



# American Journal of Environment and Climate (AJEC)

ISSN: 2832-403X (ONLINE)

VOLUME 3 ISSUE 1 (2024)



PUBLISHED BY  
E-PALLI PUBLISHERS, DELAWARE, USA



## Climate Change: A Correlate of Educational Under-Development in Rivers State, Nigeria

Okoroafor Okechukwu Ucheje<sup>1\*</sup>, Balafama Ipalibo-Wokoma<sup>2</sup>, Obiageli Jacinta Okolo<sup>1</sup>

### Article Information

**Received:** December 05, 2023

**Accepted:** January 09, 2024

**Published:** January 12, 2024

### Keywords

*Climate Change, Education,  
Under-Development, Students,  
Teachers, Academic Performance*

### ABSTRACT

The global focus on climate change has been driven by its profound influence on social, economic, educational, technical, and environmental domains. This research investigated the relationship between climatic change and educational under-development in Rivers State, Nigeria. Three objectives and three hypotheses guided this research. The study utilized a correlational survey design. The population included 286 principals of public senior secondary schools and 18,846 senior secondary school students in Rivers State, Nigeria. The research sample consisted of 559 respondents (167 principals and 392 students). The Taro Yamane method was utilized to determine the sample size. The research questions were analyzed using Simple Regression, while hypotheses were analyzed utilizing t-test associated with regression, at a significance level of 0.05. The results indicated a notable correlation between the view of principals and students about the effect of climate change and the educational underdevelopment in secondary schools. Furthermore, climate change substantially influences students' academic performance in Rivers State, Nigeria. The survey found that the majority of instructors have not received proper orientation on the potential significance of climate change and how to adjust and minimize its influence on teaching and learning. Also, students understand better in the morning hour, which has a tendency to increase their academic performance. The researchers therefore, recommended, amongst others, that classroom lessons or workshop practice should be carried out in the morning and considerably in the evening to enable better student performance; teachers and students should be properly educated on the dangers of climate change and its mitigating measures.

### INTRODUCTION

Climate patterns have a profound impact on natural ecosystems, as well as the economics and cultures of people who rely on them. The climate is now experiencing rapid and disruptive changes at a pace that surpasses any recorded observations from the previous 2,000 years (United Nations, 2014). Increases in atmospheric carbon dioxide and other greenhouse gases have led to global warming, in line with the report "Preparing for a Changing Environment." This has far-reaching consequences, including rising sea levels, melting ice and snow, more intense storms, precipitation, and floods; heatwaves; droughts; and more intense storms and wildfires (Wit, 2011).

The global recognition of climate change stems from its profound influence on several aspects of society, including social, economic, educational, technical, and environmental activities (Edo & Osuji, 2016). To combat the negative effects of climate change on classroom instruction, many public forums, including lectures, seminars, and workshops, have taken place and will take place. Along with natural temperature oscillations, activity from humans likewise modifies the Earth's atmosphere, which causes climate change, according to the United Nations Framework Convention (2010). In line with Buhang, Halvard, and Gleditch (2008) as cited in Unamma and Ubochi (2013) climate change is defined as the alteration of the Earth's temperature and average precipitation. Hayward and Sparkes (2016) established that climate refers to the overall atmospheric conditions

prevailing in a particular nation or area.

The climatic characteristics of an area are determined by the prevailing meteorological conditions, including temperature, humidity, rainfall, and wind (Hayward and Sparkes, 2016). Bunnett and Okurontifa (2014) elucidated that the climate in the southern region of Nigeria is marked by warm temperatures, elevated relative humidity, and abundant rainfall. In line with Evans (2014), weather conditions differ between regions and their impact on the physical and human environment also varies. The physical environment refers to the immediate surroundings, which might consist of natural elements, artificial structures, or a mix of both (Chudley and Greeno, 2016). Climate change impacts the human environment in two distinct ways. It may either create a state of thermal comfort, which enhances the learning experience for students, or cause thermal discomfort for humans in the human environment. Thermal comfort creates a favourable setting for teaching and learning, whereas thermal discomfort hinders the learning atmosphere. A person may experience thermal discomfort in the form of either a sense of heat or a sensation of cold. Hence, a structure utilised for educational purposes must provide an atmosphere that is favourable for effective instruction and acquisition of knowledge. This may be accomplished by designing a structure that acts as an environmental envelope, capable of altering the natural or external surroundings (Forster, 2011).

