

EFFECTS OF MNEMONICS STRATEGY ON INTEREST AND ACHIEVEMENT IN GENETICS OF SENIOR SECONDARY SCHOOL II STUDENTS' IN GOMB METROPOLIS, GOMBE STATE, NIGERIA

Kala, Muhammad Dauda,¹ Mailaya, J. Masoyi,² Agbowuro, C.,³
Lammaru R. F.⁴ & Abdullahi, U.I.⁵

¹Department of Science Education, Faculty of Education Gombe State University Gombe

²Department of Science Education, Faculty of Education Federal University of Kashere, Gombe State.

³Department of Science and Technology Education, University of Jos, Jos, Nigeria

⁴Government Day Secondary School Bolari East Gombe, Gombe State

⁵Kano State Secondary School Management Board, Tudun Wada Zone.

Corresponding Author: maikamba@gsu.edu.ng

Abstract

This research delved into the impact of the mnemonics strategy on the levels of interest and achievement in genetics among senior secondary two students in Gombe Metropolis, Gombe State, Nigeria. Employing a non-equivalent group pre-test-post-test quasi-experimental design, the study encompassed a student population of 6,607, consisting of 3,927 males and 2,680 females. From this pool, a sample of 127 biology students was selected, comprising 71 males and 56 females. These students were drawn from intact co-educational classes within senior secondary schools in Gombe metropolis, utilizing a simple random sampling technique. The data collection instruments comprised a genetics achievement test (GAT) and a genetics interest rating scale (GIRS), both designed and validated by the researcher with input from three experts. The reliability of GAT and GIRS was assessed using Kuder-Richardson formula 20 (K-R20), yielding reliability coefficients of 0.75 and 0.71, respectively. The experimental group received instruction through the mnemonics strategy, while the control group was taught using lecture-based methods. The study was guided by two research questions and two null hypotheses. Research questions were addressed through mean and standard deviation scores, while the hypotheses were tested at a significance level of 0.05 using Analysis of Covariance (ANCOVA). The findings unveiled that students taught genetics using the mnemonics instructional strategy achieved significantly better results compared to those taught using lecture-based methods. The results also indicated a noteworthy difference in mean

achievement scores between the control and experimental groups in the post-test [$F(1,124) = 74.820, P=0.000 < 0.05, \text{partial } \eta^2 = 0.673$]. Conversely, no significant difference was found in interest mean scores between male and female students when taught genetics using the mnemonics strategy [$F(1,62) = 8.212, p = 0.312, P\text{-value } 0.312 > \alpha = 0.05$]. Based on these findings, the researcher recommends the integration of mnemonics strategy by biology teachers at the secondary school level. This strategy proves to be gender-inclusive, fostering engagement from both male and female students in the learning process, thereby augmenting their interest and achievement in genetics biology.

Keywords: Effects, Interest, Achievement, Genetic, Strategy, Mnemonics.

Introduction

Genetics is a branch of Biology that deals with the study of heredity and variations. It is the study of the structure, functions and behaviour of genes that influences many aspects of daily lives; of every organisms ranging from the food we eat, identification of criminals, to treatment of diseases, among others. In agriculture, genetic advancement has enabled scientists to alter a plant or animal's structure to make it more useful. For instance, food crops such as oranges, potatoes, wheat, and soybeans has been genetically modified to make them withstand insects or pests' attacks and harsh weather conditions. In Nigeria today, the study of genetics is considered so important and crucial to the agricultural development of the society. In spite of the crucial role genetics played in our daily lives, studies have shown that students' achievement in genetics have been persistently low (Okenyi, 2015 & WAEC Report, 2022). And if the rate of this failure is allowed to continue, there is going to be problem of manpower development in science education in Nigeria, especially in the field of Medicine, Pharmacy and Nursing Science, where biology is a pre-requisite in getting admission into such fields. The West African Examination Council (WAEC, 2015-2022) reports showed that only 40% - 50% of students who sat for the examination that year passed biology at credit level. This means that about 50% - 60% of the students that sat for the WAEC examination failed biology.

