EXPLORING GEOGRAPHIC INFORMATION SYSTEM (GIS) AND REMOTE SENSING BENEFITS IN TEACHING PHYSICAL GEOGRAPHY IN SECONDARY SCHOOL IN OVIA NORTH EAST LOCAL GOVERNMENT AREA OF EDO STATE, NIGERIA.

BY

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UNIVERSITY OF BENIN
BENIN CITY, NIGERIA

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A PROJECT SUBMITTED TO THE DEPARTMENT OF EDUCATIONAL MANAGEMENT IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE BACHELOR OF SCIENCE IN EDUCATION B.Sc. (Ed) HONOURS DEGREE IN EDUCATION GEOGRAPHY

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CERTIFICATION

We, the undersigned certify that this work was carried out by Ikhidero ohifeme Nathaniel

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DEDICATION

This work is specially dedicated to God Almighty, who is the giver of knowledge and understanding, whose mercy and undeserved kindness sustained the researcher through this work.

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The researcher wish to express his profound gratitude to God Almighty who has been his strength and sustainer, and for His provision throughout the duration of this course.

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ABSTRACT

This research endeavored to uncover the yet unexplored importance of Geographic Information System (GIS) and Remote Sensing in the teaching of physical geography, specifically in secondary schools in Ovia North East Local Government Area of Edo State, Nigeria.

The integration of GIS and remote sensing technology offers students a comprehensive understanding of spatial relationships, enabling them to analyze and interpret physical geography phenomena with greater depth. GIS and remote sensing allow students to apply their knowledge to real-world scenarios, preparing them for future careers in geography and related fields.

Secondary schools in certain regions lack the necessary technological infrastructure for the effective implementation of GIS and remote sensing. Incorporating GIS and remote sensing into the curriculum requires training for educators which many teachers lack the expertise needed to effectively teach these technologies.

The study aspires to offer valuable insights that can influence educational policies and practices, with the overarching goal of elevating the standards of geography education within the local government area.

CHAPTER ONE

INTRODUCTION

BACKGROUND OF STUDY.

Geography education is essential to give children a thorough grasp of the natural world and how it interacts with human pursuits. (NRC, 2013). Geographic Information System (GIS) and remote sensing technology have recently made substantial strides in geography education, allowing for better spatial comprehension and analysis (Jensen, 2007; ESRI, 2021).

Different specialists have different ways of describing GIS. Burrough (1986) defined GIS as a group of technologies that are used to collect, save, retrieve, process, and display geographical data from the actual world for particular applications. Data input, data management (storage and retrieval), modification and analysis, and data output are the four primary GIS tasks identified by Arnoff (1989), all of which aid in the processing of geo-referenced data. According to ESRI (1990), a geographic information system (GIS) is a computer-based tool used to map and study Earth phenomena by fusing common database operations with the benefits of map-based geographic visualization. In order to gather, store, update, edit, analyze, and display various forms of geographically connected information efficiently, GIS entails an organized combination of computer hardware, software, geographic data, and personnel (ESRI, 1990). The knowledge of GIS is still not

sufficiently shared in Nigerian academic institutions, despite the promising potential of this technology (Awhen et al., 2016).

On the other side, remote sensing is the process of gathering data about the surface of the Earth using aerial or satellite sensors. It offers thorough and current information on a variety of physical aspects, such as climate, vegetation, and land cover (Jensen, 2007). Remote sensing information greatly improves students' understanding of spatial phenomena when combined with GIS. Geography students can extensively and interactively explore and investigate the Earth's surface by combining remote sensing data with GIS. Students acquire insights into changes in land use, environmental processes, vegetation dynamics, climatic trends, and more through the evaluation and study of remote sensing data (Lovett et al., 2002). Through this integration, students get a greater comprehension of the complex relationships between physical geography and human behavior, enabling them to become informed and moral citizens.

According to Koinyan's study from 1999, the potential of GIS and remote sensing software has found use in both formal and informal environmental education programs. When compared to other teaching resources, their use in classrooms is still slightly underutilized (Ifemuyiwa, 2007).

There are many advantages to integrating GIS and remote sensing into the teaching and learning of physical geography in secondary schools in the Ovia North East LGA. These

tools help students think analytically and spatially by making connections between theoretical ideas and real-world uses. Additionally, GIS and remote sensing provide dynamic and engaging learning opportunities, enhancing students' interest in the subject. Teachers can enhance geography curricula and give students the knowledge and skills they need to comprehend and navigate the complex spatial dynamics of the physical environment by giving them knowledge and abilities connected to these tools. Furthermore, since understanding of GIS and remote sensing is becoming more and more appreciated in the workforce, this integration prepares students for prospective careers in geography-related fields.

Additionally, the incorporation of GIS and remote sensing technology into the study of physical geography offers students useful and applicable applications. Students can participate in practical projects and activities that mimic real-world settings by using these resources. They are capable of mapping, spatial data analysis and interpretation, and complex geographic problem solving. They gain a deeper knowledge of geographic ideas as well as critical thinking, problem-solving, and spatial reasoning skills that are important in a variety of academic and professional disciplines thanks to this active learning strategy.

The capacity of GIS and remote sensing to link theoretical concepts with real-world applications is one of their key advantages. With the aid of these technologies, students may view and work with geographical data, giving theoretical ideas concrete forms. For instance, to analyze the links and patterns that emerge, students can overlay several layers

of data, such as population density, land use, and environmental conditions. They can better understand difficult ideas thanks to this hands-on inquiry, which also helps students appreciate how interrelated the natural and man-made worlds are.

Remote sensing and GIS also offer lively and interesting learning opportunities. Most textbooks and maps used in traditional geography lessons are static, which discourages student participation and interaction. GIS, on the other hand, enables students to explore interactive maps, examine live data, and even build their own simulations and spatial models. Students are encouraged to take an active role in their own education by participating in this dynamic and immersive learning experience, which also supports inquiry-based learning.

Additionally, the inclusion of GIS and remote sensing into geography curricula is in line with the growing need for spatial literacy and geospatial skills in the contemporary workforce. Urban planning, environmental management, transportation, and disaster response are just a few of the many businesses that depend on experts who can use GIS and remote sensing technologies proficiently. Teachers can give pupils useful abilities that will help them in their future jobs by providing these tools to them in secondary school. Additionally, GIS and remote sensing exposure might encourage students to pursue further study and jobs in geography, geospatial sciences, and related topics, resulting in the growth of a qualified and educated workforce in these domains.

Students can benefit greatly from the use of GIS and remote sensing technology in the teaching and learning of physical geography. It bridges the gap between theoretical concepts and real-world applications while improving their spatial comprehension, analytical thinking, and problem-solving skills. These tools encourage active engagement and higher knowledge by presenting dynamic and interesting learning possibilities. Incorporating GIS and remote sensing also supports the growing need for geospatial expertise across a range of industries, preparing students for future professions and building a workforce that can successfully negotiate the intricacies of the physical environment.

STATEMENT OF PROBLEM

For the teaching and learning of physical geography, it is essential to conduct in-depth study on the integration of geographic information systems (GIS) and remote sensing technologies in secondary schools in the Ovia North East Local Government Area (LGA) of Edo State, Nigeria. The use of GIS and remote sensing in education has the potential to be beneficial, but there are a number of significant issues and obstacles that must be overcome.

The fact that teachers and other interested parties are not aware of the advantages and practical applications of GIS and remote sensing in teaching physical geography is a significant problem. There's a risk that many teachers are unaware of the features and practical use of these technologies. This knowledge gap restricts students' capacities to practice and apply physical geography concepts in the actual world and to develop critical

spatial thinking abilities, which is a barrier to the widespread acceptance and deployment of GIS and remote sensing in secondary schools.

Finding the hardware, software, and geographic information required to incorporate GIS and remote sensing into the classroom is challenging. It's possible that secondary schools in the Ovia North East LGA lack the infrastructure or funding essential to acquire and maintain the required tools and data sources. Teachers confront significant challenges when it comes to providing high-quality instruction and giving students relevant learning experiences that make use of GIS and remote sensing technology.

Furthermore, it is difficult to find educators with the qualifications and training required to successfully integrate GIS and remote sensing into the physical geography curriculum. Teachers lack understanding since there aren't many programs for professional development that focus on GIS and remote sensing. It is therefore considerably more challenging to successfully integrate these technologies and to design engaging, interactive lessons that take advantage of GIS and remote sensing's potential benefits.