The education system is experiencing the negative impact of atmospheric disturbances that pose challenges

<sup>1</sup> Centre for Environmental Management and Control, University of Nigeria, Nsukka, Enugu State, Nigeria

<sup>2</sup> Department of Educational Administration, Faculty of Education, University of Port Harcourt, Rivers State, Nigeria

\* Corresponding author's e-mail: [uchejeok21@gmail.com](mailto:uchejeok21@gmail.com)

to academic activity and the running of institutional programmes (Amanchukwu, Amadi-Ali & Olofube, 2015). Many schools in Rivers State experience frequent flooding during the rainy season. However, similar environmental challenges are envisaged in northern part of Nigeria, where several secondary schools are situated in areas that are consistently impacted by whirlwinds and sandstorms. The outcome is the disturbance of educational activities, inadequate instructional delivery, inconsistent class attendance, challenges in maintaining infrastructure and other amenities. The learning processes were significantly impacted by erosion, floods, increased rainfall, severe heat, windstorms, and rainstorms (Amanchukwu, Amadi-Ali & Olofube, 2015).

Several climatic elements are expected to influence the students' perception of thermal comfort in the workshop area. The elements that influence the environment include temperature, humidity, wind (air movement), and sun radiation (Markus and Morris, 2012). In a workshop setting, students may experience thermal or cold sensations when their sense of touch is activated by exposure to a material that generates heat or cold. In addition, it is important to note that even when persons or students in the same workshop area are exposed to the same environmental conditions, their perception of thermal comfort may vary. These variances may be attributed to factors such as age, health condition, level of physical activity, clothing type and quantity, previous exposure to climate, or level of acclimatization (Charderton, 2015; Ayode, 2013).

Moreover, the environment should be capable of effectively and appealingly adapting to the educational purposes it serves, providing not just accommodation but also a unique learning environment (Will and Ovresat, 2014). An optimal classroom or workshop atmosphere can only be reached when the space is free from any negative impact of climatic indicators that may cause discomfort. However, when the impact of climate indicators is deemed significant and exceeds the acceptable or ideal level, physiological stress indicators such as weariness, boredom, restlessness, alertness, and inattentiveness are triggered in students' bodies inside a workshop environment. The students' emotions, learning, and actions are impacted by this phenomenon (O'Halloran, 2008).

Climate changes may significantly impact students' academic performance in classroom and workshop settings, particularly when they have limited time to complete tasks and are greatly exposed to the effects of climate change. Wing (2014) found that there is a noticeable decrease in performance at both very low and high temperatures, and this decrease is statistically significant. This study therefore, assesses education and the challenges of climate change in Rivers State Nigeria.

### Rational for the Study

The subject of climate change has sparked global debate, leading many organizations, educators, and governments

to regularly host workshops, conferences, and seminars focused on strategies for mitigating and acclimatizing to this phenomenon. The influence of climate change extends beyond the environment and affects several aspects such as technology, culture, political environment, and educational practices. The effectiveness of teaching and learning is determined by the degree to which the classroom atmosphere is conducive to capturing the learners' attention.

The teacher's well planned lesson goals for the day may be thwarted by the abrupt onset of climate change. For example, variations in weather conditions such as intense rainfall, cloudy atmosphere reduction in visibility, whirlwinds and storms, high temperatures accompanied by unbearable heat in the classroom, and heavy flooding that disrupts the possibility of learning, often have a tendency to impact the quality of teaching and learning in the school system.

Research findings indicate that climatic change may have both beneficial and negative impacts on a student's thermal comfort, which in turn can influence their performance in various tasks. Therefore, the researchers investigate further into how climate change is related to educational challenges in Rivers State, Nigeria.

