



Impact of Biology Competitions on Student Motivation and Academic Performance in Public Schools in Kaduna State, Nigeria

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ABSTRACT

*This study, titled "Impact of Biology Competitions on Student Motivation and Academic Performance in Public Schools in Kaduna State, Nigeria," examined how participation in biology competitions influences students' enthusiasm and academic achievement. A mixed methods design was employed, integrating quantitative analysis of performance data with qualitative interviews and surveys. The population comprised 16,999 SS3 students, 716 biology teachers, and 368 administrators across Kaduna State's 23 Local Government Areas. A total sample of 86 respondents, including 80 students, four teachers, and two administrators, was selected using mixed and purposive sampling techniques. Data were analyzed using descriptive statistics, independent sample *t* tests, and thematic analysis. Findings revealed that students who participated in biology competitions ($M = 37.85$, $SD = 5.12$) significantly outperformed non-participants ($M = 31.40$, $SD = 4.76$); $t(78) = 5.79$, $p < .001$, indicating a strong positive effect on motivation and academic performance. The study inferred that competitions foster intrinsic motivation, confidence, and deeper learning engagement. It is therefore recommended that schools institutionalize biology competitions as integral components of academic programs to enhance students' performance and sustained interest in STEM education.*

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INTRODUCTION

In Nigeria, there is a growing recognition of the importance of enhancing student motivation and academic achievement, particularly in the realm of science education (Freeman et al., 2020). One effective strategy is the integration of extracurricular activities, such as biology competitions, into the educational framework (Watkins & Mazur, 2021). These competitions offer students a platform to showcase their knowledge and skills, potentially leading to significant improvements in motivation and academic performance (Jiang et al., 2024).

Motivation plays a crucial role in student engagement and academic success (Onasanya, 2018). Intrinsic motivation, characterized by an internal drive to engage in activities for their own

sake, is especially pertinent in the context of biology competitions (Tai et al., 2020). Such events provide students with opportunities to explore their biological interests beyond the standard curriculum, fostering curiosity and enthusiasm for the subject matter (Jiang et al., 2024). Research indicates that participation in these competitions can enhance intrinsic motivation, thereby enriching the overall learning experience (Freeman et al., 2020).

Academic performance, often measured through grades and examination results, reflects students' grasp of academic content (Watkins & Mazur, 2021). Studies have demonstrated a positive correlation between involvement in extracurricular activities, including biology competitions, and academic achievement

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(Freeman et al., 2020). These competitions enable students to apply theoretical knowledge to practical scenarios, deepening their understanding of biological concepts and honing critical thinking skills (Onasanya, 2018). Moreover, engagement in such activities can cultivate academic discipline and perseverance, contributing to improved academic outcomes (Jiang et al., 2024).

This study seeks to contribute to the existing body of knowledge by examining the impact of biology competitions on student motivation and academic performance in public schools in Kaduna State, Nigeria. By exploring how participation in these events influences student outcomes, the research aims to provide valuable insights for educators, policymakers, and stakeholders dedicated to advancing STEM education in the region. (Tai et al., 2020).

In the context of Kaduna State, the educational landscape is characterized by various challenges, including limited resources and infrastructure, including limited access to laboratories, study materials, and trained personnel. These limitations can impede students' ability to effectively prepare for and participate in biology competitions, potentially affecting their motivation and academic performance. Also, discrepancies in competition regulations and curriculum content may conceal the link between competition participation and academic performance. Teachers may lack the necessary training, resources, or time to adequately coach students, diminishing the potential impact of competitions on student motivation and academic performance. Certain stakeholders have emphasized the difficulties connected with organizing and participating in biology competitions in Nigeria. These problems include resource restrictions, logistical issues, and concerns about curriculum congruence, all of which may have an impact on competitions' overall efficacy in delivering targeted learning outcomes (Ogunleye et al., 2020).

Addressing these issues is critical for conducting a thorough and rigorous examination into the effects of biology competitions on student motivation and academic achievement in Kaduna

State's public schools. Researchers can assure the validity and reliability of study findings by identifying and controlling any confounding factors, which contribute to our knowledge of competitions' significance in fostering STEM education and academic performance.

