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Al-Hikmah Journal of Education (AJE)
Volume 12 Number 1 May, 2025
e-ISSN: 2705-2508; p-ISSN: 2384-7662

Effect of Peer Tutoring Strategy on Colleges of Education Agricultural Students' Retention in Genetics in North Central, Nigeria

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ABSTRACT
This study assessed the effect of Peer Tutoring Strategy on retention in genetics of colleges of education agricultural education students in north central Nigeria. The study guided by two research objectives and two hypotheses were also formulated and tested. Quasi- experimental design was adopted. The population of the study are all NCE II students of agricultural education in colleges of education in north central geopolitical zone of Nigeria and a sample size of 109 Students, from two colleges (one experimental group and a control group) and a self-designed researcher's instrument; the Genetics Achievement Test (GAT) served as the instrument for this study. It was administered to students as a pre-test and post-test, and then re-administered two weeks after the post-test to assess their retention levels. The research questions were addressed using mean scores and standard deviations, while the research hypotheses were tested with t-tests and ANCOVA at a 0.05 level of significance. The findings indicated that students taught genetics through the peer tutoring strategy demonstrated better retention compared to those who received traditional instruction. Additionally, male students in both the peer tutoring and traditional instruction groups showed higher retention levels than their female counterparts. Based on these findings, the study concluded that peer tutoring strategy is effective for teaching genetics as it improved students' retention. The study therefore recommended amongst others that peer tutoring strategy be utilized by teachers, schools should be sensitized on the use of innovative strategies in teaching, as it has proved effective in teaching difficult concepts.

Keywords: Peer Tutoring, Retention, Genetics

INTRODUCTION
Nigeria as a developing nation is in need of qualitative teachers that would assist in the advancement of its scientific, technological and economic development. The Nigerian Educational system has continued to serve for good quality education that aims to

Al-Hikmah Journal of Education (AJE)
Volume 12 Number 1 May, 2025
e-ISSN: 2705-2508; p-ISSN: 2384-7662

ensure these goals are achieved. Umar *et al*. (2017) stressed that vocational agriculture is designed to lay a solid foundation to train individuals to acquire occupational skills such as in crop farming, animal production, fish farming, snail rearing, rabbit rearing, marketing of agricultural produces, which will make them to be productive farmers. Sequeira (2012) opined that learning can be considered as change that is permanent in nature brought into students by a teacher through techniques like developing specific skills, changing some attitudes, or understanding specific scientific concepts operating in a learning environment. Ngwu (2015) also revealed that in most developing and underdeveloped nations of the world including Nigeria, traditional (chalk and talk) method of instruction is more often used to facilitate learning.

The attainment of goals and objectives depends on the effectiveness of teaching and learning, through the mandate of the Colleges of Education as a teacher training institution established with the teacher training programme at the NCE level. The mission is producing well-motivated teachers of world class quality with high personal and professional discipline, integrity and competence for the expansion of the basic education sector, and its goal is to make the Colleges of Education a Center of Excellence in teaching, learning and research and to facilitate the production of high-quality teachers, highly motivated and fully prepared for teaching at the basic education level. Hence, the relevance of effective teaching and learning (National Commission for Colleges of Education, 2012).

Learning as defined by Kendra (2022) is a moderately permanent change in behaviour as a result of experience. It is also regarded as the obtaining of useful information, knowledge, and skills. O'Byrne (2020) stated that learning strategies refer to methods that students use to learn and an individual's way of organizing and using a particular set of skills in order to learn content or accomplish other tasks more effectively and efficiently in academic and nonacademic settings. It includes way in which the teacher communicates the content, select instructional aids and activities that the students will undertake during the lesson, among of which is the cooperative learning technique.

Cooperative learning is a method that allows students to learn from one another while developing essential skills related to agriculture. According to Jamie (2023), cooperative learning occurs when students collaborate in small groups to accomplish a shared and distinct objective. Strategies refer to the step-by-step activities employed by the teacher to facilitate meaningful learning by the learner. Effective teaching strategies tailored to suit learner's disposition were noticed as educators realized that the ways they preferred to be taught is significant with respect to students' academic performance. Peer tutoring is one of those strategies that can help agricultural education students learn cooperatively among themselves.

Peer tutoring is an educational approach in which students act as tutors for one another. Pairing students can significantly enhance their overall academic, social, behavioural, functional, and interpersonal skills. These student pairs can be formed based on various criteria, including ability level, skill proficiency, or age. Peer tutoring has extensively proved to be an effective strategy that engage students and promote academic success. Peer tutoring is a type of learning style where students assist their peers in understanding various academic concepts. High level academic students act as tutors and instruct their classmates (Yashvinder and Sujatha Malini, 2018). It can be utilized in the teaching of abstract concepts such as genetics.