### Aim and Objectives of the Study

This study was aimed at investigating the relationship that exists between climate change and educational underdevelopment in Public Secondary Schools in Rivers State. Specifically, the study seeks to:

1. Examine if a significant relationship exists between principals' perception on the impact of climate change and teaching in Rivers State's public secondary schools.
2. Access if a significant relationship exists between students' perception on the impact of climate change and learning in Rivers State's public secondary schools.
3. Investigates if climate change significantly influences the academic performance of public secondary school students in Rivers State.

### Research Questions

1. To what extent does principals' perception on impact of climate change related to teaching in Rivers State's public secondary schools?
2. To what extent does students' perception on impact of climate change related to learning in Rivers State's public secondary schools?
3. Does climate change significantly influence the academic performance of public secondary school students in Rivers State?

### Hypotheses

1. There is no significant relationship between principals' perception on the impact of climate change and teaching in Rivers State's public secondary schools.
2. There is no significant relationship between students' perception on the impact of climate change and learning in Rivers State's public secondary schools.

3. Climate change does not significantly influence the academic performance of public secondary school students in Rivers State.

### LITERATURE REVIEW

Nigeria has distinct dry and rainy seasons, characterized by intense heat and substantial rainfall, which pose challenges for mobility. Excessive rainfall not only leads to extensive flooding and damage to crops and plants, but also compels some families to move to other locations. Individuals have yet to acquire the knowledge and skills necessary to adequately prepare for weather-related calamities, which now occur annually. Climate change has already had and will have far-reaching effects on ecosystems and human lives, in line with scientific research (Amanchukwu *et al.*, 2015).

Although children are the most affected, the current UNICEF study (UNICEF, 2013) emphasized that they should not be seen as docile or feeble. Children can effectively bring about change. Research has shown that many children may exhibit remarkable resilience in the face of significant challenges. UNICEF asserts that providing children with pertinent education on climate change and disaster management may diminish their susceptibility to risk. UNICEF also advocated for sustainable community development. Teaching young people about the challenges of adapting to climate change is an effective way to raise awareness of these issues in communities (UNICEF, 2010).

As a result of the serious and negative effects of climate change on the environment, UNICEF has now focused on developing and implementing solutions to adapt to the changing climate, prepare for disasters, and reduce risks in educational systems throughout the globe. These works aim to integrate environmental challenges, climate change, disaster preparedness, and risk management into the educational system via the lens of child-centered education. Everything from plans and policies to rules and finances to teacher preparation programs, curricula, assessments, physical plants, and learning spaces; leadership and administration is part of the educational system (UNICEF, 2013).

The severe drought results in a food shortage, which subsequently causes hunger impacting the educational capacity of youngsters. Children often relocate with their families to areas that provide protection from floods, which has a detrimental impact on their education by disrupting their studies and perhaps increasing the distance between them and accessible schools. The provision of education for children also leads to the deterioration of residential properties, school structures, and other essential infrastructure, such as roads and bridges. In line with a study in 2014, some school buildings were utilised as temporary housing for those affected by disasters (Amanchukwu *et al.*, 2015). Shelter for flood victims necessitated the temporary closure of two Kilosa primary schools. Because of the shutdown, they were unable to study at home as well (IPP Media, 2011).

The dry and wet seasons of Nigeria are both significantly impacted by climate change. The system is now unbalanced, with extreme heat potentially damaging crops and vegetation and extreme rainfall leading to widespread flooding and forced migration (Amanchukwu, 2015). Ebele and Emodi (2016), Elisha (2017), and Olaniyi (2013) all cited different effects of climate change in Nigeria. Temperature increases, changes in rainfall patterns (less rain in the interior of the continent and more rain on the coast), higher sea levels, more frequent flooding and erosion, drought and desertification, degraded land, more frequent and severe weather events (including lightning, floods, droughts, and bushfires), diminished freshwater resources, and dwindling biodiversity are all consequences of climate change.

