trained on the use of GIS. The third phase is the post-test where both two groups answer questions on map reading and the researcher scores the answers. For data analysis, SPSS 22 was used. Findings revealed that at baseline there was no significant difference between the students in the experimental and control group. It was also found that there is a significant difference between the students who were taught map reading using GIS and those taught using the traditional method. Therefore, it can be concluded that GIS is an effective method of teaching map reading, and is even more effective than the traditional method. It is recommended that governments should equip schools with adequate computers and software for teaching GIS. Geography teachers should be also trained in the use of GIS in teaching map reading. It is also recommended that training modules be designed and distributed to schools for use in teaching and learning map reading using GIS

Keywords: Geographic Information System (GIS), Techniques, Computer, Map reading and interpretation (MRI)

industry is located or developed in an area using environmental impact assessment (EIA) (Mennecke & Crossland, 1996)

The whole research focuses on the need to replace those strictly traditional approaches taken to the education process where the student occupies a mere passive position, with a move towards active and critical geography that encourages the introduction of Geographic Information Systems (GIS) and other types of geospatial technologies in the education system besides GIS, geospatial and geo-information technologies also require the use of dynamic and interactive maps, virtual. (Akinyemi, 2016)

The significant development at present is that maps can be drawn using satellites through GIS tools. Computers easily convert information from satellite images into maps to show what changes development can bring about. Such information is of great benefit to society (Code, n.d.). Such mapmakers are in great demand today, without grassroots knowledge of GIS mapmaking techniques from the secondary school level Nigeria will continue to be at the bottom of the ladder for development. Since nowadays geographers, engineers, environmental scientists, city planners, social scientists, and many others depend on the use of GIS to understand the Earth better. (Akinyemi, 2016)

Problem Statement

As the world considers technology in almost everything, the Nigerian education system seems to be left behind. Map reading remains a very important topic in secondary school. While the modern

techniques of mapmaking using computers and Remote Sensing globally became indispensable tools of learning, Nigerian education seems to be lagging in adjusting to this development despite being more accurate and effective than the traditional method of map reading. (Demirci, 2009) This study therefore will compare the modern GIS method of map reading with the traditional method and develop a working guide for the easy teaching/learning process in senior secondary schools in Nigeria. This will serve as a stepping stone, while more work needs to be done to inculcate GIS innovation into our education system. No country lives in isolation, Nigeria must adopt discoveries to develop its system. (Komlenović et al., 2013)

Justification of the Study

To justify the research work, the Studies have confirmed that there are numerous advantages/benefits to teaching GIS and the art of GIS techniques in secondary schools, which include enhancing teachers' and learners' geographical content awareness; increasing teachers' geographical and pedagogical creativeness; enhancing technological awareness in both teachers and learners; and improving learners' learning outcomes. It seems to be unambiguous that, in teaching geography, computer technology plays a particularly important role in terms of visualization of geographic contents in a given area (F. Akinyemi, 2018), but also in terms of modeling some general phenomena and processes. The focus on the need to replace those strictly traditional approaches taken to the education process where the student occupies a mere passive position, with a move toward active and critical geography (de Miguel Gonzalez, R., & Donert, 2014) has encouraged the introduction of a Geographic Information System (GIS) and other types of geospatial technologies in the education system (Castellar, 2018). Besides GIS, geospatial and geo-information technology also requires the use of dynamic and interactive maps, virtual globes, remote sensing, GPS, and other devices for augmented reality. (Avdić et al., 2020)

The GIS technique is widespread in teaching geography in schools worldwide. So far, by comparing different advantages and cases, GIS application in teaching geography has been more result oriented to individual efforts of certain teachers or schools rather than a system-regulated standard in education(Carter et al., 2020). This justifies undertaking the research work

Aims and Objective(s) of the Study

This research aims to investigate the effect of GIS in teaching and learning map reading and interpretation in geography. The following objectives will be pursued to achieve the desired aim

