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Research Article

The Impact of Environmental Hazards on the Academic Performance of Public Secondary School Students

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Abstract

Environmental factors significantly influence students' academic performance, with hazardous conditions posing notable impediments to educational outcomes. This study investigated the impact of environmental hazards—air pollution, noise pollution, and flooding—on the academic performance of students in public secondary schools in the South-South region of Nigeria. Three objectives and corresponding hypotheses guided the research. Employing a correlational survey design, the study targeted all principals of public secondary schools in the region. A purposive sampling technique was used to select a sample of 240 principals representing six states in South-South Nigeria. Data were collected using two self-designed instruments: the Environmental Hazards Questionnaire (EAQ) and the Academic Performance Questionnaire (APQ). Reliability testing of the instruments yielded coefficients of 0.91 and 0.88, respectively, indicating high reliability. Data analysis was conducted using simple regression to address the research questions, while hypotheses were tested using the t-test associated with simple regression at a 0.05 significance level. The results revealed that air pollution, noise pollution, and flooding have a significant and negative impact on students' academic performance. Specifically, air pollution contributes to health issues that disrupt students' focus and attendance, while noise and flooding interfere with the learning environment and academic activities. The study concluded that mitigating these environmental hazards is essential for enhancing academic performance in public secondary schools. Recommendations include implementing policies to minimize air and noise pollution around school environments and adopting effective flood management strategies to safeguard academic infrastructure and activities.

Keywords: Academic Performance; Air Pollution; Flooding; Learning Environment; Noise Pollution.

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1. INTRODUCTION

Academic performance, or success, refers to how a student, instructor, or educational institution achieves its short-term or long-term educational objectives. Academic success is a student's ability to fulfill the demands of their enrolled courses, often measured through their Grade Point Average (GPA) [1]–[3]. Beyond GPA, academic achievement encompasses proficiency across various domains, including classroom activities, extracurricular pursuits, athletic prowess, communication skills, and cultural engagement, all indicators of a well-rounded individual [4], [5].

Basri, Alandejani, and Almadani [6] emphasize that academic performance reflects the development of students' personalities, progression through educational levels, and the enhancement of their knowledge and skills. This is typically assessed using GPAs and standardized test scores. High academic performance is a shared goal among students, educators, and other educational stakeholders, as it represents the culmination of learning efforts and institutional effectiveness.

The learning environment has a profound influence on academic achievement. An educational setting that prioritizes academic success and fosters a passion for learning enhances collaboration between students and instructors. Students

thrive in environments that encourage intrinsic motivation and provide suitable instructional techniques, adequate physical facilities, and a supportive psychological atmosphere [7], [8]. A pristine, tranquil, and comfortable learning environment is essential, with factors such as temperature, lighting, and noise control playing significant roles [9]–[11]. Similarly, Daisey, Angell, and Apte [12] emphasize the importance of indoor air quality in enhancing cognitive performance and concentration among students.

Environmental risks, defined by Nunoo, Panin, and Essien [13] as sources of potential harm to individuals within the built environment are significant yet often overlooked determinants of academic performance. Research by Grineski, Clark-Reyna, and Collins [14] highlights pervasive environmental health concerns in schools, frequently neglected in educational discourse. For example, noise pollution, a common environmental hazard, has a significant impact on students' academic performance. Gilavand and Jamshidnezhad [15] found that noise pollution in Iran—from internal sources, such as construction and vehicular noise, and external sources, including students in corridors—adversely affects academic outcomes.

Water pollution is another critical environmental challenge. Ahmed et al. [16] identified untreated sewage, garbage dumping, and industrial effluents as major contributors to water contamination. Such pollution poses significant health risks and hinders academic performance by negatively impacting students' physical well-being. Alyasi and Isaifan [17] underscore the importance of managing solid and liquid waste to achieve a sustainable environment and community, noting that waste management challenges are exacerbated by rapid urbanization, economic growth, and industrial development. Research by Asadullah [18] further supporting these findings, research highlights that prolonged exposure to contaminated water sources is correlated with increased absenteeism due to waterborne illnesses, ultimately affecting academic performance.

