KNOWLEDGE OF CLIMATE CHANGE AND ENVIRONMENTAL PRESERVATION AMONG SECONDARY SCHOOL STUDENTS IN OREDO L G A

Chinonso Marvellous ANENE

DEPARTMENT OF HEALTH, SAFETY AND ENVIRONMENTAL EDUCATION,

FACULTY OF EDUCATION,

UNIVERSITY OF BENIN,

BENIN CITY.

APRIL, 2026.

KNOWLEDGE OF CLIMATE CHANGE AND ENVIRONMENTAL PRESERVATION AMONG SECONDARY SCHOOL STUDENTS IN OREDO L G A

BY

Chinonso Marvellous ANENE

EDU2102496

A PROJECT SUBMITTED TO THE DEPARTMENT OF HEALTH, SAFETY AND ENVIRONMENTAL EDUCATION, FACULTY OF EDUCATION, UNIVERSITY OF BENIN, BENIN CITY, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS OF THE AWARD OF THE BACHELOR OF SCIENCE B.Sc (Ed), DEGREE IN ENVIRONMENTAL EDUCATION, UNIVERSITY OF BENIN, BENIN CITY, EDO STATE.

APRIL, 2026.

CERTIFICATION

We the undersigned, hereby certify that this work was carried out by **Chinonso Marvellous ANENE** with the matriculation number **EDU2102496** in the Department of Health, Safety and Environmental Education, Faculty of Education, University of Benin, Benin City, Edo State in partial fulfillment of the requirement for the award of Bachelor of Science (B.Sc. Ed) degree in Environmental Education

_____ _____

MRS. IMADE ONAIHO **Date**
Project Supervisor

_____ _____

MRS.B.H. ENABULELE
Project Coordinator **Date**

_____ _____

DR. (MRS) O. H. OBASUYI **Date**
Head of Department

DEDICATION

This project work is dedicated to God Almighty whose constant support, love, grace, mercy, and kindness have sustained me throughout my academic journey. I also dedicate it to my parents and siblings for their constant love and support.

ACKNOWLEDGEMENTS

The researcher expresses his deepest gratitude to God Almighty, whose unfailing love, mercy, and strength sustained him throughout his academic journey. He kept him, helped him endure every trial, and provided the grace he needed at each stage. Every good thing achieved in this work is a testament of His faithfulness.

The researcher is profoundly grateful to his project supervisor, Mrs Imade Onaiho, who despite her very tight schedule, always found time to guide him. She consistently prioritized her project students, offering tangible, practical advice that helped shape this work in the right direction. Her dedication, patience, and motherly disposition remain deeply appreciated.

I also wish to acknowledge the acting Head of Department, Dr. (Mrs) O.H. Obasuyi, the project supervisor Mrs. Imade Onaiho and the Project Coordinator, Mrs. B.H. Enabulele, for their unwavering support and contributions throughout this programme.

Special appreciation goes to all academic staff of the Department of Health Safety and Environmental Education. Their admirable personalities, passion for teaching, and commitment to academic excellence have shaped, inspired, and positively influenced me throughout my studies.

I extend my heartfelt appreciation to my beloved parents, Mr and Mrs ANENE, for their constant unwavering support, financially, emotionally, and in every other way possible. Their prayers, sacrifices, and encouragement formed the backbone of his success especially during challenging times.

Finally, he expresses sincere appreciation to his friends, family, and course mates for their companionship, encouragement, and constant support. Their presence made the academic journey lighter, meaningful, and truly memorable.

TABLE OF CONTENTS

TITLE	PAGES
CERTIFICATION	ii
DEDICATION	iii
ACKNOWLEDGEMENTS	iv
ABSTRACT	viii
CHAPTER ONE	1
INTRODUCTION	1
Background to the Study	1
Statement of the Problem	3
Purpose of the Study	5
Research Questions	5
Significance of the Study	6
Scope and Delimitation of the Study	6
Definition of Terms	7
CHAPTER TWO	8
REVIEW OF RELATED LITERATURE	8
Conceptual Framework	8
Distinguishing Climate Change from Weather	14
Drivers of Climate Change	14
Natural Drivers	14
Anthropogenic Drivers	15
Mechanism: The Enhanced Greenhouse Effect	15
Global Indicators of Climate Change	15
How Climate Change Happens (Process)	16

The sun sends energy to Earth 16

Causes of Climate Change 18

Systems Theory (Bertalanffy, 1968) 23

Concept of Environmental Preservation 23

Maintenance of Ecosystem Integrity 24

Pollution Prevention and Environmental Quality Enhancement 25

Environmental Education and Behavioral Change 25

Why Environmental Preservation Matters 25

Importance of Environmental Education 27

Knowledge and Awareness of Climate Change among Students 28

Nigeria's Climate Vulnerability Context 29

Secondary Students' Climate Change Knowledge in Nigeria 29

Environmental Preservation: Attitudes and Practice among Nigerian Students 31

Empirical Study

Summary of reviewed related literature

CHAPTER THREE 38

RESEARCH METHODOLOGY 38

Introduction 38

Research Design 38

Sample and Sampling Technique 41

Research Instrument 42

Validity of the Instrument 42

Reliability of the Instrument 42

Method of Data Collection 43

CHAPTER FOUR 45
PRESENTATION OF RESULTS AND DISCUSSION OF FINDINGS 45

Discussion of Findings 54

CHAPTER FIVE 56
SUMMARY, CONCLUSION AND RECOMMENDATIONS 56
Summary 56

Findings 57

Conclusion 57

Recommendations 58

Suggestions for Further Study 59

REFERENCES 60

QUESTIONNAIRE 64

APPENNDICES

ABSTRACT

This study assessed the knowledge of climate change and environmental preservation among secondary school students in Oredo Local Government Area of Edo State, Nigeria. The study was necessitated by the growing environmental challenges associated with climate change and the need to assess students' level of awareness, practices, and attitudes toward environmental sustainability. A descriptive survey research design was adopted for the study.

The population of the study comprised 8,000 secondary school students in Oredo Local Government Area, as obtained from the Edo State Ministry of Education (2024). A sample size of 200 students was selected using a multi-stage sampling technique involving stratification and simple random sampling procedures. The instrument used for data collection was a structured questionnaire containing 30 items. The instrument was validated by the researcher and two others from the Department of Health Safety and Environmental Education. Data collected were analyzed using frequency counts and percentages.

Findings revealed that the majority of secondary school students possessed a high level of knowledge of climate change and environmental preservation. The study also showed that students engaged in some environmental preservation practices such as proper waste disposal, reduction in the use of plastics, and participation in environmental conservation activities. In addition, the results indicated that most students demonstrated positive attitudes toward environmental protection, including a willingness to adopt environmentally friendly behaviors.The findings concluded that although students have good knowledge and positive attitudes toward climate change and environmental preservation, there is still a need to strengthen practical engagement in environmental activities. The study recommended that environmental education should be intensified in schools, awareness programs should be regularly organized, and students should be encouraged to actively participate in environmental conservation practices.

CHAPTER ONE
INTRODUCTION

Background to the Study

Climate change has become one of the most serious global challenges of the 21st century, affecting every aspect of human life — from food production and health to the stability of ecosystems. It refers to the long-term alteration of temperature and typical weather patterns in a particular area, primarily caused by both natural processes and human activities (Intergovernmental Panel on Climate Change, 2021). Human activities such as the burning of fossil fuels, industrialization, deforestation, and poor waste management have drastically increased the concentration of greenhouse gases in the atmosphere. These gases trap heat, leading to global warming and subsequent environmental problems such as flooding, drought, desertification, and rising sea levels (Adebayo, 2019).

In Nigeria, the effects of climate change are already evident. The northern part of the country suffers from desertification and drought, while the southern regions, including Edo State, experience increased flooding, erosion, and irregular rainfall patterns. These changes have contributed to lower agricultural productivity, loss of biodiversity, and deterioration in the quality of life of people (NEST, 2015). Climate change has also increased the vulnerability of communities to diseases and economic hardship.

Edo State, and particularly Oredo Local Government Area, is not immune to these challenges. Problems such as indiscriminate waste disposal, tree felling, open burning, and unregulated urban development have contributed environmental degradation in the local environment. Flooded streets, blocked drainage systems, polluted water bodies, and unhealthy surroundings have become common in many parts of the area. The absence of adequate awareness,

environmental management practices and environmental education among young people further worsens the situation. These conditions are worsened by limited public awareness and weak environmental management practices.

Environmental preservation refers to deliberate efforts made to protect and maintain the natural environment for future generations (Nwosu, 2017). It involves actions such as afforestation, conservation, reduction of pollution, and proper waste management. Encouraging the public — especially young students — to understand and practice environmental preservation is crucial to ensuring a sustainable future. Environmental preservation is essential for maintaining ecological balance and improving the quality of human life.

Secondary school students are considered the most strategic group in the society for promoting environmental awareness because they are young, impressionable, and can serve as change agents in their communities. When students acquire sufficient knowledge about climate change and the importance of environmental preservation, they can influence their families and peers positively (Eneji & Udo, 2018). However, research and observations show that many secondary school students in Nigeria, including those in Oredo Local Government Area, still have limited understanding of the causes, effects, and preventive measures of climate change. They may have heard of climate change but lack a deep understanding of its implications or how to contribute to environmental preservation (Uche & Eze, 2020).This gap in knowledge may hinder efforts toward sustainable environmental practices

Therefore, it becomes necessary to investigate the level of knowledge of secondary school students on climate change and environmental preservation in Oredo Local Government Area of Edo State. Such a study will help identify knowledge gaps and guide the formulation of effective environmental education programs and policies.

Statement of the Problem

Climate change is the long-term alteration of Earth's temperature and weather patterns, mainly caused by human activities like burning of fossil fuels and deforestation. Climate change poses serious threats to environmental sustainability, human health, and socio-economic development globally and in Nigeria. In recent years, Edo State, particularly Oredo Local Government Area, has experienced increasing environmental challenges such as flooding, erosion, poor waste management, loss of vegetation, and rising temperatures. These problems are largely linked to human activities and inadequate environmental practices.

In response to these challenges, the Nigerian government, through agencies such as the Federal Ministry of Environment, National Environmental Standards and Regulations Enforcement Agency (NESREA), and State Environmental Protection Agencies, has introduced several policies and programs aimed at addressing climate change and promoting environmental preservation. These include the National Climate Change Policy, environmental sanitation exercises, tree planting campaigns, waste management regulations, and the integration of environmental education into school curricula.

At the state and local levels, governments have introduced regular environmental sanitation exercises, drainage clearing programs, tree planting and afforestation campaigns, waste recycling initiatives, and public awareness programs through radio, television, and community outreach. In Edo State, agencies responsible for environmental protection have also carried out activities such as street cleaning, enforcement of waste disposal laws, and promotion of greener urban development.

The government has attempted to integrate environmental education into the school curriculum through subjects such as Geography, Integrated Science, Biology, and Civic Education. Workshops, seminars, and school-based environmental programs have also been organized occasionally to sensitize students on climate change and environmental conservation.