1. Provide baseline assessment of students in map reading
2. Determine the most effective method of teaching and learning map reading between the traditional method and the GIS method.
3. Design and develop working guide tools in teaching and learning GIS techniques and MRI

Literature Review

Historical Development of the concept GIS

Geographic Information System (GIS) is a computer-based information system used to digitally represent and analyze the geographic features present on the Earth' surface and the events (non-spatial attributes linked to the geography under study) that taking place on it. The meaning to represent digitally is to convert analog (smooth line) into a digital form. (Ali, 2020)

"Every object present on the Earth can be geo-referenced", is the fundamental key of associating any database to GIS. Here, term 'database' is a collection of information about things and their relationship to each other and 'geo-referencing' refers to the location of a layer or coverage in space defined by the co-ordinate referencing system.(Aule et al., 2023)
Work on GIS began in late 1950s, but first GIS software came only in late 1970s from the lab of the ESRI. Canada was the pioneer in the development of GIS as a result of innovations dating back to early 1960s. Much of the credit for the early development of GIS goes to Roger Tomilson. Evolution of GIS has transformed and revolutionized the ways in which planners, engineers, managers etc. conduct the database management and analysis.(Mas et al., 2014)

Defining GIS

A Geographic Information System is a computer-based system which is used to digitally reproduce and analyse the feature present on earth surface and the events that take place on it. In the light of the fact that almost 70% of the data has geographical reference as it's denominator, it becomes imperative to underline the importance of a system which can represent the given data geographically. (Singh et al., 2016). A typical GIS can be understood by the help of various definatinations:

• A geographic information system (GIS) is a computer-based tool for mapping and analyzing things that exist and events that happen on Earth. (Code, n.d.)
• Burrough in 1986 defined GIS as, "Set of tools for collecting, storing, retrieving at will, transforming and displaying spatial data from the real world for a particular set of purposes"
• Arnoff in 1989 defines GIS as, "a computer-based system that provides four sets of capabilities to handle geo-referenced data:
• data in-put
• data management (data storage and retrieval)
• manipulation and analysis
• data out-put.

Hence GIS is looked upon as a tool to assist in decision-making and management of attributes that needs to be analysed spatially.GIS has been described in two ways:

1. Through formal definitions
2. Through technology's ability to carry out spatial operations, linking data sets together.

However, there is another way to describe GIS by listing the type of questions the technology can (or should be able to) answer. Location, Condition, Trends, patterns, Modelling, Spatial questions. There are some vital questions that only a sophisticated GIS can answer:

- Location longitude/latitude……?
- Trends of events……..?
- Spatial pattern……..?

"What if…" questions are posed to determine what happens, for example, if a new road is added to a network or if a toxic substance seeps into the local ground water supply. Answering this type of question requires both geographic and other information (as well as specific models). GIS permits spatial operation.

Components of GIS

• Hardware • Software • Data • People • Method

Hardware

It consists of the computer system on which the GIS software will run. The choice of hardware system ranges from 300MHz Personal Computers to Super Computers having capability in Tera FLOPS. The computer forms the backbone of the GIS hardware, which gets it's input through the Scanner or a digitizer board. Scanner converts a picture into a digital image for further processing. The output of scanner can be stored in many formats e.g. TIFF, BMP, JPG etc. A digitizer board is flat board used for vectorization of a given map objects. Printers and plotters are the most common output devices for a GIS hardware setup.

Software

GIS software provides the functions and tools needed to store, analyze, and display geographic information. GIS softwares in use are MapInfo, ARC/Info, AutoCAD Map, etc. The software available can be said to be application specific. When the low cost GIS work is to be carried out desktop MapInfo is the suitable option. It is easy to use and supports many GIS feature. If the user intends to carry out extensive analysis on GIS, ARC/Info is the preferred option. For the people using AutoCAD and willing to step into GIS, AutoCAD Map is a good option.