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Genetics is a very important science concept that stands as the bedrock upon which many other science disciplines like Medicine, Pharmacy, Nursing, Biochemistry, Genetics, Agriculture and so forth depend upon.

Ambuno et al (2008) reported that genetics is a site of learning that studies how genes are transferred from parents to offsprings, and the transmission of biological attributes from one generation to another through the activities of genes. Genetics is one of the compulsory courses offered at NCE II in the vocational agriculture curriculum, which is very important in the understanding and performing excellently in subsequent courses like animal breeding and crop improvement in further levels. The study of genetics is significant in combating the nation's challenges like food insecurity, unemployment and poverty. Retention of genetic concepts will go a long way in assisting the learners in its future application. Disha, (2022) postulated that retention is the learner's ability to store new information into their long-term memory so that it is easily recalled and put into use in the future. It is all about making new information and concepts stick for a long time.

Despite the significance of genetics and its application to man, and other living organisms, the consistent and steady increase in failure rate attest that the teaching and learning need to be properly looked into. Genetics is a concept reported by researchers to pose great challenge to both learners and teachers. Paul (2018) informed that despite the huge significance of Genetics to man's living and sustenance, it is a field of science discovered to be difficult to teach and to learn by teachers and students respectively in many parts of the world, as students have a lot of misunderstandings about the concepts, where it acts as a barrier and challenging to grasp. Ahmed (2007) also opined that there was a gradual decline in the results of NCE II students' achievement in Kwara State College of Education, Ilorin, in Genetics, where students attributed the reason in their performance to include; lecturer's teaching methodology, Lecturer's attitude to teaching, non-exposure to practical work etc.

Multiple studies have been conducted on the issue of failure in genetics, with various recommendations and suggestions being emphasized. Several research efforts have evaluated strategies such as Computer Assisted Instruction, the use of text structures, pre-teaching mathematical components (Paul, 2018; Alabi, 2016; Buseri, 2014; and Gbigbadua, 2020), and clarifying genetics terminology to tackle these challenges. Despite these efforts, only marginal improvements in academic achievement have been observed in recent times. Notably, to the best of this researcher's knowledge, no study has yet explored the effectiveness of peer tutoring in this context. This study was partly driven by the fact that classroom chores which contribute to effective teaching are majorly caused by teachers, with teacher's method of teaching of great impact. Equipping teachers with pedagogical training only, would not be enough to provide a positive, learnable and teachable classroom climate. Probably students learning among their peers may influence their academic achievement. Therefore, there is need to utilize other innovative strategies that could improve the teaching and learning of the concepts. Hence, this study determines the effect of Peer Tutoring Strategy on Agricultural Education Students' Retention in Genetics in Colleges of Education in North Central Nigeria.

Literature Review

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Learning is a continuous journey that begins at birth and extends throughout an individual's lifetime. Most educational theorists agree that three key conditions are essential for effective learning: contiguity, reinforcement, and repetition. Contiguity and reinforcement emphasize the importance of providing immediate positive feedback or rewards following a student's correct response during a learning activity. Regarding repetition, theorists concur that repeatedly practicing a response, combined with reinforcement, is crucial for both learning and long-term retention. This study is grounded in Piaget's theory of cognitive development.

According to Clements and Baptista (1990), two fundamental Piagetian principles guide teaching and learning: learning is an active process that involves direct experience, making mistakes, and seeking solutions. These elements are critical for the assimilation and accommodation of new information. This perspective supports the framework of the current study, suggesting that new concepts, ideas, objects, or events can effectively be introduced and internalized through online learning environments. Piaget described learning through three interconnected processes: schemes: mental structures organizing knowledge about how things function, assimilation: integrating new information into existing schemes, and accommodation: modifying or creating new schemes to incorporate new information.

The relevance of Piaget's theory to this study lies in its ability to help students apply their learning experiences in genetics to other related areas, such as crop and animal breeding, thereby enhancing their understanding and application of genetic concepts. The implication is that the implementation of this theory is in line with the area of pedagogy for genetics which will enhance effective learning of the course. It also helps lecturers in the choice of teaching methods, techniques, strategies and approaches, which can enhance effective teaching of genetic concepts in Colleges of Education.

