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Bridging the Knowledge Gap: Enhancing Kogi Secondary School Students' Understanding of Climate Change through Effective Environmental Education

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ABSTRACT

This study investigates the current understanding of climate change among secondary school students in Kogi State, Nigeria. Climate change poses a significant threat, and equipping future generations with the knowledge to address it is crucial. However, a knowledge gap exists regarding student understanding. This study aims to bridge this gap by employing a quantitative research design targeting a sample population of 100 (20 teachers, 80 students) from Kogi State's 280 secondary schools with an estimated 3,000 teachers and 20,000 students. Surveys designed for teachers and students will assess their current understanding of climate change concepts, causes, impacts, and potential solutions. The study anticipates revealing existing knowledge gaps and areas requiring improvement in environmental education curriculum and pedagogy. The findings will inform the development of targeted and effective environmental education programs, fostering a generation of informed and empowered Kogi State secondary school students who can contribute to climate action.

Keywords: Climate Change Education, Secondary Education, Knowledge Gap, Environmental Education, Climate Change Understanding, Climate Action

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1. INTRODUCTION

Climate change, characterized by long-term shifts in temperature and weather patterns, has emerged as a defining challenge of the 21st century. Its far-reaching consequences, manifesting as rising sea levels, extreme weather events, and disruptions to ecosystems, threaten the very fabric of human societies and natural environments. Mitigating these impacts necessitates a global effort, and equipping future generations with the knowledge and skills to address this crisis is paramount.

Secondary education serves as a critical juncture for fostering environmental awareness and understanding. However, a concerning knowledge gap often exists regarding student comprehension of climate change. Students may struggle to grasp the complex scientific concepts underlying climate change, its diverse causes, and the cascading impacts it unleashes on our planet. This knowledge gap hinders their ability to engage meaningfully in climate action and advocate for sustainable practices. Kogi State faces heightened vulnerability to climate change impacts. Increased flooding disrupts agricultural production and displaces communities, while erratic rainfall patterns threaten food security. Understanding the current understanding of climate change among Kogi's secondary school students is crucial for developing targeted educational interventions.

The present study aims to bridge this knowledge gap by investigating the current understanding of climate change among secondary school students in Kogi State, Nigeria. By delving into student and teacher perspectives, this research seeks to illuminate existing gaps in climate change education within Kogi's secondary schools. The findings will serve as a springboard for developing targeted and effective environmental education programs, empowering Kogi's youth to become informed and engaged citizens equipped to confront the challenges of climate change.

Stressing the importance of environmental education, Bell as cited in Ogwu (2016), notes that major environmental problems can only be solved by radical transformation of the attitudes, preferences and lifestyles of the citizens of contemporary liberal democracies. Positive and negative transitions of growth around the world call for worldwide realization of environmental education in schools to save our planet earth from escalating degradation. This otherwise implies the use of a more holistic approach to educate the public on issues of global change and their responses. Environmental education programme encompasses raising awareness, acquiring new perspectives, values, knowledge and skills, and formal and informal processes leading to change of behaviour in support of a sustainable environment.

Climate change is one of the principal crises facing human race. Climate change as defined by Uchegbu and Ugwuanyi (2009) is the persistent fluctuation in the climatic elements for a considerable length of time usually 35 years. It is a phenomenon created by human beings and nature, which devastated the earth and causes hardship of unpredictable magnitude to the living. United Nations Environmental Programme (UNEPA) referred to climate change as excessive reaction of the weather occurrence which creates harmful impact on agricultural resources, water bodies, human health, and depletions of ozone layer, vegetation, soil and replication of Carbon dioxide (CO_2) in the ecosphere. Elsewhere, Akuegwu, Nwi-Ue, and Nwikina (2012) note that Climate change is a matter that is gaining wide spread apprehension and is taking center stage in virtually every human endeavour in the world today.

Corroborating this, the Inter-Governmental Panel on Climate Change, (IPCC TAR, and 2001a) refer to climate change as every change in climatic conditions over-time, attributed to natural occurrence or human activity or a combination of both. Such change in climatic condition according to BNRC (2011) normally results in the variation of atmospheric temperature, sometimes giving rise to excess heat, and variation in rainfall pattern and intensity. Corroborating this, Nasa, (2017) define climate change as: "a broad range of global phenomena created predominantly by burning fossil fuels, which add heat-trapping gases to Earth’s atmosphere.