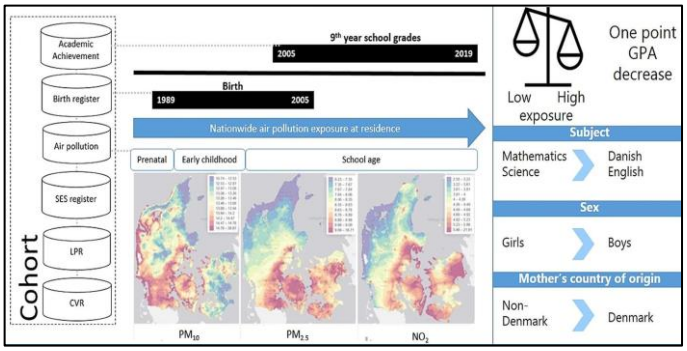

Figure 1. Lifetime Exposure to Air Pollution with Students' Academic Achievement [19].

According to Figure 1, air pollution has a negative impact on children's cognitive development and academic performance. This study confirms that long-term exposure to PM2.5 and PM10 is correlated with lower exam scores, particularly in math and science. Girls and children with non-Danish mothers are particularly vulnerable. These findings underscore the importance of environmental interventions in safeguarding children's cognitive development and academic achievement, such as reducing emissions and enhancing green spaces around schools.

Climate change and ecosystem imbalances contribute to long-term environmental challenges. Floods, for instance, have been shown to significantly disrupt educational environments. Basit, Rahman, Ibrahim, and Jumani [20] reported that floods in Pakistan caused trauma, infrastructure destruction, and educational interruptions, imposing severe social, emotional, and intellectual challenges. Pietro [21] studied the effects of the L'Aquila earthquake in Italy, finding those natural disasters negatively impacted students' academic performance by creating traumatizing conditions and disrupting study routines. Climate-related disasters such as flooding disproportionately affect marginalized communities, where access to alternative education methods or resources is limited [22].

Despite the growing body of research linking environmental challenges to academic outcomes, these issues remain underexplored, particularly in secondary schools. Studies addressing the impact of air pollution, noise pollution, and flooding on academic performance are sparse, especially in developing countries like Nigeria. Orlu [23] notes that while the environment significantly influences individuals' lives, it is often undervalued as a determinant of academic achievement. Existing studies are primarily concentrated in Asia and other developed regions, leaving a gap in understanding the collective impact of environmental factors on the academic performance of secondary students in African contexts.

This study aims to address this gap by examining the interplay between environmental challenges and academic performance among secondary school students. By focusing on air pollution, noise pollution, and flooding, the research seeks to provide a comprehensive understanding of how these environmental factors influence academic outcomes. Findings from this research will contribute to the development of targeted interventions for improved educational performance, including practical recommendations for mitigating environmental risks and promoting resilience within school communities.

2. LITERATURE REVIEW

2.1. Environmental Hazards

Environmental contamination has emerged as a critical issue in education, influencing student health and academic performance. Appannagari [24] categorizes environmental contamination into various subtypes: air, water, land, food, noise, and radioactive pollutants. Pollution-related events such as acid rain, urban heat islands, and flash floods exacerbate these challenges, particularly in urban areas. Sun and Zhu [25] emphasize that outdoor air pollution is associated with severe health conditions such as cardiovascular diseases, lung cancer, respiratory ailments, asthma, and adverse pregnancy outcomes. These health issues invariably affect students, resulting in reduced classroom attendance and impaired cognitive performance.

However, the impact of environmental pollution is not limited to external factors. Indoor environmental quality, particularly inadequate air circulation and poor classroom ventilation, plays a critical role in learning outcomes. Poor indoor air quality leads to elevated carbon dioxide levels and the accumulation of harmful substances, such as volatile organic compounds from carpets, paints, and furnishings. This, in turn, directly impairs cognitive functioning. The Indoor Air Program at the University of Tulsa analyzed 140 classrooms across 70 schools. Students in poorly ventilated classrooms scored 74 points lower on standardized exams, highlighting a significant correlation between air quality and academic achievement [26].

Furthermore, Mohai, Kweon, Lee, and Ard [27] identified 12 harmful compounds, including diisocyanatos', cobalt, and glycol ethers, constituting 95% of classroom air pollutants. Poor indoor air quality was also linked to increased absenteeism, emphasizing the connection between environmental health and academic outcomes. This aligns with findings by Grineski, Clark-Reyna, and Collins [14], who reported that schools in highly polluted environments experienced lower standardized test scores, suggesting that environmental stressors impact individual students and institutional performance.