Data

Geographic data and related tabular data can be collected in-house or purchased from a commercial data provider. The digital map forms the basic data input for GIS. Tabular data related to the map objects can also be attached to the digital data. A GIS will integrate spatial data with other data resources and can even use a DBMS, used by most organization to maintain their data, to manage spatial data.

People

GIS users range from technical specialists who design and maintain the system to those who use it to help them perform their everyday work. The people who useGIS can be broadly classified into two classes. The CAD/GIS operator, whose work is to vectorize the map objects. The use of this vectorized data to perform query, analysis or any other work is the responsibility of a GIS engineer/user.

Method

And above all a successful GIS operates according to a well-designed plan and business rules, which are the models and operating practices unique to each organization. There are various techniques used for map creation and further usage for any project. The map creation can either be automated raster to vector creator or it can be manually vectorized using the scanned images. The source of these digital maps can be either map prepared by any survey agency or satellite imagery.

GIS Applications

Computerized mapping and spatial analysis have been developed simultaneously in several related fields. The present status would not have been achieved without close interaction between various

fields such as utility networks, cadastral mapping, topographic mapping, thematic cartography, surveying and photogrammetry remote sensing, image processing, computer science, rural and urban planning, earth science, and geography.

The GIS technology is rapidly becoming a standard tool for management of natural resources. The effective use of large spatial data volumes is dependent upon the existence of an efficient geographic handling and processing system to transform this data into usable information.

Advantages of GIS

The Geographic Information System has been an effective tool for implementation and monitoring of municipal infrastructure. The use of GIS has been in vogue primarily due to the advantage mentioned below:

• Planning of project • Make better decisions • Visual Analysis • Improve Organizational Integration Planning of Project

Advantage of GIS is often found in detailed planning of project having a large spatial component, where analysis of the problem is a pre-requisite at the start of the project. Thematic maps generation is possible on one or more than one base maps, example: the generation of a land use map on the basis of a soil composition, vegetation and topography. The unique combination of certain features facilitates the creation of such thematic maps. With the various modules within GIS it is possible to calculate surface, length, width and distance. Making Decisions The adage "better information leads to better decisions" is as true for GIS as it is for other information systems. A GIS, however, is not an automated decision-making system but a tool to query, analyze, and map data in support of the decision-making process. GIS technology has been used to assist in tasks such as presenting information at planning inquiries, helping resolve territorial disputes, and siting pylons in such a way as to minimize visual intrusion.

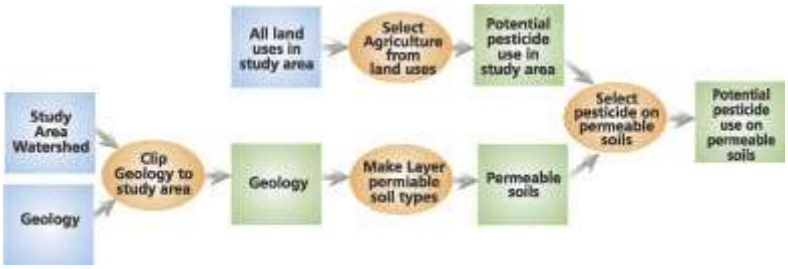
The Three Views of a GIS

A GIS is most often associated with maps. A map, however, is only one of three ways a GIS can be used to work with geographic information. These three ways are:

1. The Database View: A GIS is a unique kind of database of the world-a geographic database (geodatabase). It is an "Information System for Geography." Fundamentally, a GIS is based on a structured database that describes the world in geographic terms.

2. The Map View: A GIS is a set of intelligent maps and other views that show features and feature relationships on the earth's surface. Maps of the underlying geographic information can be constructed and used as "windows into the database" to support queries, analysis, and editing of the information. This is called geovisualization.

3. The Model View: A GIS is a set of information transformation tools that derive new geographic datasets from existing datasets. These geoprocessing functions take information from existing datasets, apply analytic functions, and write results into new derived datasets.



Source:

Together, these three views are critical parts of an intelligent GIS and are used at varying levels in all GIS applications.