Addressing these problems and constraints is crucial if secondary schools in the Ovia North East LGA are to make the most of the potential advantages of GIS and remote sensing in teaching physical geography. Teachers, lawmakers, and curriculum developers must first be aware of and understand these limitations in order to successfully integrate GIS and remote sensing technology into curricula. In the end, this research will support an increased understanding of the local physical environment in the Ovia North East LGA, Edo State,

Nigeria, as well as aid to raise the bar for physical geography instruction, provide students with critical skills and knowledge, and foster critical thinking.

RESEARCH QUESTIONS

1. Which particular advantages come from integrating GIS and remote sensing technology into the teaching and learning of physical geography in secondary schools in the Ovia North East LGA?
2. How would students' spatial reasoning abilities and critical thinking skills in the study of physical geography develop as a result of the integration of GIS and remote sensing?
3. What are some real-world GIS and remote sensing uses that could help the secondary school students in Ovia North East LGA to better understand physical processes and environmental issues?
4. How do remote sensing and GIS technology make physical geography lessons engaging and participatory for secondary school students?
5. How well would students who are exposed to GIS and remote sensing in secondary school prepare for possible jobs in physical geography-related fields?
6. What are the challenges and problems educators in the Ovia North East LGA encounter in successfully incorporating GIS and remote sensing technology into the physical geography curriculum?

PURPOSE OF THE STUDY

The purpose of this study is to look into the benefits of using remote sensing and geographic information systems (GIS) in teaching and learning physical geography in secondary schools in the Ovia North East Local Government Area (LGA) of Edo State, Nigeria.

Specifically, the purpose of the study includes:

1. To identify the precise benefits of integrating GIS and remote sensing technology into the physical geography teaching and learning in secondary schools in the Ovia North East LGA.
2. To investigate how students' spatial and analytical thinking skills in the study of physical geography are affected by GIS and remote sensing.
3. Investigate the practical uses of GIS and remote sensing that could improve students' comprehension of natural phenomena and environmental problems in the Ovia North East LGA.
4. To assess the interactive and interesting learning opportunities made possible by GIS and remote sensing in the secondary school physical geography curriculum.
5. To evaluate the degree to which secondary school exposure to GIS and remote sensing prepares students for possible jobs in physical geography-related disciplines.

SIGNIFICANCE OF THE STUDY

Exploring the advantages of geographic information systems (GIS) and remote sensing in the context of geography education can pave the way for the creation of cutting-edge instructional strategies and technologies that encourage students to actively participate in their learning and to think critically and spatially. However, it is crucial to realize that academic works frequently fail to include GIS and remote sensing into the classroom, creating a huge knowledge gap. Addressing this gap and highlighting the potential benefits of these technologies may lead to a deeper comprehension of physical geography ideas and their real-world relevance.

GIS and remote sensing have applications outside of the classroom, particularly in training students for careers in geospatial analysis, environmental science, urban planning, and natural resource management. These technologies give students a firm foundation in spatial data processing, mapping, and visualization, giving them the skills and knowledge they need to seek employment in these fields. Teachers may help the curriculum be in line with market demands by offering GIS and remote sensing to secondary school pupils, giving them useful skills. This alignment of educational objectives with business demands makes sure that students are adequately equipped for their future careers and raises their level of general career preparedness.

Using GIS and remote sensing technologies in geography education also makes it easier to include real-world scenarios and applications into the classroom. Students can participate

in practical exercises and assignments that mimic problems and problem-solving scenarios seen in the real world. Students can analyze and interpret spatial data, make wise decisions, and provide solutions to challenging geographic problems by using real geospatial data and GIS applications. Students are encouraged to apply their information to real-life circumstances by using this practical method to learning, which also stimulates creativity and strengthens critical thinking skills.

Additionally, the inclusion of GIS and remote sensing in the geography curriculum allows students to have a greater understanding of how various geographic phenomena are interconnected. Students can investigate and analyze spatial correlations, patterns, and trends thanks to these tools, which promotes a comprehensive grasp of how natural and human elements interact and influence the physical environment. Students learn more about the intricate dynamics that affect ecosystems, human civilizations, and landscapes via this exploration, which eventually fosters a more thorough understanding of their surroundings.

There are several benefits for both students and teachers when GIS and remote sensing technology are used in geography instruction. Students' spatial analytical skills, critical thinking skills, and comprehension of physical geography ideas are all improved, and it also gets them ready for possible jobs in related sectors. GIS and remote sensing support active learning and participation in the classroom by bridging the gap between theoretical knowledge and real-world applications. Additionally, the use of these technologies aids in

the curriculum's connection with business needs, ensuring that students have the abilities and information necessary for success in the workplace. In general, integrating GIS and remote sensing into geography education encourages students to have more in-depth, pertinent, and career-oriented learning experiences.

SCOPE OF THE STUDY

The project's efforts will be focused on the Ovia North East Local Government Area (LGA) in Nigeria's Edo State. The study will specifically focus on secondary schools within this specific geographic area. Students that fit within the required age range and are enrolled in secondary school will be the only ones who would participate in the study. Secondary school students, geography teachers, school administrators, and other pertinent stakeholders involved in the process of physical geography instruction and learning within the Ovia North East LGA will all be participants in the study.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

This chapter reviews related literature under the following subheadings:

- Concept of Physical Geography
- Concepts and Elements of Geographic Information System (GIS) and Remote Sensing
- Benefits of Geographic Information System (GIS) and Remote Sensing
- Application of Geographic Information System (GIS) and Remote Sensing in Physical Geography Teaching and Learning in Secondary School

CONCEPT OF PHYSICAL GEOGRAPHY

Understanding the natural patterns and processes of the Earth's physical features is the primary goal of the geography subfield known as physical geography (Strahler and Strahler, 2006). It provides insights into the intricacies of the natural world by examining the dynamic interactions between the atmosphere, hydrosphere, lithosphere, and biosphere. We obtain a thorough understanding of the physical environment of the Earth as well as how it interacts with human activities by studying physical geography.

Physical geography studies how landforms like mountains, plains, plateaus, valleys, and coasts arise, what makes them unique, and how to categorize them (Goudie, 2004). It looks into the tectonic activity, weathering, and erosion processes that shape these landforms. We

can analyze the characteristics of the Earth's surface and their effects on numerous phenomena by knowing landforms and landscapes. It also investigates the climate processes that govern the Earth, such as atmospheric circulation, climatic zones, and weather patterns (Strahler and Strahler, 2011). It investigates the climatic determinants, including solar radiation, air masses, and ocean currents. We can comprehend the distribution of temperature, precipitation, and other atmospheric factors that mold the Earth's different habitats by researching climate and weather patterns.

According to Lomolino et al. (2016), this area of physical geography focuses on the geographical distribution of plant and animal species throughout the globe. It examines the variables, such as climate, geography, soil composition, and human activities, that affect biodiversity. Understanding the biological processes that shape ecosystems and the interactions between animals and their environment are made easier with the aid of biogeography. According to Strahler & Strahler (2011), physical geography is the study of the Earth's water systems, including rivers, lakes, oceans, groundwater, and glaciers. It investigates the water cycle's processes, such as runoff, evaporation, and precipitation. We can better understand water availability, quality, and management by examining hydrological processes, which helps us solve problems like water scarcity, pollution, and the effects of climate change.

Natural calamities and dangers like earthquakes, volcanic eruptions, floods, storms, and wildfires are investigated by physical geography (Harris, 2018). The causes, mechanisms,

spatial distribution, and effects of these occurrences on populated areas and the environment are all examined. Understanding natural hazards allows us to evaluate and reduce risks, improve preparedness for emergencies, and encourage resilience. The causes and effects of environmental change, such as climate change, land use change, and ecosystem degradation, are also frequently examined (Turner et al., 2003). It looks at how environmental challenges including pollution, urbanization, desertification, and deforestation are affected by human activity. The patterns, distributions, and interactions of physical characteristics on the Earth's surface are studied using spatial analytic approaches (Longley et al., 2015). In order to comprehend spatial data and analyze geographic phenomena, geographic information system (GIS) and remote sensing technologies are essential. These tools improve our capacity to investigate the intricacies of the physical world by facilitating data visualization, spatial modeling, and decision-making.

Physical geography offers a comprehensive view of the physical environment of the Earth and how it interacts with human activity. We learn more about how landforms are formed, climatic systems, biodiversity, water resources, natural hazards, and environmental change by studying the fundamentals of physical geography.

CONCEPTS AND ELEMENTS OF GEOGRAPHIC INFORMATION SYSTEM (GIS) AND REMOTE SENSING

Due to the quick and profound changes that civilizations around the world have gone through over the past century, the educational system has undergone considerable adjustments. Due to these adjustments, schools now play a variety of roles, including educating students for global competition and adjusting to technology improvements (Namwamba, Stubblefield, Bagayoko, & Sylvia, 2010). Due to their exposure to and engagement with digital media and technology, including television, computers, video games, the internet, mobile phones, email, and instant messaging, today's students, sometimes known as "digital students," live and study in a different way than earlier generations. Students today frequently multitask in ways that were unthinkable for earlier generations. For instance, they might watch television and listen to music while working together on their homework utilizing a phone, computer, instant messaging, and the internet (Namwamba et al., 2010).

