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Influence of Environmental Factors on Academic Performance in Biology among Secondary School Students in Ilorin West, Kwara State

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Abstract

This study investigates the influence of environmental factors on students' academic performance in Biology within selected secondary schools in Ilorin West Local Government Area, Kwara State. A descriptive survey method was employed, sampling 100 students from ten schools using a self-designed questionnaire to collect data. The research aimed to assess the impact of various environmental elements, including infrastructural quality, environmental hazards, and home background, on students' performance. The findings revealed significant relationships between these factors and academic outcomes. It was observed that a supportive learning environment, along with a positive family context, plays a crucial role in enhancing student engagement and success in Biology. The study underscores the importance of improving both educational infrastructure and home conditions to foster better academic achievements in science education. based on the findings include the need to prioritize the improvement of school infrastructure, address environmental hazards, increase parental involvement in education, and provide professional development opportunities for teachers. Additionally, there is a call for greater collaboration between local authorities, educational bodies, and communities to enhance socio-economic conditions. Regular monitoring of both school and home environments, as well as the integration of health and well-being programs, should also be implemented to support students' academic success.

Keywords: Environmental factors, Academic performance, Biology, Secondary schools, Home background.

Introduction

Biology, known as the study of life, is introduced to students in secondary school and continues to be explored at higher education levels (Daworiye et al., 2015). Through Biology, students gain an understanding of themselves and their environment, learning about life forms from cellular structures to ecosystems (Steigerwald, 2019). This field, critical for human development, nurtures career skills, values, and mental and physical competencies necessary for societal participation and individual growth (Hinneh, 2017). Effective teaching of Biology is essential to meet educational goals; however, the quality of learning is heavily influenced by a variety of environmental factors. While instructional resources such as models, diagrams, and digital aids are vital for illustrating complex biological concepts, it is the broader environmental factors—such as infrastructural quality, environmental hazards, teacher accessibility, and home background—that play a more significant role in determining students' academic performance in Biology (Prachagool & Nuangchalerm, 2019; Estai & Bunt, 2016). These elements shape students' learning experiences and outcomes, and addressing them is crucial for enhancing academic performance.

Science education in Nigeria, particularly in subjects like Biology, has faced numerous challenges over the years (Fareo, 2018). While the curriculum is designed to foster interest and engagement in science, factors such as inadequate infrastructure, low teacher motivation, and limited professional development opportunities for science teachers undermine the effectiveness of education (Abakpa et al., 2016). These issues contribute to students' low performance in Biology, limiting their ability to grasp essential concepts in the subject. Outdated teaching methods, overloaded syllabi, and environmental hazards, such as poor school conditions and exposure to health risks, further exacerbate these challenges (Abidoye et al., 2023; Akpan & Babayemi, 2022).

The **environmental factors** affecting academic performance in Biology can be categorized into several key areas:

1. **Infrastructural Quality:** Poor school infrastructure, including inadequate classrooms, inadequate lighting, poor ventilation, and lack of basic facilities such as toilets and sanitation, directly impacts students' ability to learn effectively (Hande et al., 2017). Inadequate physical environments hinder cognitive development and distract students from their academic responsibilities, thereby influencing their overall performance in subjects like Biology.

2. **Environmental Hazards and Health Conditions:** Environmental hazards, including exposure to pollution, unsanitary conditions, and poor hygiene practices, negatively affect students' physical and cognitive health, which in turn impacts academic performance. Poor health, especially in the form of illness caused by unsanitary conditions, reduces students' attendance and ability to concentrate during lessons, leading to poorer academic outcomes (Iserameiya & Ibeneme, 2018).

3. **Teacher Accessibility and Quality of Instruction:** The availability and quality of teachers in schools are crucial in determining academic success in Biology. Lack of qualified teachers, low teacher morale, and ineffective teaching methods contribute to low student engagement and poor performance. Access to trained and motivated teachers is essential to providing effective Biology instruction (Akpan & Babayemi, 2022).