These phenomena include the improved temperature trends described by global warming, but also cover changes such as sea level rise; ice mass loss in Greenland, Antarctica, the Arctic and mountain glaciers worldwide; shifts in flower/plant blooming; and severe weather events." Thus, climate change can be thought to refer to considerable changes in global temperature, precipitation, wind patterns and other events of climate that happen over several decades or longer.

Evidence suggests several of these severe climate changes are linked to increasing levels of carbon dioxide as well as other greenhouse gases in the Earth's atmosphere more regularly than not, the consequence of human actions. Human activity is presently generating an excess of long-lived greenhouse gasses that unlike water vapour don't dissipate in reaction to temperature increases, resulting in a enduring buildup of heat. Carbon dioxide is the best-known, among natural sources including decomposition and animal respiration. The core source of excess carbon dioxide emissions is the burning of fossil fuels, though deforestation has reduced the quantity of plant life available to turn CO2 into oxygen. According to Jiga and Ujah (2015),

Climate change is caused by factors that include oceanic processes, biotic processes, variation in solar radiation received by earth, human-induced alterations of the natural world; these later effects are presently causing global warming, and climate change is frequently used to explain human specific impacts linked to global warming. Another factor is increase in temperature, caused by high levels of the greenhouse gases. High temperatures lead to high evaporation rate and hence reduction in ground water retention, since more water will evaporate back to the atmosphere leaving very little to infiltrate and form the ground water (Pounds & Puschendorf, 2004;Adedeji, Reuben, & Olatoye, 2014). All these appear to have devastitating effect on, not only the natural system, but also on humans.

The present study aims to bridge this knowledge gap by investigating the current understanding of climate change among secondary school students in Kogi State, Nigeria. By delving into student and teacher perspectives, this research seeks to illuminate existing gaps in climate change education within Kogi's secondary schools. The findings will serve as a springboard for developing targeted and effective environmental education programs, empowering Kogi's youth to become informed and engaged citizens equipped to confront the challenges of climate change.

Aims and Objectives of The Study

Aim: To investigate the current understanding of climate change among secondary school students in Kogi State, Nigeria.

Objectives:

- To assess the knowledge level of secondary school students in Kogi State regarding climate change concepts (causes, impacts, solutions).
- To identify existing knowledge gaps and weaknesses within the current climate change education curriculum of Kogi's secondary schools.
- To analyze teacher perspectives on climate change integration in the curriculum and student understanding.
- To inform the development of targeted and effective environmental education programs for Kogi's secondary schools.

Statement Of The Problem

The current approach to climate change education in Kogi State's secondary schools may not be effectively equipping students with the necessary knowledge and skills to understand the complexities of climate change, its causes, and potential solutions. This knowledge gap hinders student engagement in climate action and advocating for sustainable practices.

Purpose/Significance Of The Study

This study aims to bridge the knowledge gap regarding climate change understanding among secondary school students in Kogi State. By identifying existing weaknesses in the current curriculum and student understanding, the research can inform the development of targeted environmental education programs. These programs can empower Kogi's youth with a deeper understanding of climate change, fostering informed and engaged citizens capable of contributing to a sustainable future.

Research Questions

- What is the current level of understanding of climate change concepts on teaching and learning in secondary schools (students and Teachers) in Kogi State, Nigeria?
- How do teachers in Kogi State integrate climate change topics into the existing curriculum, and how do they perceive student understanding of these topics?

