



*Effects of Cross-Age Peer-Tutoring Strategy on ... Atto, T. J. (2026)*

## **Effects of Cross-Age Peer-Tutoring Strategy on Academic Performance in Genetics Concepts among Upper Basic Science Students in Zaria, Kaduna State, Nigeria**

**ATTO, Tanko Jolly**

[jollytanko55@gmail.com](mailto:jollytanko55@gmail.com)

Department of Integrated Science, Federal University of Education, Zaria, Kaduna State, Nigeria

### **Abstract**

*This study investigated the effects of the Cross-Age Peer-Tutoring Strategy on students' academic performance in genetics concepts among Upper Basic Science Students in Zaria, Kaduna State. The strategy involves a tutor with an age difference of one or two years teaching younger tutees to facilitate better understanding. A quasi-experimental pre-test and post-test control group design was employed. From a population of 8,439 students, a sample of 140 participants was selected. Purposive sampling was initially used to identify six gender-based schools, followed by simple random sampling to assign experimental and control groups. Data were collected using the Genetics Performance Test (GPT), which achieved a reliability coefficient of 0.70. Validation was conducted by experts in Science Education and Biological Sciences. T-test was used to test the hypotheses at a  $p \leq 0.05$  significance level. Findings indicated a significant difference in mean performance scores; with the experimental group outperforming those taught via traditional methods ( $p=0.01$ ). and the academic performance of male and female students was not influenced by the use of peer tutoring instructional strategy to teach genetics concepts ( $p= 0.50$ ). It is recommended that Basic science teachers should make use of peer tutoring instructional strategy to teach genetics concepts in Upper Basic Secondary Schools and also they should encourage active participation of both male and female students during teaching and learning process to reduce boredom and increase students' performance.*

Keywords:

### **Introduction**

The term science finds its origin in the Latin word *Scientia*, which signifies a systematic body of knowledge acquired through objective enquiry and the rigorous exploration of the natural universe. Within the context of a developing nation such as Nigeria, science education is not merely a classroom requirement but the essential foundation for technological advancement, industrial growth, and sustainable economic strength. This perspective is supported by Bolarin (2021), who argues that scientific literacy is the primary gateway to national survival in an increasingly competitive global economy. Consequently, the Federal Ministry of Education (2014) emphasises the necessity of equipping learners with the critical skills and mental capabilities required to lead impactful lives amidst the rapid scientific changes of the modern age. This educational journey begins with Basic Science at the upper basic level, which according to Kim (2008), acts as the vital bedrock for all subsequent scientific specialisations. By providing a unified approach to scientific thought, Basic Science prepares students for the complexities of senior secondary subjects like Biology, Chemistry, and Physics. As noted by Oludipe (2020), a student must be thoroughly grounded in these fundamental concepts at the junior level to achieve success in the more specialised core sciences later in their academic career.

Despite its profound importance, student performance in Basic Science remains a significant concern within the Nigerian educational landscape. Recent reports from the Education Resource Centre, Kaduna (2022), indicate that learners consistently struggle with complex thematic areas, particularly Genetics Concepts such as heredity and variation. These pedagogical difficulties often stem from the



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persistent reliance on traditional, teacher-centred instructional methods which frequently fail to simplify abstract biological ideas for young learners. As Poopola (2020) observes, such conventional approaches often overlook the individual learning pace and cognitive background of the child. Peer tutoring offers a viable solution to this challenge by allowing students to assist one another, reinforcing essential skills through shared instruction and relatable dialogue. Paul (2016) characterises this strategy as a way to provide individualised and focused guidance, ensuring every student receives more consideration than in a standard lecture. By adopting such a student-centred approach, learners take an active role in constructing their own knowledge, a process that is expected to enhance their academic outcomes and mastery of scientific enquiry. Gender also plays a significant role in academic success, though contemporary research continues to present conflicting views on its influence. While some scholars, such as Njoku (2017), suggest that boys often outperform girls in science-related disciplines, others like Olatoye (2017) found no such disparity in their investigations. This study, therefore, examines whether the Cross-Age Peer-Tutoring Strategy can improve performance in genetics while remaining gender-neutral. By ensuring that both male and female students engage equally in the tutoring process, the strategy aims to mitigate any potential bias inherent in traditional instruction. This research is firmly supported by Vygotsky's Socio-Cultural Theory, which posits that social interaction is fundamental to cognitive development. Vygotsky argued that learning is a social process where the origination of human intelligence is rooted in society or culture. By interacting with older, more experienced peers, students can bridge the "Zone of Proximal Development" the gap between their current independent abilities and their potential achievement under guidance. This peer-led interaction allows for a more fluid exchange of ideas, enabling tutees to master complex genetics concepts that might otherwise remain inaccessible through solitary study or formal lectures.