The Niger Delta area has been identified in several studies as being susceptible to the effects of climate change, including rising sea levels, heightened precipitation, and the intense industrial activity associated with oil drilling and vehicle emissions (Matemilola, 2019; Ucheje *et al.*, 2021). The evacuation of several villages in some sections of the Niger Delta has been mostly driven by the widespread issues of coastal erosion and flooding (Matemilola, 2019). A recent research conducted by Ucheje and Okolo (2023) has shown that the emission rate stemming from automobiles would persistently escalate, therefore making a substantial contribution to climate change, unless proactive actions are implemented to alleviate this issue. This research explores the possible effect of climate change on the educational system in Rivers State, Nigeria.

### Research Strategy

The correlational research design was utilised in this study. The correlational survey method in line with Nworgu (2006) and Nwankwo (2013) is suitable for this research, since it aims to establish a correlation between two or more ratio-based interval scale variables. Its purpose is to allow for the adjustment of scores. This approach is required for the research as it seeks to establish a correlation between climatic change and educational underdevelopment in public secondary schools in Rivers State, Nigeria.

The population included 286 public senior secondary school administrators and 18,846 senior secondary school students in Rivers State, Nigeria. The research sample consisted of 559 respondents, which include 167 principals and 392 students respectively. The Taro Yamane method was utilized to determine the sample size. The sample size of 559 participants (167 principals and 392 students) in public senior secondary schools was stratified into zones using stratified sampling approach. Data for the research was collected utilizing a self-designed questionnaire called the "Climate Change Questionnaire (CHQ) and Educational Underdevelopment Questionnaire (EUQ)". The questionnaires consisted of 30 items.

Sections A and B of the CHQ and EUQ have 15 questions each, specifically formulated to gather information related

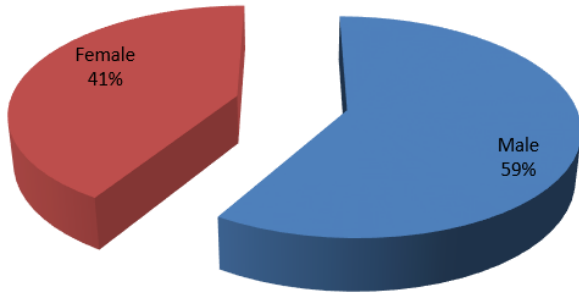
to three research questions. In contrast, section A focused on gathering basic data via direct and uncomplicated questions regarding demographic factors. A revised four-point Likert scale consisting of the categories; Very High Extent (4), High Extent (3), Low Extent (2), and Very Low Extent (1) were utilized to categorize the answers to the questions in each part. The Cronbach Alpha was utilised to ascertain the reliability indices of the instruments. The instruments' high degree of reliability values was shown to be 0.87 and 0.92 respectively. SPSS version 23 was utilized to analyze the data gathered from

the administered instruments. The three hypotheses formulated for the study were evaluated at a significance level of 0.05 using the t-test associated with simple regression analysis, while simple linear regression was used in answering research questions.

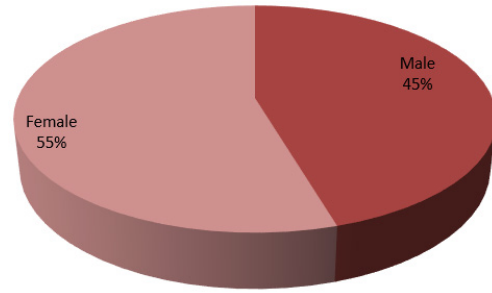
**Presentation of Data Analysis**

**Demographic Data of Participants**

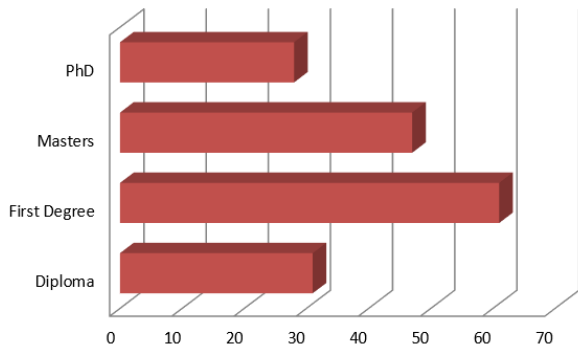
From figure 1, 98(59%) of the school principals (respondents) were male, while 69(42%) of them were females.