Hypothesis

This study is tested on this null hypothesis:

H_0: There is no significant difference on how teachers in Kogi State integrate climate change topics into the existing curriculum, and how they perceived student understanding of these topics

Scope of The Study

This study focuses on the current understanding of climate change among secondary school students and teachers in Kogi State, Nigeria. It employs a quantitative approach using surveys to assess knowledge levels and identify knowledge gaps. The study does not aim to evaluate the effectiveness of specific teaching methods or curriculum content

2. LITERATURE REVIEW

Climate change education has emerged as a critical component of secondary education curricula worldwide. Recognizing the urgency of the climate crisis, organizations like UNESCO emphasize the importance of equipping future generations with the knowledge and skills necessary to address this challenge ([UNESCO, 2015]). Research suggests that effective climate change education can enhance student understanding of the scientific concepts at play, foster critical thinking skills, and cultivate a sense of agency in addressing climate issues ([Breitenbach et al., 2017]). However, studies also highlight the presence of knowledge gaps in student understanding. As [Rickinson, 2009] points out, student knowledge about climate change can often be "limited and fragmented." This limited understanding can hinder students' ability to engage meaningfully with climate action and advocate for sustainable practices.

The context of Kogi State, Nigeria, adds further urgency to this research. Kogi State is particularly vulnerable to the impacts of climate change. Increased flooding disrupts agricultural production and displaces communities, while erratic rainfall patterns threaten food security ([Adefolalu, 2016]). Understanding the current understanding of climate change among Kogi's secondary school students is crucial for developing targeted educational interventions that address these specific vulnerabilities.

Research Gap and Significance

While research exists on climate change education and student knowledge gaps, limited studies have explored this issue within the specific context of Kogi State, Nigeria. This study aims to fill this gap by investigating the current understanding of climate change among secondary school students and teachers in Kogi State. By analyzing both student and teacher perspectives, the research seeks to identify existing knowledge gaps and weaknesses within the current climate change education curriculum of Kogi's secondary schools. The findings of this study will be significant for policymakers, educators, and curriculum developers in Kogi State. By illuminating existing knowledge gaps, the research can inform the development of targeted and effective environmental education programs. These programs can equip Kogi's secondary school students with a deeper understanding of climate change, empowering them to become informed and engaged citizens who can contribute to climate action within their communities and beyond.

3. METHODOLOGY

This study employed a quantitative research design to investigate the current understanding of climate change among secondary school students in Kogi State, Nigeria. Quantitative research allows for the collection and analysis of numerical data to test hypotheses and identify patterns ([Creswell, 2014]).

Sampling: A stratified random sampling technique was utilized to ensure the sample reflects the diverse characteristics of Kogi's secondary schools (e.g., location, size). This approach helps to reduce bias and ensure the findings are more generalizable to the entire population ([Babbie, 2010]).

Sample Size: Due to resource limitations, a sample size of 100 respondents was selected. This sample will be further divided to include 20 teachers and 80 students. While a larger sample size would be ideal, this approach can still provide valuable insights into the current state of climate change education in Kogi State.

Data Collection Instruments:

Surveys: Self-administered surveys serve as the primary data collection tool. Two separate surveys were developed, one specifically designed for teachers and another for students.

Teacher Survey: This survey gathered information on:

- Demographics (years of experience, subject area)
- Integration of climate change topics into existing curriculum ([Breitenbach et al., 2017])
- Access to resources and professional development opportunities related to climate change education ([UNESCO, 2013]
- Teacher perceptions of student understanding of climate change concepts

Student Survey: This survey assessed:

- Demographics (grade level, gender)
- Understanding of climate change concepts (causes, impacts, solutions) ([Aikenhead & Falk, 2007])
- Level of engagement with climate change issues (e.g., discussions in class, personal actions)

Pilot Testing: The surveys was piloted with a small group of students and teachers to ensure clarity, comprehensiveness, and appropriate reading level before full-scale implementation ([Fowler, 2014]).

Data Analysis: Quantitative data collected through the surveys were analyzed using statistical software. Descriptive statistics was employed to summarize the data, providing an overview of the level of understanding among students and teacher perceptions. Inferential statistics (e.g., chi-square tests, independent t-tests) was used to identify potential relationships between variables, such as student grade level and understanding of specific climate change concepts.

The instrument for data collection was validated by three experts two from Educational Administration and Planning one from Measurement and Evaluation all in the department of educational foundations of Kogi State University, Anyigba. The reliability estimate of 0.74 was obtained using Cronboch Alpha. 135 representing (100%) questionnaires came back qualified for processing and analysis, there were summarized to a 4point response scale of strongly agree (4 points), agree (3 points), disagree (2 points) and strongly disagree (1 point) and benchmark of 2.50 and above was established as accepted and any score below 2.50 was rejected. The research questions were answered descriptively using mean and standard deviation, while the hypothesis was tested inferentially using the t-test statistic. The hypothesis was tested at 0.05 level of significance.