It is essential that Geographic Information Systems (GIS) and Remote Sensing be included in university courses. In many nations around the world, the use of GIS and remote sensing into education is currently a hot topic. Increasing amount of research indicates that integrating GIS into Colleges of Education courses improves students' analytical and critical thinking skills as well as their communication abilities, which in turn boosts learning (Goldstein, 2010). In fact, the former president of the United States named

geospatial technologies (including GIS) as one of the top three rising topics in 2004, highlighting their relevance alongside nanotechnology and biotechnology (Goldstein, 2010). A need for qualified GIS specialists will arise as the global geospatial market is expected to surpass $30 billion in 2005 (Gewin, 2004). In addition to providing educational advantages, teaching GIS in colleges of education gives students access to professional options. The emergence of GIS has increased the scope of academic fields' research and instruction. The prospective uses of GIS in their respective domains have not yet been completely explored by many academics in the social sciences, physical sciences, medical sciences, and humanities, which has restricted their use to predominantly geographers and environmental scientific disciplines (Namwamba et al., 2010).

Reforms in education are required to make progress toward the elusive objective of raising student accomplishment. It is ultimately the job of teachers in the classroom to educate students in colleges of education and support them in becoming better teachers and contributing members of society, even while legislators and administrators impose requirements and laws. Teachers can start down a path of transformational teaching that changes their perceptions and potential, in turn impacting their teaching approaches, by giving them a transformative learning experience. Learning to use GIS gives instructors more confidence in technology and equips them to make the most of the subjects they teach, resulting in a more stimulating and innovative learning environment for their students. Additionally, teachers develop technology abilities for the twenty-first century that widen their horizons (Namwamba et al., 2010).

The four key components of transformative learning experience, critical reflection, reflective discourse, and action can all be included in students' learning processes when a GIS system is used (Merriam, Caffarella, & Baumgartner, 2007). If it is incorporated into the curricula of colleges of education, it has the potential to support problem-based and inquiry-based learning while also enhancing students' computer skills, extending their range of learning preferences, encouraging critical thinking, and enhancing communication and presentation skills (Goldstein, 2008). Furthermore, GIS teaches students how to develop and test research ideas using real-world issues and real-world data. All students can benefit from acquiring spatial thinking abilities because GIS is based on spatial awareness and analysis and because it makes it easier to solve problems in a variety of subjects (Namwamba et al., 2010).

The incorporation of remote sensing technology has enormous potential to improve secondary school students' learning experiences in the constantly expanding subject of geography education. Remote sensing is the process of gathering information about the Earth's surface through sensors on satellites or aircraft. It has a variety of uses that let students investigate the intricacies of the planet's physical environment. Teachers can promote a greater awareness of Earth's characteristics, environmental changes, and human consequences by introducing remote sensing into the curriculum (Jensen, 2007).

Through an engaging exploration adventure, remote sensing enables students to learn in-depth details about the Earth's various features. Students can inspect and analyze landforms, water bodies, vegetation, and urban areas using satellite imagery and aerial

photographs, which helps them better comprehend their characteristics, distribution, and interconnection (Jensen, 2007). This improves their understanding of physical geography. The capability of remote sensing to track and assess environmental changes over time is one of its key benefits. Students can recognize and evaluate changes in land cover, deforestation, urbanization, and the effects of natural disasters by comparing satellite photos taken at various times. The necessity of sustainable behaviours and conservation initiatives is emphasized by this application, which also encourages an appreciation of environmental dynamics (Jensen, 2007).

Climate trends and processes can be better understood through the use of remote sensing data. Students can research climate phenomena including El Nio, the monsoon season, and the urban heat island effect by examining satellite-derived data on temperature, precipitation, cloud cover, and atmospheric variables. With the help of this application, students will have a deeper understanding of the Earth's climate system as well as information on weather patterns and their effects. Additionally, it is an effective tool for teaching pupils about various natural disasters, such as floods, wildfires, and volcanic eruptions. Students can understand the geographic scope, effects, and changes brought about by these disasters by evaluating satellite imagery, which highlights the significance of preparedness and mitigation measures while also increasing knowledge of the hazards involved (Foody, 2019; Coppola, 2016).

For mapping and geospatial analytic tasks in secondary schools, remote sensing imagery and data are essential tools. The ability to decipher satellite photos, gather data, and make

their own maps is something that students may learn. Along with encouraging spatial thinking and problem-solving abilities, they can also be used to study the spatial relationships between different characteristics and phenomena (Lutz & Keuler, 2004).

By bridging several academic topics, remote sensing enables students to investigate the relationships between physical geography, environmental science, biology, and other fields. Students can handle difficult environmental issues and gain a holistic grasp of the interconnectivity of several scientific disciplines by combining remote sensing data with other sources of information. This interdisciplinary approach promotes the growth of well rounded perspectives, critical thinking, and an understanding of environmental concerns (Sieber & Kemp, 2000).

Students are introduced to future careers in environmental science, geospatial analysis, urban planning, or natural resource management through the use of remote sensing in secondary school instruction. Students can get knowledge of the real-world uses of these domains and can build the necessary abilities by interacting with remote sensing technologies (Marble & Schwer, 2006).

Students in secondary schools in Ovia North East LGA of Edo State, Nigeria, can learn more about the Earth's physical processes, spatial patterns, and environmental changes by integrating remote sensing into the teaching and learning of physical geography. Along with improving their geographic knowledge and abilities, this integration also gets them ready for future academic endeavors and occupations that call for a solid background in geospatial analysis and problem-solving. Additionally, remote sensing encourages

responsible stewardship of natural resources and the appreciation of the environment, which supports sustainable development both locally and globally. Students can actively participate in environmental monitoring, resource management, and decision-making processes in their local context by giving them the skills to evaluate and understand remote sensing data.

Additionally, including remote sensing into secondary school curricula is in line with international initiatives and priorities. The Sustainable Development Goals (SDGs) of the United Nations place a strong emphasis on the value of climate action, environmental sustainability, and high-quality education. Teachers can achieve these goals through creating a deeper comprehension of the Earth's processes and encouraging sustainable practices among students by integrating remote sensing technologies into the curriculum.

Students can engage in inquiry-based learning and scientific research through the use of remote sensing. Students can formulate research questions, assemble supporting data, and reach conclusions based on observations made in the real world by analyzing satellite imagery and remote sensing data. This method improves their capacity for scientific inquiry while also encouraging curiosity, critical thinking, and problem-solving skills.

Additionally, integrating remote sensing into secondary school curricula can close the knowledge gap between abstract ideas and practical implementations. Students can get firsthand knowledge of how remote sensing technology is applied in a variety of industries, including agriculture, urban planning, disaster management, and environmental conservation, by providing them with real-world examples and case studies. They have a

deeper grasp of the subject topic as a result of this exposure, which also encourages them to choose a career in geospatial sciences and related fields.

It is crucial to remember that including remote sensing in the curriculum calls for the right tools and technological setup. In educational settings with limited resources, access to satellite images, remote sensing software, and computer equipment may provide difficulties. In order to ensure that all students have equitable access to remote sensing technologies, it is vital for educational institutions, policymakers, and stakeholders to work together in providing the required support and resources.

In conclusion, the incorporation of remote sensing into secondary school curricula in Ovia North East LGA of Edo State, Nigeria, has enormous potential to improve students' educational experiences and equip them for the challenges of a fast changing global environment. Students can develop critical thinking ability, multidisciplinary skills, and an awareness for the environment by making use of remote sensing technology. Additionally, this integration supports global agendas and gives students chances to actively participate in scientific research and problem-solving in the actual world. The incorporation of remote sensing into the curriculum can enable students to actively contribute to sustainable development and informed decision-making in their communities and beyond through proper implementation and assistance.

Physical geography instruction in secondary schools would benefit greatly from the incorporation of geographic information systems (GIS) and remote sensing. GIS improves instructors' teaching strategies, gives them access to technology, and broadens their

viewpoints. The incorporation of GIS and remote sensing in the classroom encourages transformative learning, develops students' critical thinking, increases their computer literacy, and enables them to use spatial analysis to investigate real-world issues. A multidisciplinary approach is made possible and students are better prepared for potential employment in related subjects thanks to remote sensing's ability to deepen their awareness of Earth's features, environmental changes, and human influences. Secondary schools in Ovia North East LGA of Edo State, Nigeria, may offer students a thorough and interesting learning experience that equips them for the opportunities and challenges of the twenty-first century by implementing these technologies into the curriculum. GIS and remote sensing are used in education to improve academic performance as well as give students essential skills and knowledge for future employment and civic engagement.