4. **Home Background and Parental Involvement:** Family background significantly influences students' academic outcomes. Students from supportive and resourceful homes tend to perform better academically. In contrast, a lack of parental involvement, financial constraints, and a non-conducive home environment may limit students' academic engagement and success in Biology (Harerimana & Toyin, 2017).

5. **Societal and Community Factors:** Broader societal influences, such as socio-economic status, community engagement, and access to educational resources, also shape students' learning experiences. Socio-economic disadvantages often limit access to necessary learning materials and academic support, hindering students' academic potential in subjects like Biology (Iserameiya & Ibeneme, 2018).

In Nigeria, the education system has made efforts to address these environmental challenges, but the impact of inadequate learning environments and the home background on academic performance in Biology continues to be significant. Previous studies emphasize the need for comprehensive strategies to improve both the school environment and the home conditions to foster better academic outcomes (Kara, 2018). This study focuses on understanding the specific environmental factors affecting academic performance in Biology among secondary school students in Ilorin West Local Government Area, Kwara State. The aim is to explore how factors such as infrastructure, environmental hazards,

teacher quality, and family background contribute to students' performance in Biology, with the goal of providing recommendations that can improve educational policies and practices to create a more supportive learning environment.

Purpose of the Study

The primary objective of this study is to examine how environmental factors impact students' academic performance in Biology within secondary schools in Ilorin West Local Government Area, Kwara State. Specifically, the study aims to:

i. Examine the influence of environmental factors on students' academic performance in biology among secondary schools in Ilorin West LGA, Kwara State,

ii. To assess the environmental factors influencing the academic performance of Biology students among secondary schools in Ilorin West LGA, Kwara State,

iii. To examine whether home background have any influence on Biology students' academic performance among secondary schools in Ilorin West LGA, Kwara State.

Research Questions

The following research questions guided this study:

i. What influence do environmental factors have on students' academic performance in Biology?
ii. How do infrastructural services influence students' academic performance in Biology?
iii. What is the impact of pollution and a healthy environment on students' academic performance in Biology?
iv. How do environmental hazards affect students' academic performance in Biology?
v. In what ways does home background influence students' academic performance in Biology?

Research Hypotheses

The following research questions guided this study:

H_1: There is no significant relationship between environmental factors and students' academic performance in Biology.

H_2: There is no significant relationship between infrastructural services and students' academic performance in Biology.

H_3: There is no significant relationship between pollution and healthy environment and students academic performance in Biology.

H_4: There is no significant relationship between environmental hazard and student academic performance in Biology.

H_5: There is no significant relationship between the home background and students' academic performance in Biology.

Methodology

This research employed a descriptive survey method to explore how environmental factors influence academic performance in Biology among secondary school students in Ilorin West Local Government Area (LGA), Kwara State. The descriptive survey method was chosen because it allows for an in-depth understanding of the current educational environment and enables the collection of detailed data regarding the students' academic experiences. Observations were also made to complement the data gathered, ensuring a comprehensive approach to the study.

The study population comprised all 48 public secondary schools in Ilorin West LGA. To ensure a representative sample, ten schools were selected using both **random** and **purposive sampling** methods. Random sampling was used to select the schools, while purposive sampling focused on schools that have a diverse range of environmental challenges, including varying infrastructural conditions and student demographics. The target population for analysis included 100 students across these schools, who were selected randomly from each institution to represent the broader student body. To justify the sample size of 100 students, the **Cochran's Sampling Formula** was applied to determine an appropriate sample size based on the total population of 48 schools. The formula is used to calculate the minimum sample size required to achieve a valid representation. Using a confidence level of 95% and a margin of error of 5%, the formula gave a sample size of approximately 100 students, which was deemed sufficient for the study.

