

# Evaluation of the Trends of Students' Academic Performance in Basic Science in Secondary Schools in a Hoada East LGA (2020–2024)

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## **Abstract:**

The study investigated the trends in students' performance in basic science in secondary schools in Ahoada East LGA. The study adopted a descriptive survey design with a trend analysis approach. The population comprise all junior secondary school's students in public and private schools. A sample size of 200 students was selected through the stratified random sampling techniques. The study was guided by 4 research questions and also four null hypotheses was formulated and tested at 0.05 alpha level. Data were gathered through the student's termly results for a period of five years. Data was analysed using the mean and SD for the research Questions while the t-test and analysis of variance (ANOVA) was used for the testing of the null hypotheses. The results show that student's performance fluctuated over the years with 2021 having the lowest and 2024 recording the highly. There was a significant difference among the group, while students' gender did not have a significant effect on student's performance trend in basic science during the period under study. Also, there was no significant difference in the performance trends between urban and rural schools. Contrarily, school type had a significant influence on student performance trends during the study period. Based on the results, it recommended that.

**Keywords:** Basic science, performance, evaluation, trends, secondary schools.

## **INTRODUCTION**

The evaluation of trends in students' academic performance in Basic Science in secondary schools in Ahoada East Local Government Area between 2020 and 2024 presents a critical avenue for understanding the realities of science education within a rapidly changing Nigerian educational

landscape. Basic Science plays a foundational role in equipping learners with essential scientific knowledge, skills, and attitudes that serve as building blocks for advanced studies in Biology, Chemistry, and Physics at the senior secondary and tertiary levels. It is considered a gateway to science, technology, engineering, and mathematics (STEM) disciplines, which are increasingly prioritized for national development and economic competitiveness (Aina, 2022; UNESCO, 2023). Thus, monitoring and interpreting how students perform in this subject over time is essential, particularly in regions such as Ahoada East, where educational resources are constrained, and socio-economic conditions may present unique challenges.

The need for this study arises from persistent concerns about the quality of science education and declining student outcomes reported across Nigeria. Performance in Basic Science has been described as unstable, with fluctuations often linked to inadequate teaching strategies, poorly resourced classrooms, and systemic inequalities between rural and urban schools (Okoli & Orji, 2021; Nwankwo & Samuel, 2021). Ahoada East is a semi-rural LGA in Rivers State that has experienced disruptions not only from the global COVID-19 pandemic but also from recurrent flooding, economic hardship, and infrastructural limitations, coupled with other related cultural and traditional problems all of which may have contributed to students' performance during this disturbing period. Therefore, it was necessary to examine the issues that led to these performance trends from 2020 to 2024 allows for the documentation of patterns, the identification of influencing factors, and the development of evidence-based recommendations to strengthen science education.

Conceptually, academic performance in Basic Science may be understood as the measurable outcomes of students' engagement with scientific concepts, problem-solving, and practical applications as demonstrated in tests, examinations, and classroom assessments. These outcomes reflect not just the acquisition of knowledge but also the ability to apply scientific reasoning to real-life contexts (Ezeudu & Obioma, 2022). Trends in performance, on the other hand, refer to observable changes in students' results over time, which can be upward (improving), downward (declining), or fluctuating. Examining such trends was crucial because they highlight whether educational interventions are effective, whether socio-economic challenges are impacting learning, and whether the curriculum delivery is achieving its intended objectives. Performance in science subjects is multidimensional and influenced by factors such as teacher competence, availability of instructional materials, class size, gender dynamics, socio-economic background, and parental involvement (World Bank, 2022; OECD, 2023). In places like Ahoada East, the interplay of these factors creates a distinctive learning environment that must be studied in detail.

Studies across Nigeria have consistently reported challenges in students' mastery of Basic Science concepts. For instance, Adedokun and Gbadebo (2020) examined junior secondary schools in southwestern Nigeria and found that students' performance in Basic Science was inconsistent across years, largely due to poorly trained teachers and insufficient laboratory facilities. Similarly, Ugwu and Okafor (2021) highlighted gender disparities, noting that male students often outperformed female counterparts, a difference attributed to cultural norms that discourage girls from pursuing science-related subjects. Adeyemi (2022) reported more optimistic findings, showing that when teachers adopted student-centered pedagogies such as inquiry-based learning, there was significant improvement in performance, indicating that methodology plays a vital role in promoting the students' performance.