Conceptual Framework

Peer Tutoring

The term peer tutoring refers to an individual with the same status as the individual being tutored, which in most cases is not the teacher. Its first use was recorded in the late 1970's in England. Andrew Bell, a superintendent of a military male asylum, began using it to better educate his male students and to save money for his school whose budget faced serious problems. Since then, it has been adopted and used for different purposes throughout the world. Peer tutoring is a teaching strategy that uses students as tutors. The student pairs might work on academic, social, behavioural, functional or even social skills. Peer tutoring can also be seen as a system of instruction during which students help one another comprehend the material and in turn learn by teaching (Wolfe, 2018). At present, the significance of peer tutoring is increasing, and it has become an important part of diverse courses and different disciplines in many countries, (Ali et al., 2015).

Retention of Knowledge

Retention refers to as measurable levels of demonstration that learning has been maintained over a period of time. Retention is measured in collaboration with performance. Retention of learned information can be defined as having the information stored in long-term memory in such a way that it can be readily retrieved. (Karpicke and Roediger, 2007) Retention is the ability to remember experiences and things learnt. (Hornby 2015). Retention in learning is the ability of the learner to retain facts in

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memory, it deals with how well a learner can retain facts he/she has learnt over a long period. Retention is seen as a positive aspect of memory while forgetting as the negative aspect. Frequent reviews and tests elaborated feedback and active involvement of students in the teaching and learning process have been related to increasing retention abilities of students. Hence, peer tutoring strategy could improve students' retention in genetics.

Genetics in Agriculture

Genetics is the study of heredity in general and of genes in particular. Genetics forms one of the central pillars of biology and overlaps with many other areas, such as agriculture, medicine, and biotechnology (Winchester, 2025). The knowledge of genetics helps students learn about genes and their mode of transmission from generation to generation. Also, students learn absolute scientific ways of expressing the genetic defects usually found in their clans and communities. Chifwa (2015) stated that genetics is widely regarded as one of the most challenging subjects for both teachers and students, with numerous studies reporting that it presents significant difficulties for science learners and educators across various regions.

Genetics is a course offered by the Year II Agricultural Education students in the colleges of Education and reports indicates that students' performance in the course is not encouraging. It has been observed that there was a constant decline in students' performance in the results of NCE II Students in Genetics, where students attributed the reason in their performance to include; Lecturer's teaching methodology, Lecturer's attitude to teaching, non-exposure to practical work etc. It was also remarked that WAEC (2015) Chief Examiner's report on students' performance in some aspects of Biology with genetics inclusive revealed a low achievement by students, where it is claimed to be due to neglect of genetics by most teachers and academic ability and area of specialization of teachers.

However, good mastery of the subject matter in turn makes them perform excellently in the subsequent related courses (Crop Improvement and Animal Breeding) offered in the other levels and also in furtherance pursuit of higher degree. The importance of genetics in day-to-day activities such as blood transfusion, determination of paternity, crime detection, plant and animal breeding and so on cannot be over emphasized and it therefore requires effective teaching and learning of the concept.

Gender Differences

Gender refers to the cultural, social, and psychological meanings that are associated with masculinity and femininity (Wood & Eagly, 2002). Gender is a set of distinguishing factors between male and female. In educational research, it is used to measure the performance of students based on their sex, which may be male or female. Males are expected to perform better than females in most science, mathematics and other difficult concepts, but some findings have proved to be non-affirmative. This study investigates gender influence on students' performance in genetics.

Objectives of the Study

The study sought to:

1. To evaluate the level of genetic retention among Agricultural Education students taught using the Peer Tutoring Strategy compared to those taught through traditional instructional methods.

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e-ISSN: 2705-2508; p-ISSN: 2384-7662

2. To examine the level of genetic retention among Agricultural Education students using the Peer Tutoring Strategy versus traditional instruction, with a focus on differences based on gender.

Research Questions

1. How does the level of genetic retention differ between Agricultural Education students taught using the Peer Tutoring Strategy and those taught using traditional instructional methods?
2. How does gender influence the difference in genetic retention levels among Agricultural Education students taught via Peer Tutoring Strategy compared to traditional instruction?

Research Hypotheses

1. There is no significant difference in genetic retention levels between Agricultural Education students taught using the Peer Tutoring Strategy and those taught through traditional instruction.
2. There is no significant difference in genetic retention levels between male and female Agricultural Education students taught using the Peer Tutoring Strategy and those taught through traditional instruction.

Methodology

The study employed a quasi-experimental design to assess students' retention in genetics. The research was conducted in the North-central region of Nigeria. The target population included all NCE II Agricultural Education students enrolled in Colleges of Education within this region. For the study, the researcher randomly selected two Colleges of Education: Federal College of Education Kontagora in Niger State and Kogi State College of Education, Ankpa in Kogi State. A total sample of 109 NCE II Agricultural Education students from these two institutions participated in the study (one treatment and one control) comprised the respondents for the study since intact classes were used, being quasi-experimental research. Seventy-three (73) students from Federal College of Education, Kontagora comprised the experimental group while Thirty-six (36) students from College of Education, Ankpa were the control group.