The instrument used for data collection was a **researcher-designed questionnaire**, which was structured to assess various environmental factors (such as infrastructure, pollution, environmental hazards, and home background) and their influence on students' academic performance in Biology. The questionnaire was reviewed by the research supervisor for content validity and revised based on the feedback received. **Reliability** of the instrument was assessed using the **test-retest method**. The

questionnaire was administered to a small pilot group of 20 students from a different set of schools within Ilorin West LGA, three weeks before the main study. After analyzing the results, the **reliability coefficient** was found to be **0.87**, indicating a high level of consistency and reliability in the instrument.

Data Collection and Analysis

With permission from the principals of each selected school, 100 questionnaires were distributed across the ten schools. After collecting the completed questionnaires, data analysis was conducted using both **descriptive** and **inferential statistics**. Descriptive statistics (such as frequency counts and percentages) were used to summarize and describe the characteristics of the sample population and the patterns observed in the data. For testing the hypotheses, **inferential statistics**, specifically **chi-square tests**, were applied to assess the relationship between environmental factors and students' academic performance in Biology. The **expected chi-square value** was determined based on the standard chi-square distribution table, considering the number of categories in each variable and the sample size.

Table 1: Distribution of Respondents Based on Sex

Gender	**Frequency**	**Percentage**
Male	30	30%
Female	70	70%
Total	**100**	**100%**

Table 1 indicates that male students made up 30% of the study participants, while female students accounted for 70%.

Table 2: Distribution of Respondents Based on Class

Class	**Frequency**	**Percentage**
SS I	36	36%
SS II	38	38%
SS III	26	26%
Total	**100**	**100**

Table 2 shows that 36% of the students were in SS I classes, with a total of 36 students. SS II classes included 38 students, representing 38%, while SS III classes had 26 students, making up 26% of the participants.

Research Question One: What influence do environmental factors have on students' academic performance in Biology?

Table 3: Environmental factors and students' academic performance

S/N	ITEMS	SA%	A%	D%	SD%	TA %	TD %
1.	Does environmental factors contribute largely to students academic performance in Biology in secondary school?	34%	58%	4%	4%	92%	8%
2.	Does environment determines whether student will be happy and ready to learn or become a deviant in Biology subject?	28%	58%	12%	2%	86%	14%
3.	Does the physical environment where student study determines the comfort of student and thereby influencing their learning ability in Biology?	38%	46%	14%	2%	84%	16%
4.	Do students in uncomfortable environments learn faster than their peers in comfortable environments?	20%	32%	36%	12%	52%	48%
5.	Do environmental factors has impact on the developmental, social, emotional and physical health of students which may in turn influence their academic performances?	34%	42%	12%	12%	76%	24%
6.	Does school environment that is free from indecent waste have impact on the health of student which may contribute greatly to their academic performance in Biology?	38%	38%	20%	4%	76%	24%

The table reveals that a majority of respondents believe environmental factors significantly influence academic performance in Biology, with 92% agreeing on its impact. Additionally, 86% of students indicated that a supportive environment affects their willingness to learn, while 84% agreed that a comfortable study environment enhances learning. Interestingly, 52% believed that students in less comfortable environments learn faster, whereas 76% agreed that environmental factors affect students' social, emotional, and physical health, which can, in turn, impact academic outcomes. Finally, 76% also felt that a clean school environment positively affects students' health and their academic performance in Biology.

Research Question Two: How do infrastructural services influence students' academic performance in Biology?

Table 4: Infrastructural services and students academic performance

S/N	ITEMS	SA%	A%	D%	SD%	TA%	TD%
7.	Do proper infrastructure services such as waste disposal, water and sanitations system, transport system and drainage system may affect students health and safety as well as their self-esteem and psychological state which may in turn influence their academic performance in Biology?	42%	48%	8%	2%	90%	10%
8.	Do proper infrastructure services like lighting, good temperature and safe learning environment supports the educational programme of a school which greatly influence student academic performance in Biology?	26%	46%	18%	10%	72%	28%

Table 4 shows that 90% of respondents agreed that adequate infrastructure services—such as waste disposal, water and sanitation systems, transportation, and drainage—can impact students' health,

safety, self-esteem, and psychological well-being, thereby influencing their academic performance in Biology, while 10% disagreed. Additionally, 72% felt that proper infrastructure, including sufficient lighting, optimal temperature, and a safe learning environment, supports the school's educational program and significantly enhances students' academic performance, with 28% disagreeing.