Modeling Our World

Most computer technology is designed to increase a decision-maker's access to relevant data. GIS goes beyond mining data to give you the tools to interpret that data, allowing you to see relationships, patterns, or trends intuitively that are not possible to see with traditional charts, graphs, and spreadsheets.

More than that, a GIS lets you model scenarios to test various hypotheses and see outcomes visually to find the outcome that meets the needs of all the stakeholders. For example, a retail manager looking to build a new store can analyze consumer demographics and the locations of competitors in relation to potential locations in a spreadsheet view. GIS lets that manager visualize potential locations on a map along with drive-time analysis, environmental concerns such as wetlands or protected species that might hamper construction, or any number of siting criteria that would be too cumbersome to comprehend otherwise.

Transforming the human thinking

The application if GIS is unlimited. It has been used to solve problems as diverse as where to place self-service coin counting machines, how to improve the yield of crops in a traditional Tuscan vineyard, or how to manage an entire city enterprise.

GIS can provide you with powerful information-not just how things are, but how they will be in the future based on changes you apply. GIS is, therefore, about modeling and mapping the world for better decision making. GIS tools range from simple contact mapping tools to consumer analysis to complex enterprise systems that are part of an organization's overall enterprise resource planning infrastructure, Used wisely, it can be a transformational tool for your organization.

Many professionals, such as foresters, urban planners, and geologists, have recognized the importance of spatial dimensions in organizing & analyzing information. Whether a discipline is concerned with the very practical aspects of business, or is concerned with purely academic research, geographic information system can introduce a perspective, which can provide valuable insights as:

- 70% of the information has geographic location as it's denominator making spatial analysis an essential tool.
- Ability to assimilate divergent sources of data both spatial and non-spatial (attribute data).
- Visualization Impact
- Analytical Capability
- Sharing of Information

Factors aiding the rise of GIS

• Revolution in Information Technology.
• Computer Technology.
• Remote Sensing.
• Global Positioning System.
• Communication Technology.
• Rapidly declining cost of Computer Hardware, and at the same time, exponential growth of operational speed of computers.
• Enhanced functionality of software and their user-friendliness.
• Visualizing impact of GIS corroborating the Chinese proverb "a picture is worth a thousand words."
• Geographical feature and data describing it are part of our everyday lives & most of our everyday decisions are influenced by some facet of Geography.

Major areas of application

• Different streams of planning Urban planning, housing, transportation planning architectural conservation, urban design, landscape.
• Street Network Based Application It is an addressed matched application, vehicle routing and scheduling: location and site selection and disaster planning.
• Natural Resource Based Application Management and environmental impact analysis of wild and scenic recreational resources, flood plain, wetlands, acquifers, forests, and wildlife.
• View Shed Analysis Hazardous or toxic factories siting and ground water modelling. Wild life habitat study and emigrational route planning.
• Land Parcel Based Zoning, sub-division plans review, land acquisition, environment impact analysis, nature quality management and maintenance etc.

• Facilities Management Can locate underground pipes and cables for maintenance, planning, tracking energy

Akinyemi (2018) conducted a study on the "Assessment of GIS Use for Teaching in Rwandan Secondary Schools An Assessment of GIS Use for Teaching in Rwandan Secondary Schools." Using a sample of 234 students, the author found that GIS is a more effective method of teaching and learning map reading than the traditional method. In a similar study conducted in Bosnia on a sample of 120 secondary school students, Avdić, Drešković, and Mirić (2020) used ANOVA to determine the effect of GIS in teaching map reading. The authors found that students who were taught map reading using GIS scored significantly higher and therefore concluded that GIS is effective in teaching map reading in secondary schools. Similar studies were conducted in European and some African countries like the studies of Castellar (2018), Komlenović, Manić & Malinić (2013) and (Kah et al., 2019)

Using Geography teachers of around 200 private secondary schools in Turkey, Demirci (2009) was able to ascertain that knowledge of GIS helps teachers to deliver effective teaching of map reading and as such enables the students to have more understanding of map reading. (Khan et al., 2023) conducted a study on college students to determine the effect of GIS map reading on learning map reading. Using stratified random sampling the authors were able to find out that at baseline there was no difference between the students in the experimental and control group. The authors finally conclude that the use of GIS in map reading is effective. It can be observed from the above literature review most studies conducted on the use of GIS in teaching and learning map reading were conducted outside Nigeria. As noted earlier, the use of GIS in Nigerian secondary schools is not been fully explored. This study therefore will investigate the effect of GIS in teaching and learning map reading and interpretation in geography.