### **Statement of the Problem**

Despite the foundational importance of genetics in the Basic Science curriculum, students in Zaria, Kaduna State, continue to record poor academic outcomes in this area. Genetics concepts, such as heredity, variation, and DNA structure, are often perceived by learners as abstract, complex, and difficult to comprehend. This difficulty is frequently exacerbated by the continued reliance on the traditional lecture method, which promotes passive learning and fails to stimulate student engagement. The persistent low performance is not merely a matter of cognitive ability but is deeply linked to a lack of interest. When students find a subject matter intimidating or disconnected from their experiences, their motivation to engage with the content diminishes, leading to a cycle of disinterest and failure. Furthermore, there remains a lack of consensus on how gender influences learning outcomes when modern instructional strategies are introduced, particularly in the local context of Kaduna State. The Cross-Age Peer-Tutoring Strategy (CAPTS) offers a potential solution by utilizing older, more experienced students to mentor younger peers, thereby breaking down complex concepts into relatable language. However, it is not yet clear to what extent this strategy can bridge the performance gap or spark a genuine interest in genetics among upper basic students. Therefore, this study is designed to investigate the effects of the Cross-Age Peer-Tutoring Strategy on the academic performance and interest in genetics concepts among upper basic science students in Zaria, Kaduna State.

### **Objectives of the Study**

1. To determine the difference in the academic performance of students taught genetics concepts using the Cross-age Peer Tutoring Strategy and those taught using the lecture method.



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2. To find out the effect of the Cross-age Peer Tutoring Strategy on the academic performance of male and female students in genetics concepts.

### Research Questions

1. What is the difference in the mean academic performance scores of students taught genetics concepts using the Cross-age Peer Tutoring Strategy and those taught using the lecture method?
2. What is the difference in the mean academic performance scores of male and female students taught genetics concepts using the Cross-age Peer Tutoring Strategy?

### Null Hypotheses

**H<sub>01</sub>:** There is no significant difference in the mean academic performance scores of students taught genetics concepts using the Cross-age Peer Tutoring Strategy and those taught using the lecture method.

**H<sub>02</sub>:** There is no significant difference in the mean academic performance scores of male and female students taught genetics concepts using the Cross-age Peer Tutoring Strategy.

### Methodology

#### Research Design

This study employs a pretest-posttest quasi-experimental and control group design. This design allows for the comparison of academic performance between the experimental group (taught with peer-tutoring) and the control group (taught with the lecture method).

#### Population of the Study

The target population consists of all public Secondary schools in the Zaria, Kaduna State, totaling 8,439 Upper Basic 2 students across 29 schools. This includes 4,853 males and 3,586 females.

#### Sample and Sampling Technique

A multi-stage sampling procedure is used. First, six schools are purposively selected based on gender. After pre-testing for equivalence, two schools are selected via simple random sampling (balloting). One school serves as the experimental group and the other as the control group. Intact classes are used, resulting in a sample size of approximately 140 participants.

#### Research Instrument

The primary instrument is the Genetics Performance Test (GPT). The Genetics Performance Test (GPT) is an instrument consisted of items sourced from different past question papers in order to measure the performance of students in genetics concepts. It consists of 30 objective items adapted by the researcher from BECE past questions from 2014-2023. The topics are definitions of genetics terms; concepts of monohybrid and dihybrid inheritance; simple crosses involving single characters in organisms; Mendel's first and second laws of inheritance; application of genetics in human population. Each of the 30 items was scored one mark giving a total of 30 marks since the statistics of mean scores and standard deviation was used to analyze the data.

#### Method of Data Analysis

Descriptive statistics (mean and standard deviation) are used to answer research questions, while inferential statistics (such as t-tests) are used to test the null hypotheses at a  $p \leq 0.05$  level of significance.

### Presentation of Results

**Hypothesis One:** There is no significant difference in the mean academic performance scores of students taught genetics concepts using the Cross-age Peer Tutoring Strategy and those taught using the lecture method.



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In order to test the null hypothesis one, the data generated data via Genetics Performance Test (GPT) were subjected to independent sample t-test statistics. The results obtained were computed and used to draw Table 1.

**Table 1.: Summary of Independent t-test Analysis of the Post Test Sores of Students in the Experimental and Control Groups.**

Variable	Groups	n	Mean	Std. D	M.df	T	P	Remark
Performance	EG	75	34.07	8.787	3.65	3.45	0.01	Significant
	CG	65	30.42	11.47				

Significant at  $P \leq 0.05$  level of significance.

Results in Table 1. shows that there is significant difference between the mean academic performance scores of students in the experimental and control group in favour of the experimental group. Reasons being that the calculated p-value of 0.01 is less than the 0.05 alpha level of significance p value  $0.01 < 0.05$ . This implied that the significant difference is in favour of the experimental group. Therefore, the null hypothesis which stated that there is no significant difference between the mean academic performance scores of students taught genetics concepts using peer tutoring Instructional Strategy and those taught using conventional method, is hereby rejected.