Research Question Three: What is the impact of pollution and a healthy environment on students' academic performance in Biology?

Table 5: Influence of pollution and healthy environment on students academic performance

S/N	ITEMS	SA%	A%	D%	SD%	TA%	TD%
9.	Does proper sanitation of school has positive influence on secondary school students academic performance in Biology subject?	44%	48%	6%	2%	92%	8%
10.	Does proper hygiene condition of the school environment promote good cleanliness and make student safe from any forms of disease which may affect their academic performance in Biology subject?	44%	42%	8%	4%	88%	12%
11.	Does environment where there is always occurrence of flood exposes student to danger and this perhaps makes students skip school which later affect their performances in school?	42%	40%	12%	6%	82%	18%
12.	Does high rates of vulnerability to flood impact/ decrease the quality of education as it disrupts access to schoolings for the students?	36%	22%	30%	12%	58%	42%
13.	Do school who experienced damages of school infrastructure due to incidence of environmental hazards like floods are prone to discontinuation of education and thereby increases children's rate?.	26%	40%	24%	10%	66%	34%

The table illustrates student responses regarding the effects of pollution and a healthy environment on academic performance in Biology. It shows that 92% of students agreed that proper school sanitation positively impacts their academic performance, while 8% disagreed. Additionally, 88% believed that a hygienic school environment promotes cleanliness and reduces disease risk, enhancing academic outcomes, with 12% disagreeing. Furthermore, 82% agreed that frequent flooding puts students at risk, causing school absences that affect their performance, while 18% disagreed. Over half (58%) felt that high vulnerability to flooding disrupts education quality by limiting school access, while 42% disagreed. Lastly, 66% agreed that flood-related damage to school infrastructure can lead to educational discontinuity and higher dropout rates, with 34% disagreeing.

Research Question Four: How do environmental hazards affect students' academic performance in Biology?

Table 5: Environmental Hazard and Students' Academic Performance

S/N	ITEMS	SA%	A%	D%	SD%	TA%	TD%
14.	Do environmental hazards indirectly cause trauma and anxiety to people's lives which may later affect students' academic performance?	48%	34%	16%	2%	82%	18%
15.	Does possible disastrous incidents such as destruction of school infrastructure and homes causes fears among the victims which was likely to have effect on student academic performance in Biology?	30%	34%	24%	2%	74%	26%

The table indicates that 82% of respondents agreed that environmental hazards indirectly contribute to trauma and anxiety, potentially impacting students' academic performance, while 18% disagreed. Additionally, 74% felt that incidents like destruction of school infrastructure and homes cause fear among affected individuals, which may negatively affect students' academic performance in Biology, while 26% disagreed.

Research Question Five: In what ways does home background influence students' academic performance in Biology?

Table 7: Home background and students' academic performance

S/N	ITEMS	SA%	A%	D%	SD%	TA%	TD%
21.	Do students from average socio-economic families perform better than those from lower class?	46%	32%	16%	6%	78%	22%
22.	Do student from highly educational qualify families are likely to perform better than those from lower educational qualification?	26%	34%	30%	10%	69%	40%
23.	Do students who come from highly influential families are treated separately by their teachers which perhaps have impact on their academics activities than those for lower class?	36%	24%	28%	12%	60%	40%
24.	Do students who comes from polygamous families are likely to be distracted because of challenges/problems they faced and this negatively have impact on their academic performance?	32%	28%	29%	11%	60%	40%
25.	Does home background of student is always reflected in their ability, capacity and determination to learn in school?	40%	32%	20%	8%	72%	28%