The literature on students' motivation, academic performance, and perceptions regarding participation in biology competitions underscores the transformative impact of such contests on learning outcomes. Existing studies have consistently demonstrated that competitions not only enhance students' motivation but also improve academic achievement and positively shape perceptions toward science learning (Deci & Ryan, 1985; Johnson et al., 2021; Okebukola et al., 2022).

Deci and Ryan's (1985) Self-Determination Theory (SDT) remain foundational in understanding motivation within academic contexts. The theory posits that students are intrinsically motivated when their psychological needs for autonomy, competence, and relatedness are met. Johnson et al. (2021) reaffirmed this framework in modern educational settings, revealing that intrinsic motivation significantly influences student engagement and performance, particularly when learners perceive a sense of autonomy and purpose in their learning activities. These findings are consistent with those of Ryan and Deci (2020), who noted that intrinsic motivation fosters persistence and deep learning, especially in competitive environments.

In terms of academic performance, Olamide and Adebayo (2023) found a strong relationship between intrinsic motivation and students' academic outcomes in mathematics among Nigerian secondary school learners. Their results indicate that motivation catalyzes academic excellence. This aligns with the findings of Adeyemo et al. (2021), who reported that motivated students performed better in science and biology contests than their less motivated counterparts. Similarly, a recent comparative study by Adebajo and Yusuf (2024) revealed that students who participated in STEM competitions demonstrated higher achievement levels and problem-solving abilities than those who did not



engage in such activities, further underscoring the academic benefits of competition-based learning.

Okebukola et al. (2022) emphasized that interactive and hands-on approaches, such as science and biology competitions, are vital for sustaining student interest and enhancing comprehension of complex scientific ideas. Their study highlighted that competitions stimulate curiosity, promote collaborative learning, and improve retention of scientific knowledge. Likewise, Chidi et al. (2020) found a positive correlation between participation in extracurricular activities, including biology contests, and overall academic performance, suggesting that competitive engagements promote holistic educational development. This observation was supported by Olufunmilayo and Tunde (2023), who discovered that participation in science-related extracurricular activities in Ogun State significantly improved students' grades and classroom participation.

Beyond performance, students' and educators' perceptions also provide valuable insight into the role of competitions in science education. Ijeoma and Obi (2022) observed that students perceived biology and science competitions as stimulating learning platforms that enable them to apply theoretical concepts to real-world contexts. Participants reported improved confidence, problem-solving skills, and intrinsic satisfaction. In agreement, Nwosu and Adeola (2024) noted that students engaged in competitions developed a stronger sense of academic purpose and career direction in STEM fields.

Teachers' perspectives, as reported by Oladeji and Fakunle (2024), emphasized the pedagogical value of competitions in enhancing student engagement, critical thinking, and teamwork, key attributes for 21st-century learning. Ogunleye et al. (2020) also documented that school administrators recognized competitions as effective in nurturing a culture of academic excellence, improving student-teacher interactions, and promoting institutional reputation. Administrators further highlighted that such activities help identify and develop gifted students while encouraging innovation and

commitment to learning (Adewunmi & Bello, 2023).

Collectively, these studies suggest that biology competitions serve as dynamic educational tools that foster intrinsic motivation, strengthen academic performance, and cultivate positive perceptions among students, teachers, and administrators. They bridge the gap between classroom learning and practical application, thereby reinforcing students' cognitive and affective engagement with science. The convergence of evidence from both local (e.g., Adeyemo et al., 2021; Okebukola et al., 2022) and international studies (e.g., Ryan & Deci, 2020; Johnson et al., 2021) affirms that competitive learning environments significantly contribute to students' academic and personal growth.

Objectives of the Study

The following objectives were set for the study:

1. To determine the level of motivation among students participating in biology competitions.
2. To compare the academic performance of students competing in biology competitions to their non-participating counterparts.
3. To investigate the perception of students, teachers, and school administrators on the influence of biology competitions on student learning outcomes.