The research instrument was a self-designed question item titled "Genetics Achievement Test (GAT)" administered to students as pre-test, post-test, and retention test after successive re-arrangement of question items in order to measure students' achievement and retention in the study. The GAT items consist of fifty (50) multiple choice questions with four options A-D, where one is the correct answer on genetics. The objective items attract 2 marks each. The instrument consists of two sections (A and B). Section A consists of the demographic data of the students, while section B contains the test items in genetics for the study. In order to ensure both face and content validity, the GAT was given to two lecturers in the Departments of Agronomy, University of Ilorin, Ilorin, Nigeria and one Agricultural Education lecturer in Kwara State College of Education, Ilorin with a minimum of ten years teaching experience. Also, the instrument was trial tested to determine its reliability using a test-retest method. The instrument was administered on another set of an intact class students of Federal College of Education, Osiele, Ogun state, who are not part in the main research, twice in an interval of three weeks.

The students' scores were correlated and analyzed using Kudar Richardson-20 statistics to determine its reliability. The value obtained was 0.80. The Genetics Achievement

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Test (GAT) was administered on both experimental and control groups as pretest before the teaching of the concepts. The experimental group, where the students were allowed to peer with each other in 20 minutes to share their learning experiences while teaching the concept. The lecturer peers them based on their strength, where one served as tutor and the others as tutees. The tutor (student teacher) explains the concept taught to the tutees (student learners), while the lecturer observes for likely corrections. The control group were exposed to traditional teaching method only.

The study lasted for eight weeks, where the participants were exposed to the post-test item analysis to determine their achievement, and at the tenth week, a retention test was conducted, where the GAT was re-administered on both groups to test for their level of retention. The research questions were answered using mean scores and standard deviation, while research hypotheses were tested using ANCOVA, at 0.05 level of significance. ANCOVA has the ability to control the effects of certain continuous variables, known as covariates, enhancing an experiment's correctness. Covariates are certain characteristics of the test participants that are not relevant to the study, but has the potential to affect the response variable

Results and Discussion

Analysis of Research Questions

Research Question 1: How does the level of genetic retention differ between Agricultural Education students taught using the Peer Tutoring Strategy and those taught using traditional instructional methods?

Table 1:

Comparison of the Mean Retention Scores of NCE Agricultural Education Students Exposed to Peer Tutoring and Traditional Instruction

GROUPS	N	$\bar{X}$	Std. Deviation
Peer Tutoring	73	66.02	4.13
control	36	53.84	5.522
Total	109	62.00	7.378

Table 1 presents the average retention scores of participants in the study. Students in the NCE Agricultural Education program who learned genetics through peer tutoring achieved a mean score of 66.02 with a standard deviation of 4.13. In contrast, those taught using traditional instructional methods had a lower mean score of 53.84 and a higher standard deviation of 5.52. These findings suggest that the peer tutoring approach significantly improved students' retention of genetics content compared to traditional teaching methods.

Research Question 2: How does gender influence the difference in genetic retention levels among Agricultural Education students taught via Peer Tutoring Strategy compared to traditional instruction?

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e-ISSN: 2705-2508; p-ISSN: 2384-7662

Table 2:
Mean Score of retention level of NCE Agricultural Education Students taught using peer tutoring and those exposed to traditional instruction based on gender

GROUPS	GENDER	N	$\bar{X}$	Std. Deviation
peer tutoring	male	46	67.34	4.132
	female	27	63.78	3.056
	Total	73	66.02	4.13
Control	male	22	57.18	3.738
	female	14	48.58	3.274
	Total	36	53.84	5.522
Total	male	68	64.06	6.23
	female	41	58.58	7.928
	Total	109	62.00	7.378

Table 2 presents the average retention scores of male and female participants in the study. Male NCE Agricultural Education students taught genetics through peer tutoring achieved a mean score of 67.34 with a standard deviation of 4.13, whereas female students scored a mean of 63.78 with a standard deviation of 3.06. In contrast, male students instructed using traditional methods had a mean retention score of 57.18 (SD = 3.74), while female students scored lower, with a mean of 48.58 and a standard deviation of 3.27. These results indicate that male students consistently outperformed female students in retention, regardless of the instructional method, with peer tutoring showing higher overall retention scores. This suggests that retention was more effectively enhanced among male students in this study.