The effects of air pollution extend beyond academic achievement to broader developmental concerns [28]. Air pollution was linked to attention deficits, impaired brain development, behavioral disorders, and heightened absenteeism [29], [30]. The adverse effects were particularly pronounced in students with pre-existing respiratory conditions, such as asthma, which exacerbated fatigue, reduced concentration, and led to more frequent absences.

The presence of environmental hazards within school settings is a growing concern. Rickinson [31] argues that nearly all aspects of the human environment can pose risks, and schools—where students spend a significant portion of their time—are no exception. Keles [32] categorizes environmental hazards into natural and human-made. Natural hazards, such as earthquakes and floods, differ from human-generated hazards, including fires, industrial accidents, traffic-related incidents, and inadequate waste management. These hazards degrade the environment, negatively impact health, and increase trauma and stress levels, particularly among vulnerable populations.

Flooding is among the most significant environmental hazards impacting school infrastructure and student performance. Chaudhary and Timsina [33] analyzed the effects of flooding on school facilities, community resources, and educational outcomes. Their findings indicate that flooding disrupts access to education, damages school infrastructure, and undermines students' sense of safety and stability. In flood-prone areas, students experience higher dropout rates, reduced performance, and increased anxiety, particularly when their homes and schools are severely affected. These disruptions impair individual academic outcomes and exacerbate existing educational inequalities.

Environmental contamination and hazards impact not only student performance but also school operations, teacher effectiveness, and community engagement. Earthman [34] underscores the importance of high-quality school infrastructure, noting that well-maintained facilities with proper ventilation, noise insulation, and clean environments are essential for optimal learning. Conversely, poorly maintained schools contribute to health problems, absenteeism, and lower academic achievement.

Research by Tanner [35] highlights that environmental design elements such as natural lighting, thermal comfort, and acoustic quality enhance teaching effectiveness and student engagement. Schools in economically disadvantaged areas are disproportionately affected by environmental hazards, exacerbating educational disparities [36]. These findings underscore the importance of equitable investment in school infrastructure to mitigate the adverse effects of environmental contamination.

2.2. Learning Environment

Learning plays a crucial role in enhancing students' academic performance. Numerous studies indicate that physical, social, and psychological conditions within the school environment significantly contribute to students' learning outcomes. Supportive environments enable students to focus better, remain motivated, and engage actively in learning activities.

Shamaki [37] examined the impact of the learning environment on students' academic achievement in Yobe State, Nigeria. His findings revealed that students studying in ideal environments showed significant improvements in performance compared to those in less supportive settings. Well-designed classrooms, adequate furniture, quality teaching materials, and controlled class sizes positively influence academic performance [38], [39].

In another context, Mudassir and Norsuhaily [40] studied the effect of school climate on student performance in Kuala Terengganu, Malaysia. Their research demonstrated that schools with adequate resources, competent teachers, and a supportive atmosphere yielded better academic results than those with suboptimal conditions. Duruji, Azuh, and Oviasogie [41] reported similar findings, identifying that school aesthetics, facility maintenance, cleanliness, class size, and location significantly affect students' external examination results in Ota, Nigeria. A positive classroom climate significantly influences students' academic performance, with student engagement amplifying this effect [42]–[44]. Additional environmental factors such as lighting, color usage, open spaces, and school art are vital in creating a supportive learning atmosphere [15], [45], [46]. These factors highlight that the physical elements of the learning environment, both at the primary and secondary levels, have a substantial influence on students' academic success.

Eimuhi and Ogedegbe [47] highlighted that rich learning environments provide extensive academic and non-academic benefits in Edo State, Nigeria. Meanwhile, school atmosphere, discipline, and infrastructure quality boost students' academic performance [48]–[50]. These studies reinforce the notion that inadequate learning environments can pose significant barriers to the academic potential development of students.

Numerous global studies support the view that high-quality learning environments have a profound impact on

students' academic performance. Fraser (2013) explained that the learning environment encompasses physical, social, and emotional elements that collectively create a supportive atmosphere for learning [51]. In a study by Blackmore et al. (2011) in Australia, researchers found that flexible classroom designs that facilitate active interaction between students and teachers significantly enhance learning outcomes [52].

Lizzio, Wilson, and Simons [53] underscored the importance of students' perceptions of their learning environment, such as resource availability and a supportive social atmosphere, in fostering academic engagement. Access to quality educational resources, including technology, positively influences student performance [54], [55]. Tanner [35] emphasized the significance of physical design elements in creating conducive learning environments, including natural lighting, optimal acoustics, adequate ventilation, and appropriate color use. Conversely, poor physical conditions, such as high noise levels and inadequate ventilation, could impede concentration and academic performance [34], [56], [57].