Teachers can expose students to practical applications and scenario-based problem-solving by utilizing GIS and remote sensing technologies. Students are able to actively interact with spatial data, analyze information, and come to wise judgments thanks to this practical method. Students can investigate the physical geography of their immediate environment, look into trends and changes over time, and develop a deeper understanding of how human endeavors and the natural world are intertwined through the use of satellite imagery, aerial photographs, and other remote sensing data.

Additionally, incorporating GIS and remote sensing into the curriculum encourages students to develop their spatial literacy and critical thinking skills. They gain the ability to analyze critically, formulate insightful inquiries, and apply geospatial technologies to

research intricate problems. Students can investigate the relationships between variables, find geographical patterns, and draw conclusions based on evidence by looking at data layers and performing spatial analysis. These abilities are crucial in a variety of academic domains and can be used to address issues in the catastrophe, environmental management, and urban planning. Interdisciplinary learning is further supported by the use of GIS and remote sensing. Students can draw links between physical geography, environmental science, biology, social sciences, and other fields as they interact with spatial data and investigate geographic patterns. This interdisciplinary approach promotes a comprehensive awareness of the world and equips students to take on complicated problems that call for a variety of viewpoints and specializations.

Additionally, including GIS and remote sensing into secondary school curricula is in line with world trends and labor market needs. Urban planning, resource management, transportation, agriculture, and public health are just a few of the industries that are increasingly using geospatial technologies. By exposing students to these technologies at a young age, educators are giving them essential knowledge and abilities that may one day lead to a variety of job prospects. These tools can also help students develop an entrepreneurial mindset by teaching them how to use geospatial data to spot market gaps and suggest creative solutions.

Both pupils and teachers stand to gain significantly from the secondary school curriculum's inclusion of GIS and remote sensing in Ovia North East LGA of Edo State, Nigeria. Students can receive practical information applicable to many different sectors and

potential vocations while also developing critical thinking, spatial analysis, and transdisciplinary abilities by integrating these tools into the curriculum. As technology continues to change the world, incorporating GIS and remote sensing into the classroom guarantees that students have the skills and knowledge needed to function in and contribute to a society that is more interconnected and spatially aware.

Education professionals frequently face difficulties when a new technology is introduced. Geographic Information System (GIS) and Remote Sensing have not yet been fully incorporated into the Nigerian Colleges of Education system. There are several reasons for this. On the one hand, administrators might not completely appreciate how important GIS and Remote Sensing are to educators in training and trainees at colleges of education. In the course of developing policies, they could also run into administrative challenges. GIS and remote sensing, on the other hand, by their very nature combine ideas and techniques from many fields, including geography, geology, medicine, sociology, and statistics. Due to the interdisciplinary nature of GIS and remote sensing, higher education departments are not primarily responsible for educating and training students in these subjects. There are some exceptions, such as the Federal School of Surveying in Oyo, Oyo state, even though the Departments of Geography in the majority of higher education institutions in Nigeria have assumed much of the responsibilities.

GIS and remote sensing can be seen as both tools that need instruction in how to utilize them and as a set of ideas that need to be taught in schools. Because administrators, users, and developers need different kinds of GIS and Remote Sensing knowledge, there are

numerous obstacles associated with GIS and Remote Sensing education and training. Unresolved is the conflict between a training and education approach.

The expense of procuring GIS and Remote Sensing components, including hardware, software, and techniques, is a substantial barrier to the development and application of these technologies at colleges of education. This comprises hardware like scanners and plotters as well as servers, workstations, the Global Positioning System (GPS), ILWIS, ArcGIS, and Erdas Imagine. Maintenance of the equipment, the purchase of consumables and spare parts, and the training of trainers to keep them abreast of new software advancements and ongoing upgrades are additional obstacles.

Like all other information technology systems, GIS and remote sensing are continually evolving and changing. The education sector confronts difficulties with resource provision, but commercial customers can find it simpler to set up GIS and Remote Sensing systems and react to quick changes. Within the educational system, there is a widespread belief that GIS and remote sensing are inaccessible technologies because they are costly to deliver and maintain. Other factors that contribute to the slow adoption of GIS and Remote Sensing include unstable power supplies, a lack of technology funding, inadequate leadership support and guidance, inadequate professional development for teachers, and reluctance on the part of college administrators to add new components to already overburdened curricula.

Another important barrier to the implementation of GIS and remote sensing in Nigerian colleges of education is conservatism. Many system professionals are hesitant or unwilling

to move away from conventional approaches to data collecting and analysis. Some still use drawing boards, pens, and T-squares in manual procedures. However, it should be highlighted that in order to stay relevant in the ever-changing environment, professionals in the social studies and science sectors need to get familiar with the power of automation in GIS and Remote Sensing.

Awareness, interdisciplinary coordination, resource provision, cost, technological perceptions, power supply, funding, support, professional development, curriculum load, and resistance to change are some of the issues that hinder the implementation of GIS and Remote Sensing in Nigerian Colleges of Education. To fully utilize GIS and remote sensing's enormous potential for improving education and educating students for the needs of the modern world, these obstacles must be overcome.

The gathering, storage, analysis, and presentation of spatial data are all revolutionized by the Geographic Information System (GIS), a powerful and adaptable technology. To make it easier to visualize, interpret, and comprehend spatial relationships and patterns, it acts as a comprehensive framework that includes software, hardware, and data. Users can gather, organize, alter, and analyze many kinds of geographic data, such as maps, satellite imagery, aerial pictures, and GPS data, by utilizing GIS.

The core tenet of geographic information systems (GIS) is that position is a crucial characteristic of any object or phenomenon on Earth. GIS helps users to explore complicated issues, solve spatial issues, and make well-informed decisions based on spatial

relationships and patterns by correlating qualities with spatial data. GIS enables the exploration and analysis of complex relationships between various geographic characteristics and qualities by integrating many layers of data.

The following are the main elements of GIS:

Data: GIS uses a wide variety of data formats, including both raster (grids or pixels) and vector (points, lines, and polygons) data. These statistics can reflect a wide range of information, including physical characteristics like elevation and land cover, socioeconomic information like income levels and population density, and environmental characteristics like climate and vegetation. In essence, a GIS can incorporate any kind of geographic data.

Software: The core of the technology is GIS software, which offers users a complete set of tools and functionalities for creating, editing, analyzing, and visualizing spatial data. Google Earth, ArcGIS, and QGIS are some notable examples of GIS applications that are in use today. These tools provide a wide range of capabilities that let users investigate geographical relationships, carry out intricate analysis, and produce insightful representations.

Hardware: Hardware platforms that can be used to install GIS include desktop or laptop computers, as well as dedicated GIS servers. The size and complexity of the GIS project, as well as the processing speed and memory needed to manage huge datasets and carry out computationally intensive spatial analysis, all influence the hardware selection.

Methods and Techniques: Spatial data processing and analysis methodologies and procedures are under the umbrella of GIS. These methods could consist of many different things, such as network analysis, geostatistics, geographical modeling, and spatial analysis. With the use of these approaches, users can discover patterns, spot trends, and draw insightful inferences from spatial data.

