EFFECT OF CONCEPT MAPPING STRATEGY ON INTEREST IN GENETICS CONCEPTS AMONG SECONDARY SCHOOL STUDENTS IN JIGAWA STATE, NIGERIA

Usaini Jafar
08032326319
usainijafar@gmail.com
Jigawa State College of Education Gumel.
Department of Biological Science.

Abstract
This study investigated the effect of concept mapping strategy on interest in genetics concept among secondary school students in Gumel education zone, Jigawa state, Nigeria. Two research objectives, two research questions and two null hypotheses were formulated to guide this study. The study adopts a quasi-experimental design, particularly the pretest, posttest experimental and control group design. The population comprised 3555 SS2 biology students from 17 public senior secondary schools in Gumel education zone. A sample of 156 students from two randomly selected schools out 4 co-educational schools was used for the study. The study involves two groups experimental and control. The experimental group was taught genetics concept using concept mapping strategy while the control group was exposed to the same concept using lecture method. Instrument used for data collection was Genetics Concept Interest Questionnaire (GCIQ). The instrument was validated by experts in Ahmadu Bello University, Zaria and have reliability coefficient of 0.88 estimated using Cronbach alpha. Research questions were answered using mean rank and sum of rank statistics while null hypotheses were tested using independent sample t-test at 0.05 level of significance. The findings revealed a significant difference between the mean scores of experimental and control groups in their interest, all in favour of the experimental group. Based on the findings, the study concludes that the concept mapping strategy significantly enhances the interest of secondary school students in genetics concepts. The study recommended that concept mapping strategy should be used in teaching genetics concept in secondary schools.
Keywords: Concept Mapping Strategy, Interest, Genetics Concepts.

Introduction

Science is the system of knowing the universe through data collected by observation and controlled experimentation. Science could be seen as a problem solving in order to enhance the living standard of man. There are different definitions of science by different scholars. Shuaib (2014) defined science as a complex human activity that leads to the productions of a body of the universal statement called laws, theories or hypotheses which serve to explain the observable behavior of the universe or part of it which in themselves have predictive characteristics. In addition, science deals with nature by observing it and phenomena to experimental investigation. Science as a discipline has many branches such as Biology, Chemistry, and Physics. Therefore, the importance of science in our society made the federal government of Nigeria, through the Federal Ministry of Education to introduce science education in the Nigerian Schools. Thus, science education is the field concerned with sharing

science content and process with individuals not traditionally considered parts of the scientific community. Science education researchers like Lawal (2009) and Ajaja (2013) pointed out that the performance of science students in Nigerian schools still leaves much to be desired right from the primary school through secondary school to the tertiary level of education. A general review of Nigerian students performances in Science in the West African Examination Council (WAEC) from 2020 to 2024. Science education is divided into Biology education, Chemistry Education and Physics education.

Biology is the study of living organisms, their structures, functions, evolution, distribution and interrelationships. Biology occupies a central position in the secondary school education curriculum because of its importance as a science of life. Biology as one of the science subjects taught in Nigeria senior secondary schools, is a popular science subject of choice among students. To further emphasize its significance, Lawal (2010) stated categorically that a credit pass in Biology would determine to a large extent whether or not a candidate could be admitted to read a number of major professional science based courses at university such as Human and Veterinary Medicine, Pharmaceutical Sciences, Agricultural Science, Nursing Sciences, Biochemistry, Biotechnology, Bioinformatics, Forensic Sciences and to mention a few. This is perhaps why the Nigerian Educational Research and Development Council (NERDC, 2012) noted that the science subject is required for everyday life especially on matters of personal and community health and agriculture. However, contrary to the stated objectives of science education in Nigeria and despite the importance of Biology as a science subject, empirical studies such as those of Etobro and Fabinu (2017) and Jafar (2025) have shown that students still perform poorly in Biology at Senior Secondary School level. Lawal (2010) reported that Biology is one of the science subjects having downward trend in the performance of students at Senior School Certificate Examinations (SSCE). In fact, the failure rate in Biology is even more alarming compared to Chemistry and Physics despite its popularity among science students. Considering the huge importance of Biology as a science subject, there is need stimulate students' interest in it through the use of innovative instructional approaches that are student-centered so that learners will be actively involved in the learning process. Biology is divided into Ecology, physiology, Anatomy, Zoology, Botany, Genetics concept.

Genetics is a branch of Biology that studies the function and behavior of genes. Genes influence many aspects of our daily life from the food we eat to identification of criminals, and treatment of diseases. In agriculture, genetics advances have enabled scientists to alter a plant or an animal structure to make it more useful. Lawal (2009) opined that understanding of the concepts of genetics and its mode of operation appears to be more difficult than any other topic in Biology. This evidence is showed in the WAEC and NECO Chief Examiners Report (2020 – 2024). This study therefore, find out the effect of Concept mapping Strategy, which is learner-centered in its characteristics, on genetic concepts for better performance among Senior Secondary School Biology Students. The persistent poor performance of students in Biology specifically in Genetics concepts at senior secondary certificate examination raises doubt about

the effectiveness of current teaching approaches in use by Biology teachers. More so the topics are perceived as difficult topics by secondary school Biology students (Shuaibu, 2017 & Joda, 2019). Exposing learners to the understanding of basic concepts in Biology and achieving desirable outcomes requires the use of creative, innovative and interactive teaching approaches such as concept mapping strategy that may arouse the performance and interest of the learners and demystify difficult concepts in core subjects like Biology. In addition, it is counter-productive to present ideas to learners without fully engaging them in the learning process.