Despite being directly affected by these environmental challenges, secondary school students in Oredo Local Government Area appear to have limited knowledge of climate change, its causes, and its consequences. Many students engage in environmentally harmful practices such as indiscriminate waste disposal, tree cutting, and open burning, often without understanding how these actions contribute to climate change and environmental degradation.

Furthermore, the implementation of government policies and environmental programs in schools remains weak. Practical environmental education activities such as environmental clubs, conservation projects, and regular awareness campaigns are poorly organized or absent in many secondary schools. This situation is of serious concern because secondary school students represent future leaders and key agents of sustainable development. Inadequate knowledge and positive attitudes toward climate change and environmental protection, government efforts may not achieve the desired results. The continued lack of effective environmental education may hinder long-term sustainability. Climate change and environmental preservation are not sufficiently emphasized within the secondary school curriculum, and practical environmental education programs such as environmental clubs, clean-up exercises, and conservation activities are poorly developed in many schools. As a result, students' awareness, attitudes, and participation in environmental preservation activities remain low. Without a clear understanding of climate change and environmental preservation, efforts to promote sustainable environmental practices within the community may be ineffective.

Therefore, this study aims to identify existing knowledge gaps, examine students' attitudes and practices regarding environmental preservation, and provide evidence that can inform the development of effective educational programs, school policies, and youth-focused sustainability initiatives in Oredo Local Government Area of Edo State.

Research Questions

To guide the study, the following research questions were formulated:

1. What is the level of knowledge of climate change among secondary school students in Oredo Local Government Area?
2. What are the primary sources through which secondary school students in Oredo L G A obtain information on climate change?
3. What is the level of awareness of environmental preservation among secondary school students in Oredo LGA?
4. To what extent do secondary school students in Oredo LGA engage in environmental preservation practices?

Purpose of the Study

The purpose of this study is to assess the knowledge of climate change and environmental preservation among secondary school students in Oredo Local Government Area of Edo State.

Specifically, the study seeks to:

1. Assess the level of knowledge of climate change among secondary secondary school students in Oredo LGA
2. Identify the major sources of information on climate change among secondary school students in Oredo LGA

3. Examine the level of awareness of environmental preservation among secondary school students in Oredo LGA
4. Determine the extent of engagement in environmental preservation practices among secondary school students in Oredo LGA

Significance of the Study

A Significant number of stakeholders find value in the study's conclusion namely;

The findings will enhance students' understanding of environmental issues, enabling them to develop positive attitudes and habits that promote a sustainable environment. The study will encourage teachers to include more environmental education topics and practical activities in their teaching. School administrators will gain insight into the need to establish environmental clubs, organize clean-up campaigns, and promote green school initiatives. The results will help in developing policies that integrate climate change and environmental education into the school curriculum. The findings can be used to design effective awareness programs and interventions for young people by the government and NGO's. The study will contribute to the growing body of literature on climate change awareness and serve as a reference for further studies.

Scope and Delimitation of the Study

The study focuses on the knowledge of climate change and environmental preservation among secondary school students in Oredo LGA, Benin City.

Definition of Terms

Climate Change: Long-term alteration of temperature and weather conditions largely due to human activities such as burning of fossil fuels and deforestation.

Environmental Preservation: Protection, maintenance, and management of natural resources to ensure their sustainability for future generations.

Environmental Awareness: The ability to recognize the importance of protecting and maintaining the environment.

Sustainability: Responsible use of resources to meet present needs without compromising the ability of future generations to meet theirs.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

The review is organized under the following subheadings:

- Conceptual framework
- Theoretical framework
- Concept of climate change
- Drivers of climate change
- Process of climate change
- Causes of climate change
- Effects/impacts of climate change
- Concept of environmental preservation
- Dimensions of Environmental preservation
- Environmental preservation strategies
- Empirical study
- Summary of reviewed related literature.

Climate change is no longer an abstract global phenomenon discussed only in international policy rooms; it is a visible reality affecting nations, communities, schools, and households across Nigeria. The increasing recurrence of environmental disasters such as urban flooding in southern states, prolonged dry spells in the north, rising temperatures, air pollution, and ecosystem disruptions have intensified the need to foster climate literacy among young learners. Secondary school students represent a crucial demographic cohort because adolescence is a stage where cognitive maturity allows for scientific understanding while behavioral patterns and environmental values begin to solidify. What students know about the climate crisis not only

determines their personal attitudes toward environmental responsibility but also influences peer behavior, household practices, and broader community sustainability footprints.

This chapter reviews relevant literature related to the topic, "Knowledge of Climate Change and Environmental Preservation among Secondary School Students in Oredo Local Government Area." The review aims to provide a theoretical and conceptual understanding of the study by drawing on ideas, findings, and theories of scholars in the field. It synthesizes conceptual explanations, educational theories, and extensive empirical evidence that focuses strictly on secondary school students in Nigeria, highlighting climate knowledge levels, environmental preservation behaviors, determinants of environmental attitudes, curriculum deficiencies, teacher influence, media and social learning exposure, common misconceptions, and urban-specific climate awareness disparities with direct relevance to Oredo LGA in Edo State. The review identifies knowledge gaps, explains factors that contribute to environmental behavior formation, and provides evidence-based justification for targeting Nigerian adolescents within formal and informal educational systems to address climate vulnerability through awareness, participation, and behavioral change.

Concept of Climate Change

Climate change refers to long-term variations in the average weather conditions of the Earth, including changes in temperature, rainfall patterns, wind systems, and the frequency of extreme weather events over an extended period of time. Unlike short-term weather fluctuations, climate change occurs gradually and persists for decades or longer. It is one of the most pressing global environmental challenges facing humanity in the 21st century, with significant implications for natural ecosystems, human health, and socio-economic development. Climate change can occur as a result of natural processes such as volcanic eruptions, variations in solar radiation, and

changes in the Earth's orbit. However, in recent decades, scientific evidence has shown the major drivers of contemporary climate change. Activities such as the burning of fossil fuels for energy, deforestation, industrial production, and agricultural practices release amounts of greenhouse gases into the atmosphere. These gases, including carbon dioxide, methane, and nitrous oxide, trap heat within the Earth's atmosphere, leading to a phenomenon known as global warming.

Global warming, which is a major component of climate change, refers to the gradual increase in the Earth's average surface temperature. As temperature rise, they disrupt normal climatic patterns and contribute to environmental changes such as melting glaciers, rising sea levels, prolonged droughts, flooding, heat waves, and unpredictable rainfall. These changes affect both developed and developing countries, although developing countries, including Nigeria, are often more vulnerable due to limited adaptive capacity. Climate change has far-reaching effects on the environmental context, it contributes to biodiversity loss, desertification, soil degradation, and changes in vegetation cover. Many plant and animal species struggle to adapt to rapidly changing climatic conditions, leading to habitat loss and species extinction. In addition, climatic change affects water resources by altering rainfall patterns and reducing the availability of clean water in many regions.

From a socio-economic perspective, climate change poses serious threats to agriculture, food security, and livelihoods. Changes in temperature and rainfall patterns affect crop yields and livestock production, thereby increasing the risk of hunger and poverty. In coastal areas, rising sea levels and flooding threaten human settlements, infrastructure, and economic activities . Climate change also has health implications, as it increases the spread of climate-sensirive diseases such as malaria and cholera and exposes populations to heat-related illnesses.

Education plays crucial role in addressing climate change, particularly at the secondary school level. Knowledge of climate change enables students understand it's causes, effects, and possible solutions. When students are well informed, they are more likely to develop positive attitudes and engage in environmentally responsible behaviors such as proper waste disposal, tree planting, energy conservation, and participation in environmental protection activities. Therefore, understanding the concept of climate change is essential for promoting environmental preservation and sustainable development.

Climate change is a complex environmental issue driven largely by human activities and characterized by long-term alterations in global regional climate patterns. It's impacts are evide instability, and threats to human health and well-being. Addressing climate change requires collective efforts, including increased awareness, education, policy implementation, and individual responsibility, particularly among young people who represent future decision-makers and environmental stewards.

Conceptual Framework

Climate change is broadly defined as long-term alterations in the earth's climate system, particularly in temperature, precipitation, wind patterns, and other elements, sustained over several decades or longer. According to the Intergovernmental Panel on Climate Change (IPCC, 2021), climate change refers to any change in climate over time, whether due to natural variability or as a result of human activity.

Climate change refers to long-term shifts in temperature, precipitation, atmospheric conditions, and environmental systems observed over decades due to natural variability but more significantly due to anthropogenic (human-induced) activities. Modern climate change involves

both global warming and accompanying climate system disruptions resulting from increased greenhouse gas accumulation in the atmosphere. The greenhouse effect is scientifically explained as the process where certain gases trap heat by allowing solar radiation to enter the Earth's atmosphere but preventing significant amounts of emitted heat from escaping. This heat-trapping phenomenon intensifies when human activities increase atmospheric concentrations of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), all mainly produced from fossil fuel combustion, gas flaring, deforestation, burning of waste materials, and large-scale industrial expansion.

Scientific evidence indicates that human activities—especially the burning of fossil fuels (coal, oil, and gas), deforestation, industrial processes, and modern agricultural modification—are the dominant drivers of recent climate change (IPCC, 2022; United Nations, 2024). These activities increase atmospheric concentrations of greenhouse gases (GHGs) such as carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), which trap heat within the Earth's atmosphere, intensifying the natural greenhouse effect and causing global warming (IPCC, 2022; NASA, 2023).

Climate change has extensive impacts on ecosystems, public health, food and water security, and socioeconomic development—especially in developing nations where adaptive capacity is limited (United Nations, 2024; World Bank, 2023). In Africa and particularly Nigeria, climate change contributes to desertification in the North, coastal flooding in the South, erosion, biodiversity loss, increased vector-borne diseases, and agricultural instability (Federal Ministry of Environment Nigeria, 2021; Adelekan et al., 2023).

The Earth has experienced climatic shifts over geological time due to natural causes, including volcanic eruptions, orbital variations (Milankovitch cycles), plate tectonics, and solar irradiance

fluctuations (Lindsey & Dahlman, 2023). However, the rapid warming trend observed since the mid-20th century cannot be explained by natural causes alone, and is strongly correlated with anthropogenic GHG emissions (IPCC, 2022; NASA, 2023).

The Earth has warmed significantly above pre-industrial baselines, with land surfaces warming faster than oceans, while polar regions warm most intensely — an effect known as 'Arctic amplification'. These warming trends affect ecosystems, water bodies, air systems, and weather stability, leading to more frequent extreme weather conditions, sea-level rise, biodiversity extinction risks, ecosystem imbalance, and environmental degradation if not mitigated. These scientific foundations provide the core conceptual baseline climate knowledge required to properly examine how much Nigerian students understand about climate change beyond terminology or general exposure.

Climate change and environmental preservation are two closely related global issues that have attracted widespread attention from governments, researchers, and environmental advocates due to their far-reaching implications for human existence and sustainable development. The conceptual framework for this study is built around the understanding of key concepts such as climate change, its causes and effects, environmental preservation, environmental education, and students' awareness and attitudes toward sustainability.

While climatic fluctuations have always occurred naturally, the rapid changes experienced in recent decades are predominantly caused by anthropogenic (human-induced) factors. These include industrialization, deforestation, excessive use of fossil fuels, and population growth. These activities increase the concentration of greenhouse gases such as carbon dioxide, methane, and nitrous oxide, which trap heat in the atmosphere and lead to global warming.