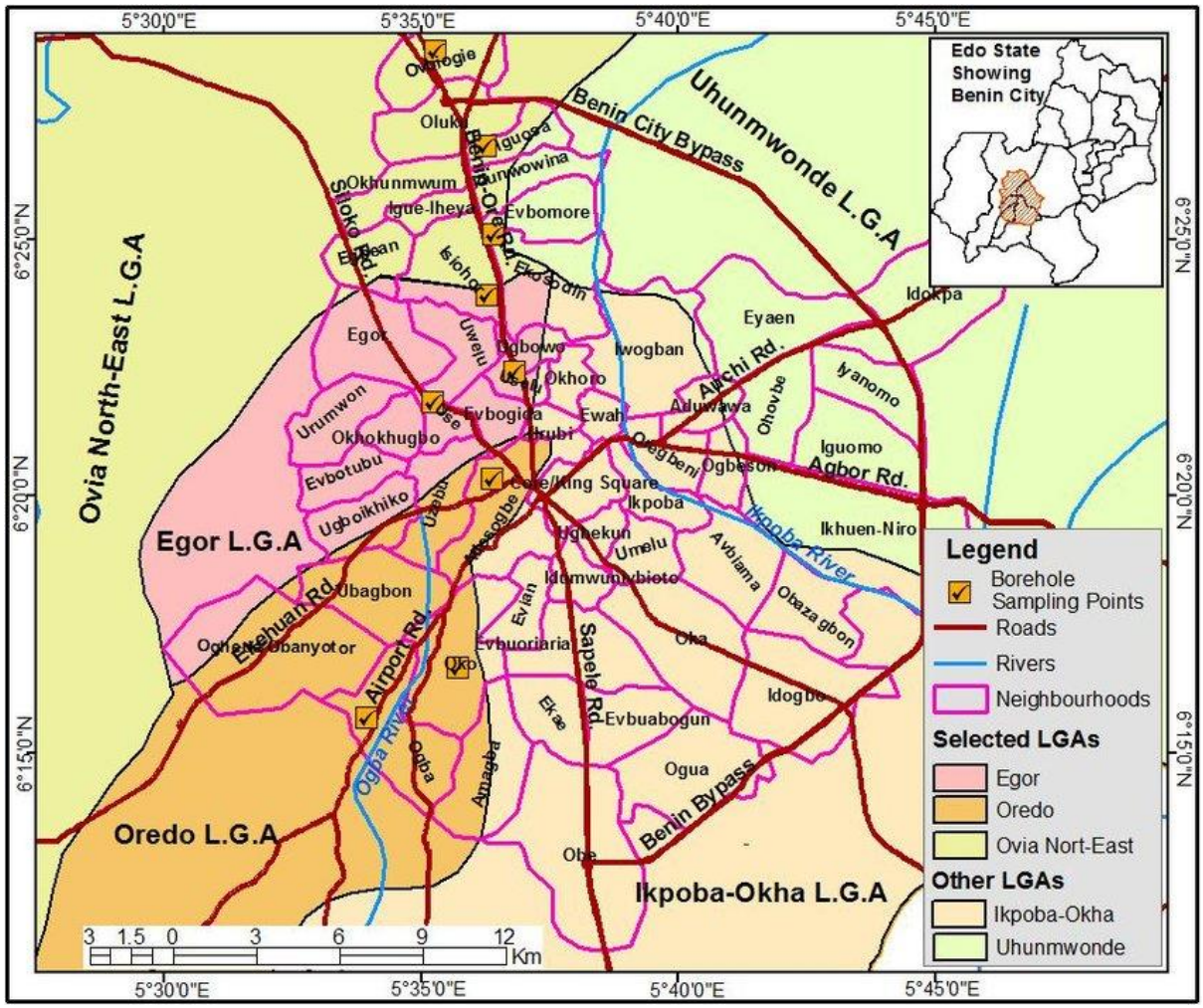

Fig 1. ***GIS Imagery Showing the Map of Benin City (Source: Go to School Limited, 2018)***

On the other side, remote sensing enhances GIS by offering a way to gather data about the Earth's surface from a distance. This technique uses sensors that are installed on satellites, aircraft, or drones to take pictures and measurements of the electromagnetic radiation coming from the Earth. A wide range of data, including optical (visible and infrared), thermal, and radar imaging, are included in remote sensing data.

We can watch and track large regions of the Earth's surface throughout time thanks to remote sensing. We can learn important things about changes in the environment, natural disasters, urban growth, and vegetation health by studying remote sensing data. For instance, remote sensing enables us to track vegetation health, measure deforestation rates, detect changes in land cover, and evaluate the environmental effects of urbanization. Remote sensing data, when combined with GIS, improves the analysis and interpretation of geographic data, allowing for a deeper comprehension of spatial phenomena.

In the realm of geographic analysis, remote sensing and GIS work in symbiotic harmony to produce powerful results. They provide never-before-seen ability to investigate, evaluate, and interpret the physical world, empowering academics, professionals, and others to confront challenging spatial issues and obtain new perspectives on a range of geographical phenomena. By combining the strengths of GIS and remote sensing, we can

gain a better understanding of the world and help with sustainable development and informed decision-making.

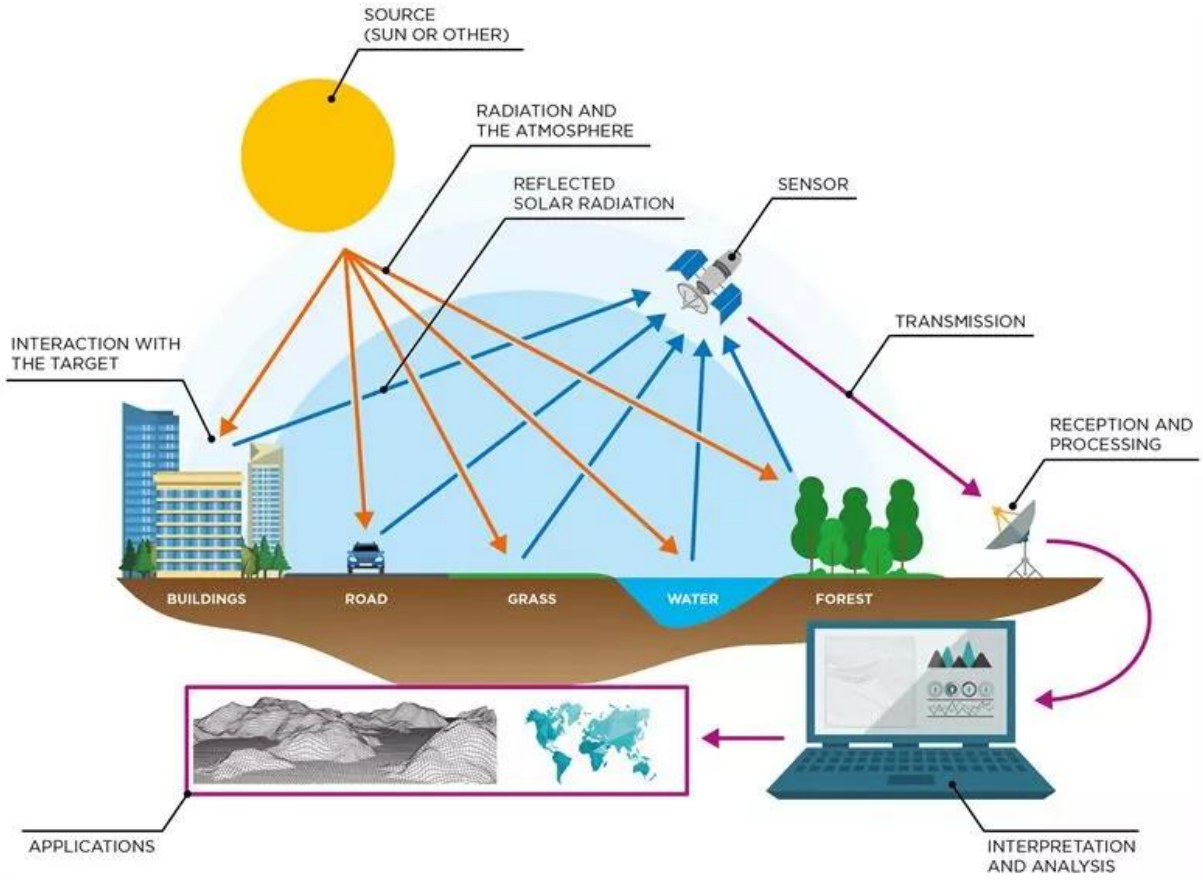

Fig 2. An Image Showing the *Principle of Remote Sensing and GIS (Source: geolearn)*

BENEFITS OF GEOGRAPHIC INFORMATION SYSTEM (GIS) AND REMOTE SENSING

Remote sensing and geographic information systems (GIS) have a wide range of advantages in a variety of industries and applications. Here are a few of the main benefits:

Enhanced Spatial Analysis and Decision-Making: GIS offers strong tools for spatial analysis that enable users to look at and comprehend intricate spatial relationships and patterns. GIS enables users to make educated decisions and address spatial issues by integrating various data layers and carrying out spatial operations. By offering current and comprehensive data about the Earth's surface, remote sensing data significantly improves spatial analysis.

Accurate and Timely Data: Data about the Earth's surface is accurate and timely thanks to remote sensing and GIS technologies. GIS enables users to manage a variety of geographic data types while maintaining data quality and accessibility. Through the use of satellite pictures or airborne sensors, remote sensing gathers up-to-date data that offers useful insights into environmental factors including vegetation health and land cover.

Improved Planning and Resource Management: Data about the Earth's surface is accurate and timely thanks to remote sensing and GIS technologies. GIS enables users to manage a variety of geographic data types while maintaining data quality and accessibility. Through the use of satellite pictures or airborne sensors, remote sensing gathers up-to-date data that offers useful insights into environmental factors including vegetation health and land cover.