Methodology

The fast rate of technological development in today's modern, digitalized society provides new opportunities and challenges for the future of geography education. The availability of geographic applications and geographical information systems (GIS) also creates many interesting possibilities for the analysis, interpretation, and, production of geographic information (GI).

Research Design

This research adopts a Quasi-Experimental Design which involves a pretest for both the control and experimental group followed by training for the students in the experimental group on using GIS in map reading and finally a post-test assessment. This research explores how a digital GIS portfolio is used as an educational method for teaching and learning about map reading. In this work, a design-based research (DBR) approach is used to develop a portfolio model for use in a Geo-media course in some selected secondary schools in Katsina state. The design process will be for teachers and students.

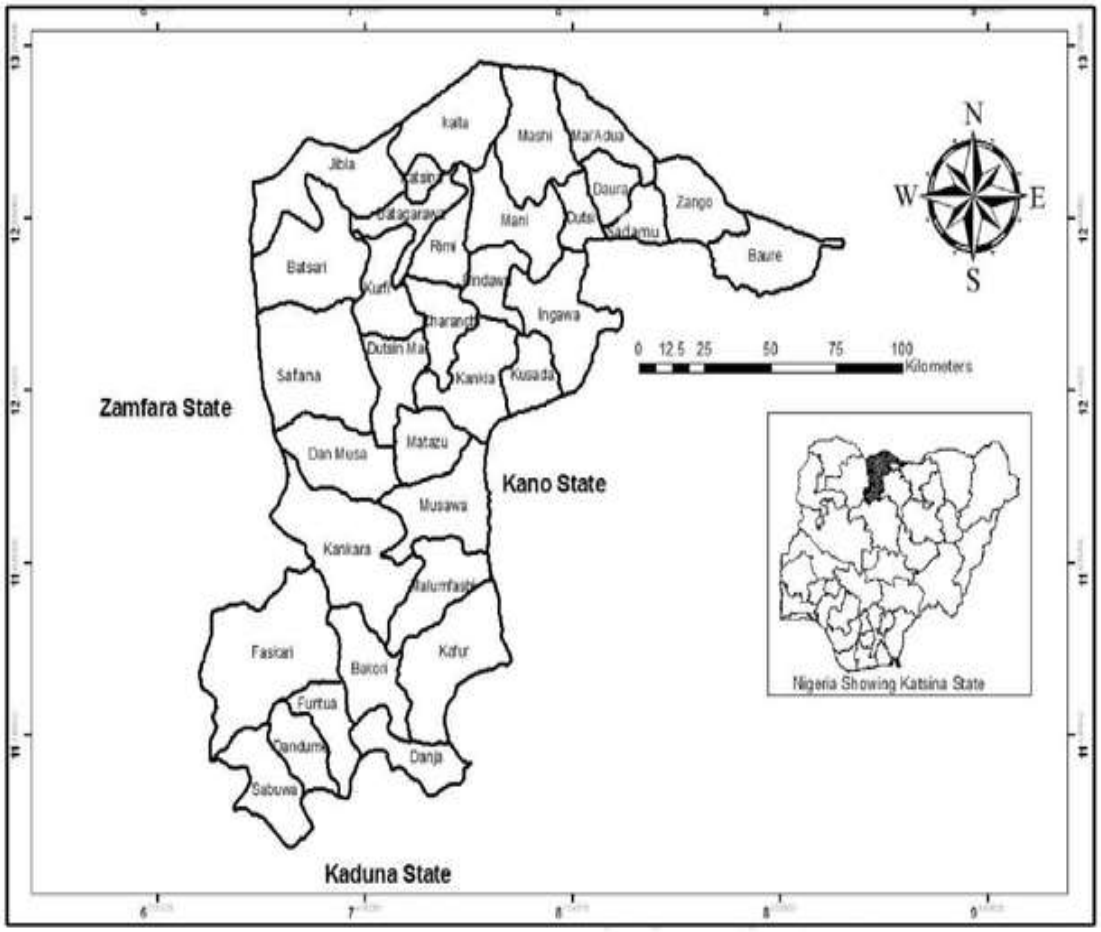
The idea of a DBR approach is not only to ease technique instructional materials to support teachers/students in their learning and development of GIS skills but also to be an educative process for pre-service teachers who have minimal experience in teaching GIS skills. It turned out that, the use of a digital GIS portfolio is a very promising method for GIS education. The use of the