In the Nigerian context, climate change manifests in various forms: desertification and drought in the North, flooding and coastal erosion in the South, and irregular rainfall patterns in the Middle Belt. The consequences include reduced agricultural productivity, loss of livelihoods, health hazards, and damage to infrastructure (NEST, 2015). Oredo Local Government Area, as part of southern Nigeria, experiences flooding, deforestation, and pollution—local reflections of global climate disruptions.

Distinguishing Climate Change from Weather

Weather describes short-term atmospheric conditions measured in minutes to weeks, while climate refers to long-term trends and patterns that determine seasonal and regional characteristics (WMO, 2023; NASA, 2023). Climate change is therefore not an occasional hot day or heavy rainfall, but a directional alteration of climatic behavior, including sustained warming, hydrological disruption, and increased occurrence of extreme events (IPCC, 2022; WMO, 2023).

Drivers of Climate Change

Climate change can be triggered by both natural and anthropogenic (human-induced) forces, but scientific consensus affirms that recent warming is overwhelmingly anthropogenic, particularly from greenhouse gas emissions (IPCC, 2022; UNEP, 2024; NASA, 2023).

Natural Drivers

Natural climate forcing agents influence global climate on geological and interdecadal timescales (Lindsey & Dahlman, 2023). These include:

Volcanic aerosols, which temporarily cool climate by reflecting solar radiation (Schmidt et al., 2023)

Solar irradiance variability, which affects Earth's radiative forcing (Hansen et al., 2023)

Orbital cycles (Milankovitch cycles), responsible for historical glacial and interglacial periods (Lindsey & Dahlman, 2023)

Anthropogenic Drivers

Human-driven climate change stems mainly from:

Fossil fuel combustion, the largest source of CO_2 emissions (IPCC, 2022; UNEP, 2024)

Deforestation and land-use change, reducing carbon sinks (FAO, 2022; IPCC, 2022)

Industrial emissions, including fluorinated gases and black carbon aerosols (UNEP, 2024)

Agriculture, generating methane from enteric fermentation and rice paddies, and nitrous oxide from fertilizers (IPCC, 2022; Adelekan et al., 2023)

Mechanism: The Enhanced Greenhouse Effect

Greenhouse gases naturally maintain Earth's habitable temperature by trapping longwave radiation. However, excessive emissions intensify this greenhouse effect, causing energy imbalance known as radiative forcing and resulting in global warming—a core component of climate change (IPCC, 2022; NASA, 2023). CO_2 concentration has risen beyond pre-industrial levels, with unprecedented warming rates compared to past millennia, confirming human causal dominance (IPCC, 2022; NOAA, 2023).

Global Indicators of Climate Change

Major observable changes include:

Global average temperature increase of ~1.1–1.3°C above pre-industrial levels (IPCC, 2022)

Arctic warming at 3× the global average, accelerating ice melt (NOAA, 2023)

Ongoing sea-level rise from thermal expansion and glacier loss (Fox-Kemper et al., 2021; IPCC, 2022)

Ocean acidification from excess CO_2 reacting with seawater forming carbonic acid (NOAA, 2023)

Extreme weather intensification including floods, drought, cyclones, and heatwaves (WMO, 2023; UN, 2024)

How Climate Change Happens (Process)

1. The sun sends energy to Earth.
2. Earth absorbs this energy and reflects some back.
3. Greenhouse gases block the reflected heat from escaping.
4. Heat accumulates, increasing Earth's temperature.
5. Rising temperature alters ocean currents, weather systems, ice sheets, and ecosystems.

The sun sends energy to Earth

The Sun drives the Earth's climate. It releases massive heat and light energy through solar radiation. This energy travels through space and reaches the atmosphere and surface of the Earth. Without this incoming energy, the planet would be too cold to support life, oceans would freeze, and atmospheric circulation (winds and rain formation) would not occur. The amount of energy received influences temperature zones, seasons, and weather behaviour, forming the natural foundation of the climate system.

- **Earth absorbs this energy and reflects some back**

  When sunlight reaches Earth, surfaces like soil, rocks, forests, buildings, rivers, and oceans absorb part of it, converting it into heat and warming the environment. However, the Earth does not retain all the energy; a portion is radiated back toward the atmosphere and outer space as infrared heat radiation. This balance between absorbed heat and reflected heat keeps the global temperature relatively stable under normal conditions. Different surfaces absorb and reflect heat differently — for example, forests absorb more heat, while ice reflects most of it, which plays a key role in regulating climate.

- **Greenhouse gases block the reflected heat from escaping**

  Greenhouse gases naturally exist in the atmosphere and help retain heat needed for life, but human pollution has excessively increased their concentration. Gases such as carbon dioxide, methane, nitrous oxide, and fluorinated gases accumulate to form a thick atmospheric barrier. When Earth sends heat upward, these gases absorb and re-emit it in multiple directions, including back toward the surface instead of allowing it to exit into space. This intensified trapping of heat disrupts the natural energy balance, making the atmosphere warmer than it should be — a mechanism known as the enhanced greenhouse effect, which is the main scientific cause of present-day climate change.

- **Heat accumulates, increasing Earth's temperature**

  The upward-moving heat is repeatedly trapped and pushed back, it builds up in the lower atmosphere. Over decades, this gradual accumulation raises the planet's average surface temperature beyond historical norms. This warming is not uniform across all areas but affects

global systems collectively. The rise in temperature alters evaporation rates, humidity levels, cloud formation, atmospheric pressure, and wind systems. The sustained increase in global average temperature is what scientists call global warming, which is a major component and trigger of wider climate change effects.

- **Rising temperature alters ocean currents, weather systems, ice sheets, and ecosystems**

  As temperature increases, it creates chain reactions across Earth's natural systems. In the oceans, excess heat changes density and circulation, disrupting ocean currents that distribute warmth globally, which then shifts climate patterns far beyond coastal regions. In the atmosphere, weather systems become unstable, producing extreme heat waves, intense storms, droughts, or unexpected flooding. At the poles, ice melts rapidly, reducing Earth's natural ability to reflect sunlight, which accelerates warming and causes sea levels to rise. Across ecosystems, plant and animal life lose habitats, fail to adapt quickly, or migrate, leading to species decline or extinction. These combined disruptions define climate change — a long-term, large-scale transformation of the Earth's environmental balance.

  This cycle leads to what is called Global Warming, which is a major component of climate change.

Causes of Climate Change

Burning of Fossil Fuels

Coal, oil, and gas release large amounts of carbon dioxide (CO_2) when burned. CO_2 traps heat in the atmosphere, leading to global warming. IPCC states that CO_2 from fossil fuels is the largest contributor to human-induced climate change (Intergovernmental Panel on Climate Change, 2021).

Example: Nigeria uses petrol and diesel for transportation and electricity. In cities like Benin, heavy traffic emissions contribute to rising temperatures.

Deforestation

This reduces the planet's capacity to absorb carbon dioxide. Trees absorb CO_2 from the atmosphere. Cutting them down means more CO_2 remains trapped in the air, increasing global temperatures. "Deforestation significantly increases atmospheric CO_2 levels due to loss of carbon sinks" (FAO, 2020).

Example: In Nigeria, forests are cleared for farming, housing, and wood fuel. Edo State has experienced forest reduction due to agricultural expansion.

Agricultural Activities

Activities such as open burning and overuse of fertilizers, which release methane and nitrous oxide. Farming produces methane (CH_4) and nitrous oxide (N_2O), which are greenhouse gases more powerful than CO_2. Agriculture contributes about 23% of global greenhouse gas emissions (IPCC, 2019).

Example: Rice farming in flooded fields and livestock (cows, goats) release methane. Open grazing systems increase emissions across many Nigerian states.

Industrial Emissions

Factories emit CO_2 and other greenhouse gases during production processes like cement, steel, and chemical manufacturing. Industrial processes are major sources of greenhouse gas emissions (IEA, 2022).

Example: Cement production plants in Nigeria release high CO_2 emissions during processing, which contributes to atmospheric warming.

Waste and Landfills

Decomposing waste in landfills emits methane, a potent heat-trapping gas. "Uncontrolled waste disposal contributes significantly to methane emissions" (UNEP, 2021).

Example: Poor waste management in Nigerian urban areas leads to open dumps, which emit methane as plastics and organic waste decomposition.

Power Generation

Electricity production that uses gas, coal, or diesel releases greenhouse gases into the atmosphere. Energy production is responsible for over 70% of global emissions (UNFCCC, 2021).

Example: Many Nigerian households and schools rely on generators due to unstable electricity. Diesel generators emit CO_2, contributing to warming.

Summary of Key Greenhouse Gases

Gas	Source	Impact
CO_2	Vehicles, generators, factories	Main cause of warming
CH_4	Rice farms, livestock, landfills	25× stronger than CO_2
N_2O	Fertilizers, agriculture	300× stronger than CO_2

According to Uche and Eze (2020), more than 90% of present-day global warming is attributed to human-induced activities, indicating that behavioral change and environmental education are vital for reversing the trend.

Effects/Impacts of Climate Change

Climate change affects both natural ecosystems and human systems.

Environmental Impacts

Biodiversity loss and species migration to cooler climates (IPBES, 2022; IPCC, 2022)

Degraded forests, increased wildfires, and ecological imbalance (UNEP, 2024)

Desertification and land degradation, particularly in West Africa (UNCCD, 2022)

Socio-economic Impacts

Agricultural yield decline, impacting food security (World Bank, 2023; FMEnv, 2021)

Water scarcity and hydrological variability, worsening drought in arid zones (UN, 2024; Nwachukwu et al., 2023)

Economic loss and displacement from flooding and erosion (World Bank, 2023)

Public Health Impacts

Heat-related stress and mortality increase

Worsening vector-borne disease transmission

Increased malnutrition due to crop failure

Water-related diseases due to flooding contamination (WHO, 2023; IPCC, 2022)

Social effects

This include forced migration, conflicts over scarce resources, and displacement of vulnerable populations.

In Edo State, flooding has become a recurrent problem due to heavy rainfall, deforestation, and blocked drainage systems. These challenges highlight the urgent need for stronger environmental awareness and proactive preservation practices among students and communities.

Theoretical Framework

The theoretical framework provides the foundation for understanding how knowledge and social influences affect students' attitudes and behaviors toward climate change and environmental preservation.

Environmental Awareness Theory (Hungerford & Volk, 1990)

This theory posits that awareness and understanding are the first steps toward responsible environmental behavior. It suggests that when individuals are knowledgeable about environmental issues and their consequences, they are more likely to develop positive attitudes and engage in preservation activities. The theory supports this study because it emphasizes the relationship between awareness and behavior, showing that increased knowledge of climate change among students will lead to better environmental practices.

Social Learning Theory (Bandura, 1977)

Bandura's theory explains that learning occurs through observation, imitation, and modeling. Students observe environmental behaviors of others — such as teachers, parents, or media personalities — and model these behaviors in their own actions. The theory implies that teachers

and parents play a vital role in shaping students' environmental habits. When students see adults practicing recycling, tree planting, or proper waste disposal, they are more likely to imitate such behaviors.