Concept mapping teaching learning technique has features that could be the alternative to the lecture method used in the past. Is a teaching -learning strategy in which students are made to construct concepts making use of ideas that contains two or more concept that are connected with other words to form a meaningful statement represented diagrammatically. Concept mapping teaching learning technique characteristics are in line with the modern idea of learning, which emphasized that learning should be students centered whether infrastructure are available or lacking in the schools. It can be seen as a teaching -learning technique in which ideas that contains two or more concepts are connected with other words to form a meaningful statement represented diagrammatically. The Theoretical Framework This study is hinged on Social Constructivism by Vygotsky (1978). Therefore, the researcher seeks to investigate the effects of Concept mapping Strategy on academic performance in Genetics concept among secondary school students in Gumel education zone, Jigawa state, Nigeria.

Interest in academic context could be referred to as what influences student learning behavior and intention to participate in learning. Interest is a vital factor in teaching and learning. The factors behind what the learners can achieve in any content of the learning are a function of his or her interest to the learning material, the teacher and method of teaching. Irrespective of the teaching style, skill, method used by the teacher, the performance will still be staggered if the interest of the students is not initiated and sustain in and through the learning process. According to Chukwuagu (2006) viewed interest as a psychological construct that defines individual's degree of responsiveness to a given activity, engage with an object or person for maximum output. Walter and Hart (2009) defined interest as an individual's desire, power and tendency to act in a particular way. This study also finds out using scaffolding instructional strategy could result in gender disparity.

Another factor to interest in science and biology education is gender. Okeke, (2008) ender refers to the socio-culturally constructed or created characteristics and roles which are ascribed to male and female in any society. Before now science was preserved for males with little participation of female students. This is due to the fact that girls did not embrace formal education and specifically science education early enough as to their male counterparts. As a result, Okeke (2008), opined that women and girls grapple with a lot of discrimination and difficulties in science learning. Not withstand in any academic setting such as science learning, there is always the participation of male and female students. This brings to play the issue of gender to educationist and researchers. There is bound to be interaction between male and

female students in the cause of learning. It becomes paramount to understand the rate to which both genders can achieve in what is taught as well as their interest.

Statement of the Problem

There has been a persistent poor performance and lack of interest among senior secondary school students in Biology, particularly in Genetics concepts, which are often perceived as abstract, complex, and difficult to understand (Etobro & Fabinu, 2017). This lack of interest has implications for students' engagement and meaningful learning, and may also contribute to the continuous poor performance observed in Biology, as reported by the Chief Examiner of the West African Examinations Council (WAEC) from 2020 to 2024. Factors such as teacher-centered instructional strategies, inadequate laboratory facilities, insufficient instructional materials, and large class sizes have been identified as contributing to students' low interest and poor engagement in Biology (Lakpini, 2006; Lawal, 2009; Hayatu, 2023, 2025; WAEC, 2024; Jafar, 2025). Traditional teaching approaches often fail to motivate students to actively participate in learning, particularly in conceptually challenging topics like Genetics. Given the critical role of interest in motivating students and enhancing their learning experience, there is a need to explore instructional strategies that can increase students' enthusiasm and engagement. Learner-centered approaches, such as concept mapping, have been suggested as effective in fostering interest and supporting better understanding of scientific concepts. This study, therefore, seeks to determine the effect of concept mapping instructional strategy on senior secondary school students' interest in genetics concepts, with students' performance considered as a contextual outcome, in Gumel education zone, Jigawa state, Nigeria.

Objectives of the Study

The main objectives of this study are:

1. find out the effect of concept mapping on the interest of students in genetics concepts.
2. examined the effect of concept mapping on the interest of male and female students in genetics concepts.

Research Questions

1. What is the mean interest scores of students taught genetics concept using concept mapping and those taught using the lecture method?
2. What is the mean interest scores of male and female students taught genetics concept using concept mapping?

Hypotheses

The following hypotheses were formulated to guide the study:

Ho_1. There is no significance difference in the mean interest scores of students taught genetics concept using concept mapping and those taught using the lecture method.

Ho_1. There is no significant difference in the mean interest scores of male and female students taught genetics concepts using concept mapping.