Worlu and Chikere (2023) conducted a study comparing Basic Science performance between rural and urban schools and observed that while urban students showed gradual improvement from 2018 to 2022, rural schools, including those in Ahoada East, faced declines. The study attributed these patterns to limited infrastructure, inadequate supervision, and frequent disruptions caused by flooding and community instability. Okechukwu (2021) attributed the observed poor student's performance to the negative impact of the COVID-19 pandemic on learning outcomes, particularly in science subjects, as many rural students lacked access to digital devices and internet connectivity

for online learning which was the general view of UNESCO (2021), which found that the widening educational inequality caused by the pandemic, particularly in sub-Saharan Africa.

According to OECD (2023), students in environments with well-trained teachers, supportive policies, and adequate infrastructure tend to perform consistently better. In the other hand, schools and environments that lack this infrastructure show declining or unstable performance. The World Bank (2022) also noted that recovery from COVID-19 disruptions has been uneven, with rural schools in low- and middle-income countries lagging behind in restoring learning outcomes. These general perspectives reflect with the situation in Ahoada East, where local conditions mirror broader challenges but are compounded by unique environmental factors such as recurrent flooding and other factors that are visibly contributing to the academic dilemma.

Despite these insights, there remains a clear gap in the literature. While several studies have assessed science performance at the state and national levels, very few have focused specifically on localized contexts such as Ahoada East LGA. This gap is problematic because generalized findings often mask the realities of specific communities, where contextual challenges require tailored interventions. Furthermore, there is limited documentation on how performance trends evolved in the immediate aftermath of the pandemic (2020–2021) compared to the recovery years (2022–2024) in rural Nigerian contexts. Understanding these distinctions is critical because it highlights whether interventions and recovery strategies were effective in stabilizing learning outcomes in Basic Science.

The rationale for this study is therefore rooted in the urgent need to provide empirical evidence on performance trends in Basic Science within Ahoada East between 2020 and 2024. The findings will provide useful insights for teachers, school administrators, policymakers, and curriculum developers who aim to improve science education outcomes. By documenting the trajectory of performance, the study can inform targeted interventions such as teacher retraining, provision of instructional resources, and community-based support systems. It will also contribute to discussions on equity in education by shedding light on the unique challenges faced by students in semi-rural environments. Finally, the study supports national and international educational priorities, including Nigeria's commitment to strengthening STEM education and the global Sustainable Development Goal 4, which emphasizes inclusive and equitable quality education (Federal Ministry of Education, 2022; UNESCO, 2023).

In conclusion, evaluating the trends of students' academic performance in Basic Science in Ahoada East between 2020 and 2024 is both timely and significant. It addresses an urgent need to understand localized realities of science education, clarifies conceptual and empirical perspectives, highlights gaps in existing literature, and provides a strong rationale for research that can guide policy and practice. The outcomes of such an evaluation will not only contribute to improving performance in Basic Science but will also enhance the broader effort to strengthen science education and prepare Nigerian students for meaningful participation in the 21st-century knowledge economy.

### **Research Questions**

The following research questions were raised to guide the study:

1. What are the trends in students' academic performance in Basic Science in secondary schools in Ahoada East LGA between 2020 and 2024?
2. Does students gender influence the trends of students' performance in Basic Science within the period under review?
3. What are the performance trends in Basic Science in public and private secondary schools in Ahoada East LGA between 2020 and 2024?

4. To what extent do school location (urban vs. rural) differences account for variations in students' academic performance in Basic Science from 2020 to 2024?

### **Hypotheses**

**HO<sub>1</sub>:** There is no significant difference in students' academic performance trend in Basic Science in Ahoada East LGA between 2020 and 2024.

**HO<sub>2</sub>:** There is no significant difference between male and female students' performance in Basic Science in Ahoada East LGA between 2020 and 2024.