Systems Theory (Bertalanffy, 1968)

The Systems Theory views the environment as an interdependent system where all components — air, water, soil, plants, animals, and humans — interact. Any disruption in one part of the system affects all others. This theory helps students understand that human activities such as pollution or deforestation can upset the balance of nature, leading to severe climate consequences. It promotes the concept of sustainable coexistence between humans and the environment.

Concept of Environmental Preservation

Environmental preservation refers to the conscious effort to protect the natural environment from degradation, maintain ecological balance, and ensure the sustainable use of natural resources for future generations. It focuses on maintaining the integrity of ecosystems rather than exploiting them for short-term gains (Nwosu, 2017).

Environmental preservation refers to the planned protection and maintenance of the natural environment to prevent its degradation, ensure the sustainability of ecosystems, and safeguard biodiversity for present and future generations. Unlike conservation, which allows controlled use of resources, preservation emphasizes minimal or no interference with nature, especially in fragile or biodiversity-rich areas. The goal is to maintain environmental systems in their original state as much as possible, allowing ecological processes to continue without human disruption.

Core Dimensions of Environmental Preservation

Protection of Natural Resources

Environmental preservation seeks to shield vital natural resources—air, water, soil, minerals, and forests—from pollution, overexploitation, and destruction. Since these resources form the foundation of human survival and economic activity, their degradation threatens both ecological stability and societal well-being. Preservation involves actions such as protecting watersheds, preventing illegal logging, reducing emissions, restoring degraded soils, and promoting alternatives to non-renewable energy sources.

Maintenance of Ecosystem Integrity

Ecosystems are networks where living organisms interact with each other and their physical environment. Preservation focuses on maintaining these interactions, cycles, and balances—such as the carbon cycle, oxygen production, water filtration by wetlands, and natural pest control by wildlife. When ecosystems are disrupted, environmental challenges like climate change, flooding, soil infertility, and species extinction intensify. Therefore, environmental preservation ensures that natural systems remain functional and resilient.

Biodiversity Safeguarding

Biodiversity refers to the variety of plants, animals, and microorganisms that exist on Earth. Environmental preservation protects species from extinction by maintaining their habitats and limiting human activities that endanger them. Protecting biodiversity also preserves genetic resources that are important for medicine, agriculture, and ecological adaptation. By preserving biodiversity, ecosystems retain the ability to adapt to environmental stresses, such as changes in climate or emergence of diseases.

Pollution Prevention and Environmental Quality Enhancement

Pollution alters the chemical and physical structure of the environment. Preventing pollution is central to environmental preservation, involving regulation of industrial emissions, safe waste disposal, reduction of plastic use, treatment of wastewater, and monitoring of environmental contaminants. Preservation aims for cleaner environments, not only to protect wildlife but to ensure healthy living conditions for humans.

Environmental Education and Behavioral Change

Preservation cannot be fully achieved without awareness and participation. Environmental education informs individuals—especially students—about environmental problems, encourages eco-friendly behaviors, and fosters responsibility toward nature. Through education, society develops habits such as tree planting, recycling, energy saving, refraining from open burning, and participating in environmental protection initiatives.

Sustainable Development Alignment

Sustainable development meets human needs without jeopardizing environmental systems. Environmental preservation supports development that is low-carbon, resource-efficient, and environmentally conscious. This includes renewable energy adoption, green urban planning, climate-smart agriculture, sustainable waste management, and policies that ensure economic growth does not come at the cost of environmental destruction.

Why Environmental Preservation Matters

Ensures human health: Clean air and water reduce disease rates.

Stabilizes climate: Protected forests absorb CO_2, helping regulate global temperatures.

Protects livelihoods: Many communities depend on undisturbed natural resources for farming, fishing, and tourism.

Prevents natural disasters: Healthy ecosystems like mangroves, wetlands, and forests reduce flooding and erosion.

Secures the future: Preserving nature guarantees resources will still exist for coming generations.

Examples of Environmental Preservation Practices (Nigerian Context)

Creation of protected forest reserves and national parks to maintain undisturbed biodiversity (e.g., Okomu National Park, Cross River Rainforest).

Promotion of anti-bush burning campaigns in schools and communities to prevent air pollution and land degradation.

Environmental sanitation days adopted in cities and schools to reduce indiscriminate waste dumping.

Youth and school participation in tree-planting initiatives supported by government and NGOs to restore vegetation cover.

Advocacy against single-use plastics to prevent blockage of drainage systems and landfill methane emissions.

Common Environmental Preservation Strategies

Strategy	Description
Afforestation & reforestation	Planting trees to restore lost forests
Protected areas	Restricting access to vulnerable ecosystems
Anti-pollution laws	Limiting landfills and plastic pollution

Green energy	Solar, wind, hydropower to replace generators
Pubic awareness	Educating citizens and students to change habits

Distinction: Preservation vs. Conservation

Environmental Preservation	Conservation
Emphasizes non-interference	Allows controlled, sustainable use
Protects nature in it's original state	Protects resources while benefiting humans
Best for fragile ecosystems	Best for resource management
Restricts activities like logging or mining	May allow regulated logging, hunting etc.

Environmental preservation includes actions such as:

Afforestation and reforestation to combat deforestation and improve air quality.

Waste management and recycling to minimize pollution and conserve resources.

Pollution control to ensure cleaner air, water, and soil.

Conservation education to instill environmental responsibility.

Preservation is closely linked with sustainable development — the idea of meeting current needs without compromising the ability of future generations to meet theirs. It ensures that natural resources such as water, soil, and forests are used efficiently and protected for long-term survival.

Importance of Environmental Education

Environmental education is the process of equipping individuals with the knowledge, attitudes, and skills necessary to make informed decisions and take responsible actions for the environment.

According to UNESCO (2020), environmental education aims to create a population that is aware of and concerned about the environment and its associated problems, and that has the motivation and skills to work toward their solution.

In the school context, environmental education helps students:

Understand how human activities affect the environment.

Develop problem-solving skills for addressing local environmental issues.

Foster positive attitudes and habits such as recycling, energy conservation, and tree planting.

Participate actively in school and community environmental projects.

Okolie (2021) emphasized that environmental education goes beyond theoretical knowledge; it must involve hands-on learning through field trips, clean-up exercises, and participation in environmental clubs. Such activities allow students to connect knowledge with action.

Knowledge and Awareness of Climate Change among Students

Knowledge and awareness represent the foundation for behavior change. Knowledge refers to accurate understanding of facts and processes related to climate change, while awareness denotes consciousness or concern about its existence and impacts.

Eneji and Udo (2018) observed that Nigerian students often have general awareness of environmental problems but lack deep scientific understanding of climate change. Most students acquire information from social media or television rather than formal instruction, resulting in fragmented knowledge.

Awareness among secondary school students can be improved through classroom teaching, media exposure, and participation in environmental clubs. Students who are aware of the link

between human behavior and environmental degradation are more likely to adopt sustainable habits such as proper waste disposal and tree planting.

Nigeria's Climate Vulnerability Context

Climate change manifestations in Nigeria occur unevenly with distinct regional environmental and socio-ecological impacts. Northern states face desertification, declining arable land, heat-related health risks, and drought-induced agricultural decline, while southern Nigeria experiences intense rainfall variability, coastal erosion, blocked drainage systems, indiscriminate waste dumping, deforestation, and large-scale urban flooding — especially during peak rainy seasons. A national youth report estimates that six out of ten Nigerian youths have never been properly exposed to formal climate education or awareness platforms, revealing that awareness remains incomplete or unequal.

In Edo State, particularly within Benin City and Oredo LGA, climate risks are visibly aggravated by human environmental stressors including deforestation, poor drainage planning, increasing built-up surfaces (urbanization), and waste-induced flooding, making local environmental preservation literacy not only important but urgent. These patterns show that Nigerian adolescents are growing in environments where climate effects are visible, yet scientific interpretation of how and why these effects occur remains inconsistent, pointing to the importance of conceptual literacy as a bridge between awareness and action.

Secondary Students' Climate Change Knowledge in Nigeria

General Knowledge Trends

Research shows a distinction between 'having heard of climate change' and 'understanding climate change with scientific accuracy.' Many secondary school students across Nigeria

recognize the term but do not adequately understand its mechanisms, long-term environmental implications, or evidence-supported mitigation strategies. Falaye and Okwilagwe (2016), in a large cross-sectional survey among senior secondary learners, reported that students' overall mean score in climate knowledge was slightly low, demonstrating gaps in scientific understanding even among older students. Misconceptions remained common, though environmental attitudes were moderately positive.

A study among biology-oriented students in Lagos found that most students had heard of climate change but could not explain the scientific causes beyond vague references to "pollution" or natural change, indicating superficial rather than conceptual knowledge. Similarly, Eneji and Udo (2018) highlighted that students were more aware of climate impacts than of climate mechanisms, and many could not differentiate climate change from short-term weather irregularities.

In northern Nigeria (Plateau: Pankshin LGA), Zumyil and Antip (2024) found that although students recognized global warming, a significant proportion believed it was caused by the ozone hole, showing misunderstanding of greenhouse gas mechanisms. Only a small percentage could correctly identify CO_2 and methane as core drivers of global warming.

These studies show national-level variability but converge on one important point: climate change is a recognized term among students, but deep conceptual literacy remains insufficient in many Nigerian schools.

Oredo LGA Urban Exposure Advantage

Among students sampled across Edo South Senatorial District, secondary school learners within Oredo LGA scored the highest average in environmental and climate knowledge compared to

those from Egor or Ikpoba-Okha. The authors noted that urban infrastructural exposure, access to environmental information, and better availability of school-based programs may contribute to higher environmental awareness in Oredo. However, even in Oredo, awareness-to-participation gaps still existed, suggesting that baseline knowledge does not always guarantee behavioral adoption.

Environmental Preservation: Attitudes and Practice among Nigerian Students

Attitudes Toward the Environment

Attitude is the mental disposition that determines how individuals react to environmental issues. Positive attitudes motivate people to take care of the environment, while negative attitudes lead to negligence and exploitation.

According to Adebayo (2019), the development of a positive environmental attitude depends largely on exposure to environmental education, family background, and community influence. Students with adequate environmental education tend to show concern for their surroundings, avoid littering, and participate in activities that promote environmental cleanliness.

In Oredo Local Government Area, where waste disposal and open burning are common, students' attitudes play a crucial role in shaping community behavior. If students develop positive environmental values early, they can influence their peers, parents, and the broader community toward sustainability.

Environmental preservation involves personal and collective responsibility to promote ecosystem stability, reduce pollution footprints, and protect the natural environment through sustainability practices such as waste recycling, conserving natural resources, planting trees, reducing plastic dependence, and protecting air and water bodies.

Many studies report moderately positive environmental attitudes among secondary students, especially when exposed to campaigns, environmental clubs, or practical school sustainability initiatives. In Ibadan-based schools in Nigeria, Ana, Oloruntoba, and Sridhar (2009) found that environmental clubs significantly boosted environmental awareness, participation, and positive student attitudes when properly implemented.

Observed Behavior Gaps

Despite moderately positive environmental attitudes, Nigerian students' actual environmental practices remain inconsistent:

In Ogun, students showed awareness of environmental waste problems but possessed very poor waste management practices, with almost zero recycling culture.