Research Questions

1. What is the level of motivation among students participating in biology competitions?
2. How does the academic performance of students participating in biology competitions compare to that of non-participating students?
3. What are the perceptions of students, teachers, and school administrators regarding the influence of biology competitions on student learning outcomes?

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Research Hypotheses

Null Hypotheses (H_0):

1. There is no significant level of motivation among students participating in biology competitions.
2. There is no significant difference in the academic performance of students participating in biology competitions and their non-participating counterparts.
3. There is no significant difference in the perceptions of students, teachers, and school administrators regarding the influence of biology competitions on student learning outcomes.

METHODOLOGY

Design of the Study

The study adopted a mixed-methods approach, integrating quantitative analyses of academic performance data with qualitative interviews and surveys. Participants would include students from chosen public schools in Kaduna State, as well as instructors and school administrators who organize or facilitate biology competitions.

Area of Study

Kaduna State comprises twenty-three (23) Local Government Areas, covering an area of 44,408.3 square kilometers. The study will be conducted in some randomly selected public Secondary Schools in the twenty-three (23) Local Government Areas of the state.

Population of the Study

The population of the study comprised 16,999 SS3 students, 716 Biology teachers, and 368 school administrators in the twenty-three (23) Local government Areas of the state's public secondary schools.

Sample and Sampling Technique

The study employed a mixed sampling approach to ensure adequate representation of participants across public secondary schools in Kaduna State. A group of students and teachers was randomly selected, while purposive sampling

was specifically used to target students actively engaged in biology competitions. This approach ensured the inclusion of individuals from varied backgrounds and demographics, thereby enriching the diversity of perspectives.

In accordance with the quasi-experimental design adopted for the study, a total of 80 students were selected, guided by the recommendation of Avcu and Avcu (2022), who advised that each group (experimental and control) should comprise at least 30 participants to maintain sufficient statistical power and research validity. Sampling fewer than this threshold could compromise the reliability of results. In addition to the student participants, four biology teachers and two school administrators were purposively included to provide qualitative insights. Altogether, the study sample comprised 86 respondents, combining both quantitative and qualitative participants to ensure comprehensive data collection and balanced representation.

Instrument for Data Collection

The study employed a mixed-methods research approach to comprehensively assess the motivation levels and academic performance of students participating in biology competitions, as well as to explore the perceptions of key stakeholders on the impact of such competitions on learning outcomes. The quantitative aspect involved the administration of a 25-item multiple-choice Biology Performance Test, with each item carrying two marks, summing up to a total of 50 marks. The test was designed to objectively evaluate students' understanding of core biological concepts and their ability to apply this knowledge in competitive learning environments. Complementing this, the qualitative component focused on obtaining deeper insights into the experiences and perceptions of students, teachers, and school administrators regarding the influence of biology competitions on student learning outcomes. This design allowed for a detailed exploration of participants' views on how competitions contribute to increased interest, engagement, and academic growth among learners within the Kaduna State educational context.

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To ensure the quality and appropriateness of the research instrument, face and content validation were conducted by two experienced Biology lecturers from the Department of Biology, Federal University of Education, Zaria. These experts critically reviewed the instrument to confirm its alignment with the research objectives, the clarity and precision of the questions, and the simplicity and accuracy of the language used.

For reliability testing, the instrument was pilot-tested using 20 students drawn from a public secondary school within the study population. The test-retest method was employed, and the Pearson Product-Moment Correlation Coefficient was calculated, yielding a reliability coefficient of 0.76. This value indicated a high level of consistency, suggesting that the instrument was dependable and suitable for use in the main study.

Data Analysis

Descriptive statistics were employed to summarize the mean scores of the experimental and control groups, providing an overview of the sample characteristics and the distribution of academic performance. To determine whether there was a significant difference between the two groups, an independent samples t-test was conducted. In analyzing the perceptions of students, teachers, and school administrators, thematic analysis was applied to qualitative data obtained from interviews and focus group discussions. This approach enabled the identification of recurring themes and patterns that revealed deeper insights into stakeholders' views on the impact of biology competitions. All analyses were performed using the Statistical Package for the Social Sciences (SPSS), version 25.