**HO<sub>3</sub>:** There is no significant difference in the performance trends in Basic Science in public secondary schools in Ahoada East LGA between 2020 and 2024

**HO<sub>4</sub>:** There is no significant difference in the performance trends of students in urban and rural secondary schools in Basic Science between 2020 and 2024.

### **Methodology**

The study adopted a descriptive survey design with a trend analysis approach. A descriptive survey design was considered appropriate because the research sought to describe and analyze existing conditions of students' academic performance without manipulation of variables. A trend analysis approach was adopted since the study covered performance data over a five-year period, which made it possible to examine changes and fluctuations across time and to determine factors contributing to these trends. The area of the study was Ahoada East Local Government Area in Rivers State, Nigeria. Ahoada East is predominantly rural but contains semi-urban centers with government-owned secondary schools. The area was chosen for the study because reports from the Rivers State Ministry of Education (2024) and local stakeholders suggested persistent concerns about fluctuating student performance in Basic Science, which is a core subject at the junior secondary level. Furthermore, the area has faced unique challenges such as flooding, infrastructural deficiencies, and pandemic disruptions that potentially influence students' academic outcomes.

The population of the study comprised all junior secondary school students in public secondary schools within Ahoada East LGA who sat for Basic Science examinations between 2020 and 2024. Data from the Rivers State Ministry of Education (2024) indicated that there were approximately 7,800 students enrolled in Junior Secondary School classes (JSS1–JSS3) across 23 public secondary schools within the LGA during this five-year period. A sample size of two hundred was drawn using stratified random sampling techniques. Where 20 students were selected from each selected schools totaling two hundred (200) students from the ten (10) selected schools. Within these schools, archival records (termly results) of students' Basic Science performance for the years 2020 to 2024 were retrieved, producing a dataset of approximately 2,000 student records. Stratified random sampling ensured that both genders were adequately represented in the dataset. The instruments employed for data collection was Archival Performance Data Retrieval Checklist (APDRC) developed by the researcher to systematically collect students' performance scores in Basic Science examinations from school records across the selected years. The instrument does not require any validity nor reliability because it only assist the teachers concern to retrieve the results of the students for each year under the study. The procedure for data collection involved obtaining official permission from the principals of the selected schools. Archival performance data were retrieved by the researcher with the assistance of subject teachers and school administrators to ensure accuracy. The retrieved results of the students from each participating school for the period of 2020-2024 were gathered and send for analysis The method of data analysis combined both descriptive and inferential statistics. Descriptive statistics, such as mean and standard deviations were used to answer the research questions as presenting the trends in students' performance from 2020 to 2024. The ANOVA and independent samples t-tests were employed to test the null

hypotheses formulated in the study at the 0.05 level of significance using the Statistical Package for the Social Sciences (SPSS) version 25.

## Results

**Research question 1.** What are the trends in students' academic performance in Basic Science in secondary schools in Ahoada East LGA between 2020 and 2024?

**Table 1. Mean and SD of the performance trends of students in basic science between 2020-2024**

	Year	N	Mean	SD
1	2020	200	56.47	15.56
2	2021	200	27.11	15.10
3	2022	200	47.71	20.66
4	2023	200	53.22	14.95
5	2024	200	57.47	13.65

The Table 1 shows the students' performance trends in Basic Science between 2020 and 2024. The table revealed fluctuated performance over the years. The mean score was **56.47 in 2020**, dropped sharply to **27.11±15.10 in 2021**, and then gradually improved to **47.71±20.66 in 2022**, **53.22±14.95 in 2023**, and **57.47±13.65 in 2024**. The **lowest performance occurred in 2021**, while **2024 recorded the highest mean score**, indicating steady improvement in recent years.

**HO<sub>1</sub>** There is no significant trend in students' academic performance in Basic Science in Ahoada East LGA between 2020 and 2024.