Falaye & Okwilagwe observed that secondary students' environmental behaviors generally did not predispose the environment to serious harm, but were not proactive enough (e.g., lack of recycling or landfill avoidance).

Oredo students had better mean practice scores than other LGAs, but still required practical reinforcement.

This suggests that awareness without behavioral platforms (clubs, curriculum, teacher reinforcement) does not translate into environmental stewardship.

Teacher and Curriculum Influence

Secondary students' climate literacy levels are influenced strongly by the currency, accuracy, and consistency of knowledge delivery platforms through teachers and curriculum designs.

Teachers in Rivers and Enugu openly admitted that climate content delivery competence is low, largely because there is no standalone climate curriculum.

A curriculum review emphasizes that climate change education must be included in Nigerian secondary school curriculum, supported with teacher training and standardized school resources.

Over half of sampled teachers had very low climate knowledge and were reluctant to seek training, raising misinformation risks.

This reinforces the need for teacher training and school curriculum integration as a way to increase accurate climate knowledge among Nigerian adolescents.

Media, Peer, and Family Influence

Media Exposure

Modern Nigerian youths understand environmental discourse largely through digital media, social networks, and school-driven environmental campaigns, but national media coverage on climate education remains sparse and inconsistent. Students often access climate information online or through news, but are exposed to misinformation due to the lack of regulated climate education platforms.

Peer and Family Learning

School clubs, social modeling, and informal youth environmental champions are now being leveraged to influence siblings, peers, households, and communities — especially through Environment Clubs created by the Federal Ministry of Environment. Students' environmental literacy and behaviors at household levels are also influenced by parental education backgrounds, especially maternal education.

Common Misconceptions among Nigerian Secondary Students

Recurring student misconceptions include:

Believing that global warming is caused by ozone-layer holes instead of greenhouse gases.

Confusing climate change with short-term or seasonal weather variation.

Assuming climate change is foreign-induced and not urgent in Nigeria.

Lacking clarity on mitigation strategies despite baseline awareness.

These misconceptions reveal cognitive gaps in climate science conceptual literacy among many Nigerian adolescents.

Conceptual Relationship among Climate Change, Knowledge, and Environmental Preservation

The conceptual relationship guiding this study is that knowledge of climate change influences awareness, and awareness influences attitudes and practices toward environmental preservation. In other words, knowledge acts as a foundation for behavioral change. When students are well-informed about climate change and understand its causes, they are more likely to value the environment and engage in preservation practices.

This conceptual linkage implies that education and awareness serve as tools for environmental transformation. Schools therefore play a pivotal role in fostering environmentally conscious citizens capable of addressing climate challenges through informed actions.

Empirical Study

A number of empirical studies have been conducted in Nigeria and beyond regarding students' knowledge of climate change and environmental preservation.

Eneji and Udo (2018) studied students' awareness of environmental issues in Cross River State and found that while students were aware of environmental problems, their knowledge of scientific causes and mitigation methods was low.

Uche and Eze (2020) examined students' knowledge of climate change in secondary schools in Enugu State and discovered that most students understood the general idea of climate change but lacked knowledge of its effects and preventive measures.

Oboh (2022) conducted a study in Edo State and found that although students had moderate awareness of climate change, their participation in environmental preservation activities was limited due to inadequate school programs.

Okolie (2021) emphasized that environmental education significantly influences students' attitudes toward sustainability. Schools that include environmental education in their curriculum reported better student engagement.

Nwosu (2017) highlighted that effective environmental preservation requires continuous awareness campaigns, particularly among youths who are the future custodians of the environment.

These studies consistently show a gap between awareness and active participation, indicating that while students may know about climate change, this knowledge often does not translate into sustainable behavior.

Summary of Reviewed Related Literature

The reviewed literature focused on the knowledge of climate change and environmental preservation among secondary school students in Oredo Local Government Area. Climate change was examined as a major global and national environmental challenge, with particular emphasis on its relevance to Nigeria. It was revealed that climate change has become increasingly evident through rising temperatures, irregular rainfall patterns, flooding, erosion, and other environmental problems that negatively affect human health, agriculture, and socio-economic development. The importance of environmental preservation was also emphasized as a proactive approach to reducing these adverse effects.

The literature further highlighted the role of education, especially at the secondary school level, in promoting awareness and understanding of climate change and environmental preservation. Secondary school students were identified as a crucial group due to their ability to develop lasting environmental attitudes and practices. Despite various efforts such as environmental policies, awareness campaigns, and climate change education initiatives, environmental degradation and poor environmental practices still persist. This situation raises concerns about students' level of knowledge, attitudes, and practices, thereby justifying the need for the present study.

In addition, the concept of climate change was explored in terms of its meaning, causes, and effects on both the environment and human society. The literature established that climate change is largely driven by human activities such as deforestation, fossil fuel combustion, and poor waste management. Environmental preservation practices such as proper waste disposal, conservation of natural resources, tree planting, biodiversity protection, and sustainable environmental management were also discussed.

Furthermore, theoretical perspectives on environmental knowledge and behavior were reviewed, showing that awareness and education significantly influence students' attitudes and practices toward environmental protection. Empirical studies revealed varying levels of knowledge and environmental practices among students, influenced by factors such as school type, curriculum content, exposure to environmental education, and demographic characteristics. While some studies reported moderate to high levels of awareness, gaps were identified between knowledge and actual environmental practices.

Overall, the reviewed literature showed that although climate change and environmental preservation have received considerable attention globally and nationally, significant gaps still exist in students' practical understanding and engagement, particularly at the local level. These gaps underscore the need for further empirical investigation in Oredo Local Government Area. The present study therefore builds on existing literature by assessing the knowledge, attitudes, and practices of secondary school students, with the aim of contributing to improved environmental education and sustainable environmental management.

CHAPTER THREE
RESEARCH METHODOLOGY

Introduction

This chapter discusses the methods and procedures adopted for carrying out the study. It includes:

- Research design
- Population of the study
- Sampling size and sampling techniques
- Research instrument
- Validity of instrument
- Reliability of instrument
- Method of data collection
- Method of data analysis

Research Design

The study adopted a descriptive survey design. This design is appropriate because it allows the researcher to collect information from a large population without manipulating any variables. Descriptive survey research focuses on describing existing conditions, opinions, knowledge, and attitudes of respondents as they naturally occur.

According to Creswell and Creswell (2018), descriptive survey design is suitable for studies that seek to obtain information about individuals' perceptions, attitudes, and behaviors through the use of questionnaires. The design enabled the researcher to assess the level of knowledge, awareness, and attitudes of secondary school students toward climate change and environmental preservation in Oredo Local Government Area. The choice of this design also allows for the

generalization of findings to the larger population when appropriate sampling techniques are employed.

This design enabled the researcher to investigate the current level of knowledge, awareness, and attitudes of secondary school students toward climate change and environmental preservation in Oredo Local Government Area. The descriptive survey design was chosen because it helps to generalize findings to a larger population when the sample is carefully selected.

Population of the Study

The population of this study comprised eight thousand (8,000) secondary school students in Oredo Local Government Area Edo State. This figure was obtained from official records of the Edo State Ministry of Education (2024). The population includes students from both public and private secondary schools at the junior secondary [JSS 1-3] and senior secondary [SSS 1-3] levels.

Out of the total population of 8,000 students, 5,200 students are enrolled in public secondary schools, while 2,800 students are enrolled in private secondary schools within the local government area. These students collectively formed the target population for the study.

The population was considered appropriate because secondary school students are at a developmental stage where environmental education can significantly influence their knowledge, attitudes, and long-term environmental behavior. Investigating the knowledge climate change and environmental preservation among 8,000 students in Oredo Local Government Area therefore provides a reliable basis for understanding students' environmental awareness in the area.

Table 1: Population of Secondary School Students in Oredo Local Government Area

S/N	Name of School	School Type
1.	Adesuwa Grammar School, Benin City	Public
2.	Ihogbe College, Benin City	Public
3.	Idia College, Benin City	Public
4.	Edokpolor Grammar School, Benin City	Public
5.	Oredo Girls Secondary School, Benin City	Public
6.	Immaculate Conception College, Benin City	Public
7.	Lucia Secondary School, Benin City	Public
8.	Gaius Obaseki International School, Benin City	Private
9.	Columbia High School, Benin City	Private
10.	Mercy Grace School, Benin City	Private
11.	Ihuogbe Secondary School, Benin City	Private

Table 2: Names of secondary schools and population selected

Name of School	School Type	Number of Students selected
Adesuwa Grammar Girls College Benin City	Public	40
Ihogbe College Benin City	Public	40
Idia College Benin City	Public	40

Gaius Obaseki International High School	Private	40
Columbia High School	Private	40

Sample and Sampling Technique

The sample size is two hundred (200) secondary school students selected from a total population of eight thousand (8,000) students in Oredo Local Government Area.

The sample size was determined using the Taro Yamane formula, which is commonly used in survey research to obtain a representative sample from a known population.

The formula is expressed as:

$N = N / [1 + N€^2]$

Where N = 8,000 and e = 0.07

Substituting the values, a sample size of approximately 199 was obtained and rounded up to 200 respondents for ease of administration. This represents about 2.5% of the total population and was considered adequate for the study.

A multistage sampling technique was employed to ensure proper representation of the study population.

Stage One: Secondary schools in Oredo Local Government Area were first stratified into public and private schools to ensure adequate representation of both categories.

Stage Two: Five secondary schools were selected using simple random sampling technique. The selected schools comprised three public secondary schools and two private secondary schools drawn from different zones within the local government area.

Stage Three: From each of the selected schools, 40 students were randomly chosen. The selection cut across junior and senior secondary classes and included both male and female students.

At the end of the sampling process, a total of 200 students were selected for the study.

Research Instrument

The instrument used for this study was self structured questionnaire titled "knowledge of climate change and environmental preservation among secondary school students in Oredo Local Government Area .

The instrument was divided into four sections; A, B, C and D. Section A; demographic information of the respondents, Section B; knowledge of climate change, Section C; sources of information on climate change while Section D; awareness and practice of environmental preservation.

Validity of the Instrument

The instrument was validated by the researcher's supervisor and two other experts from the Department of Health Safety and Environmental Education, Faculty of Education, University of Benin, Benin City. Their suggestions and recommendation helped in the production of the final copy of the instrument.

Reliability of the Instrument

The reliability of the instrument was determined using the test–retest method. The questionnaire was administered to 20 students from two schools outside Oredo Local Government Area but

with similar characteristics as the study group. After an interval of two weeks, the same questionnaire was re-administered to the same respondents.

After an interval of two weeks, the same questionnaire was re-administered to the same respondents. The scores obtained from the two administrations were correlated using the Pearson Product Moment Correlation Coefficient. The analysis yielded a reliability coefficient of 0.78, indicating a high level of consistency.

Method of Data Collection

Approval to conduct the study was obtained from the relevant authorities of the selected secondary schools in Oredo Local Government Area before the commencement of data collection. The researcher personally administered the questionnaires to the respondents with the assistance of class teachers during normal school hours. The purpose of the study was clearly explained to the students before the administration of the instrument to ensure their cooperation and honest responses. Copies of the questionnaire were distributed to the selected students and were collected immediately after completion to minimize loss and ensure a high return rate. Out of the 200 questionnaires distributed, 190 were correctly completed and returned, representing a high response rate.