Ethical Considerations:
This study adherered to strict ethical guidelines outlined in research ethics codes. Participation was voluntary, and informed consent was obtained from both teachers and students (with parental consent for students under 18). Anonymity and confidentiality of responses were ensured throughout the research process.

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4. DATA ANALYSIS AND PRESENTATION OF RESULT

The data analysis and presentation of result in line with the research questions and hypothesis.

Table 1: Analysis of mean and standard deviation of response of teachers and students on What is the current level of understanding of climate change concepts on teaching and learning in secondary schools in Kogi State, Nigeria?

S/N	ITEM DESCCRIPTIONS	Teacher		Students		Decision
		X	SD	X	SD	
1	Changes in atmospheric temperature affects rainfall pattern thereby the intensity can affect education.	3.40	0.48	3.61	0.44	Agreed
2	Excessive heat due to high atmospheric temperature brings discomfort in the classroom.	3.32	0.46	3.20	0.93	Agreed
3	Heat related stresses amongst students make teaching and classroom management difficult.	3.40	0.06	3.10	0.49	Agreed
4	Strong winds and floods can damage facilities and physical equipments set outside the classrooms.	3.50	0.48	3.41	0.60	Agreed
5	Climate change results in high temperature, rainfall and extreme weather events have impact on school activities.	3.10	0.39	3.51	0.82	Agreed
6	Extreme weather condition leads to additional cost for the rehabilitation of damaged infrastructure which may drain constrained education budgets.	3.44	0.48	3.12	0.49	Agreed
7	Extreme weather condition can lead disruptions to schooling which has significant impact on learning.	3.10	0.58	3.50	0.48	Agreed
8	Warmer temperatures foster disease transmission, which affect schooling.	2.70	0.82	3.00	0.48	Agreed
9	Warming temperatures are even bringing dead viruses back to life which has effect on education.	2.51	1.20	3.16	0.88	Agreed
10	Conflict between herders and farmers affects education of children leading to obstacles in their development..	3.48	0.49	3.14	0.81	Agreed
	CLUSTER MEAN	3.20	.57	3.32	.68	Agreed

Sources: Fieldwork September, 2023.

The result in table one reveals the mean and standard deviation of responses of teachers and students on What is the current level of understanding of climate change concepts on teaching and learning in secondary schools in Kogi State, Nigeria shows that items 1 to10 respectively were accepted by teachers and students, as their means scores went above 2.50 as average score for acceptance. The result above implies that there is deeper understanding of climate change concept on teaching and learning in secondary schools in Kogi State, Nigeria

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Table 2: Table 1: Analysis of mean and standard deviation of response on how do teachers in Kogi State integrate climate change topics into the existing curriculum, and how do they perceive student understanding of these topics.

S/N	ITEM DESCCRIPTIONS	Teacher		Students		Decision
		X	SD	X	SD	
11	Participatory approach and combination of learning and action helps in improving the environments of schools and their local communities.	3.13	0.34	3.51	0.61	Agreed
12	Environmental education provides an excellent opportunity for students to take decisions to improve school environments.	3.49	0.50	3.63	0.45	Agreed
13	It strives to increase environmental awareness of students, staff and communities and to improve school environments.	3.18	0.38	3.23	0.42	Agreed
14	The schools are given the opportunity to create links with the other schools giving them the chance to share environmental education ideas.	3.02	0.51	3.23	0.42	Agreed
15	Climate change education encourages the change in attitudes needed to construct a new generation of climate change conscious citizens.	3.30	0.44	3.40	0.48	Agreed
16	Inculcating climate change and environmental education at young age is in the end the best way to change behaviours of the youths.	3.01	0.81	3.25	0.42	Agreed
17	The curriculum should center on the advancement of knowledge needed to contribute to the mitigation the effect of climate change.	3.12	0.32	3.61	0.46	Agreed
18	Teaching the young learners to imbibe true love for nature and awareness' of renewable natural resources, helps reducing incidence of soil erosion, deforestation.	3.20	0.41	2.92	0.78	Agreed
19	Ignorance is a barrier to environmental education.	3.29	0.42	3.42	0.48	Agreed
20	Education as an informative tool for behaviour change has a slow speed of change.	2.88	0.81	6.82	9.80	Agreed
21	It is crucial for the learners to develop the capacity for critical thinking to raise their awareness of the connections between environmental, social and economic dimensions in our world.	3.02	0.51	3.50	0.48	Agreed
22	Promoting lasting change through environmental education requires that teachers' themselves acquire requisite skills to contribute fully to the effort since they are the implementers of the curriculum.	3.18	0.60	3.50	0.48	Agreed
23	Integrating Climate Change and Environmental Education (CCEE) in a trans-disciplinary manner into existing subject areas such as social studies, sciences, citizenship education, geography, human right education, language education will help in mitigating the effect of climate change.	3.29	0.42	3.40	0.62	Agreed
	CLUSTER MEAN	3.18	0.52	3.62	1.20	Agreed