The table presents findings on the impact of home background on students' academic performance in Biology. For the first item, 78% of respondents agreed that students from average socio-economic backgrounds perform better than those from lower socio-economic classes, while 22% disagreed. Additionally, 60% believed that students from families with higher educational qualifications are likely to perform better academically compared to those from less educated backgrounds, with 40% in disagreement. Furthermore, 60% agreed that students from polygamous families might face distractions due to various challenges, which can negatively affect their academic performance, while

40% disagreed. Finally, 72% of respondents agreed that a student's home background often reflects in their learning ability, capacity, and determination, while 28% disagreed.

Testing of Hypothesis

Hypothesis One: There is no significant relationship between environmental factors and students' academic performance in Biology.

Table 8: Relationship between environmental factors and students' academic performance in biology

X^2 Cal.	X^2. Crit.	df	p-value	Remarks
65.11	24.92	15	0.05	Rejected

The results indicate that the calculated chi-square (X^2) value of 65.11 exceeds the critical X^2 value of 24.92 at a 0.05 level of significance. Consequently, the hypothesis stating that there is no significant relationship between environmental factors and students' academic performance in Biology is rejected. This finding implies that a significant relationship exists between environmental factors and students' academic performance in Biology.

Hypothesis Two: There is no significant relationship between infrastructural services and students' academic performance in Biology.

Table 8: Relationship Between Infrastructural Services and Students' Academic Performance

X^2 Cal.	X^2. Crit.	df	p-value	Remarks
88.34	7.82	3	0.05	Rejected

The results reveal that the calculated chi-square (X^2) value of 88.34 is greater than the critical X^2 value of 7.82 at a 0.05 level of significance. As a result, the hypothesis asserting that there is no significant relationship between infrastructural services and students' academic performance in

Biology is rejected. This indicates that infrastructural services significantly influence students' academic performance.

Hypothesis Three: There is no significant relationship between pollution and healthy environment and students' academic performance in Biology.

Table 9: Significant Influence on Pollution and healthy environment on Students Academic Performance in Biology

X^2 Cal.	X^2. Crit.	df	p-value	Remarks
64.32	21.03	12	0.05	Rejected

The results indicate a relationship between pollution, a healthy environment, and students' academic performance in Biology. The calculated chi-square (X^2) value of 64.32 exceeds the critical X^2 value of 21.03 at a 0.05 level of significance. Consequently, the null hypothesis stating that there is no significant relationship between pollution and a healthy environment and students' academic performance in Biology is rejected. This finding implies that both pollution and a healthy environment significantly influence students' academic performance in Biology.

Hypothesis Four: There is no significant relationship between environmental hazard and student academic performance in Biology.

Table 9: Significant relationship between environmental hazard and students' academic performance

X^2 Cal.	X^2. Crit.	df	p-value	Remarks
74.32	7.82	3	0.05	Rejected

The results indicate a relationship between environmental hazards and students' academic performance. The calculated chi-square (X^2) value of 74.32 is greater than the critical X^2 value of 21.03 at a 0.05 level of significance. Therefore, the null hypothesis asserting that there is no

significant relationship between environmental hazards and students' academic performance is rejected. This implies that environmental hazards have a direct influence on students' academic performance in Biology.

Hypothesis Five: There is no significant relationship between the home background and students' academic performance in Biology.

Table 9: Home background and students academic performance

X^2 Cal.	X^2. Crit.	df	p-value	Remarks
72.32	21.03	12	0.05	Rejected

The findings indicate a significant relationship between students' home backgrounds and their academic performance. The calculated chi-square (X^2) value of 72.32 is greater than the critical X^2 value of 21.03 at the 0.05 significance level. As a result, the null hypothesis, which posits that there is no significant relationship between students' home backgrounds and their academic performance in Biology, is rejected. This suggests that students' home environments have a considerable impact on their performance in Biology.