Throughout the data collection process, the researcher maintained neutrality and avoided any form of interference that could influence the respondents' responses.

The instrument was administered by the researcher with the aid of two research assistants. The instrument was retrieved after completion to ensure 100% rate of return.

Method of Data Analysis

The data collected from the respondents through the questionnaire were carefully organized, coded, and analyzed using appropriate statistical methods. After collection, the responses were sorted and checked to ensure completeness and accuracy. Invalid or incomplete questionnaires were excluded from the analysis.

The data were analyzed using descriptive statistics such as frequency counts, percentages, and tables. These statistical tools were used to summarize the responses and present the findings in a clear and simple manner. They helped in describing the level of students' knowledge of climate change, their environmental preservation practices, and their attitudes towards environmental sustainability.

The results obtained from the analysis were presented In tabular form and interpreted accordingly. The interpretation was based on the research questions and objectives of the study. This enabled the researcher to draw meaningful conclusions and make relevant recommendations based on the findings.

CHAPTER FOUR
PRESENTATION OF RESULTS AND DISCUSSION OF FINDINGS

This chapter presents, analyzes, and interprets the findings based on the data collected from respondents in relation to the four research questions guiding the study.

Four research questions were raised to guide the study. Based on these research questions, forty (40) items were generated and presented in a questionnaire form administered to two hundred (200) respondents. Out of the 200 questionnaires distributed, 190 were correctly completed and returned. The results of the respondents are carefully analyzed and presented in the tables below.

Research Question 1: What is the level of knowledge of climate change among secondary school students in Oredo Local Government Area?

Table 1: Level of Knowledge of Climate Change among Secondary School Students

S/N	ITEMS	YES (%)	NO (%)	TOTAL
1	Have you ever heard of climate change?	156 (82%)	34 (18%)	190 (100%)
2	Have you been taught about climate change in school?	139 (73%)	51 (27%)	190 (100%)
3	Human activities can cause climate change.	138 (73%)	52 (27%)	190 (100%)
4	Cutting down trees can increase climate change.	128 (67%)	62 (33%)	190 (100%)
5	Burning fossil fuels (petrol, diesel, gas) contributes to climate change.	139 (73%)	51 (27%)	190 (100%)
6	Climate change affects agricultural	124 (65%)	66 (35%)	190

S/N	ITEMS	YES (%)	NO (%)	TOTAL
	production and food supply.			(100%)
7	Climate change can affect human health.	140 (74%)	50 (26%)	190 (100%)
8	Climate change can cause water shortage.	133 (70%)	57 (30%)	190 (100%)
9	Climate change is a global environmental problem.	141 (74%)	49 (26%)	190 (100%)
10	Agricultural production and food supply is affected by climate change.	122 (64%)	68 (36%)	190 (100%)

Source: Field survey, 2026

Table 1 presents the level of knowledge of climate change among secondary school students in Oredo Local Government Area. The results indicate that a large majority of respondents demonstrated awareness of climate change concepts. Specifically, 156 (82%) had heard of climate change, while 139 (73%) had been taught about it in school. Furthermore, 138 (73%) acknowledged that human activities can cause climate change, and 128 (67%) recognized that cutting down trees increases climate change. Similarly, 139 (73%) identified burning of fossil fuels as a contributor to climate change. Regarding the effects of climate change, 124 (65%) knew it affects agricultural production and food supply, 140 (74%) were aware it can affect human health, 133 (70%) recognized that it can cause water shortage, and 141 (74%) identified it as a global environmental problem. Additionally, 122 (64%) acknowledged that agricultural production and food supply is affected by climate change.

Based on the findings, it can be concluded that the majority of secondary school students in Oredo Local Government Area possess a high level of knowledge of climate change.

Research Question 2: What are the primary sources through which secondary school students in Oredo LGA obtain information on climate change?

Table 2: Sources of Information on Climate Change among Secondary School Students

S/N	ITEMS	ALWAYS	SOMETIMES	RARELY	NEVER
1	I get information about climate change from my teachers in school.	89 (47%)	72 (38%)	18 (9%)	11 (6%)
2	I learn about climate change through school subjects or textbooks.	82 (43%)	75 (39%)	21 (11%)	12 (6%)
3	I receive information about climate change from television programs.	97 (51%)	65 (34%)	20 (11%)	8 (4%)
4	I get information about climate change from radio broadcasts.	61 (32%)	70 (37%)	38 (20%)	21 (11%)
5	I use social media (e.g. WhatsApp, Facebook, Instagram) to learn about climate change.	103 (54%)	58 (31%)	19 (10%)	10 (5%)
6	I obtain information about climate change from the internet (websites, blogs, videos).	99 (52%)	61 (32%)	22 (12%)	8 (4%)
7	My parents or family members discuss climate change with me.	55 (29%)	68 (36%)	42 (22%)	25 (13%)
8	I learn about climate change through environmental clubs or school activities.	47 (25%)	60 (32%)	50 (26%)	33 (17%)
9	I get information about climate change from newspapers or	44 (23%)	63 (33%)	51 (27%)	32 (17%)

S/N	ITEMS	ALWAYS	SOMETIMES	RARELY	NEVER
	magazines.				
10	Government or community awareness programs provide me with information about climate change.	53 (28%)	66 (35%)	46 (24%)	25 (13%)

Source: Field survey, 2026

Table 2 shows the sources through which secondary school students in Oredo Local Government Area obtain information on climate change. The findings reveal that social media (WhatsApp, Facebook, Instagram) was the most frequently cited source, with 103 (54%) of respondents indicating they always use it to learn about climate change. The internet (websites, blogs, videos) was also a prominent source, with 99 (52%) always obtaining information from it. Television programs ranked third, with 97 (51%) always receiving climate change information through this medium. Teachers and school-based learning were also notable sources; 89 (47%) always obtained information from teachers, and 82 (43%) always learned through school subjects or textbooks. In contrast, environmental clubs and school activities were less consistent sources of information, with only 47 (25%) always accessing information through this channel, and 33 (17%) never doing so. Similarly, newspapers and magazines were the least utilized, with 44 (23%) always using them and 32 (17%) never using them. Family discussion was also a limited source, with only 55 (29%) indicating their parents always discuss climate change with them.

Based on the findings, it can be concluded that the primary sources of climate change information among secondary school students in Oredo Local Government Area are social media, the internet, and television, while school-based sources such as environmental clubs and government awareness programs remain underutilized.

Research Question 3: What is the level of awareness of environmental preservation among secondary school students in Oredo LGA?

Table 3: Level of Awareness of Environmental Preservation among Secondary School Students

S/N	ITEMS	ALWAYS	SOMETIMES	RARELY	NEVER
1	Climate change is a serious problem that needs attention.	115 (61%)	56 (29%)	12 (6%)	7 (4%)
2	Proper waste disposal, such as recycling and avoiding littering, helps preserve the environment.	116 (61%)	57 (30%)	13 (7%)	4 (2%)
3	Students have a role to play in protecting the environment.	107 (56%)	63 (33%)	14 (7%)	6 (3%)
4	Environmental protection should be taught in schools.	129 (68%)	37 (19%)	14 (7%)	10 (5%)
5	Schools should organize programs that promote environmental preservation.	104 (55%)	64 (34%)	15 (8%)	7 (4%)
6	Reducing the use of plastics and polythene bags helps in environmental protection.	100 (53%)	60 (32%)	22 (12%)	8 (4%)
7	Climate change does not affect my daily life.	48 (25%)	65 (34%)	42 (22%)	35 (18%)
8	Burning of waste materials contributes negatively to the environment.	127 (67%)	45 (24%)	10 (5%)	8 (4%)

S/N	ITEMS	ALWAYS	SOMETIMES	RARELY	NEVER
9	Biodiversity conservation helps in protecting the environment.	100 (53%)	55 (29%)	25 (13%)	10 (5%)
10	Government alone should be responsible for environmental protection.	47 (25%)	56 (29%)	52 (27%)	35 (18%)

Source: Field survey, 2026

Table 3 presents the level of awareness of environmental preservation among secondary school students in Oredo Local Government Area. The findings indicate that the majority of students demonstrated a high level of awareness. Specifically, 129 (68%) always believed that environmental protection should be taught in schools, and 127 (67%) always recognized that burning of waste materials contributes negatively to the environment. Furthermore, 116 (61%) always acknowledged that proper waste disposal helps preserve the environment, and 115 (61%) always agreed that climate change is a serious problem that needs attention. Additionally, 107 (56%) always recognized that students have a role to play in protecting the environment, while 104 (55%) always believed schools should organize programs promoting environmental preservation. On the other hand, only 47 (25%) agreed that government alone should be responsible for environmental protection, with 35 (18%) never agreeing to this statement, suggesting students recognize shared responsibility in environmental protection.

Based on the findings, it can be concluded that the majority of secondary school students in Oredo Local Government Area possess a high level of awareness of environmental preservation.

Research Question 4: To what extent do secondary school students in Oredo LGA engage in environmental preservation practices?

Table 4: Extent of Engagement in Environmental Preservation Practices among Secondary School Students

S/N	ITEMS	ALWAYS	SOMETIMES	RARELY	NEVER
1	I feel concerned when the environment is being polluted.	117 (62%)	56 (29%)	11 (6%)	6 (3%)
2	I believe protecting the environment is a personal responsibility.	117 (62%)	53 (28%)	13 (7%)	7 (4%)
3	I am willing to change some of my daily habits to protect the environment.	105 (55%)	67 (35%)	12 (6%)	6 (3%)
4	I dispose of waste properly in a dustbin.	109 (57%)	62 (33%)	14 (7%)	5 (3%)
5	I support rules and laws that protect the environment.	110 (58%)	59 (31%)	14 (7%)	7 (4%)
6	I avoid throwing refuse on the road.	119 (63%)	54 (28%)	10 (5%)	7 (4%)
7	I believe students should be involved in decision-making on environmental issues in schools.	108 (57%)	54 (28%)	20 (11%)	8 (4%)
8	I try to conserve water at home.	92 (48%)	63 (33%)	27 (14%)	8 (4%)
9	I help in planting of trees.	98 (52%)	65 (34%)	17 (9%)	10 (5%)
10	I encourage others to take part	115	51 (27%)	15 (8%)	9 (5%)

S/N	ITEMS	ALWAYS	SOMETIMES	RARELY	NEVER
	in activities that protect the environment.	(61%)			

Source: Field survey, 2026

Table 4 presents the extent to which secondary school students in Oredo Local Government Area engage in environmental preservation practices. The results reveal that students engaged considerably in a range of environmental preservation practices. The most prominent practice was avoiding throwing refuse on the road, with 119 (63%) always doing so. Additionally, 117 (62%) always felt concerned when the environment was being polluted, and the same proportion always believed that protecting the environment is a personal responsibility. Furthermore, 115 (61%) always encouraged others to participate in environmental protection activities. Regarding more active forms of engagement, 110 (58%) always supported rules and laws that protect the environment, 109 (57%) always disposed of waste in a dustbin, and 108 (57%) always believed that students should be involved in environmental decision-making in schools. Tree planting was practiced by 98 (52%) always, while water conservation at home was practiced by 92 (48%) always. Willingness to change personal habits for environmental protection was expressed by 105 (55%) of students.