Environmental Monitoring and Assessment: In order to monitor and evaluate the environment, GIS and remote sensing are essential. They make it possible to spot and examine environmental changes including deforestation, urbanization, and shifts in land cover. Researchers and environmental specialists can monitor and assess the effects of human activities on the natural environment by incorporating remote sensing data into GIS.

Disaster Management and Emergency Response: Effective emergency response and catastrophe management are made possible by GIS and remote sensing. Emergency responders can effectively allocate resources, organize evacuation routes, and gauge the scale of disasters by evaluating satellite imagery and real-time data. Additionally, GIS aids in locating weak points and foreseeing future dangers.

Improved Efficiency in Urban Planning: Urban planning initiatives are aided by GIS and remote sensing, which provide precise and thorough spatial data. Urban planners may now examine population density, transit systems, land use patterns, and infrastructure needs thanks to these technologies. GIS aids in developing cities that are more sustainable and habitable by visualizing and simulating various situations.

Education and Research: In both research and education, GIS and remote sensing have become indispensable tools. They encourage participatory and interesting learning by giving students the freedom to investigate, evaluate, and visualize spatial data. Researchers may explore intricate spatial phenomena, evaluate enormous datasets, and advance knowledge in a variety of subjects, such as geography, environmental science, and urban planning, thanks to GIS and remote sensing.

Improved Data Visualization and Communication: GIS has strong visualization features that enable users to portray spatial data in an engaging way visually. GIS aids in conveying complicated information to a variety of audiences by producing maps, charts, and interactive visualizations. By adding a visual component to the research, remote sensing imaging makes it simpler to communicate knowledge and insights.

Cost and Time Savings: In many applications, GIS and remote sensing technologies save money and time. They do away with the necessity for time- and money-consuming manual data collecting and processing. GIS and remote sensing optimize workflows and boost productivity by automating procedures and offering effective tools for data management and analysis.

Career Opportunities: Knowledge of remote sensing and GIS provides up a variety of professional prospects. In sectors including environmental science, urban planning, natural resource management, geospatial analysis, and disaster management, there is a high demand for professionals with these skills. Students can gain important skills and knowledge that improve their employment chances by integrating GIS and remote sensing into their curriculum.

Overall, the combination of GIS with remote sensing has several advantages for many industries, allowing for more effective decision-making, better resource management, and a better comprehension of the Earth's physical environment. These technologies are still developing and are essential for addressing difficult spatial problems and advancing sustainable development.

APPLICATION OF GEOGRAPHIC INFORMATION SYSTEM (GIS) AND REMOTE SENSING IN PHYSICAL GEOGRAPHY TEACHING AND LEARNING IN SECONDARY SCHOOL

Secondary school physical geography teaching and learning can benefit greatly from the use of geographic information systems (GIS) and remote sensing, which also enhances the educational process. These tools are fun and interactive, helping students better learn physical geography subjects and develop their critical thinking abilities. The following are some significant GIS and remote sensing applications in physical geography education:

Spatial Analysis and Mapping: According to Lutz and Keuler (2004), GIS enables students to evaluate spatial data, discover patterns, and produce maps that depict physical geography phenomena. Students can better comprehend ideas like landforms, climate zones, and vegetation distribution by manipulating and visualizing geographical data. They are able to spot patterns and trends by analyzing the connections between different geographic elements.

Data Visualization: With the use of GIS, students may visualize large geographic data sets in a visual and interactive way (Demirci and Demirci, 2017). Students can successfully convey their findings and views by using maps, charts, and graphs. As communication and data interpretation skills are crucial in the study of physical geography, this aids their development.

Fieldwork and Data Collection: Students can participate in fieldwork and data collection activities using GIS and remote sensing technology (Sieber and Kemp, 2000). During field

trips, students can utilize handheld GPS devices to gather georeferenced data, such as measuring the amount of vegetation cover, recording the characteristics of the water quality, or mapping landforms. Students may put their classroom learning to use and hone their fieldwork abilities thanks to this practical experience.

Environmental Analysis: Students can examine environmental changes such altered land cover, deforestation, or urbanization using GIS and remote sensing (Macharia et al., 2020). Students can recognize and evaluate the effects of human activities on the physical environment by looking at geospatial data and satellite photography. Understanding the intricate relationships between human behaviour and natural systems is fostered through this.

Problem-solving and Decision-making: Students can use GIS to engage in problem-solving activities and make defensible conclusions based on the study of spatial data (Bodzin et al., 2019). Students can assess situations, weigh trade-offs, and suggest solutions to physical geography problems by integrating different data layers. Critical thinking, problem-solving, and decision-making abilities are developed in this way.

Virtual Field Trips and Simulations: Students can virtually explore various geographic regions and mimic real-world situations using GIS and remote sensing technology (Santos et al., 2020). Students can explore remote sites, examine landscapes, and research phenomena like volcano eruptions, climate change, or coastline erosion through interactive

virtual field trips and simulations. This broadens their geographic knowledge and improves their comprehension of physical geography ideas.

Career Readiness: Students are better prepared for future professions in areas like environmental science, urban planning, geospatial analysis, and natural resource management when they are exposed to GIS and remote sensing in secondary school (Marble and Schwer, 2006). Students who are proficient in these technologies have essential job-marketable abilities such as data analysis, spatial thinking, and geospatial technology competency.

Secondary school physical geography instruction and learning that incorporates geographic information systems (GIS) and remote sensing technologies gives students dynamic, practical experiences that increase their comprehension of the material. Students gain critical thinking, problem-solving, and decision-making abilities through participating in activities like geographical analysis, data visualization, fieldwork, and environmental study. Additionally, GIS and remote sensing training prepares students for professions in geospatial-related sectors in the future.

CHAPTER THREE

METHODOLOGY

This chapter describes the methodology of the study under the following subheadings:

- Research Design
- Population of the Study
- Sample and Sampling Technique
- Research Instrument
- Method of Data Collection
- Method of Data Analysis

RESEARCH DESIGN

The research design used for this study is descriptive survey. This research design was adopted because it describes in a systematic manner the characteristics and facts about a population of study. It was designed to identify the possible advantages of including Geographic Information System (GIS) and Remote Sensing in physical geography teaching

and learning in secondary school in Ovia North East Local Government Area of Edo State, Nigeria.

POPULATION OF THE STUDY

The population of this study comprises of only Geography teachers of secondary schools in Ovia North East Local Government Area of Edo State.

SAMPLE AND SAMPLING TECHNIQUE

A sample size of twenty-five (25) respondents was used for this study from secondary schools in Ovia North East Local Government Area of Edo State through the convenience sampling technique.

RESEARCH INSTRUMENT

The instrument of this study was a structured questionnaire tagged 'The possible advantages of including Geographic Information System (GIS) and Remote Sensing in physical geography teaching and learning in secondary school in Ovia North East Local Government Area of Edo State, Nigeria. The questionnaire was divided into five (5) parts; Section A, B, C, D and E.

Section A was used to collect the teacher's years of experience of the respondents, section B consisted of questions on 'current teaching methods', section C consisted of questions on 'knowledge of GIS and Remote Sensing', section D consisted of questions on 'perceived benefits of GIS and Remote Sensing', and section E consisted of questions on 'student engagement and learning outcomes'

METHOD OF DATA COLLECTION

The researcher visited the secondary schools and personally administered the questionnaire in order to ensure high response rate. Some were collected on the day it was administered while others were collected the following day.

METHOD OF DATA ANALYSIS

The data collected for this study was analyzed using frequency counts and simple percentage.

CHAPTER FOUR

DATA ANALYSIS AND DISCUSSION OF FINDINGS

INTRODUCTION

This chapter presents and analyses the results of the data collected from the field. The presentation and analysis take into cognisance the objectives of the study, and the analysis is based on the questionnaire administered.

RESPONSE RATE

Table 1: Response Rate

Questionnaires Printed	Questionnaires Distributed	Questionnaires Returned	Response Rate
25 Copies	25 Copies	25 Copies	100%

DATA ANALYSIS AND DISCUSSION OF FINDINGS

Data collected from the field were organized and presented in frequency tables showing percentages to facilitate data analysis. The following tables show the analysis of the data collected from the respondents. Data from the study were analysed using descriptive statistics.

TEACHER'S YEARS OF EXPERIENCE

Table 2: Years of Teaching Experience.

Year	Frequency	Percentage (%)
1	4	16
2	7	28
3	5	20
4	2	8
5	3	12
6	1	4
7	3	12
Total	**25**	**100**

Table 2 shows the Years of Teaching Experience of teachers. It shows that Teachers of 1 year experience are 4 persons (16%), 2 years of experience are 7 persons (28%), 3 years of experience are 5 persons (20%), 4 years of experience are 2 persons (8%), 5 years of experience are 3 persons (12%), 6 years of experience is 1 person (4%), and 7 years of experience are 3 persons (12%).