Sources: Fieldwork September, 2023.

The result in table two reveals the mean and standard deviation of responses on how do teachers in Kogi State integrate climate change topics into the existing curriculum, and how do they perceive student understanding of these topics shows that items 11 to 23 respectively were accepted by teachers and students, as their means scores went above 2.50 as average score for acceptance. The above result implies that the teaching and learning of environmental education plays effective part in mitigating the effect of climate change in secondary schools in Kogi State.

H_0: There is no significant difference on how teachers in Kogi State integrate climate change topics into the existing curriculum, and how they perceived student understanding of these topics

Table 3: t-test Analysis showing no significant difference on how teachers in Kogi State integrate climate change topics into the existing curriculum, and how they perceived student understanding of these topics

Item	N	Mean	SD	Df	T-Cal	Sig	Decision
Effect of Climate change	100	3.28	.61	130	5.11	.000	Reject
Curriculum education	100	3.41	.87				

An examination of the above data in Table 3 shows that the calculated t-value of 5.11 is greater than the Sig value of .000 at 130 degree of freedom and 0.05 alpha Level. Hence, the null hypothesis of no significant different was rejected and the alternate hypothesis of the existence of difference was accepted. This implies therefore, that the respondents differed in their opinion on the role of the teaching and learning of curriculum education in secondary schools in understanding the effect of climate change in Kogi State, Nigeria.

5. DISCUSSION OF FINDINGS

The result in research question one reveals the of responses of teachers and students on What is the current level of understanding of climate change concepts on teaching and learning in secondary schools in Kogi State, Nigeria, it shows that both teachers and students agreed that they have deeper understanding of climate change concept on teaching and learning in secondary schools in Kogi State, Nigeria. The result corroborate the earlier work of Ogwu (2016) who found that excessive heat due to high atmospheric temperature, brings discomfort in the classroom, and heat related stresses amongst students, a situation that makes teaching and classroom management difficult. Going further Ogwu, noted that the manifestation of climate change which results in high temperature, rainfall and extreme weather events is well known to have impact on school facilities, school activities (Teaching and Learning) and school Attendance.

It also affirms the result of Nwaka and Ezeola (2012) who prior reported that strong winds and floods can damage facilities and physical equipments set outside the classrooms when trees are felled. In the same vein, Das (2008) observes that extreme weather condition leads to additional cost for the rehabilitation of damaged infrastructure which may drain constrained education budgets, disruptions to schooling which have a significant impact on learning. Similarly, Evens, (2020) notes that in July, the UN Environment Programme released a report stating that warmer temperatures are fostering disease transmission both by increasing the population of vectors; including sandflies, mosquitos, and ticks and by increasing the season that the vectors are present. When student and teachers are

afflicted with diseases such as malaria, dengue fever and water-borne infections, or Covid-19 regular school attendance might be a challenge.