**Table 2. Summary of ANOVA of the performance trends of students in basic science between 2020-2024**

Variables	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	123048.14	5.00	24609.63	93.17	0.00
Within Groups	258591.37	979.00	264.14		
Total	381639.51	984.00			

The Table 2 revealed that there was a **significant difference** in students' mean performance scores across the five groups examined. The ANOVA result showed a **Between-Groups Sum of Squares of 123,048.14** with **5 degrees of freedom**, and a **Within-Groups Sum of Squares of 258,591.37** with **979 degrees of freedom**, giving a **Total Sum of Squares of 381,639.51**. The **Mean Square Between Groups** was **24,609.63**, while the **Mean Square Within Groups** was **264.14**. The computed **F-value of 93.17** with a **significance level of 0.00** ( $p < 0.05$ ) indicates that the differences among the group means were statistically significant. This implies that students' performance varied across the groups, and at least one group's mean score differed significantly from the others. Hence, the null hypothesis of no significant difference in performance was rejected.

**Research Question 2.** Does student's gender influence the trends of students' performance in Basic Science within the period under review

**Table 3. Mean and SD of gender performance trends in basic science in secondary schools**

Year	Gender	N	N	SD
2020	Male	96	55.88	15.72
	Female	104	57.02	15.47
2021	Male	96	28.93	17.79
	Female	104	25.42	11.94

2022	Male	96	45.13	21.18
	Female	104	50.10	19.97
2023	Male	96	53.53	15.06
	Female	104	52.93	14.91
2024	Male	96	56.74	14.51
	Female	104	58.14	12.83

Table 3 shows the mean and standard deviation of students' performance in Basic Science by gender from 2020 to 2024. The result reveals that both male and female students experienced fluctuations in performance across the years. Female students slightly outperformed their male counterparts in 2020, but both genders recorded their lowest performance in 2021. From 2022 onward, their mean scores improved steadily, with female students maintaining a marginal advantage through 2024.

**HO<sub>2</sub>:** There is no significant difference between male and female students' performance in Basic Science in Ahoada East LGA between 2020 and 2024.

**Table 4. Summar of ANOVA of students' performance trends between 2020-2024 based on gender.**

ANOVA					
Variables	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	136.75	1.00	136.75	0.35	0.55
Within Groups	381502.76	983.00	388.10		
Total	381639.51	984.00			

Table 4 revealed that there was no significant difference in students' performance trends in Basic Science between male and female students from 2020 to 2024. The ANOVA result showed  $F(1,983) = 0.35$ ,  $p = 0.55$ , which is greater than the 0.05 level of significance. This implies that gender did not have a significant effect on students' performance trends in Basic Science during the period under review. Therefore, the null hypothesis ( $H_0$ ), which states that there is no significant difference in the performance trends of students in Basic Science based on gender, is retained.

**Research Question 3:** What are the performance trends in Basic Science in public and private secondary schools in Ahoada East LGA between 2020 and 2024?

**Table 5. Mean and SD of students' performance trends in basic science in public and private schools.**

Year	School type	N	Mean	SD
2020	Public schools	116	61.66	13.40
	Private schools	84	49.30	15.56
2021	Public schools	116	33.04	15.23
	Private schools	84	18.90	10.37
2022	Public schools	116	44.38	22.37
	Private schools	84	52.31	17.12
2023	Public schools	116	52.58	15.70
	Private schools	84	54.11	13.90
2024	Public schools	116	55.30	13.15
	Private schools	84	60.46	13.82

The results show that public school students performed better in 2020 ( $M = 61.66$ ,  $SD = 13.40$ ) and 2021 ( $M = 33.04$ ,  $SD = 15.23$ ) than their private school counterparts ( $M = 49.30$ ,  $SD = 15.56$ ;  $M = 18.90$ ,  $SD = 10.37$ ). However, from 2022 to 2024, private school students improved steadily, recording higher mean scores ( $M = 52.31$ ,  $54.11$ , and  $60.46$ ) than public school students ( $M = 44.38$ ,  $52.58$ , and  $55.30$ ). This indicates that while public schools led initially, private schools later showed better performance in Basic Science

**HO<sub>3</sub>** There is no significant difference in the performance trends of students in Public and Private secondary schools in Basic Science between 2020 and 2024.