Okeke (2015) observed that in a country like Nigeria, the teaching and learning of science using activities or process skills methods have been a neglected fact. Students' under-achievement in biology could be attributed to some psychological factors such as lack of interest, anxiety, self-efficacy, reasoning ability, low self-esteem, and lack of motivation. And as such, the students perceived the learning of genetics as difficult and abstract that should be learnt only by rote learning (Memorization). However, Okeke (2016) opined that, the low achievement of students in genetics may be related to poor teaching method used by biology teachers, used of teaching aids, and students level of interest. Any effort to tackle the problem of low achievement in biology will be a mirage if the highlighted factors above are not taken into consideration.

It was as a result of this repeated failure that Science Teachers Association of Nigeria (STAN) has worked very hard over the years on improving students' academic achievement in science by emphasizing on the use of better and innovative teaching Strategy that could improve science delivery. The desire to improve science achievement through more effective instructional strategies has led to the increasing awareness in recent years of the importance of learners' centeredness in teaching. The National policy on education (2014), and the biology curriculum see biology as a practical and inquiry oriented subject that should be taught practically with different teaching Strategy involving students' participation and motivation. Science educators and researchers have been worried about how students learn science and the possible ways of enhancing science achievement in Secondary Schools. One of the efforts of Nigerian Government towards improvement of science and technology was reviewing of Senior Secondary School Curriculum from teacher/centered-oriented to student/activity-oriented with emphasis on experimentation, questioning, discussion, problem-solving, and exploitation. The new curriculum came into effect in September, 2011 according to Federal Ministry of Education 2014, as such; the learning of biology becomes necessary because of its important to human life. Governments of Nigeria

are more conscious more than ever about the importance of science and technology in the development of a nation in several aspects, such as educational development, economic growth, social awareness, cultural enrichment and technological development.

The federal government of Nigeria spends most of her budgetary allocation on science and technology education through building science and special schools, giving scholarships to science students within/abroad and providing laboratory equipment in various schools and institutions. So, also, there are several in-service training workshops organized for teachers by the Millennium Development Goals (MDGs') project in Nigeria, workshops, conferences are being organized annually by Science Teachers' Association of Nigeria (STAN) to sharpen teachers' skills and enhance their competences in teaching science and technology subjects. Teaching Method is a determinant factor of learning experience. It has direct impacts on students' interest and achievement in any subject. In order to actualize the goals of Nigeria Government, effective learning and teaching Strategy should be employed by biology teachers. This is because the conventional lecture method of teaching employed by biology teachers in Nigerian Secondary Schools is inappropriate because it does not encourage students' active participation in the class. And as such it does not result in metacognition, reflective thinking of concepts and its principles.

Chollom (2013) also noted that teachers in the Secondary Schools use conventional teaching method in teaching all concepts including difficult ones. Interest is a motivating force, a subjective feeling of curiosity or intentness over something (Hornby, 2017). Alireza and Shella (2014) view interest as an excitement or feeling accompanied by special attention to something. It is an important variable in learning because when one becomes interested in an activity, he/she is likely to become more deeply involved in that activity. The enthusiasm with which students enter into any learning activity is determined by their interest in that particular activity. Students seem to learn more efficiently to a thing that appears to

interest them. The interest people have can frequently influence the way they act in situation. For this reason, administrators, psychologists, educators, and sociologists are concerned with interest development, how they affect behavior and how they can be changed. Interest therefore; refers to readiness (intentness) or curiosity of students towards the study of genetics biology.

Achievement has been defined by different authors in different ways. According to Ricardo (2014), it is the measure of students' acquisition of certain skills at the end of teaching and learning activities, the result of an examination written by students which is often a reflection of learning; it is the result of students' ability to perform a given role effectively. Achievement refers to how well a student is accomplishing his or her tasks and studies (Scott, 2015). Grades are certainly the most well-known indicator of academic achievement in secondary school. Achievement represents performance outcomes that indicate the extent to which a person has accomplished specific goals that were the focus of activities in instructional environments, specifically in school, college, and university. School systems mostly define cognitive goals that either apply across multiple subject areas (e.g., critical thinking), or include the acquisition of knowledge and understanding in a specific intellectual achievement domain (e.g., numeracy, literacy, science, history). Therefore, achievement may be considered to be a multifaceted construct that comprises different domains of learning (Spinath, 2014). This includes the knowledge attained or skills developed in school subject by test-scores.