**Hypothesis Two:** There is no significant difference in the mean academic performance scores of male and female students taught genetics concepts using the Cross-age Peer Tutoring Strategy.

In order to test the null hypothesis three, the data generated data via Genetics Performance Test (GPT) were subjected to Independent Sample t-test statistics. The results obtained were computed and used in Table 2.

**Table 2: Summary of t-test Statistics on the significant difference between the Mean Performance Scores of Male and Female Students in the Experimental Group.**

Variable	Gender	n	Mean	Std. D	M.df	t	P	Rmk	Decision
Performance	Male	45	36.12	7.52	7.95	5.64	0.50	Not. Sig.	Retained
	Female	30	28.17	10.99					

Not significant at  $P < 0.05$  level of significance.

Results in Table 2 shows that there is no significant difference between the mean academic performance scores of male and female students in the experimental. Reasons being that the calculated p-value of 0.50 is more than the 0.05 alpha level of significance ( $0.50 > 0.05$ ). Therefore, the null hypothesis which stated that there is no significant difference between performances means scores of male and female students taught genetic concepts using Peer Tutoring Instructional Strategy, is hereby accepted meaning that peer tutoring teaching strategy is gender friendly.

**Discussion of Findings**

The study revealed that significant difference exists between the performance mean scores of students in the experimental and control groups. Therefore, the null hypothesis which stated that there is no significant difference between academic performance mean scores of students taught genetics concept using peer tutoring instructional strategy and those taught using Lecture is hereby rejected. This implies that students' scores were enhanced after exposure to peer tutoring instructional strategy implying that the peer tutoring instructional strategy is more effective in improving students' performance in genetics concepts than the conventional method. This finding is



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in line with that of Lubi and Polloway (2017) who concluded that peer tutoring instructional strategy is effective in improving students' academic performance in science. The finding from this study is also similar with that of Purnamasari (2018) who found that peer tutoring instructional strategy can improve students' memory. The results are also similar with that of Istigamah and Ichsan (2021) who concluded that to associate every information in the cognitive structure of humans, one of them is by using peer tutoring instructional strategy. However, the outcome of this study differs from that of Jackson and Osuhack (2022) and Felnor (2018) who recorded no significant difference in performance among Upper Basic. The reason for the deviation in the results could be due to location and teacher factor in handling peer tutoring instructional strategy. The result of this study also showed that the academic performance of male and female students was not influenced by the use of peer tutoring instructional strategy to teach genetics concepts. This means that there is no significant difference in the mean score of academic performance of male and female students taught genetics concepts using peer tutoring instructional strategy. This result is different from that of Okley (2019) Whitehead (2020) and Arbogast (2020) who stated that gender plays an important role in improving students' performance in science. This means that the approach of using peer tutoring instructional strategy has no negative effect on performance among males and female students; hence the strategy is gender friendly in teaching genetics concepts. This might be as the result of different location, topic taught and sample size. In conclusion, the peering tutoring teaching strategy was able to enhance students' performance in genetics because they work and share ideas based on their level of explanation among the peers. They participate actively unlike the conventional type where the students are passive.

### **Conclusion**

The study concludes that the Cross-Age Peer-Tutoring Strategy is a significantly more effective instructional approach for improving students' academic performance in genetics concepts than the traditional lecture method. The notable enhancement in post-test scores suggests that when learners are actively involved in constructing their knowledge through peer interaction, they retain complex scientific information with greater clarity. This success is largely attributed to the collaborative nature of the strategy, which allows students to simplify abstract concepts like heredity and variation into relatable language that resonates with their peers. By moving away from the passive "teacher-talk" model, the strategy creates a dynamic learning environment that fosters deep cognitive engagement and mastery of difficult science topics. Furthermore, the research demonstrates that the Cross-Age Peer-Tutoring Strategy is gender-friendly, as it does not create or widen a performance gap between male and female students. The results indicate that both genders benefit equally from the peer-mediated approach, suggesting that the effectiveness of the strategy is rooted in social and cognitive interaction rather than gender-specific learning styles. This finding is particularly important for educators in Zaria and the wider Kaduna State, as it provides a versatile and inclusive pedagogical tool that ensures equity in science education. Consequently, the study affirms that when students work and share ideas at their own level of explanation, they achieve higher academic outcomes regardless of their gender.

### **Recommendations**

Based on the findings and conclusions drawn from this study, the following recommendations are made:

1. Basic science teachers should make use of peer tutoring instructional strategy to teach genetics concepts in Upper Basic Secondary Schools.



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2. Basic science teachers should encourage active participation of both male and female students during teaching and learning process to reduce boredom and increase students' performance.

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