Based on the findings, it can be concluded that the majority of secondary school students in Oredo Local Government Area engage in environmental preservation practices to a high extent, as evidenced by responsible waste disposal, avoidance of littering, willingness to modify personal habits, and encouragement of peers to protect the environment.

Discussion of Findings

The purpose of the study was to assess the knowledge of climate change and environmental preservation among secondary school students in Oredo Local Government Area of Edo State. Based on the data collected and analyzed, the findings are discussed below in relation to each research question.

The findings revealed that the majority of secondary school students in Oredo Local Government Area possess a high level of knowledge of climate change. Most students were aware that human activities cause climate change, that cutting down trees worsens it, and that burning fossil fuels contributes to it. They also recognized the effects of climate change on agricultural production, human health, and water availability. This finding is consistent with Ogunbode and Arnold (2012), who reported that students in developing countries demonstrate considerable awareness of climate change due to increased exposure through education and media. Similarly, Ajuang, Abu Bakar, and Mahmud (2016) found that secondary school students possessed substantial knowledge about the causes and impacts of climate change, particularly where environmental education is integrated into the school curriculum.

The findings indicated that the primary sources of climate change information for secondary school students in Oredo Local Government Area are social media, the internet, and television. School-based channels such as environmental clubs and government awareness programs were comparatively underutilized. This finding aligns with Eneji and Udo (2018), who observed that most Nigerian students acquire climate change information from social media and television rather than formal instruction, resulting in fragmented and sometimes inaccurate knowledge. It also reflects a pattern identified across Nigerian secondary schools, where digital media has

become the dominant channel for environmental awareness among youth, ahead of formal curriculum delivery.

The results showed that secondary school students in Oredo Local Government Area demonstrated a high level of awareness of environmental preservation. The majority of students acknowledged the importance of proper waste disposal, the need for schools to teach and organize environmental programs, and the negative consequences of waste burning. They also recognized the shared responsibility for environmental protection, rejecting the idea that government alone should bear this responsibility. This finding corroborates Oboh (2022), who found moderate to high environmental awareness among students in Edo State, and supports Okolie (2021), who emphasized that environmental education significantly influences students' attitudes toward sustainability.

The findings showed that the majority of secondary school students in Oredo Local Government Area engaged considerably in environmental preservation practices. Most students reported always avoiding throwing refuse on the road, disposing of waste in dustbins, encouraging others to protect the environment, and supporting environmental laws. These findings are consistent with Stevenson, Nicholls, and Whitehouse (2017), who observed that environmental education encourages students to engage in responsible environmental practices such as waste management and conservation activities. Furthermore, Otto and Pensini (2017) reported that environmental knowledge significantly influences students' environmental behavior and motivates participation in environmental protection activities.

CHAPTER FIVE
SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary

The purpose of the study was to assess the knowledge of climate change and environmental preservation among secondary school students in Oredo Local Government Area of Edo State. To achieve this purpose, four (4) research questions were raised and relevant literature related to climate change and environmental preservation was reviewed. The descriptive survey research design was adopted for the study. The population comprised eight thousand (8,000) secondary school students in Oredo Local Government Area of Edo State, as obtained from the Edo State Ministry of Education (2024). A multistage sampling procedure was adopted to select two hundred (200) students from five secondary schools across the local government area.

The instrument used for data collection was a well-structured, close-ended questionnaire titled "Knowledge of Climate Change and Environmental Preservation among Secondary School Students in Oredo Local Government Area" (KCCEPSS). The questionnaire contained forty (40) items divided into four sections: Section A (demographic information), Section B (knowledge of climate change), Section C (sources of information on climate change), and Section D (awareness and practice of environmental preservation). The instrument was validated by the project supervisor and two other lecturers in the Department of Health, Safety and Environmental Education. The test-retest reliability method yielded a reliability coefficient of 0.78. Out of 200 questionnaires administered, 190 were correctly completed and returned. Data collected were analyzed using frequency counts and percentages.

Findings

Based on the data collected and analyzed, the following findings were made:

1. The majority of secondary school students in Oredo Local Government Area possess a high level of knowledge of climate change.
2. The primary sources of climate change information among secondary school students in Oredo Local Government Area are social media, the internet, and television.
3. The majority of secondary school students in Oredo Local Government Area demonstrated a high level of awareness of environmental preservation.
4. The majority of secondary school students in Oredo Local Government Area engage in environmental preservation practices to a high extent.

Conclusion

Based on the findings of the study, it can be concluded that secondary school students in Oredo Local Government Area possess a high level of knowledge of climate change and a strong awareness of environmental preservation. Social media and the internet have emerged as the dominant channels for obtaining climate change information, surpassing formal school-based sources. Students also demonstrated a reasonably high level of engagement in environmental preservation practices, including responsible waste disposal, avoidance of littering, and encouragement of peers to protect the environment. While these findings are encouraging, there is still a need to strengthen formal environmental education, improve school-based information channels, and bridge the gap between awareness and consistent active participation in environmental conservation activities.

Recommendations

Based on the findings of the study, the following recommendations are made:

- Environmental education should be strengthened and made more comprehensive in secondary schools so that students can deepen their knowledge of the causes, effects, and mitigation of climate change beyond surface-level awareness.
- Schools should establish and actively support environmental clubs and organize environmental awareness programs such as seminars, workshops, clean-up exercises, and tree-planting activities to provide students with practical channels for engaging in environmental preservation.
- Since social media and the internet are the most utilized sources of climate change information among students, teachers, government agencies, and environmental organizations should leverage these platforms to disseminate accurate, curriculum-aligned climate change content.
- Government and school authorities should strengthen community-based and school-based climate change awareness programs to serve as formal, reliable sources of information, reducing students' reliance on unregulated digital content.
- Schools should promote and provide adequate facilities for environmental preservation practices, including waste disposal bins, recycling stations, and tree-planting spaces, to encourage and sustain students' engagement in environmental protection activities.
- Students should be actively encouraged and empowered to adopt environmentally friendly habits such as reducing the use of plastics, conserving water, avoiding littering, and participating in environmental conservation projects within their schools and communities.

Suggestions for Further Study

1. Barriers to the effective utilization of school-based channels for climate change information among secondary school students in Oredo Local Government Area of Edo State.
2. The influence of social media exposure on environmental preservation practices among secondary school students in Oredo Local Government Area of Edo State.
3. Impact of Environmental Education on students' knowledge and attitudes towards climate change and environmental preservation among secondary school students in Oredo Local Government Area of Edo State.

REFERENCE

Adebayo, A. A. (2019). Climate change and environmental sustainability in Nigeria. *Journal of Sustainable Development in Africa, 21(3), 45–58.*

Adelekan, I., Adeniji, O., & Nwaogu, C. (2023). Urban climate vulnerability and youth adaptive capacity in Nigeria. Springer Climate.

Ajuang, C. O., Abu Bakar, S., & Mahmud, M. (2016). The level of awareness and understanding of climate change among secondary school students. *International Journal of Environmental & Science Education, 11(15),* 8310–8320.

Bandura, A. (1977). Social learning theory. Prentice Hall.

Bertalanffy, L. V. (1968). General system theory: Foundations, development, applications. George Braziller.

Eneji, C. V. O., & Udo, E. J. (2018). Environmental education and sustainable development in Nigerian secondary schools. *Journal of Environmental Studies, 6(2), 45–56.*

Eneji, C. V. O., & Udo, S. M. (2018). Environmental sustainability and ecological protection in Nigerian communities. *Journal of Environmental Management and Safety, 9(4), 45–60.*

Falaye, A. O., & Okwilagwe, E. A. (2016). Environmental education and sustainable school practices in Nigeria. *International Journal of Environmental & Science Education, 11(12), 5209–5223.*

Federal Ministry of Environment (FME). (2020). National climate change policy for Nigeria. Abuja: Government Press.

Food and Agriculture Organization of the United Nations (FAO). (2020). The state of food and agriculture 2020: Overcoming water challenges in agriculture. FAO.

Fox-Kemper, B., Hewitt, H. T., Xiao, C., Aadlandsvik, B., et al. (2021). Ocean, cryosphere and sea level change. In IPCC, Climate Change 2021: The physical science basis (AR6 Working Group I Report). Cambridge University Press.

Hansen, J., Sato, M., Ruedy, R., et al. (2023). Global surface temperature change and environmental impacts. *Earth System Science Data, 15, 229–248.*

Hungerford, H. R., & Volk, T. L. (1990). Changing learner behavior through environmental education. *The Journal of Environmental Education, 21(3), 8–21.*

Intergovernmental Panel on Climate Change (IPCC). (2019). Special report on climate change and land. Cambridge University Press.

Intergovernmental Panel on Climate Change (IPCC). (2021). Climate change 2021: The physical science basis (AR6 Working Group I Report). Cambridge University Press.

Intergovernmental Panel on Climate Change (IPCC). (2021). Climate change 2021: The physical science basis. Cambridge: Cambridge University Press.

Intergovernmental Panel on Climate Change (IPCC). (2022a). Climate change 2022: Impacts, adaptation and vulnerability (AR6 Working Group II Report). Cambridge University Press.

Intergovernmental Panel on Climate Change (IPCC). (2022b). Climate change 2022: Mitigation of climate change (AR6 Working Group III Report). Cambridge University Press.

Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). (2022). Summary for policymakers of the global biodiversity and ecosystem services assessment. IPBES Secretariat.

International Energy Agency (IEA). (2022). World energy outlook 2022. IEA Publications.

Leal Filho, W., Hemstock, S., Quiang, W., & Balogun, A. (2019). Climate change awareness and sustainable behavior among students. *International Journal of Sustainability in Higher Education, 20(4),* 656–672. https://doi.org/10.1108/IJSHE-10-2018-0190

Lindsey, R., & Dahlman, L. (2023). Climate change: Global temperature. National Aeronautics and Space Administration (NASA).

National Oceanic and Atmospheric Administration (NOAA). (2023). State of the climate: Global climate report 2023. NOAA National Centers for Environmental Information.

National Oceanic and Atmospheric Administration (NOAA). (2023). State of the climate: Global climate report 2023. NOAA National Centers for Environmental Information.

Nigeria Environmental Study/Action Team (NEST). (2015). Nigeria's adaptation communication report to the UNFCCC. NEST Publishers.

Nigerian Environmental Study/Action Team (NEST). (2015). Nigeria's vulnerability to climate change. Ibadan: NEST Publications.