Mnemonics is an instructional Strategy designed to help students improve their memory of important information. This technique connects new learning to prior knowledge through the use of visual and/or acoustic cues. Mnemonics are strategies that can be modified to fit a variety of learning content. This method enhances memory of complex words or ideas and promotes better retention of materials to be learned. Mnemonics is a tool that helps learners recall larger pieces of information, especially

in the form of lists like characteristics, steps, stages, parts, phases, etc. Mnemonics Strategy enhances imagination, improvement in memory.

Teaching Strategy is a teacher way in teaching learning process to manipulate the students in achieving the desired objectives effectively and interestingly. The teacher has the role not only to teach the students but also advise and guide the students through teaching Strategy that is applied. Teaching Strategy are the tools of the teacher for reaching out to the students thereby achieving the set objectives. An effective teacher has multiple of strategies at his disposal and must be prepared to select the one which will be more effective and interesting for the learner in order to achieve the desired goal. The teacher must put into consideration: the age of the students, their individual level and ability, the class setting, the length of the class and the curriculum. The teacher will use different teaching Strategy to reach out to all students with different learning abilities and intelligent quotient (IQ) (Finzi, 2015). The educational Strategy is a process of cognitive and effective development whose aim is to moulds the teacher towards a total contribution to the development of the learner and the community (Durosaro, 2014). In achieving this by the teacher, there is need to improve on the use of teaching Strategy like the Mnemonics Strategy. Therefore, this study is aim at investigating if appropriate use of mnemonics strategy in teaching genetics could yield a better interest and achievement of students' in Gombe State, Nigeria.

Statement of the Problem

The learning of genetics biology in Nigerian secondary schools have been found to be difficult for students' due to lack of qualified and well-trained Science teachers, overcrowded classrooms, lack of suitable and adequate science laboratories/equipment, and inappropriate teaching methodology. These have caused very serious problems to the education sector thereby leading to students' lack of interest and under-achievement in internal and external examinations. Other problems include: difficult biological concepts, teaching strategy, level of organization and abstract level of concepts. Observed that, topics that involve physiological process,

such as Mendelian genetics, trait, heredity, gene theory, chromosomes, mitosis and meiosis are difficult to learn by secondary school students. This study was therefore designed to determine the effects of mnemonics strategy on the interest and achievement of senior secondary school students in genetics in Gombe State, Nigeria.

Objectives of the Study

The study intends to achieve the following objectives.

1. Determine the achievement mean scores of students taught genetics using mnemonics strategy with those taught using conventional teaching method?
2. Disclose the difference in the interest mean scores of Male students compared with Female students when taught genetics using mnemonics strategy.

Research Questions

To guide this study, the following research questions were answered.

1. What is the achievement mean scores of students taught genetics using mnemonics strategy compared with those taught using conventional teaching method?
2. What is the difference in the interest mean scores of male students compared with female students when taught genetics using mnemonics strategy?

Hypotheses

The following hypotheses were formulated and tested at 0.05 level of significance

Ho₁: There is no significant difference in the achievement mean scores of students taught genetics using mnemonics strategy with those taught using conventional teaching method.

H₀₂: There is no significant difference in the interest mean scores of Male students compared with Female students when taught genetics using mnemonics strategy.

Research Methodology

This study adopted the non-equivalent control groups, pre-test post-test quasi-experimental research design. These become imperative in accordance to Amos (2015), in checking internal invalidity that will arise during the study. In this study, no randomization was applied in assigning samples to either experimental or control groups, rather intact groups (classes) were assigned to the experimental and the control groups. A pre-test was administered to both groups to determine the differences in the ability of the two groups on the test as well as their entry level. The researcher makes used of intact classes and normal school period to carry out the study. The target population for this study comprised of all the SSII biology students' in the 14 co-educational public secondary schools in Gombe Metropolis, Gombe State. A total of 127 students were sampled and this comprised of 71boys and 56 girls. Two secondary schools were selected and this was achieved through simple random sampling. The instruments used for data collection are the Genetics Achievement Test (GAT) and the Genetics Interest Rating Scale (GIRS) questionnaire to seek the opinion of students on their interest toward the method and on their academic achievement in genetics.