2.3. Noise Pollution

Noise pollution is a significant environmental factor affecting student performance, cognitive functions, and overall well-being. Research demonstrates that external and internal noise sources can disrupt learning, hinder cognitive development, and impair academic achievement [58]–[60].

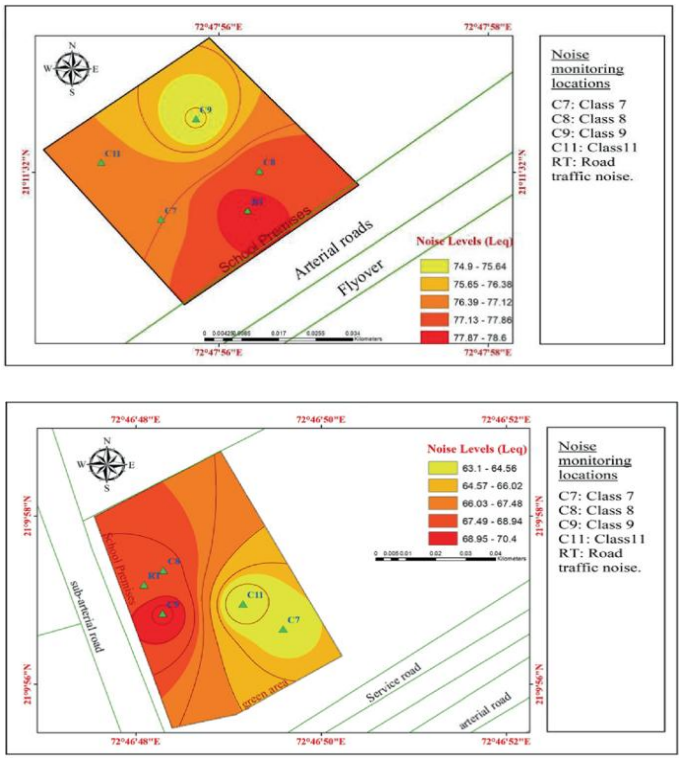

Figure 2. Level of a Noisy Classroom [61].

Figure 2 illustrates the study by Shukla and Tandel, which highlights the increased classroom distractions caused by road traffic noise. Approximately 67% of students reported difficulty with speech intelligibility, and 78% struggled with concentration. The study highlights the adverse effects of traffic noise on academic performance and the well-being of schoolchildren. Dockrell and Shield [62] provided further insights into the adverse effects of classroom noise on student outcomes. They reported that excessive noise in primary schools disrupted communication between teachers and students, reducing language comprehension and task performance. Long-term exposure to high noise levels was associated with lower academic achievement, particularly in literacy and numeracy skills.

Braat-Eggen, van Heijst, Hornikx, and Kohlrausch [63], studied students' perceptions of noise in five open study spaces in the Netherlands. They found that approximately 38 percent of students were distracted by background noise and speech, particularly when engaging in cognitively demanding activities such as reading, writing, and exam preparation. Similarly, Bulunuz et al. [64] compared noise levels in public and private elementary schools in Turkey, highlighting that public schools experienced significantly higher decibel levels (82.18 dBA versus 74.56 dBA), negatively affecting students' focus and classroom engagement.

The cognitive effects of noise pollution are well-documented. Bhang et al. [65] investigated noise's impact on 268 students in Korea, finding that loud noise environments significantly impaired sustained attention and cognitive performance, as measured by Stroop tests and IQ-based assessments. Clark et al. [66] conducted a large-scale study examining the impact of aircraft noise on reading comprehension in children near major airports in Germany, the UK, and the Netherlands. Their findings revealed a linear relationship between higher noise levels and reduced reading performance, with students exposed to louder environments consistently scoring lower.

Students with special educational needs, such as ADHD, are particularly vulnerable to noise pollution. Batho, Martinussen, and Wiener [67] explored the effects of noise on 52 youths with ADHD, discovering that while white noise improved reading fluency, it did not enhance writing accuracy or organizational skills.

Noise pollution also affects students' physical and mental health. Basner et al. [68] highlighted how nocturnal exposure to traffic noise disrupted adolescent sleep quality, impairing memory consolidation and daytime alertness. Chronic noise exposure has also been linked to elevated stress levels, which can indirectly hinder academic performance. Smith [69] explored noise exposure among 327 university students and found limited direct effects on health but significant impacts on stress and study habits. Noise-induced Stress can lead to reduced motivation, lower academic persistence, and poorer time management.