portfolio improved student competence in using GIS; it developed teacher/student motivation to learn about GIS; and increased teacher/students' perceptions about the importance of GIS.

Study Area

Katsina state was created on 23rd September 1987, it has a land coverage of about 23,938 km^2, a population of about 5,792,578 (2006 estimate), with 34 local government areas, and is located between latitudes 11°08'N and 13°22'N and longitudes 6°52'E and 9°20'E. The state is bounded to the north by the Niger republic, Jigawa and Kano to the east, Kaduna to the south, and Zamfara states to the west.

The Katsina State has 2,771 primary schools with pupils enrolment of 1,963,468 (1,004,698 males and 958,770 females), 251 Junior Secondary Schools, and 245 Senior Secondary Schools with an enrolment of 300,125 (166,270 males and 133,855 females) and 198,773 (119,037 males and 79,736 females) respectively. There are also 18 Science, Technical, and Vocational Secondary Schools and 13 Tertiary Institutions which include three Universities. (Katsina State Ministry of Education, 2022)



A Map of Katsina Showing the Study Area
Source: National Population Commission Data

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Population and Sample

The study population includes all secondary schools in Katsina State. However, A Multistage sampling method is used to select the sample. First, 2 schools are purposively selected from each senatorial district of the state. The criteria for the selection of schools that have functional computer centers that will enable the training. Secondly, the selected schools are then randomly assigned to either the control group or the experimental group. The third involves the selection of the students within the school. Because the research is quasi-experimental and involves training, using a large sample size is not possible. Therefore, 30 students who are taking geography in SS2 will be randomly selected from each school. This selection is justified by (Series, 2021) who explained that for quasi-experimental research 20 is sufficient.

Instrumentation

Two instruments are used in this study. First is the Training Module which is developed by the researchers and is used in teaching the students the use of GIS in map reading and the second instrument is WAEC 2022 Geography questions on map reading. WAEC marking guide will be used to score the student's responses.

Data Collection

The data are collected in 3 phases. Phase one is the pretest when both the control and experimental groups answer WAEC 2022 questions on map reading. The research scores the answers based on the WAEC marking guide. The second phase is the training phase where respondents in the experimental group only trained on the use of GIS. The third phase is the post-test. Where both two groups answer questions on map reading and the researcher scores the answers.

Data Analysis

The study utilizes descriptive statistical tools for presentation. The student's scores from the pretest and post-test are computed and analyzed using T-test. The Findings of the study are discussed below

Results

Table 1: Baseline comparison of Students satisfaction between the experiment group and control group

Demography	Study Groups		Total (N=180) n (%)
	Control Group (N=90) n (%)	Intervention Group N=90) n (%)	
Gender			
Male	42(46.7)	38(42.2)	80(44.4)
Female	48(53.3)	52(57.8)	100(55.6)
Age			
14 years	2(2.2)	8(4.4)	6(3.3)