The Implication of the finding indicates that, there are more teachers that teach Geography in secondary school with two (2) years of experience.

CURRENT TEACHING METHODS

Research Question 1

What teaching methods do you currently use to convey concepts of Physical Geography to your students?

Table 3: Teaching Methods Currently Used to Convey Concepts of Physical Geography to Students.

Items	Frequency	Percentage (%)
Lecture-Based Instruction	4	16
Lecture & Visual Aids	15	60
Visual Aids	0	0
Visual Aids & Field Trips and Practical	6	24
Field Trips and Practical Exercises	0	0
Others	0	0
Total	**25**	**100**

Table 3 shows the Teaching Methods Currently Used to Convey Concepts of Physical Geography to Students. The table shows that out of 25 respondents (100%), 4 (16%) utilizes Lecture Based Instruction, 15 (60%) utilizes both Lecture & Visual Aids, 0 (0%) utilizes Visual Aids, 6 (24%) utilizes both Visual Aids & Field Trips and Practical Exercises, 0 (0%) utilizes Field Trips and Practical Exercises, and 0 (0%) utilizes other methods.

The Implication of the finding indicated that more teachers tend to utilize both Lecture & Visual Aids.

Research Question 2

Are there any challenges you encounter while teaching Physical Geography using traditional methods?

Table 4: Challenges Encountered while Teaching Physical Geography Using Traditional Methods.

Items	Frequency	Percentage (%)
Yes	6	24
No	19	76
Total	**25**	**100**

Table 4 indicates the Challenges Encountered while Teaching Physical Geography Using Traditional Methods. The table shows that out of 25 respondents (100%), 6 (24%) encountered challenges (Yes) and 19 (76%) did not encounter any challenge (No).

The Implication of the finding indicates that more teachers (76%) did not encounter any challenge teaching physical geography using traditional methods.

Research Question 3

Which of the methods do you use often?

Table 5: Methods Used Often.

Items	Frequency	Percentage (%)
Lecture-based instruction	14	56
Visual aids	11	44
Field trips and practical exercises	0	0
Others	0	0
Total	**25**	**100**

Table 5 shows the Methods Used Often. The table shows that out of 25 respondents (100%), 14 (56%) uses Lecture Based Instruction, 11 (44%) uses Visual Aids, 0 (0%) uses Field Trips and Practical Exercises, and 0 (0%) uses other methods.

The Implication of the finding indicates that more teachers tend to use Lecture based instruction more often.

KNOWLEDGE OF GIS AND REMOTE SENSING

Research Question 4

How familiar are you with Geographic Information System (GIS) and Remote Sensing technologies?

Table 6: How Familiar Teachers are with Geographic Information System (GIS) and Remote Sensing Technologies.

Items	Frequency	Percentage (%)
Very familiar	9	36
Somewhat familiar	7	28
Not familiar	9	36
Total	**25**	**100**

Table 6 shows how familiar teachers are with Geographic Information System (GIS) and Remote Sensing Technologies. The table showed that out of 25 respondents (100%), 9 (36%) are Very familiar, 7 (28%) are Somewhat familiar, and 9 (36%) are Not familiar.

The Implication of the finding indicated that there is a balanced percentage between 36% of people that are very familiar with GIS and Remote Sensing Technologies and 36% of people that are not familiar with GIS and Remote Sensing Technologies.

Research Question 5

Have you ever used GIS or Remote Sensing technologies in your teaching?

Table 7: Teachers' Response on Teaching with GIS or Remote Sensing Technologies.

Items	Frequency	Percentage (%)
Yes	0	0
No	25	100
Total	**25**	**100**

Table 7 shows Teachers' Response on Teaching with GIS or Remote Sensing Technologies. The table showed that out of 25 respondents (100%), 0 (0%) have used GIS or Remote Sensing technologies in teaching (Yes), and 25 (100%) have not used GIS or Remote Sensing technologies in teaching (No).

The Implication of the finding indicates that most geography teachers have not used GIS or Remote Sensing technologies in teaching.

PERCEIVED BENEFITS OF GIS AND REMOTE SENSING

Research Question 6

In your opinion, what are In your opinion, what are the potential advantages of incorporating GIS and Remote Sensing technologies into Physical Geography teaching and learning?

Table 8: The Potential Advantages of Incorporating GIS and Remote Sensing Technologies into Physical Geography Teaching and Learning.

Items	Frequency	Percentage (%)
Real-world applications of theoretical concepts	0	0
Increased student engagement	1	4
Better understanding of environmental issues	0	0

All	14	56
Real-world applications of theoretical concepts & Increased student engagement	1	4
Increased student engagement & Better understanding of environmental issues	1	4
Others	0	0
None	8	32
Total	**25**	**100**

Table 8 showed the potential advantages of incorporating GIS and Remote Sensing Technologies into physical geography teaching and learning. The table shows that out of 25 respondents (100%), 0 (0%) chose Real-world applications of theoretical concepts, 1 (4%) chose Increased student engagement, 0 (0%) chose better understanding of environmental issues, 14 (56%) chose All, 1 (4%) Real-world applications of theoretical concepts & Increased student engagement, 1 (4%) chose Increased student engagement & Better understanding of environmental issues, 0 (0%) chose others and 8 (32%) chose None.

The Implication of the finding indicated that most geography teachers acknowledges that all (Real-world applications of theoretical concepts, Increased student engagement, and Better understanding of environmental issues) are potential advantages of incorporating GIS and Remote Sensing Technologies into physical geography teaching and learning.

Research Question 7

How do you think GIS and Remote Sensing can enhance students' understanding of geographical concepts?

Table 9: How GIS and Remote Sensing can Enhance Students' Understanding of Geographical Concepts.

Items	Frequency	Percentage (%)
Enabling interactive exploration of geographic data	2	8
Providing hands-on experience with data analysis	0	0
Connecting theoretical concepts to real-world scenarios	1	4
All	13	52

Enabling interactive exploration of geographic data & Providing hands-on experience with data analysis	1	4
Providing hands-on experience with data analysis & Connecting theoretical concepts to real-world scenarios	0	0
Others	0	0
None	8	32
Total	**25**	**100**

Table 9 showed how GIS and Remote Sensing can enhance students' understanding of geographical concepts. The table shows that out of 25 respondents (100%), 2 (8%) chose Enabling interactive exploration of geographic data, 0 (0%) chose Providing hands-on experience with data analysis, 1 (4%) chose Connecting theoretical concepts to real-world scenarios, 13 (52%) chose All, 1 (4%) Enabling interactive exploration of geographic data & Providing hands-on experience with data analysis, 0 (0%) Providing hands-on experience with data analysis & Connecting theoretical concepts to real-world scenarios, 0 (0%) chose others and 8 (32%) chose None.

The Implication of the finding was that most geography teachers acknowledged that all (Enabling interactive exploration of geographic data, Providing hands-on experience with data analysis, and Connecting theoretical concepts to real-world scenarios) shows how GIS and Remote Sensing can enhance students' understanding of geographical concepts.

PERCEIVED BENEFITS OF GIS AND REMOTE SENSING

Research Question 8

How do you think the use of GIS and Remote Sensing could potentially impact students' engagement and interest in learning Physical Geography?

Table 10: How the Use of GIS and Remote Sensing could Potentially Impact Students' Engagement and Interest in Learning Physical Geography.

Items	Frequency	Percentage (%)
Increase engagement significantly	9	36
Increase engagement moderately	7	28
Not sure	9	36
Total	**25**	**100**

Table 10 showed how the use of GIS and Remote Sensing could potentially impact students' engagement and interest in learning physical geography. The table showed that

out of 25 respondents (100%), 9 (36%) chose Increase engagement significantly, 7 (28%) chose Increase engagement moderately, and 9 (36%) are Not sure.

The Implication of the finding indicated that there is a balanced percentage (36%) between people that chose Increase engagement significantly with GIS and Remote Sensing Technologies and people that chose Increase engagement moderately, which could potentially impact students' engagement and interest in learning physical geography.

Research Question 9.

In your opinion, could the inclusion of GIS and Remote Sensing lead to improved learning outcomes in Physical Geography?

Table 11: The Inclusion of GIS and Remote Sensing Leads to Improved Learning Outcomes in Physical Geography.