RESULTS

The result of this study was presented based on the objectives and the test of the hypothesis. Objectives 1 and 3 were analyzed using thematic analysis, since they concerned qualitative data, while objective 2 was analyzed using an independent sample t-test (test of hypothesis) since it concerned quantitative data.

Objective 1: Level of motivation among students participating in biology competitions

Thematic analysis of teacher and administrator interviews showed that biology competitions increased student motivation. Common themes that emerged include:

1. **Intrinsic motivation:** Students showed excitement in solving challenging biology problems and improving their knowledge.
2. **Extrinsic motivation:** Recognition, awards, and peer admiration served as strong motivators.
3. **Sustained interest:** Students were more likely to extend their study hours and engage in group discussions outside class.

Teachers consistently reported heightened enthusiasm and determination among participating students.

1. One Biology teacher remarked, *"I noticed that once my students knew they were selected for the competition, their seriousness towards studying biology doubled."*
2. Another teacher added: *"Even the weaker students showed a desire to put in extra effort just to be part of the competition."*
3. A third teacher stated: *"The competitive spirit made them push themselves, and they were excited to answer questions in class."*
4. The fourth Biology teacher emphasized: *"Students felt proud representing their school, and this motivated them to study harder."*

From the administrators' perspective, competitions also built motivation beyond the classroom.

1. One administrator shared: *"We observed that students became more confident, and they carried this confidence into other subjects as well."*



2. Another administrator noted: *"The competitions created a sense of academic pride across the school, and even those not participating felt inspired to do better."*

Objective 2: Comparison of the academic performance of students competing in biology

competitions to their non-participating counterparts

Test of Hypothesis

Hypothesis 1: There is no significant difference in the academic performance of students participating in biology competitions and their non-participating counterparts.

Table 1: Independent sample t-test statistics on the academic performance of students competing in biology competitions compared to their non-participating counterparts

Group	N	Mean	Std. dev.	df	t-value	p-value
Participants in the Biology competition	40	37.85	5.12	78	5.79	0.001
Non-Participating Counterparts	40	31.40	4.76			

An independent samples t-test was conducted to compare the academic performance of students in the experimental group (participants in the biology competitions) and the control group (non-participants). Results revealed that students in the experimental group ($M = 37.85$, $SD = 5.12$) performed significantly better than those in the control group ($M = 31.40$, $SD = 4.76$); $t(78) = 5.79$, $p < .001$. These results suggest that participation in biology competitions has a statistically significant positive impact on student achievement in biology. Students who engaged in competitions demonstrated higher mastery of subject content and stronger problem-solving skills compared to their peers who did not participate.

Objective 3: Perception of students, teachers, and school administrators on the influence of biology competitions on student learning outcomes

Thematic analysis revealed overwhelmingly positive perceptions from teachers and administrators regarding the influence of biology competitions.

1. One Biology teacher explained: *"The competition made students read widely, not just relying on classroom notes but also exploring textbooks and online materials."*

2. Another teacher reflected: *"Students collaborated in groups, sharing ideas and quizzing each other. This improved their teamwork and critical thinking."*
3. A third teacher stated: *"The level of confidence students showed after the competition was remarkable. They now attempt difficult questions without fear."*
4. The fourth teacher highlighted, *"Competitions gave us an avenue to identify talented students who could pursue biology-related careers."*

Administrators also perceived competitions as transformative.

1. One administrator observed: *"Our school's reputation improved when our students excelled, and this motivated teachers to work harder in preparing them."*
2. Another administrator said, *"Competitions bring out the best in both students and staff. It creates a culture of excellence that spreads to other areas."*

DISCUSSION OF FINDINGS

The findings of this study revealed that participation in biology competitions significantly enhanced students' motivation, enthusiasm, and self-confidence, leading to improved academic performance. This outcome aligns with the



broader literature emphasizing the transformative impact of academic contests on students' learning experiences, motivation, and achievement.