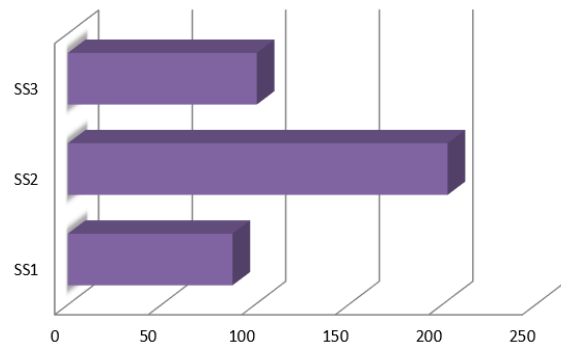
**Figure 1:** Percentage distribution of Principals based on gender



**Figure 2:** Percentage distribution of Students based on gender



**Figure 3:** Percentage distribution of Principals based on highest educational qualification



**Figure 4:** Percentage distribution of Students based on class Level

Figure 2 revealed the gender of students who participated in the survey. It showed that, 178(45%) of the students were male, while 214(55%) of them were female students. It was shown in figure 3, that 31(19%) of principals who participated in the survey has diploma (PGD) as their highest education qualification, 61(36%) of them has first degree, 47(28%) of them has master's degree, while 28 (17%) of principals have a PhD as their highest educational level.

Figure 4, revealed that 88(22%) of students who participated in the survey were in SS1 class, 203(52%) of

them were in SS2 class, while 101(26%) of them were SS3 students.

**Answer to Research Questions**

**Research Question One**

To what extent does principals' perception on impact of climate change related to teaching in Rivers State's public secondary schools?

Table 1 presents the results of the regression analysis, which indicate that the regression squared value is 0.534 and the regression coefficient R is 0.731. This shows

**Table 1:** Simple Regression Analysis on the extent principals' perception on impact of climate change relate to teaching in Rivers State's public secondary schools

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.731 <sup>a</sup>	.534	.533	2.39543	.534	455.509	1	165	.000

that principals' perception on impact of climate change is related to teaching in public secondary schools in Rivers State to a high extent Judging by the coefficient of determination, it shows that 53.4% change in teaching in public secondary schools can be explained by principals' perception on impact of climate change, while 46.6% was

accounted by other variables not measured in this study.

**Research Question Two**

To what extent does students' perception on impact of climate change related to learning in Rivers State's public secondary schools?

**Table 2:** Simple Regression Analysis on the extent \students' perception on impact of climate change relate to learning in Rivers State's public secondary schools

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.863 <sup>a</sup>	.745	.744	1.77209	.745	1161.565	1	390	.000

Table 2 presents the regression squared value of 0.745 and the regression coefficient R of 0.863. Students' perceptions of the effects of climate change and their academic performance at Rivers State's public secondary schools are highly correlated. It is clear from the coefficient of determination that students' perceptions of the effects of climate change account for 74.5% of the variance in learning outcomes in public secondary

schools. Other variables not included in this study have an impact on the remaining 25.5% of the variance.

**Research Question Three**

Climate change does not significantly influences the academic performance of public secondary school students in Rivers State?

Table 3 analysis shows that the regression squared value

**Table 3:** Simple Regression Analysis on the extent climate change influences the academic performance of public secondary school students in Rivers State

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.766 <sup>a</sup>	.587	.586	2.25455	.587	565.505	1	557	.000

was found to be 0.587 and the regression coefficient R was found to be 0.766. This suggests that students' academic performance in Rivers State's public secondary schools is significantly impacted by climate change. In line with the coefficient of determination, climate change is most likely responsible for 58.7% of the variance in academic performance among students attending public secondary schools, with other variables accounting for 41.3% of the variation in performance that was not investigated in this study.