Items	Frequency	Percentage (%)
Yes, by providing practical application of concepts	16	64
Yes, by enhancing critical thinking and problem-solving	0	0
No, it may not significantly impact learning outcomes	0	0
Not sure	9	36
Total	**25**	**100**

Table 11 showed how the inclusion of GIS and Remote Sensing could lead to improved learning outcomes in physical geography. The table showed that out of 25 respondents (100%), 16 (64%) chose Yes, by providing practical application of concepts, 0 (0%) chose Yes, by enhancing critical thinking and problem-solving, 0 (0%) chose No, it may not significantly impact learning outcomes, and 9 (36%) chose not sure.

The Implication of the finding indicated that more of the teachers of about 16 respondent (64%) chose Yes, by providing practical application of concepts.

DISCUSSION OF FINDINGS.

This study examined the investigation of the possible advantages of including geographic information system (GIS) and Remote Sensing in physical geography teaching and learning in secondary school in Ovia North East Local Government Area of Edo State Nigeria.

The first research question examined the teaching methods currently used to convey concepts of physical geography to students. From the percentage value in Table 4.2.1 it was observed that more teachers tend to utilize both Lecture & Visual Aids.

The second research question examined the challenges encountered while teaching physical geography using traditional methods. From the percentage value in Table 4.2.2 it was observed that more teachers did not encounter any challenge teaching physical geography using traditional methods. This agrees with Awhen et al. (2016), which they

said that conservatism is a major factor slowing down the implementation of GIS in our Colleges of

Education. A lot of professionals in the system are not willing or are reluctant to change from the old methods of collecting and analyzing data. Many are yet to change their focus from the traditional drawing boards, pens, and T-squares. Many people still acquire, store, process, sort, retrieve, and display data manually. It must be said however that any professional in social studies and science circles that wants to continue to be relevant in the new dispensation would have to acquaint himself with the power of automation.

The third research question examined the methods used often. From the percentage value in Table 4.2.3 it was observed that more teachers tend to use Lecture based instruction more often.

The fourth research question examined how familiar teachers are with Geographic Information System (GIS) and Remote Sensing Technologies. From the percentage value in Table 4.3.1 it was observed that there is a balanced percentage between 36% of people that are very familiar with GIS and Remote Sensing Technologies and 36% of people that are not familiar with GIS and Remote Sensing Technologies. This supports Namwamba, Stubblefield, Bagayoko, & Sylvia, (2010), which they said that Due to the quick and profound changes that civilizations around the world have gone through over the past century, the educational system has undergone considerable adjustments. Due to these

adjustments, schools now play a variety of roles, including educating students for global competition and adjusting to technology improvements.

The fifth research question examined teachers' response on teaching with GIS or Remote Sensing Technologies. From the percentage value in Table 4.3.2 it was observed that most geography teachers have not used GIS or Remote Sensing technologies in teaching. This agrees with Awhen et al. (2016), which they said that administrators have not realized the abundant importance of GIS to the trainers and the trainees in the Colleges of Education.

The sixth research question examined the potential advantages of incorporating GIS and Remote Sensing Technologies into physical geography teaching and learning. From the percentage value in Table 4.4.1 it was observed that most geography teachers acknowledges that all (Real-world applications of theoretical concepts, Increased student engagement, and better understanding of environmental issues) are potential advantages of incorporating GIS and Remote Sensing Technologies into physical geography teaching and learning. This agrees with Goldstein, (2010), who said that, An increasing amount of research indicates that integrating GIS into Colleges of Education courses improves students' analytical and critical thinking skills as well as their communication abilities, which in turn boosts learning.

The seventh research question examined how GIS and Remote Sensing can enhance students' understanding of geographical concepts. From the percentage value in Table 4.4.2 it was observed that most geography teachers acknowledges that all (Enabling interactive

exploration of geographic data, providing hands-on experience with data analysis, and connecting theoretical concepts to real-world scenarios) shows how GIS and Remote Sensing can enhance students' understanding of geographical concepts. This agrees with Goldstein, (2008), who said that, If it is incorporated into the curricula of colleges of education, it has the potential to support problem-based and inquiry-based learning while also enhancing students' computer skills, extending their range of learning preferences, encouraging critical thinking, and enhancing communication and presentation skills.

The eighth research question examined how the use of GIS and Remote Sensing could potentially impact students' engagement and interest in learning physical geography. From the percentage value in Table 4.5.1 it was observed that there is a balanced percentage between 36% of people that chose Increase engagement significantly with GIS and Remote Sensing Technologies and 36% of people that chose Increase engagement moderately, which could potentially impact students' engagement and interest in learning physical geography.

The ninth research question examined the inclusion of GIS and Remote Sensing leads to improved learning outcomes in physical geography. From the percentage value in Table 4.5.2 it was observed that more of the teachers (64%) chose Yes, by providing practical application of concepts. This agrees with Jensen, (2007), who said that, the incorporation of remote sensing technology has enormous potential to improve secondary school students' learning experiences in the constantly expanding subject of geography education.

CHAPTER FIVE.

SUMMARY, CONCLUSION AND RECOMMENDATION

SUMMARY.

The study examines the investigation of the possible advantages of including Geographic Information System (GIS) and Remote Sensing in physical geography teaching and learning in secondary school in Ovia North East Local Government Area of Edo State, Nigeria. Specifically, the study was to show the importance or benefits of incorporating GIS and Remote Sensing into the curricula of colleges of education, it has the potential to support problem-based and inquiry-based learning while also enhancing students' computer skills, extending their range of learning preferences, encouraging critical thinking, and enhancing communication and presentation skills.

The research method adopted for gathering information for this study was descriptive survey design. The population of this study comprises of only Geography teachers of secondary schools in Ovia North East Local Government Area of Edo State, in which twenty-five (25) questionnaires were distributed and these questionnaires were divided into 5 sections (A, B, C, D, and E).

The findings revealed that;

1. Teachers tend to utilize both Lecture & Visual Aids.
2. More teachers did not encounter any challenge teaching physical geography using traditional methods.

3. Teachers tend to use Lecture based instruction more often.
4. There is a balanced percentage between people that are very familiar with GIS and Remote Sensing Technologies and people that are not familiar with GIS and Remote Sensing Technologies.
5. Most geography teachers have not used GIS or Remote Sensing Technologies in teaching.
6. Geography teachers acknowledges that all (Real-world applications of theoretical concepts, Increased student engagement, and better understanding of environmental issues) are potential advantages of incorporating GIS and Remote Sensing Technologies into physical geography teaching and learning.
7. Geography teachers acknowledges that all (Enabling interactive exploration of geographic data, providing hands-on experience with data analysis, and connecting theoretical concepts to real-world scenarios) shows how GIS and Remote Sensing can enhance students' understanding of geographical concepts.
8. There is a balanced percentage between people that chose Increase engagement significantly with GIS and Remote Sensing Technologies and people that chose Increase engagement moderately, which could potentially impact students' engagement and interest in learning physical geography.
9. More teachers agrees that the inclusion of GIS and Remote Sensing lead to improved learning outcomes in Physical Geography, by providing practical application of concepts.

CONCLUSION.

The investigation into the potential advantages of incorporating Geographic Information System (GIS) and remote sensing in physical geography teaching and learning in secondary schools within the Ovia North East Local Government Area (LGA) of Edo State, Nigeria, has revealed significant benefits and opportunities for both students and educators.

Firstly, GIS and remote sensing technologies offer powerful tools for enhancing spatial comprehension and analysis. These technologies enable students to explore and understand the physical environment in ways that were previously unimaginable. By integrating GIS and remote sensing data, students can gain insights into land use, environmental processes, vegetation dynamics, climatic patterns, and more, fostering a deeper understanding of the complex relationships between the natural world and human activities.

Moreover, the incorporation of GIS and remote sensing in geography education encourages critical thinking, analytical skills, and problem-solving abilities among students. It bridges the gap between theoretical concepts and practical applications, making learning dynamic and engaging. This, in turn, equips students with valuable skills that are relevant not only in geography but also in various other fields and potential careers.

Furthermore, the use of GIS and remote sensing in secondary schools aligns with the growing

RECOMMENDATIONS.

Based on the findings of this investigation, several recommendations can be made:

1. Education authorities and curriculum developers in Ovia North East LGA should consider integrating GIS and remote sensing modules into the geography curriculum at the secondary school level. This integration should be accompanied by appropriate training and resources for teachers.
2. Teachers should receive training in GIS and remote sensing technologies to effectively incorporate them into their teaching methods. Training programs and workshops should be organized to enhance their proficiency.
3. Conduct awareness campaigns among students, parents, and the community to highlight the importance of GIS and remote sensing in education and future career opportunities.
4. Encourage research on the effectiveness of GIS and remote sensing in enhancing geography education. Regular evaluations should be conducted to measure the impact of these technologies on student learning outcomes.

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