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15 Years	6(6.6)	12(13.3)	18(10)
16 Years	30(33.3)	34(37.8)	64(35.6)
17 Years	40(44.4)	32(35.6)	72(40)
18 Years	8(8.8)	6(6.7)	14(7.8)
19 years and Above	4(4.4)	2(2.2)	6(3.3)
Religion			
Islam	82(91.1)	84(93.3)	166(92.2)
Christianity	8(8.9)	6(6.7)	14(57.8)
Other	0(0)	0(0)	0(0)
Ethnicity			
Hausa	77(85.6)	75(83.33)	152(84.4)
Fulani	12(13.3)	12(13.33)	24(13.3)
Other	1(1.1)	3(3.33)	4(2.3)
Fathers Occupation			
Civil servant	24(26.7)	25(27.8)	49(27.2)
Farmer	30(33.3)	31(34.4)	61(33.9)
Others	36(40)	34(37.8)	70(38.9)

Source: Field Survey, 2023

The table above shows that male students constitute 44.4% of the respondents while the majority of the respondents (55.6%) are female. Two age groups make up the majority of the respondents where 40% of the students belong to 17 years age group and 35.6% belong to the 16 years age group. The table also shows that 166 out of the 180 constituting the majority (92.2%) were Muslims, on the ethnicity of the respondents, the table depicts that 85.6% of the respondents in the control group and 83.3% of those in the experimental group are Hausa. The table further revealed the occupation of the parents of the students. It shows that 40% of the students in the control group, 37.8% of the students in the experimental group, and 38.9% of the total sample belong to other professions.

Baseline Assessment of Students in Map Reading

The baseline assessment of the students in map reading is presented in the table below

Table 2: Baseline comparison of students between the experiment group and control group on Map reading.

Test	Groups	N	Mean	SD	Mean Difference	P-value
Pre-intervention	Experimental Group	90	13.32	4.67	0.47778	.425
	Control Group	90	13.80	4.02		

T-test

Significance at $p<0.05$

At baseline the mean score of the students in the experimental group is slightly lower than those in the control group with a mean difference of 0.477 which was found to be statistically insignificant ($p> 0.05$, $p=.435$)

Comparison of the Effect of the Traditional and The GIS Methods of Teaching and Learning Map Reading

The comparison of the effect of the traditional and the GIS methods of teaching and learning map reading is given in the table below.

Table 3: Baseline comparison of Students satisfaction between the experiment group and control group

Test	Groups	N	Mean	SD	Mean Difference	P-value
Post-intervention	Experimental Group	90	18.69	3.78	5.4	.000
	Control Group	90	13.29	4.78		

T-test
Significance at p<0.05

The table depicts that the mean score of the students in the experimental group who were trained in using GIS for map reading is higher than that of students in the control group who have not trained in the use of GIS. A mean difference of 5.4 was found and is statistically significant (p<0.05, p=0.00).

Discussion

This study found that there was no significant difference in the scores of the students in the control and experimental groups before the training was conducted. Possible reasons may be because all the students are been taught using the same traditional method and materials since all the schools are situated within the same state and regulated by the same authority. This finding is in concordance with most of the experimental studies where at baseline no significance is observed like the study of (Avdić et al., 2020)

This study also found a significant difference between the scores of students taught using GIS and those taught using the traditional method. This implies that the GIS method is more effective than the traditional method since the scores have improved significantly. This result is consistent with the findings of (Artvİnlİ, n.d.) and (Mennecke & Crossland, 1996) Who concluded that GIS is a more effective method for teaching map reading? The finding also implies that the training module/guide developed and used in this study is effective.

Conclusion

Based on the findings of this study it can be concluded that GIS is an effective method of teaching map reading, and is even more effective than the traditional method. Hence it should be utilized for effecting teaching and learning map reading in Nigerian secondary schools.

Recommendation

This study recommends that:

- Governments should equip schools with adequate computers, power source, data and software for teaching GIS.
- Geography teachers should be also trained in the use of GIS in teaching map reading.
- It is also recommended that training modules be designed and distributed to schools for use in teaching and learning map reading using GIS.

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