Discussion of Findings

The study's findings reveal a strong influence of environmental factors on students' academic performance in Biology, with infrastructure, environmental hazards, access to qualified teachers, and family background identified as key contributors. These elements not only impact academic success individually but are also interconnected, collectively shaping students' educational outcomes. Contrary to some popular and common assumptions that environment does not significantly affect academic achievement, this research highlights how each factor, from school facilities to family support, plays a critical role in students' academic journeys and achievements in Biology.

Supporting research reinforces the substantial role of environmental and familial factors in education. [20] underscores that school infrastructure, including air quality, lighting and temperature, influences students' health and self-esteem, thereby affecting their performance. Studies by [21, 22] show that sanitation and air quality significantly impact academic outcomes by improving students'

psychological well-being and cognitive functioning. Family background also plays a pivotal role: [23] links low parental involvement and insufficient resources with lower academic performance, while [24] finds that socioeconomic factors, especially parental education levels, strongly correlate with student success. These findings emphasize the importance of both school environment and family support in shaping students' academic outcomes.

Conclusion

This study aimed to investigate how environmental factors affect students' academic performance in Biology across selected secondary schools in Ilorin West Local Government Area, Kwara State. The research formulated five questions and three hypotheses to determine the impact of these factors. Using a descriptive survey method, the study sampled 100 students from ten secondary schools, employing a self-designed questionnaire with 20 items to gather data. Data were analyzed with descriptive and inferential statistics, including chi-square. Findings showed a significant relationship between environmental factors such as infrastructure, environmental hazards, pollution, and home background and students' academic performance, suggesting that these factors influence students' engagement and success in school activities. The study concludes that students' academic outcomes are indeed shaped by the quality of their environmental and home conditions, which play a crucial role in their overall educational experience.

Recommendations

Here are the recommendations based on the findings of the study:

1. **Improvement of School Infrastructure:** Schools should prioritize the enhancement of their physical infrastructure, including improving air quality, lighting, ventilation, and classroom temperature. These factors contribute to students' health, self-esteem, and overall academic performance. Investment in maintaining and upgrading school facilities is essential to creating a conducive learning environment.

2. **Addressing Environmental Hazards:** Schools and local authorities should take proactive measures to mitigate environmental hazards within and around school premises. This includes

ensuring safe sanitation practices, reducing pollution, and addressing any environmental risks that could negatively affect students' well-being and cognitive functioning.

3. **Parental Involvement and Support:** Schools should encourage greater parental involvement in students' academic lives. Organizing regular parent-teacher meetings, workshops, and providing resources to help parents support their children's education can positively influence academic outcomes. Parental engagement has been shown to improve student performance, particularly when parents are involved in their children's learning processes.

4. **Training and Development of Teachers:** Teachers play a critical role in shaping student success. Professional development programs should be implemented to enhance teachers' pedagogical skills, particularly in Biology. Teachers should be trained to effectively integrate environmental and familial factors into their teaching methods to support diverse student needs.

5. **Community and Government Collaboration:** Local government authorities and educational bodies should work together to improve the socio-economic conditions of families, especially in low-income areas. Initiatives to provide educational resources, scholarships, and support for parents, particularly in disadvantaged communities, will help address the socio-economic barriers to academic success.

6. **Monitoring and Evaluation of Educational Environments:** Regular assessment and monitoring of both school and home environments should be conducted to ensure they are conducive to learning. Educational policies should be reviewed and updated regularly to address emerging challenges related to environmental and family factors that affect academic performance.

7. **Health and Well-being Programs:** Schools should integrate health and well-being programs to support students' psychological and physical health. Ensuring access to mental health resources, counseling services, and promoting healthy lifestyles can enhance students' cognitive functioning and overall academic engagement.

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