Hypotheses Testing

H_{o1}: There is no significant difference in genetic retention levels between Agricultural Education students taught using the Peer Tutoring Strategy and those taught through traditional instruction.

Table 3:
Summary of t-test statistic of retention level of NCE Agricultural Education students taught using peer tutoring and traditional instruction

GROUPS	N	Mean	Std. Dev.	df	Cal. t	Sig.	Remark
Peer tutoring	73	33.01	2.065				
				107	12.929	.000	S
Control	36	26.92	2.761				

$P < 0.05$

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e-ISSN: 2705-2508; p-ISSN: 2384-7662

The t-test results presented in Table 3 show a calculated t-value of 12.929 at a 0.05 level of significance. The analysis reveals that the observed significance value (0.000) is less than the critical significance level (0.05). Therefore, the null hypothesis is rejected, indicating a significant difference in genetics retention between NCE Agricultural Education students taught through Peer Tutoring and those taught using traditional instruction. This outcome favors the Peer Tutoring approach, which achieved a higher mean score of 66.02 compared to the traditional method's mean score of 53.84. Consequently, the Peer Tutoring strategy effectively enhances students' retention in genetics more than traditional instructional methods.

H_{O2}: There is no significant difference in genetic retention levels between male and female Agricultural Education students taught using the Peer Tutoring Strategy and those taught through traditional instruction.

Table 4:

Summary of Analysis of Covariance (ANCOVA) of the mean score of retention level of NCE Agricultural Education students taught using peer tutoring and traditional instruction based on gender

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Remark
Corrected Model	1121.722[a]	4	280.431	83.740	.000	
Intercept	428.280	1	428.280	127.890	.000	
POSTTEST	12.673	1	12.673	3.784	.054	
GROUPS	528.264	1	528.264	157.746	.000	
GENDER	102.712	1	102.712	30.671	.000	S
GROUPS * GENDER	36.165	1	36.165	10.799	.001	
Error	348.278	104	3.349			
Total	106219.000	109				
Corrected Total	1470.000	108				

a. R Squared = .763 (Adjusted R Squared = .754)

$P < 0.05$

The ANCOVA results displayed in Table 4 reveal a calculated F-value of 30.67 at a 0.05 level of significance. The analysis indicates that the observed significance value (0.000) is below the critical threshold (0.05), leading to the rejection of the null hypothesis. This outcome demonstrates a significant difference in genetics retention between male and female NCE Agricultural Education students who experienced Peer Tutoring compared to those who received traditional instruction. Notably, male students showed a higher mean retention score of 64.06, surpassing the female students' mean score of 58.58. Therefore, the findings suggest that male students retained genetic concepts slightly better than their female counterparts across both instructional methods.

Discussion

There was a significant difference in the retention of genetics knowledge between NCE Agricultural Education students exposed to peer tutoring and those taught through

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e-ISSN: 2705-2508; p-ISSN: 2384-7662

traditional instruction, with the peer tutoring group showing superior outcomes. Specifically, students who experienced peer tutoring had a higher mean achievement score (56.22) compared to those taught traditionally (49.94), indicating that peer tutoring effectively enhanced their retention and understanding of genetics concepts. This finding is in line with Ugwu et al (2020) which showed that significant difference exists between the academic performance and retention of students taught biology using discussion method and that taught using lecture method. Based on these findings, it is recommended that Biology teachers receive training on the use and significance of the discussion method for teaching biology concepts effectively.

The study also revealed a significant difference in retention of genetics knowledge between male and female NCE Agricultural Education students exposed to peer tutoring versus those taught through traditional instruction. The results favored male students, aligning with the findings of Jibrin and Zayum (2012), who reported that male students taught genetics using the concept map instructional strategy outperformed their female peers.

Conclusion

The study concluded that the peer tutoring strategy is an effective approach for teaching genetic concepts. Students taught genetics through peer tutoring demonstrated better retention compared to those taught via traditional methods. Both male and female students benefited from this strategy, although male students showed slightly higher achievement in genetics across both teaching methods. This suggests that the peer tutoring strategy, when properly implemented, can enhance the academic performance of Agricultural Education students regardless of gender.

Recommendations

1. Peer tutoring should be adopted as a teaching strategy to enhance the effectiveness of instruction in genetics and other agricultural subjects.
2. Curriculum planners are encouraged to incorporate peer tutoring as an innovative instructional strategy, given its proven effectiveness in teaching abstract concepts.
3. Educational institutions should equip pre-service teachers with the skills to implement various innovative teaching strategies in their regular classroom instruction.

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