**Table 6. Summary of ANOVA of students’ performance in private and public secondary schools between 2020-2024**

ANOVA					
Variables					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	1454.51	1.00	1454.51	3.76	0.05
Within Groups	380185.00	983.00	386.76		
Total	381639.51	984.00			

The ANOVA result revealed a statistically significant difference in students’ performance in Basic Science between public and private schools,  $F(1,983) = 3.76$ ,  $p = 0.05$ . This implies that school type had a significant influence on students’ performance trends during the study period. Therefore, the null hypothesis stating that there is no significant difference in students’ performance based on school type is **rejected**

**Research Question 4.** To what extent do school location (urban vs. rural) differences account for variations in students’ academic performance in Basic Science from 2020 to 2024?

**Table 7. mean and SD of students’ performance trends in basic science between 2020-2024 in Urban and Rural secondary schools**

Year		N	Mean	SD
2020	Urban	87	63.71	12.98
	Rural	113	50.89	15.12
2021	Urban	87	34.83	16.81
	Rural	113	21.16	10.30
2022	Urban	87	38.79	21.11
	Rural	113	54.58	17.51
2023	Urban	87	50.14	15.79
	Rural	113	55.59	13.88
2024	Urban	87	53.90	13.43
	Rural	113	60.22	13.23
	Total	200	57.47	13.65

Table 7 shows the mean and standard deviation of students’ performance trends in Basic Science between 2020 and 2024 based on school location. The results indicate that students in urban schools generally performed better than their rural counterparts in 2020 ( $M = 63.71$ ,  $SD = 12.98$ ) and 2021 ( $M = 34.83$ ,  $SD = 16.81$ ). However, from 2022 to 2024, rural students had higher mean scores than those in urban schools — in 2022 ( $M = 54.58$  vs.  $38.79$ ), 2023 ( $M = 55.59$  vs.  $50.14$ ), and 2024 ( $M = 60.22$  vs.  $53.90$ ). Overall, the trend suggests that while urban students initially outperformed rural students, rural schools showed steady improvement over the years, eventually surpassing urban schools in the later years of the study period.

**HO4:** There is no significant difference in the performance trends of students in urban and rural secondary schools in Basic Science between 2020 and 2024.

**Table 8. Summary of ANOVA on the students' performance trends in basic science between 2020-2024**

ANOVA					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	12.21	1.00	12.21	0.03	0.86
Within Groups	381627.30	983.00	388.23		
Total	381639.51	984.00			

Table 8 presents the ANOVA result on students' performance trends in Basic Science between 2020 and 2024 based on school location. The result shows a Between-Group Sum of Squares of 12.21 with 1 degree of freedom and a Within-Group Sum of Squares of 381,627.30 with 983 degrees of freedom, resulting in a Total Sum of Squares of 381,639.51. The computed F-value of 0.03 at a significance level of 0.86 ( $p > 0.05$ ) indicates that there was **no significant difference** in students' mean performance between urban and rural schools during the study period. Hence, the null hypothesis ( $H_0$ ) which states that there is no significant difference in students' performance trends in Basic Science based on school location is **retained**.

### Discussion

The result presented in Table 1 shows that students' performance in Basic Science between 2020 and 2024 fluctuated over the years, with the lowest mean score recorded in 2021 and the highest in 2024. This pattern indicates a sharp decline in 2021 followed by steady improvement from 2022 to 2024, suggesting a gradual recovery in learning outcomes. The improvement may be linked to enhanced teaching practices, curriculum stability, and renewed classroom engagement after disruptions caused by the COVID-19 pandemic (UNESCO, 2022; Oboh & Abah, 2023).

The steady decline in standard deviation values from 2022 to 2024 shows that students' performance became more consistent, implying reduced variation in achievement levels. This could reflect greater adaptation to post-pandemic learning and the use of interactive and technology-supported teaching strategies (Adigwe & Okoye, 2023). The ANOVA and post hoc results confirmed that these differences were statistically significant and likely due to real changes in instructional quality, teacher competence, and school conditions rather than random variation (Nwosu & Igwe, 2022).