**Hypotheses Testing**

The null hypotheses generated for the research were evaluated utilizing a t-test in associated with simple regression, which examines the connection between variables.

HO<sub>1</sub>: There is no significant relationship between principals' perception on the impact of climate change and teaching in Rivers State's public secondary schools.

Table 4 revealed that principals' perception on the impact of climate change is related to teaching in public secondary

**Table 4:** T-test associated with simple Regression on how principals' perception on the impact of climate change is related to teaching in Rivers State's public secondary schools

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.977	.519		7.668	.000
	Impact of Climate Change	.737	.035	.731	21.343	.000

schools by 0.731. The t-test value 21.343 associated with linear regression is statistically significant at 0.000 when subjected to 0.05 alpha level of significance. However, the null hypothesis was rejected, implying that there is a significant relationship between principals' perception on the impact of climate change and teaching in public secondary schools in Rivers State.

HO<sub>2</sub>: There is no significant relationship between

students' perception on the impact of climate change and learning in Rivers State's public secondary schools.

Table 5 revealed that students' perception on the impact of climate change is related to learning in public secondary schools by 0.863. The t-test value 34.082 associated with linear regression was statistically significant at 0.000 when subjected to 0.05 alpha level of significance. However, the null hypothesis was rejected, implying that there is

**Table 5:** T-test associated with simple Regression on how students’ perception on the impact of climate change is related to learning in Rivers State’s public secondary schools

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.349	.374		6.275	.000
	Impact of Climate Change	.842	.025	.863	34.082	.000

a significant relationship between students’ perception on the impact of climate change and learning in public secondary schools in Rivers State, Nigeria.

HO<sub>3</sub>: Climate change does not significantly influence the academic performance of public secondary school students in Rivers State, Nigeria.

Table 6 revealed that climate change influences the

academic performance of public secondary school students by 0.766. The t-test value 23.780 associated with linear regression was statistically significant at 0.000 when subjected to 0.05 alpha level of significance. Notably, the null hypothesis was rejected, indicating that climate change significantly influences the academic performance of public secondary school students in Rivers State.

**Table 6:** T-test associated with simple Regression on how climate change influences the academic performance of public secondary school students in Rivers State, Nigeria

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.001	.466		8.592	.000
	Impact of Climate Change	.737	.031	.766	23.780	.000

**DISCUSSION OF FINDINGS**

The data reported in tables 1-3 demonstrate a robust correlation between climatic change and the academic achievement of secondary school students. Teaching and learning were closely linked to variations in meteorological conditions. Research conducted by Akuegwu, Nwue, and Etudor-Eyo (2013) found that the impact of climate change, which occurs from extreme heat, had a notable correlation with the teaching and learning processes in educational institutions. In other words, high temperatures affect the degree to which students engage in classroom activities. This aligns with the results of the current investigation.

Hammer and Price (2011) established that there is a consensus about the detrimental impact of elevated temperatures on performance, while there are varying viewpoints on the extent and threshold at which performance degradation occurs. The statement above aligns with the findings of the current investigation. This indicates that in the event of excessively high temperatures, there is a consequential increase in heat, which may lead to physical discomfort. Such conditions are not conducive to effective teaching procedures.

Similarly, the research conducted by Burberry (2016) aligns with the current study. He reported that the level of activity of a person has a significant impact on the optimal temperature for comfort. In addition, he disclosed that when students are in a workshop or classroom with high temperature and relative humidity, and minimal air circulation, their metabolic rate increases. High metabolic rate may lead to a rise in body temperature, which in turn can produce heat, tension, and discomfort throughout the learning process.

Ayoade (2013) supported the above view by explaining

that flooding, windstorm and whirlwind disrupt or affect the academic activities in secondary schools. This implies that rainstorm with awful thunder and lightning, excessive heat and greenhouse gases effect can discourage teaching and learning.