Results

The results of the study were analyzed and presented under the following research questions and hypotheses.

Research Question One: What is the achievement mean scores of students taught genetics using mnemonics strategy compared with those taught using conventional teaching method?

Table 1: Achievement Mean Scores and Standard Deviation of Students of Experimental and Control Groups

Group	N	Pre-test		Post-test		Mean difference
		Mean	S. D	Mean	S. D	
Experimental	65	35.17	10.44	53.74	9.77	18.57
Control	62	37.82	8.23	42.58	8.96	4.76
						13.81

Table 1 shows that the pre-test mean scores and standard deviation of students in experimental group was ($n = 65$, $M = 35.17$, $SD = 10.44$) and that of their counterparts in control ($n = 62$, $M = 37.82$, $SD = 8.23$). After exposure to mnemonics Strategy (Post-test), the achievement mean scores have increased, students in experimental group was ($n = 65$, $M = 53.74$, $SD = 9.77$) and that of their counterparts in control ($n = 62$, $M = 42.58$, $SD = 8.96$), mean achievement difference of 13.81 between experimental and control groups was obtained, the difference was in favour of the experimental groups. The significant of the difference was further determined by testing the hypothesis.

Research Question Two: What is the difference in the interest mean scores of male students compared with female students when taught genetics using mnemonics strategy?

Table 2: Interest Mean Scores and Standard Deviation of Male and Female Students of Experimental Group

Gender	N	Pre-interest		Post-interest		Mean difference
		Mean	S. D	Mean	S. D	
Male	42	2.21	0.20	3.59	0.04	1.38
Female	23	2.26	0.18	3.56	0.05	1.30
						0.08

Table 2 show that the pre-interest mean scores and standard deviation of male students was ($n = 42$, $M = 2.21$, $SD = 0.20$) and their female counterparts ($n = 23$, $M = 2.18$, $SD = 0.18$). After exposure to mnemonics

strategy, the interest mean scores have increased that of male students ($n = 42$, $M = 3.59$, $SD = 0.04$) and their female counterparts ($n = 23$, $M = 3.56$, $SD = 0.05$), mean interest difference of 0.08 between male and female students was obtained, the difference was in favour of the male students. The significant of the difference was further determined by testing the hypothesis.

Hypotheses

The following null hypotheses postulated were tested at 0.05 level of significance

Ho₁: There is no significant difference in the achievement mean scores of students taught genetics using mnemonics strategy compared with those taught using conventional teaching methods.

Table 3: Summary of Analysis of Covariance (ANCOVA) of Achievement Mean Scores of Students in the Experimental and Control Groups

Source	Type III Sum of Squares	Df	Mean Square	F	P	Partial Eta Squared	Remark
Corrected Model	6878.818 ^a	2	3439.409	52.774	.000	.460	
Intercept	6770.158	1	6770.158	103.880	.000	.456	
Pretest	2928.248	1	2928.248	44.931	.000	.216	
Group	4876.241	1	4876.241	74.820	.000	.673	Rejected
Error	8081.402	124	65.173				
Total	311131.000	127					
Corrected Total	14960.220	126					

Analysis of Covariance (ANCOVA) result in Table 3 revealed that $F(1, 124) = 74.820$, $P < 0.05$, partial $\eta^2 = 0.673$. Since the P-value of 0.000 is less than 0.05 level of significance with a high effect size (67.3%). This indicated that there was a significant effect of mnemonics strategy on students' achievement in genetics and the magnitude of the effect was 67.3% in favour of students using mnemonics strategy. Therefore, hypothesis one which states that there is no significant difference in the achievement of students taught genetics using mnemonics strategy

compared with those taught using conventional teaching method was rejected.

Ho₂: There is no significant difference in the interest mean scores of Male students compared with Female students when taught genetics using mnemonics strategy.