The socio-economic context of noise pollution cannot be ignored. Schools near busy urban streets were more likely to face challenges in maintaining a conducive learning environment due to higher noise exposure [70]–[72]. Students in quieter classrooms achieved significantly higher reading levels than their peers in noisy environments, such as those near elevated subway tracks [62], [73]–[75].

3. MATERIAL AND METHODS

3.1. Research Design

The study employed a correlational research design, a widely recognized approach for investigating the nature and strength of relationships among multiple variables measured on a ratio or interval scale. This design is particularly well-suited for studies aiming to identify patterns, associations, or predictive links without manipulating the variables, as supported by prior research [76], [77]. This design facilitates the statistical correction of scores, aligning with the study's primary goal of exploring the relationship between environmental hazards and the academic performance of pupils in public secondary schools in South-South Nigeria.

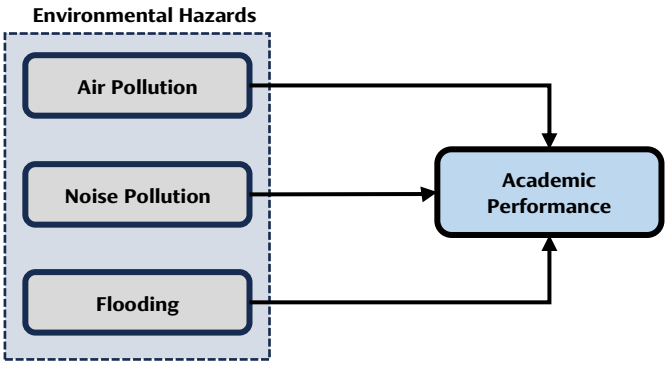

Figure 3. Conceptual Framework Relationship between Environmental Hazards and Academic Performance.

3.2. Population and Samples

The study targeted a population comprising secondary school principals across six states in South-South Nigeria: Rivers, Bayelsa, Akwa Ibom, Edo, Delta, and Cross Rivers. This region was chosen due to its diverse environmental challenges, which could impact academic performance.

The researchers employed purposive sampling to ensure a representative and purposeful sample. This method was chosen because it allows for the deliberate selection of participants who will most likely provide meaningful insights aligned with the study's objectives [78]–[80].

A total of 240 principals were selected for the study, with 40 principals from each of the 6 states. This distribution ensured coverage of the region's diverse demographic and institutional characteristics, providing a robust foundation for a comprehensive analysis. The purposive sampling strategy was particularly suitable as it captured a wide range of perspectives and experiences from public secondary schools, enhancing the reliability and validity of the findings.

3.3. Research Instruments

The study utilized two custom-designed questionnaires, the Environmental Hazards Questionnaire (EAQ) and the Academic Performance Questionnaire (APQ), as primary data collection tools. These instruments were meticulously developed to align with the study's objectives and to ensure their relevance in capturing data on environmental hazards and their potential impact on academic performance. Each questionnaire was structured into two main sections. Section A collected demographic information about the respondents, including age, gender, years of professional experience, and school location, providing essential context for the study. Section B, on the other hand, consisted of 30 carefully constructed questions designed to address the study's research objectives. The questions employed a modified 4-point Likert scale with response options ranging from "Very High Extent" (4) to "Very Low Extent" (1). Using a Likert scale was instrumental in quantifying perceptions, enabling nuanced analysis of subjective responses [81], [82].

3.4. Instrument Reliability

To ensure the reliability of the instruments, the test-retest method was employed. This method involved administering the instruments to the same subset of respondents at two different intervals, yielding reliability coefficients of 0.91 for the EAQ and 0.88 for the APQ. These coefficients indicate excellent reliability, surpassing the generally accepted threshold of 0.70 for social science research [83]–[85]. Such high reliability underscores the consistency and dependability of the instruments in measuring the intended variables.

3.5. Data Collection and Analysis

The data collected through the questionnaires were analyzed using IBM SPSS, a robust statistical software widely recognized in social science research [86], [87]. The research questions and hypotheses guided the analysis. Simple regression analysis was employed to investigate the relationships between environmental hazards and academic performance, providing insight into the strength and direction of these relationships. Hypothesis testing was conducted at a significance level of 0.05, employing the t-test associated with simple regression analysis. This approach ensured rigorous statistical validation and facilitated the derivation of meaningful conclusions [88].