These findings align with Afolabi and Eze (2023), who observed that yearly variations in students' performance often mirror changes in teaching methods and resource availability. The upward trend from 2022 to 2024 suggests that educational reforms, such as digital learning integration and teacher motivation, positively influenced student outcomes (Ogunleye & James, 2023; Adeyemi, 2024). Overall, the results imply that consistent instructional improvement and supportive learning environments were key contributors to the observed progress in Basic Science achievement.

The results presented in Tables 3 and 4 show that while students' performance in Basic Science fluctuated between 2020 and 2024, gender did not have a statistically significant effect on achievement. Both male and female students recorded their lowest performance in 2021, likely due to academic disruptions caused by the COVID-19 pandemic (Ogunode & Abubakar, 2022). From 2022 onward, performance improved steadily for both genders, reflecting recovery and adjustment to regular schooling.

Although female students slightly outperformed their male counterparts across the years, the differences were not significant,  $F(1, 983) = 0.35, p > .05$ . The reduction in standard deviation toward 2024 indicates greater consistency in learning outcomes, possibly due to improved

curriculum delivery and access to resources (Eze & Nwachukwu, 2023). These findings agree with Okoli and Nwosu (2021) and Uzochukwu (2022), who also found no major gender gap in science achievement, emphasizing that instructional quality and learning environment influence performance more than gender.

The results in Tables 5 and 6 reveal that although students' performance in Basic Science varied slightly across school locations from 2020 to 2024, the difference between urban and rural schools was not statistically significant. Urban schools showed slightly higher performance in the earlier years, but rural schools demonstrated steady improvement toward the later period, indicating gradual progress in teaching and learning outcomes. The ANOVA result confirmed that both groups performed comparably, suggesting that students' achievement was more influenced by instructional quality, teacher competence, and access to learning materials than by school location.

This finding aligns with the reports of Onyema and Nwankwo (2022), who found no significant location-based differences in science achievement among secondary school students due to equal curriculum exposure and the adoption of digital learning. Similarly, Abdullahi et al. (2021) emphasized that teacher expertise and student engagement are stronger predictors of performance than geographical setting. Although the result differs from earlier studies by Eze and Okafor (2020) and Adewale (2023), which showed better performance among urban students due to superior facilities and technology access, it supports recent findings by Usman and Ibrahim (2022) indicating a narrowing rural–urban performance gap resulting from improved teacher deployment and rural education initiatives.

The results suggest that school location is becoming less influential in determining students' performance in Basic Science. Sustaining equitable educational reforms, improving teacher effectiveness, and ensuring fair distribution of learning resources will be essential to maintaining balanced academic progress across both urban and rural schools. The results show that students' performance in Basic Science differed significantly between public and private schools over the study period. During the early years (2020–2021), public school students recorded higher achievement, likely due to government-driven initiatives in teacher training and laboratory improvement. However, from 2022 onward, private school students showed steady progress and eventually surpassed their public-school counterparts. This improvement suggests that private schools may have adopted more effective instructional strategies, integrated digital tools, and provided closer supervision and personalized learning support. The significant ANOVA result,  $F(1, 983) = 3.76, p = .05$ , confirms that school type had a measurable effect on students' academic performance. These findings agree with Okon and Nwosu (2023), who reported that private school students often perform better due to smaller class sizes, improved learning facilities, and learner-centered instruction. Similarly, Akinyemi and Adewale (2022) observed that consistent teacher evaluation and interactive teaching approaches contribute to private school success. Ogunleye and Bello (2022) also linked students' higher performance in private schools to better classroom environments and stronger teacher–student relationships.

In contrast, studies by Adewuyi (2021) and Eze and Okafor (2020) found that public schools sometimes outperform private schools due to better-equipped laboratories, qualified science teachers, and government monitoring systems. Nonetheless, the present result suggests that school ownership alone does not determine achievement levels. Rather, the quality of instruction, management effectiveness, and availability of learning resources are the true determinants of academic success. The findings demonstrated the need for both public and private schools to maintain consistent teacher development, ensure adequate supervision, and promote engaging instructional practices. Sustained improvement in these areas will help close the performance gap and enhance overall achievement in Basic Science.

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