Furthermore, Lind (2013) opined that students in secondary schools achieve thermal comfort in the morning hours while afternoon sun (heat) affects the student’s level of understanding in secondary schools. Markins and Morris (2012) observed that higher temperature is more disturbing for an individual in carrying out a given task. This implies that as a result of adverse effect of climate change, evening classes is more preferred that afternoon classes. Students have higher chances of understanding better in the morning hours, thereby advancing their academic performance. Therefore, the outcome of this research has demonstrated that climate change negatively influences academic performance of public secondary school students in Rivers State, Nigeria, and requires immediate attention.

**CONCLUSION**

Based on the findings of this stud, it was concluded that a significant relationship exist between principals’ perception on the impact of climate change and teaching; students’ perception on the impact of climate change and learning and climate change significantly influences the academic performance in public secondary schools in Rivers State, Nigeria. These however, have demonstrated the role climate change play towards teaching and learning in public secondary schools that has no modern facilities especially, Rivers State, Nigeria. Moreover, the issue of climate change which has gained global attention poses a serious threat to developing economy like Nigeria, which

is characterized by widespread poverty, fragile health care systems, and weak governmental institutions, requires studies on whether it has an adverse effect on secondary education. Hence, this study fills the gap, by not only relating climate change to educational instability among public secondary school students, but creating awareness on what needs to be done in mitigating its impact.

#### Contributions to the study

This study has been able to reveal climate change as one of the major causes of educational underdevelopment in Rivers State, Nigeria. Secondary school teachers by this study have gotten insight on what period of the day students prefers to learn for better performance. Also, from the findings of this study, awareness has been raised in understanding the vital role educating students on climate change will play, in coping environmental challenges

### RECOMMENDATIONS

In line with the study's results and conclusion, the following recommendations are made:

1. Classroom lessons or workshop practice should be carried out in the morning and considerably in the evening, to enable better performance by the students.
2. Classrooms should be well spaced and not overcrowded, to enable proper ventilation for students learning.
3. Teachers and students should be properly educated on dangers of climate change and its mitigating measures.
4. Artificial ventilation such as fans, air conditioners should be provided in the classrooms, to aid ventilation.
5. Encouraging tree planting in secondary schools would significantly mitigate the impact of climate change.

### REFERENCES

Akuegwu, B. A., Nwi-ue, F. D., & Etudor-Eyo, E. (2013) Lecturers' Participation in Capacity Building Programmes in South-South Nigeria: Implications for Sustainable Development. *Makerere Journal of Higher Education*, 4(2), 279-292

Amanchukwu, R. N. (2015). Climate change education in Nigeria: The role of curriculum review. *Education*, 5(3), 71-79.

Amanchukwu, R. N., Amadi-Ali, T., & Olorube, N. P. (2015) Climate Change Education in Nigeria: The Role of Curriculum Review. *Education*, 5(3), 71-79

Ayoade, J. O. (2013). *Introduction to Climatology for the Tropics*. Ibadan: Spectrum Books Ltd.

Bunnet, R. B., & Okunrotifa, P. O. (2014). *General Geography in Diagrams for West Africa*. Essex England: Longman Group Ltd.

Burberry, P. (2016). *Environment and Services*. London: B.T. Batsford.

Charderton, D. V. (2015). *Building Services Engineering*. London: E & FN Spon.

Chuldley, R., & Greeno, R. (2016). *Building construction hand book*. (11th Edition), Routledge, London

Ebele, N. E., & Emodi, N. V. (2016). Climate change and

its impact in Nigerian economy. *Journal of Scientific Research & Reports*, 10(6), 1-13.

Edo, B. L., & Osuji, C. (2016). Teachers and Students' Perception of Climate Change Dimensions on Teaching/Learning in Secondary Schools, Port-Harcourt Local Government Area, Rivers State. *International Journal of Education and Evaluation*, 2(3), 43-50

Elisha, I. (2017). Evidence of climate change and adaptation strategies among grain farmers in Sokoto State, Nigeria. *IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT)*, 11(3), 1-7.

Evans, M. (2014). *Tropical Design*. In P. Tutt & D. Adle (Eds). *New Metric Handbook* (pp. 402-511). London: Architectural Press Ltd.

Foster, J. S. (2011). *Structure and Fabric Part 1*. London: B. T. Batsford.