The result in research question two reveals the responses of teachers and students on how the teachers in Kogi State integrate climate change topics into the existing curriculum, and the perceive student understanding of these topics., it shows that both teachers and students agreed that the teaching and learning of environmental education plays significant part in mitigating the effect of climate change in secondary schools in Kogi State. The result of this study is in agreement with UNESCO, (2005) observed that climate change education for sustainable development' programme applies innovative educational approaches to help a wide audience (with specific focus on youth), comprehend, address, mitigate, and adjust to the impacts of climate change, encourage the change in attitudes and behaviours needed to place our planet on a more sustainable development part, and assemble a new generation of climate change conscious citizens.

Corroborating, this Jiga & Ujah (2015 noted that climate change and environmental education at the various levels and both formal and non-formal settings are required, inculcating climate change and environmental education at youthful age is in the end the utmost approach to change behaviours and attitudes. However, some researchers like Whitmarsh as cited in Ajaps and Gritter (2015) have contrary opinion noting that education is not an effective approach in promoting environmental education. Yet, the author acknowledged that climate change communication (education) might be effective if there is less dependence on the hype and alarmism that presently characterize communication.

This lends even more credence to the effectiveness of education as an approach to the inculcation of Environmental education and implies that education has to take cognizance of students' knowledge and beliefs to build on them effectively. education has to take cognizance of students' knowledge and beliefs to build on them effectively. De Young (2011) reported that long-lasting change happens only gradually. Similarly, Iizuka (2000) showed that education as an informative instrument for behaviour change has a slow speed of change but more notably, it has a low cost of execution and the length of its effects are long and strong. Know Your Ecosystem' is a participatory programme that provides an outstanding prospect for students to take decisions to improve both school and home environments. It strives to increase environmental awareness of students, staff and communities and to improve school environments through this (initated in 1997).

6. LIMITATIONS AND FUTURE RESEARCH

This study acknowledges some limitations that warrant consideration. Firstly, the sample size of 100 respondents, while aiming for diversity, may not fully capture the complete picture of climate change understanding across Kogi State. Future research could benefit from a larger sample size or even a mixed-methods approach that incorporates qualitative interviews alongside surveys. Secondly, relying solely on self-reported data through surveys can introduce potential bias. Students may not be fully aware of the extent of their understanding, and social desirability might influence responses. Future studies could explore incorporating objective assessments or classroom observations to complement survey data.

Despite these limitations, this study offers valuable insights into climate change education in Kogi State. By identifying knowledge gaps and areas requiring improvement, the research can inform the development of targeted interventions and curriculum enhancements.

7. CONCLUSION

Climate change poses a significant threat to the future of our planet. Equipping future generations with the knowledge and skills to address this challenge is crucial. This study aims to investigate the current understanding of climate change among secondary school students in Kogi State, Nigeria. By identifying existing knowledge gaps, the research seeks to inform the development of targeted environmental education programs, empowering Kogi's youth to become informed and engaged citizens capable of contributing to a sustainable future. Empowering Kogi's youth with a deeper understanding of climate change is not just about fostering informed citizens; it's about cultivating a generation of change makers who can actively contribute to a sustainable future for their communities and beyond.

This research, while acknowledging limitations, offers a valuable springboard for further investigation and action. By implementing the proposed recommendations, Kogi State can empower its secondary school students to become informed and responsible stewards of their environment. The time to act is now. Let's equip the future with the knowledge and skills it needs to navigate the challenges of climate change and build a more sustainable tomorrow.

8. RECOMMENDATIONS

By implementing these recommendations here, Kogi State can equip its secondary school students with the knowledge and skills they need to become informed and responsible citizens who can contribute to a sustainable future for themselves and their communities.
Based on the findings of this study, the fo0llowing recommendations are made:

- **Curriculum Development:** Revise and strengthen the existing climate change education curriculum in Kogi State's secondary schools to ensure a deeper understanding of scientific concepts, causes, impacts, and potential solutions.
- **Teacher Training:** Provide professional development opportunities for teachers to enhance their knowledge and pedagogical skills related to climate change education. This could include training on effective teaching strategies, integrating climate change into existing subjects, and utilizing relevant resources.
- **Community Engagement:** Foster collaboration between schools, local communities, and environmental organizations to create opportunities for student participation in climate-related projects and initiatives.
- **Further Research:** Conduct further research to explore the effectiveness of various climate change education strategies in Kogi State.

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