4. RESULTS

The analysis presents the findings from the regression analyses conducted to assess the impact of various environmental hazards on the academic performance of public secondary school students in South-South Nigeria. Researchers evaluated each environmental factor—air pollution, noise pollution, and flooding—to determine its significance and specific contribution to variations in student academic achievement. The results, summarized in Tables 1, 2, and 3, provide detailed insights into how these environmental hazards impact educational outcomes and underscore the urgent need for interventions to mitigate their effects. By examining these relationships, the study aims to clarify how environmental conditions directly affect students' academic performance in the region.

Table 1. Correlation Coefficient on Air Pollution and Academic Performance

R	R-Square	Adjusted R-Square	Std. Error of the Estimate	Change Statistics				
				R-Square Change	F-Change	df1	df2	Sig. F-Change
0.731	0.534	.533	2.39543	0.534	455.509	1	238	0.000

Table 2. Correlation Coefficient on Noise Pollution and Academic Performance

R	R-Square	Adjusted R-Square	Std. Error of the Estimate	Change Statistics				
				R-Square Change	F-Change	df1	df2	Sig. F-Change
0.863	0.745	0.744	1.77209	0.745	1161.565	1	238	0.000

Table 3. Correlation Coefficient on Flooding and Academic Performance

R	R-Square	Adjusted R-Square	Std. Error of the Estimate	Change Statistics				
				R-Square Change	F-Change	df1	df2	Sig. F-Change
0.766	0.587	0.586	2.25455	0.587	565.505	1	238	0.000

The data reveals significant insights into the influence of environmental hazards on the academic performance of public secondary school students in South-South Nigeria. Table 1 indicates that the regression squared value is 0.534, and the regression coefficient (R) is 0.731. This strong correlation suggests that air pollution has a considerable adverse effect on student learning outcomes. Specifically, while other factors account for 46.60 percent of the variation in academic performance across public secondary schools, air pollution alone explains 53.40 percent of this variation, underscoring its critical role in hindering educational achievement.

Table 2 presents the derived values for the regression squared and the regression coefficient (R), which are 0.745 and 0.863, respectively. These results further suggest that noise pollution has a significant impact on students' academic performance in South-South Nigeria. The coefficient of determination analysis reveals that noise pollution accounts for a substantial 74.50% of the variance in students' academic performance, with the remaining 25.50% attributable to other confounding factors. This highlights the pressing need to address noise pollution in educational settings, thereby fostering better learning environments.

Table 3 estimates a squared regression value of 0.587, and the regression coefficient (R) is determined to be 0.766. This evidence suggests that flooding also has a significantly negative impact on the academic achievement of students in public secondary schools in the region. Specifically, flooding accounts for 58.70 percent of the variation in students' academic performance, while other factors account for 41.30 percent. These findings collectively underscore the urgent need for policy interventions to enhance environmental conditions within schools, as they are crucial for maximizing students' academic potential and overall educational success.

Table 4. Regression Coefficient on Air Pollution and Academic Performance

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	3.977	0.519		7.668	0.000
Air Pollution	0.737	0.035	0.731	21.343	0.000

Table 5. Regression Coefficient on Noise Pollution and Academic Performance

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2.349	0.374		6.275	0.000
Noise Pollution	0.842	0.025	0.863	34.082	0.000

Table 6. Regression Coefficient on Flooding and Academic Performance

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	4.001	0.466		8.592	0.000
Flooding	0.737	0.031	0.766	23.780	0.000

The data presented in Table 4 reveals a significant correlation of 0.731 between air pollution and students' academic achievement in public secondary schools, as evidenced by t-test and regression analysis. The t-test result of 21.343, related to the linear regression, achieved statistical significance at the 0.000 level when tested at the 0.05 alpha level, leading to the implicit rejection of the null hypothesis. This suggests that air pollution negatively impacts the academic performance of public secondary school pupils in South-South Nigeria.

In addition to air pollution, Table 5 reveals a significant correlation of 0.731 between noise pollution and students' academic achievement. The linear regression-related t-test result of 34.082, tested at the 0.05 significance level, also yielded statistical significance with a p-value of 0.000. Consequently, the null hypothesis was implicitly rejected, indicating that noise pollution has a severe impact on the academic performance of students in public secondary schools in South-South Nigeria.