Hammer, W., & Price, D. (2011). *Occupational Safety Management and Engineering*. New Jersey: Prentice-Hall Inc.

Hayward, A. L., & Sparkes, J. J. (2016). *Cassell's English Dictionary*. London: Cassell and Co. Ltd.

IPP Media (2011). Can climate change impact on education achievement? Available from <http://www.ippmedia.com/frontend/index.php?l=30822> [Accessed 12th May 2023]

Lind, A. R. (2013). Tolerable Limits for Prolonged and Intermittent Exposures. In J. D. Hardy (Ed), *Temperature – Its Measurement and Control in Science Industry*, 3(2), 337- 335 New York: Reinhold.

Markus, T. A., & Morris, E. N. (2012). *Building Climate and Energy*. London: Pitman Publishing Ltd.

Matemilola, S. (2019). Mainstreaming climate change into the EIA process in Nigeria: Perspectives from projects in the Niger Delta Region. *Climate*, 7(2), 29

Nwankwo, O. C. (2013). *A practical Guide to Research Writing*. Port Harcourt: Pam Unique Publishers Co. Ltd.

Nworgu, B. G. (2006). *Educational Research Basic issues and methodology*: Ibadan. Wisdom Publishers Ltd. Nigeria.

O'Halloran, K. L. (2008) Systemic functional-multimodal discourse analysis (SF-MDA): constructing ideational meaning using language and visual imagery. *Visual Communication*, 7(4), 443-475

Olaniyi, O. A. (2013). Review of climate change and its effect on Nigeria ecosystem. *International Journal of African and Asian Studies*, 1, 57

Ucheje, O., Ogbuene, E. B., & Ofoezie, I. E. (2021) Modeling of CO and PM2.5 Concentration Level in High Traffic Density Areas, using Regression Model. *International Journal of Environment and Pollution Research*, 9(3), 33-50

Ucheje, O. O., & Okolo, (2023) Contribution of Vehicular Emissions to Climate Change in Nigeria: A Closer Look. *International Journal of Environment and Pollution Research*, 11(1), 43-62

- Unamma, A. O., & Ubochi, I. (2013). Extent of Nigerian Teachers' Utilization of Climate Change Adaptation Practice Charts as Curriculum Learning Materials for Effective Instruction. *International Journal of Arts and Commerce*, 5(6), 55
- UNICEF (2010). Climate change. Available from [www.unicef.org/cfs/...UNICEF-ClimateChange-ResourceManual-lores-c.pdf](http://www.unicef.org/cfs/...UNICEF-ClimateChange-ResourceManual-lores-c.pdf). [Accessed 5th May 2023]
- UNICEF (2013). Chair of the United Nations inter-agency committee (IAC) decade on education for sustainable development. Available from [www.unicef.org/education/bege-61668.html](http://www.unicef.org/education/bege-61668.html). [Accessed 29th April 2023]
- United Nations (2014). IPCC Report: 'severe and pervasive' impacts of climate change will be felt everywhere. Available from <http://www.un.org/climatechange/blog/2014/03/ipcc-report-severe-and-pervasive-impacts-of-climate-change-will-be-felt-everywhere/>. [Accessed 19th May 2023]
- United Nations Framework Convention on Climate Change (2010). Available from: [http://unfccc.int/essential\\_background\\_I\\_convention/background/items](http://unfccc.int/essential_background_I_convention/background/items). [Accessed 2nd May 2023]
- Will, Jr, P., & Ovresat, R.C. (2014). Educational – Elementary and Secondary School. In J.H. Callendar, (Ed).Time Saver Standard for Building Types, (pp. 169-172) New York: McGraw-Hill Book Company.
- Wing, J. M. (2014) Computational thinking benefit societies. Available from: Fonte: <http://socialissues.cs.toronto.edu/2014/01/computational-thinking/> [Accessed 10th May 2023]
- Wit, S. D. (2011). Global Warning. Available from <http://www.ascleiden.nl/Pdf/thesis-dewit.pdf>. [Accessed 17th May 2023]