Table 4: Summary of Analysis of Covariance (ANCOVA) of Interest Mean Scores of Male and Female Students in Experimental Group

Source	Type III Sum of Squares	Df	Mean Square	F	P	Remark
Corrected Model	.014 ^a	2	.007	4.106	.021	
Intercept	6.356	1	6.356	3680.051	.000	
Pre-Interest	6.655	1	6.655	.039	.105	
Gender	.014	1	.014	8.212	.312	Retained
Error	.107	62	.002			
Total	831.372	65				
Corrected Total	.121	64				

Analysis of Covariance (ANCOVA) result in Table 4 revealed that there was no significant difference in male and female students' interest, $F(1, 62) = 8.212$, $p = 0.312$. Since the ($p\text{-value } 0.312 > \alpha = 0.05$) hypothesis two which states that there was no significant difference in the interest mean scores of male students compared with female students when taught genetics using mnemonics strategy was retained. This indicated that when mnemonics strategy was used in teaching genetics, gender has no effect on students' interest. This implies that there was no significant gender difference on students' interest in genetics when mnemonics strategy was used as medium of instruction.

Discussion

This study aimed at investigating the effects of Mnemonics Strategy on Senior Secondary two Biology Students' Interest and Achievement in Genetics in Gombe Metropolis, Gombe State, Nigeria. Two research questions were answered and their corresponding hypotheses were

tested using mean, standard deviation and ANCOVA respectively. The pre-test and posttest established in table 1 shows that the students' had equivalent knowledge of genetics. Therefore, the observed differences in the results were due to the effect of the treatment in the posttest. The analysis of results, research questions and hypotheses are hereby discussed below.

The analysis of result as presented in the post-test shows that students' taught genetics using mnemonics strategy achieved higher mean score than those taught genetics using conventional teaching method as seen in table 3 above, testing hypothesis one. This indicates that the use of mnemonics strategy has helped in improving students' achievement. The strategy can be adopted to enhance students learning of genetic at the senior secondary school level since it is gender friendly as seen in table 4, testing hypothesis two. This significant achievement is in line with the study of Sousa (2014), whose work supports the view that mnemonics teaching strategy improves students' achievement and influence students interest towards learning tasks and become independent lifelong learners.

The use of mnemonics in the classrooms is not just for fun but also served many educational purposes such as creative thinking, critical thinking, reflective thinking, problem solving and collaborative work, among others. This finding is evident in a study conducted by Gerald R. Miller (1967). He found that students who regularly used mnemonics increased test scores up to 77%. Stalder (2015), and VanVoorhis (2014), observed that the use of mnemonics is very effective and also helpful to the teachers for teaching difficult concept in the classrooms. In addition, the use of mnemonics strategy improves achievement of students because it makes the learning interesting and thereby creating better interactions through the activities involved. This further confirm the assertion by Galton (2014), that students' achievement in any field of study can be greatly enhance if students are allow to take charge of their learning. Interaction among the students provides a better opportunity to develop their cognition. With the use of the mnemonics strategy students participated actively during

learning. Therefore, with this empirical evidence in this study, it is undisputed that the use of mnemonics strategy is necessary for increasing and boosting achievement of students in genetics.

The results obtained from the analysis of pre-test and post-test scores of the experimental group as shown in table 3, testing hypothesis one revealed that there is a significant difference in the pre-test and post-test mean achievement scores of the experimental group of students who were taught genetics using mnemonics strategy and their counterpart in the control group taught using lecture method. This indicated that students who were taught genetics with the mnemonics strategy performed better than students taught genetics using lecture or conventional method of teaching. It is therefore clear that the use of mnemonics strategy in teaching genetics (Biology) enhances achievement. These finding is in conformity with that of Ogunleye (2015), who observed that, what is learned is usually determined by what is taught and how it is being taught. Bellezza (2014) stated that mnemonics is a self-help device designed effectively to boost the confidence of learner unconfident power of the memory.