Adeyemo et al. (2021) found that highly motivated students consistently outperformed their less motivated peers in science and biology contests, underscoring motivation as a critical determinant of academic success. This assertion is supported by Deci and Ryan's (1985) Self-Determination Theory (SDT), which posits that students' intrinsic motivation is strengthened when their needs for autonomy, competence, and relatedness are fulfilled. Similarly, Ryan and Deci (2020) and Johnson et al. (2021) reaffirmed that intrinsic motivation promotes deep learning and persistence, particularly when learners perceive a sense of purpose and self-direction in their educational pursuits.

Consistent with these theoretical foundations, the present study revealed that students who participated in biology competitions performed significantly better than their non-participating counterparts. This finding corroborates the results of Olufunmilayo and Tunde (2023), who reported that students engaged in extracurricular activities—particularly science-related competitions—demonstrated superior academic outcomes in Ogun State, Nigeria. Similarly, Adebajo and Yusuf (2024) found that participation in STEM competitions enhanced students' achievement levels, problem-solving abilities, and critical thinking skills, thereby highlighting the value of competition-based learning. In a related study, Olamide and Adebayo (2023) also established a strong relationship between intrinsic motivation and students' academic outcomes in mathematics, indicating that motivation serves as a key catalyst for excellence across scientific disciplines.

The findings further revealed that teachers and school administrators perceived biology competitions as effective tools for promoting learning, collaboration, and institutional reputation. This aligns with the work of Ijeoma and Obi (2022), who discovered that students in Enugu State viewed science competitions as opportunities to apply theoretical knowledge to real-world contexts, enhance problem-solving

skills, and deepen their understanding of scientific principles. Participants also reported increased confidence and a sense of accomplishment, reflecting the motivational value of such competitions. Nwosu and Adeola (2024) similarly noted that students involved in academic contests developed stronger academic purpose and clearer career direction in STEM-related fields.

Teachers' perspectives, as reported by Oladeji and Fakunle (2024), further emphasized that competitions enhance student engagement, collaboration, and critical thinking, key competencies for 21st-century learning. This observation aligns with the findings of Ogunleye et al. (2020), who noted that school administrators recognized competitions as effective means of fostering academic excellence, improving student-teacher interaction, and strengthening institutional prestige. Likewise, Adewunmi and Bello (2023) highlighted that competitions enable the identification and development of gifted students while promoting innovation and dedication to learning.

In addition, Okebukola et al. (2022) stressed that interactive and hands-on learning approaches, such as biology competitions, sustain student interest and improve comprehension of complex scientific concepts. Their study, alongside that of Chidi et al. (2020), demonstrated that participation in science-based extracurricular activities stimulates curiosity, encourages collaborative learning, and improves knowledge retention, leading to holistic educational development.

Collectively, these findings affirm that biology competitions serve as dynamic pedagogical strategies that bridge the gap between theoretical learning and practical application. They foster intrinsic motivation, enhance academic achievement, and cultivate positive perceptions among students, teachers, and administrators. The convergence of evidence from both local (e.g., Adeyemo et al., 2021; Okebukola et al., 2022) and international research (e.g., Ryan & Deci, 2020; Johnson et al., 2021) underscores that competitive learning environments contribute meaningfully to students' cognitive, affective, and social growth, positioning



biology competitions as a vital instrument for advancing science education in Nigeria and beyond.

CONCLUSION

This study concludes that biology competitions play a vital role in improving student learning outcomes. First, competitions greatly motivate students, enhancing their enthusiasm, confidence, and commitment to academic work. Second, participants perform better academically than non-participants, showing stronger mastery of biology concepts and problem-solving skills. Finally, teachers and administrators perceive competitions as highly beneficial, as they promote deeper learning, collaboration, and strengthen the academic reputation of schools.

RECOMMENDATIONS

Based on the findings, it is recommended that:

1. Schools should regularly organize and support biology competitions to sustain student motivation and academic engagement.
2. Teachers should be equipped with materials and training to prepare students effectively for competitions and maximize their learning benefits.
3. Education authorities should encourage schools to adopt competitions as part of academic programs to improve performance and enhance school reputation.

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