Table 6 demonstrates that students' academic performance declines by 0.766 points in the presence of flooding. The t-test result of 23.780, associated with the linear regression analysis, showed statistical significance at the 0.000 level when tested at the 0.05 alpha level, resulting in the implicit rejection of the null hypothesis. Therefore, these findings confirm that flooding has a substantially negative impact on the academic achievement of students attending public secondary schools in the South-South region of Nigeria. These results underscore the need for immediate and effective interventions to mitigate the adverse effects of environmental hazards on educational outcomes in this region.

5. DISCUSSIONS

3.1. Impact of Air Pollution on Academic Performance

Table 1 demonstrates a strong correlation between air pollution and students' academic performance. In contrast, Table 4 provides additional evidence indicating that air pollution has a substantially negative impact on students' academic performance in public secondary schools in South-South Nigeria. The study identified twelve compounds, including diisocyanatos, cobalt, and glycol ethers, which accounted for up to 95% of the total pollutants found in classroom air. These findings align with Mohai, Kweon, Lee, and Ard [27] research showed that indoor air pollution significantly affects students' health and concentration.

Furthermore, students' attendance rates were lowest in schools located in regions with the highest levels of air pollution. This suggests that air pollution may have a negative impact on students' health, leading to increased absenteeism. Higher absenteeism has a direct impact on students' academic performance. Grineski, Clark-Reyna, and Collins [14] found that higher school pollution levels correlated with lower aggregate standardized test scores, likely due to increased respiratory problems and cognitive impairments.

Air pollution has been associated with difficulties in attention, cognition, and behavior among children, as well as their academic performance, absenteeism, and brain development [14], [19], [29]. These results demonstrate that air pollution impacts students' physical health and their ability to learn and reach their full potential in school environments.

Furthermore, students' attendance rates were lowest in schools located in regions with the highest air pollution levels. This suggests that air pollution may have a negative impact on students' health, leading to increased absenteeism. Higher absenteeism has a direct impact on students' academic performance. Prolonged exposure to particulate matter (PM2.5) significantly reduced cognitive test scores among students in highly polluted urban areas, further corroborating the detrimental impact of air pollution on learning outcomes [89]–[91].

The consistency between these findings highlights the importance of mitigating air pollution, especially in school settings. Additional evidence from previous studies by Mendell and Heath [92] emphasizes that indoor air quality directly affects students' learning productivity, with higher pollution levels causing fatigue, headaches, and respiratory problems that hinder their concentration. Similarly, Greenstone and Jack [93] demonstrated that declining air quality correlates with reduced cognitive performance among students, particularly in regions experiencing heavy industrial pollution.

These findings underscore the need for stricter policies to control air pollution, particularly in high-pollution areas such as South-South Nigeria. Measures such as improving classroom ventilation, creating green zones around schools, and reducing industrial emissions near schools can effectively mitigate the adverse effects of air pollution on students' academic performance. Further research is needed to explore interventions to improve air quality in resource-limited schools.

3.2. Impact of Noise Pollution on Academic Performance

Table 2 and Table 5 reveal that noise pollution also severely reduces students' academic progress in public secondary schools in South-South Nigeria. Students' academic performance is significantly impacted when schools are exposed to high levels of noise pollution. Braat-Eggen, van Heijst, Hornikx, and Kohlrausch's [60] study explored the relationship between students' perceptions of loud noise

sources and disruptions to academic tasks. They found that approximately 38% of students were distracted by speech and background noise while engaging in cognitively demanding tasks such as reading, writing, or studying. However, their results suggested that most students were unaffected by noise, which contrasts with the findings of this study.

In contrast, research by Oselumese, Omoike, and Andrew [70] demonstrated that schools on busy urban streets negatively affected students' ability to focus and learn. This finding is consistent with the current study, which demonstrates that noise pollution hinders students' ability to understand their teachers in the classroom and, in turn, affects their grades. Noise pollution from nearby highways disrupts learning and negatively impacts students' academic outcomes. Further, Shield and Dockrell [62] found that high noise levels in school environments, particularly from traffic and classroom chatter, significantly impaired students' reading comprehension and memory retention, emphasizing the cognitive toll of prolonged exposure to noise pollution.

The combined evidence highlights the dual challenges posed by air and noise pollution to students' learning environments. These environmental stressors compromise students' concentration, health, and academic performance. Addressing these issues requires implementing measures such as soundproofing classrooms, regulating noise levels near schools, and urban planning that prioritizes education-friendly zones.