Nwachukwu, P., Chukwu, K. E., & Nwankwo, C. F. (2023). Environmental conservation behavior and climate awareness among Nigerian secondary school students. *Nigerian Journal of Environmental Sciences, 7(1), 33–50.*

Nwosu, A. A. (2017). Environmental preservation and natural resource management in developing countries. *African Journal of Environmental Management, 5(1), 23–34.*

Nwosu, J. C. (2017). Environmental knowledge and climate change literacy among young Nigerians. *African Journal of Environmental Education, 32, 12–29.*

Nwosu, J. C. (2017). Environmental knowledge and climate change literacy among young *Nigerians. African Journal of Environmental Education, 32, 12–29.*

Oboh, P. A. (2022). Environmental preservation awareness among Nigerian adolescents. West *African Educational Research Journal, 5(2), 18–34.*

Ogunbode, C. A., & Arnold, K. (2012). A study of environmental awareness and attitudes among secondary school students in Nigeria. *Environmental Education Research, 18(1),* 1–13. https://doi.org/10.1080/13504622.2011.574208

Ogunjinmi, A. A., Onadeko, S. A., & Ogunjinmi, K. O. (2013). Knowledge, attitude and practice of environmental conservation among secondary school students in Nigeria. *Journal of Environmental Education Research, 19(2), 120–134.*

Okolie, U. C. (2021). Integrating environmental conservation into science education in Nigerian secondary schools. *Journal of Sustainable Education in Africa, 13(3), 77–91.*

Oloruntoba, E. O., & Sridhar, M. K. C. (2009). Public health, environment and climate interaction in Nigeria. *Annals of Ibadan Postgraduate Medicine, 7(2), 32–39.*

Olujide, J. O. (2019). Urbanization and environmental challenges in Nigeria. International *Journal of Environmental Studies, 14(1), 67–79.*

Otto, S., & Pensini, P. (2017). Nature-based environmental education of children: Environmental knowledge and connectedness to nature. *Environmental Education Research, 23(8),* 1141–1154. https://doi.org/10.1080/13504622.2016.1214869

Schmidt, G., et al. (2023). Climate forcing and global temperature response trends. *Nature Climate Change, 13, 512–521.*

Stevenson, R. B., Nicholls, J., & Whitehouse, H. (2017). What is climate change education? *Curriculum Perspectives, 37(1),* 67–71. https://doi.org/10.1007/s41297-017-0015-9

Uche, I. I., & Eze, P. I. (2020). Perception of climate change and environmental sustainability among Nigerian secondary school learners. *Nigerian Educational Research Journal, 4(2), 21–37.*

Uche, O. C., & Eze, I. F. (2020). Climate change awareness among secondary school students in southeastern Nigeria. *International Journal of Education and Research, 8(4), 101–114.*

United Nations (UN). (2024). United Nations climate change annual report 2024. UN Publications.

United Nations Convention to Combat Desertification (UNCCD). (2022). Global land outlook, 2nd edition. UNCCD Secretariat.

United Nations Educational, Scientific and Cultural Organization (UNESCO). (2020). Education for sustainable development: A roadmap. UNESCO.

United Nations Educational, Scientific and Cultural Organization (UNESCO). (2017). Education for sustainable development goals: Learning objectives. Paris: UNESCO.

United Nations Environment Programme (UNEP). (2018). Climate change and environmental education. Nairobi: UNEP.

United Nations Environment Programme (UNEP). (2021). Making peace with nature: A scientific blueprint to tackle the climate, biodiversity and pollution emergencies. UNEP.

United Nations Environment Programme (UNEP). (2024). Emissions gap report 2024. UNEP.

Wachholz, S., Artz, N., & Chene, D. (2014). Warming to the idea: University students' knowledge and attitudes about climate change. *International Journal of Sustainability in Higher Education, 15(2),* 128–141. https://doi.org/10.1108/IJSHE-03-2012-0025

World Bank. (2023). Climate change action plan: Progress report 2023 edition. World Bank Publications.

World Health Organization (WHO). (2021). Climate change and human health. Geneva: WHO Press.

World Health Organization (WHO). (2023). Climate change and health 2023. WHO Press.

World Meteorological Organization (WMO). (2023). State of the global climate 2023. WMO Publications.

Zumyil, J. T., & Antip, J. A. (2024). Environmental preservation behavior in Nigerian secondary schools. *Global Journal of Environmental Education, 14(5), 101–120.*

QUESTIONNAIRE

DEPARTMENT OF HEALTH SAFETY AND ENVIRONMENTAL EDUCATION

FACULTY OF EDUCATION

UNIVERSITY OF BENIN

Dear Respondent,

I am a final-year student in the Department of Health Safety and Environmental Education, Faculty of Education, University of Benin. This questionnaire is designed purely for academic purposes as part of a study on **"Knowledge of Climate Change and Environmental Preservation among Secondary School Students in Oredo Local Government Area."** Your responses will be treated with the utmost confidentiality. Please answer all questions as honestly as possible. Thank you for your cooperation.

SECTION A: Demographic Information

(Please tick ✓ the appropriate option)

1. Gender: [ ] Male [ ] Female
2. Age: [ ] 10–13 years [ ] 14–16 years [ ] 17–19 years [ ] 20 years and above
3. School Type: [ ] Public [ ] Private
4. Class Level: [ ] Junior Secondary School (JSS) [ ] Senior Secondary School (SSS)

SECTION B: Knowledge of Climate Change

S/N	Items	YES	NO
1.	Have you ever heard of climate change?		
2.	Have you been taught about climate change in school?		
3.	Human activities can cause climate change.		
4.	Cutting down trees can increase climate change.		
5.	Burning fossil fuels (petrol, diesel, gas) contributes to climate change.		
6.	Climate change affects agricultural production and food supply.		
7.	Climate change can affect human health.		
8.	Climate change can cause water shortage.		
9.	Climate change is a global environmental problem.		
10.	Agricultural production and food supply is affected by climate change.		

SECTION C: Sources of Information on Climate Change

S/N	Items	ALWAYS	SOMETIMES	RARELY	NEVER
1.	I get information about climate change from my teachers in school.				
2.	I learn about climate change through school subjects or textbooks.				
3.	I receive information about climate change from television programs.				
4.	I get information about climate change from radio broadcasts.				
5.	I use social media (e.g WhatsApp, Facebook, Instagram) to learn about climate change.				
6.	I obtain information about climate change from the internet (websites, blogs, videos).				
7.	My parents or family members discuss climate change with me.				
8.	I learn about climate change through environmental clubs or school activities.				
9.	I get information about climate change from newspapers or magazines.				
10.	Government or community awareness programs provide me with information about climate change.				

Section D

Awareness of Environmental Preservation

S/N	Items	ALWAYS	SOMETIMES	RARELY	NEVER
1.	**Climate change is a serious problem that needs attention**				
2.	Proper waste disposal, such as recycling and avoiding littering, helps preserve the environment.				
3.	Students have a role to play in protecting the environment.				
4.	Environmental protection should be taught in schools.				
5.	Schools should organize programs that promote environmental preservation.				
6.	Reducing the use of plastics and polythene bags helps in environmental protection.				
7.	Climate change does not affect my daily life.				
8.	Burning of waste materials contributes negatively to the environment.				
9.	Biodiversity conservation helps in protecting the environment.				
10.	Government alone should be responsible for environmental protection.				

Environmental preservation practices

S/N	ITEMS	ALWAYS	SOMETIMES	RARELY	NEVER
1	I feel concerned when the environment is being polluted.				
2	I believe protecting the environment is a personal responsibility.				
3	I am willing to change some of my daily habits to protect the environment.				
4	I dispose of waste properly in a dustbin.				
5	I support rules and laws that protect the environment.				
6	I avoid throwing refuse on the road.				
7	I believe students should be involved in decision-making on environmental issues in schools.				
8	I try to conserve water at home.				
9	I help in planting of trees.				
10	I encourage others to take part in activities that protect the environment.				

APPENDICES

APPENDIX I

Letter of Introduction

Department of Health, Safety and Environmental Education

Faculty of Education

University of Benin

Benin City, Edo State

Dear Respondent,

I am a final year student of the above-named institution carrying out a research study titled: "Knowledge of Climate Change and Environmental Preservation among Secondary School Students in Oredo Local Government Area."

You have been selected as one of the respondents for this study. Kindly provide honest answers to the questions as your responses will be used strictly for academic purposes.

All information provided will be treated with confidentiality.

Thank you for your cooperation.

Yours faithfully,

Researcher

APPENDIX II

Research Questionnaire (KCCEPSS)

Section A: Demographic Information

Gender: Male [ ] Female [ ]

Age: 10–12 [ ] 13–15 [ ] 16–18 [ ]

Class: JSS1 [ ] JSS2 [ ] JSS3 [ ] SSS1 [ ] SSS2 [ ] SSS3 [ ]

School Type: Public [ ] Private [ ]

Section B: Knowledge of Climate Change (Yes/No)

1 Have you ever heard of climate change? Yes[ ] No[ ]

2 Have you been taught climate change in school? Yes[ ] No[ ]

3 Human activities can cause climate change. Yes[ ] No[ ]

4 Cutting down trees increases climate change. Yes[ ] No[ ]

5 Burning fossil fuels contributes to climate change. Yes[ ] No[ ]

6 Climate change affects agriculture. Yes[ ] No[ ]

7 Climate change affects human health. Yes[ ] No[ ]

8 Climate change can cause water shortage. Yes[ ] No[ ]

9 Climate change is a global problem. Yes[ ] No[ ]

10 Climate change affects food supply. Yes[ ] No[ ]

Section C: Sources of Information (Always / Sometimes / Rarely / Never)

(Use same format for all items)

Options: Always [ ] Sometimes [ ] Rarely [ ] Never [ ]

- Teachers
- School subjects
- Television
- Radio
- Social media
- Internet
- Family
- Environmental clubs
- Newspapers
- Government programs

Section D: Awareness & Practices

Options: Always [ ] Sometimes [ ] Rarely [ ] Never [ ]

Includes:

- Waste disposal
- Tree planting
- Environmental responsibility

- Avoiding littering
- Water conservation
- Participation in environmental activities

APPENDIX III

Sample Size Determination (Taro Yamane Formula)

Where:

N = 8,000

e = 0.07

Sample size ≈ 200 respondents

Sampling Procedure

Stage 1: Stratification (Public & Private schools)

Stage 2: Random selection of 5 schools

Stage 3: Selection of 40 students per school

Total = 200 students

Distribution of Sampled Schools and Students

School Type	Numbers of schools Selected	Students per School	Total Students
Public Secondary Schools	3	40	120
Private Secondary Schools	2	40	80
Total	5	-	200

APPENDIX IV

Data Analysis Framework

Coding System

Yes = 1, No = 0

Always = 4, Sometimes = 3, Rarely = 2, Never = 1

Percentage Formula

Decision Rule

≥ 50% = Accepted

< 50% = Rejected

Mean benchmark = 2.5

Response Rate

- Statistical Tools Used
- Frequency counts
- Percentages
- Tables

APPENDIX V

Ethical Considerations

- Participation was voluntary
- Respondents were informed
- Data was confidential
- No names were required

Link Between Findings & Recommendations

Finding	**Recommendation**
High knowledge	Improve depth of education
Digital sources dominant	Use social media for awareness
High awareness	Strengthen programs
Good practices	Provide facilities

Limitations of Study

- Limited to Oredo LGA
- Questionnaire-based responses
- Possible response bias

Contribution of Study

- Adds to climate education research in Nigeria
- Identifies gaps in knowledge vs practice
- Provides practical recommendations

Justification for Further Study

- Need to explore digital influence
- Improve school-based learning
- Address behavioral gaps