Major Findings

The following findings were deduced from the study:

- i. There was a significant difference in the achievement mean scores of students taught genetics using mnemonics strategy compared with those taught genetics using conventional teaching methods.
- ii. There is no significant difference in the interest mean scores of Male students compared with Female students when taught genetics using mnemonics strategy

Conclusion

The findings of this study have shown that mnemonics instructional strategy is effective at improving the students' achievement in genetics. The results revealed that mnemonics strategy had the higher mean score

than the conventional lecture teaching method. The reason is that mnemonics strategy enables students to remember and retained factual information, answer questions and demonstrate comprehension. It also provides a visual or verbal prompt for students who may have difficulty retaining information. As regards to lecture teaching method, it has been established that it can be used to incorporate meaning into newly acquired material. Also, it influences how learners interpret new information and decide what aspects of that information are relevant and irrelevant. Based on the findings of the study, it has been recommended that teachers should facilitate the use of mnemonics instructional strategy in schools to enhance positive interest of students towards biology and improve their achievement in the subject. They should also include varieties of mnemonics into their instructional strategies to effectively cater for the diverse abilities of students within their classrooms. Teachers should conduct active review of students' relevant prior knowledge at the commencement, during and at the conclusion of the lesson. Periodic and regular training, seminars and workshops should be organized for teachers to update their knowledge on current and innovative teaching strategies at secondary schools' levels.

Recommendations

From the findings of this study, the following recommendations are made:

- i. Curriculum planners and curriculum development bodies in Nigeria like NERDC should design programme and policies that will incorporate the use of Mnemonics Strategy in teaching and learning of science subjects, since it has the potential of bringing about meaningful learning and improved achievement.
- ii. Professional associations such as Science Teachers Association (STAN), Mathematics Association of Nigeria (MAN) and Research Centers like Nigerian Educational and Research Development Council (NERDC) should incorporate Mnemonics Strategy in their science curricular at senior secondary schools' levels and encourage the use of the strategy by science teachers.
- iii. Workshops and seminars should be organized by Secondary Education Board, STAN, NERDC and all stakeholders of education

in order to train teachers for effective implementation on the use of Mnemonics Strategy.

References

- Alizera, N.A., & Shella, E.Y. (2014). How Professionals are our Science Teachers? In U. Nzewi (Ed.), *46th Annual Conference Proceeding of the Science Teachers' Association of Nigeria*: Ibadan: Heinemann Education Books Plc.
- Chollom, A. (2013). *What makes Biology Learning Difficult and Effective: Students' views? Research and Reviews vol.7 (3)*, 61-71. Retrieved from www.academicjournals.org/ERR
- Duraso, C. S. (2014) 'Factors which Influence Academic Achievement in Biology in Kenya: A Perspective for Global Competitiveness' *International Journal of Current Research*, 5(12), 4296-4300.
- Eccles, J. S., Fredrick, J. A & Epstein A. (2015). Understanding Well-developed Interests and Activity Commitment. *Education Research and Reviews*, 7(3), 61-71 Experience.
- Finzi, L. (2015). *Challenges Affecting Teaching and Learning of Secondary School Basic Science and Technology in Nasarawa State Junior Secondary School Keffi, Nigeria*.
- Federal Government of Nigeria (2014). Revised National Policy on Education.
- Hornby, S. (2017). Interest and its Contribution as a Mental Resource for Learning. *Review of Educational Research*, 60(4), 549-571.
- Okenyi C.I (2015) The Problems and Prospects of Biology Education Development in Nigeria Beyond 2020. *Knowledge Review* 33(1), 55-63.
- Okeke, B. (2015 & 2016). The main causes of student under- achievement in agricultural science. *A Journal of Federal Ministry of Education*, 13(1), 10-14.
- Ricardo, S. (2014). Understanding Well-developed Interests and Activity Commitment. *Education Research and Reviews*, 7(3), 61-71 Experience. *European Scientific Journal*, 9 (28), 312 -320.
- Scottt, M. (2015). Research on Interest in Science: Theories, Methods and Findings. *International Journal of Science Education*, 33(2), 27-50.
- Spinatch, M. (2014). Mnemonic versus Non Mnemonic Vocabulary-Learning Strategies for Children. *American Educational Research Journal*, 19(1), 121-136.