These findings underscore the need for stricter policies to control air and noise pollution, particularly in high-pollution areas such as South-South Nigeria. Measures such as improving classroom ventilation, creating green zones around schools, soundproofing buildings, and reducing industrial and vehicular emissions near schools can effectively mitigate the adverse effects of these environmental factors on students' academic performance. Further research is needed to explore interventions to improve air and noise quality in resource-limited schools.

3.3. Impact of Flooding on Academic Performance

Tables 3 and 6 also indicate that flooding has a significant impact on the academic performance of public secondary school students in South-South Nigeria. The results suggest that flooding disrupts students' education by damaging homes, schools, and community infrastructure, thereby impacting their academic performance. These findings align with research by Chaudhary and Timsina [33], which demonstrated that flooding has an adverse effect on the academic performance of secondary school students. Their study highlighted that flood-related disruptions, such as damaged school buildings and transportation challenges, significantly reduce students' ability to attend classes regularly.

Flooding not only causes physical damage to educational facilities but also leads to psychological stress among students, as they worry about the safety of their families and homes. This often results in decreased focus and motivation in their studies. Additionally, destroying school infrastructure compels children to abandon their education, sometimes exacerbating dropout rates. The interruption in schooling caused by floods has a lasting impact on academic achievement, as students face challenges in catching up with missed lessons and adapting to temporary learning environments.

Supporting evidence from studies by Ahmed et al. [94] underscores that recurring flooding events in vulnerable regions lead to significant educational setbacks. These studies found that prolonged school closures due to flooding forced many students to discontinue their education, particularly in low-income communities with limited resources for recovery. Similarly, research by Beck and Franke [95] reported that natural disasters such as floods resulted in a 15-20% decrease in attendance rates in affected regions, further highlighting the long-term impact on students' educational outcomes.

Additional findings from Newsome et al. [96] demonstrated that frequent flooding in communities disrupted the academic calendar, forcing schools to shorten instructional periods, which affected both teaching quality and students' preparedness for examinations. These disruptions often result in learning gaps, making it challenging for students to maintain their academic progress. Another study by Kreft and Eckstein [97] emphasized that flooding exacerbates existing educational inequalities, disproportionately affecting underprivileged students who lack access to alternative learning resources or transportation to unaffected schools.

The results from this study emphasize the need for proactive measures to mitigate the impact of flooding on education. Strategies such as constructing flood-resistant school buildings, creating effective disaster response plans, and integrating remote learning technologies can help minimize disruptions caused by floods. Hossain et al. [98] highlighted the effectiveness of mobile learning platforms in providing educational continuity during environmental crises. Policymakers should also prioritize investments in resilient infrastructure, such as elevated classrooms and drainage systems, and community awareness programs to ensure continuity in education during and after flooding events.

Moreover, collaborative efforts between government agencies and non-governmental organizations (NGOs) can provide critical support in rebuilding and equipping schools in flood-prone areas. Implementing early warning systems and training teachers and students on disaster preparedness can further reduce the educational impact of flooding.

This study reinforces existing literature on the relationship between environmental factors, such as air and noise pollution, and students' academic performance. It highlights the pressing need for strategic actions to create healthier, quieter, and more conducive learning environments while addressing the challenges posed by natural disasters such as flooding. By adopting a multifaceted approach, stakeholders can ensure that education remains resilient in the face of environmental adversities.

6. CONCLUSION

This builds upon a consistent body of academic literature that underscores the critical role of the environment in shaping human activities, particularly in the context of students'

academic performance. It highlights the detrimental effects of environmental hazards on learning within public secondary schools, specifically in the South-South region of Nigeria. Air pollution, for instance, not only adversely affects students' health but also serves as a significant distraction that can impede their focus and overall academic achievement. This study highlights those environmental threats, such as flooding and noise pollution, can severely disrupt educational activities if left unaddressed. By highlighting these external environmental factors, this research provides valuable insights into the existing literature, advocating for proactive measures to mitigate risks that can hinder students' performance at the secondary school level.

Ultimately, it is essential to recognize that human actions are inherently adaptable, and education remains a fundamental pillar for national economic stability. By prioritizing efforts to create healthier and more conducive learning environments, we can enhance educational outcomes and support the development of future generations. This perspective reinforces the urgency of addressing environmental issues and highlights the profound interconnectedness between education, public health, and economic security.

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