Methodology

The study adopted the quasi-experimental design, specifically the pre-test, post-test, quasi experimental and control group design. The population of this study is made up of three thousand, four hundred and ninety-six (3,555) SS2 secondary school Biology students in the study area. One hundred and twenty four (156) SS2 secondary school Biology students constituted the sample for this study and were derived from two (2) co-educational schools sampled from the seventeen (17) public senior secondary schools in Gumel education zone. The instrument used for data collection is Genetics Concept Interest Questionnaire (GCIQ) with a reliability coefficient of 0.88. Pre-test was administered before treatment to measure the students' interest level in genetics concept. The students in the experimental group were taught using concept mapping instructional strategy while those in the control group were taught using conventional method. Treatment lasted for six weeks each. The concept genetics concept as derived from the senior secondary school biology curriculum (NERDC, 2012) was taught in six lessons (one topic per week for each group). After the treatment, post-test was administered to both groups to measure their interest level of learnt concepts. The data collected were analyzed using descriptive statistics of means and standard deviations to answer the research questions as well as independent sample t-test to test the null hypotheses at $p < 0.05$ level of significance. All analyses were done using the Statistical Package for Social Sciences (SPSS) IBM version 26.

Results

Research Question One: What is the difference between the mean interest scores of students taught genetics concepts using concept mapping strategy and those taught using lecture method?

Table 1: Mean Rank and Sum of Rank Statistics for Students in Experimental and Control Groups.

Group	N	Mean Rank	Sum of Ranks	MR. df
Experimental	75	128.64	10163.5	79.18
Control	81	49.46	4204.5	
Total	156			

Table 1 revealed that difference exist between the interest of students taught genetics concepts using concept mapping strategy those taught using lecture method. The students in the experimental group have a mean rank score of 128.64, with a sum of rank of 10163.5. Conversely, their counterparts in the control group have a mean rank score of 49.46, with a sum of ranks of 4204.5. The resulting mean rank difference of 79.18 indicates the attitude scores of students in the experimental group are higher than their counterparts in the control group taught genetics concepts.

Hypothesis One: There is no significant difference between mean Interest of students taught genetics concepts using concept mapping strategy and their counterpart taught using lecture method.

Table 2: Summary of Man Whitney U-test on the difference between the Interest of Students in Experimental and Control Groups.

Groups	n	Mean. Rank	Sum of Ranks	U-value	df	P	Remark
Experimental	75	128.64	10163.5				
				111.5	162	0.00	Sig.
Control	81	49.46	4204.5				

The Mann-Whitney U-test results in table 2 shows a significant difference between the experimental and control groups in terms of interest towards genetics concepts. The Mann-Whitney U-value of 111.5, and a p-value of 0.00 at degree of freedom (df) of 162, indicates a significant difference in favour of the experimental group. This shows that students taught genetics concepts using the concept mapping strategy have higher interest compared to those taught using the lecture method. Therefore, the hypothesis that states that, there is no significant difference between the interest of Biology students taught genetics concepts using concept strategy and those taught using lecture methods, is hereby rejected.

Research Question two: What is the difference between the mean interest score of male and female students taught genetics concepts using mapping strategy?

Table 3: Mean Rank and Sum of Rank Statistics on the Interest of Male and Female Students in Experimental Group.

Group	Gender	N	Mean Rank	Sum of Ranks	MR.Df
	Male	45	39.33	1888.00	
Experimental					-1.5
	Female	30	40.87	1267.00	

The data presented in table 3 reveals that in the experimental group, male and female students have a mean rank score of 39.33 and 40.87, with a mean difference of -1.5. These findings shows a difference in the interest of male and female students towards genetics concepts.

Hypothesis Two: There is no significant difference between mean Interest of male and female SSII students taught genetics concept using concept mapping strategy.

Table 4: Summary of Man Whitney U-test on the difference between the Interest of Male and Female Students in the Experimental Group.

Group	Gender	n	Mean. Rank	Sum of Ranks	Mann-Whitney	df	P	Remark
Experimental	Male	45	39.33	1888.00	637.00	77	0.18	N.S
	Female	30	40.18	1267.00				

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

The outcomes from the Mann-Whitney U-test in table 4, reveals that the P calculated value of 0.18 is greater than the 0.05 alpha level of significance and a Man Whitney U value 637.00, indicating no significant difference between the interests mean rank response of male and female students in experimental group. Therefore, the hypothesis which stated that there is no significant difference in the interest of male and female Biology students taught genetics concepts using concept mapping strategy is hereby, accepted and retained.

Discussion of Findings

The results of the findings show that students in the experimental group had a higher mean interest score than those in the control group. The difference was significant as indicated by the t-test analysis in table 1 and 2. This signifies that students taught genetics concept using concept mapping strategy had a significantly higher mean score than those taught using lecture method. By implication, the concept mapping strategy was able to foster a significant higher interest than the lecture method. The significant difference implies rejection of null hypothesis and retaining alternate hypothesis. Therefore, null hypothesis that states that there is no significant difference in the mean interest score of students taught genetics concept using concept mapping strategy and their counterparts taught using lecture method is rejected. The significant difference indicates that students in experimental group recorded a higher mean score than those in the lecture method. This finding supports that of Jafar (2025). These researches revealed that students exhibited significant improvements in interest as a result of treatment with Concept mapping Strategy as compared to the lecture method. The findings of this study also agree with findings of Danjuma (2017). The finding of this study also concurs with the assertion of Danjuma (2017) and Shehu (2021) that effective use of concept mapping strategy facilities in teaching should be employed as it will enhance student's interest and improve performance of in SSS level of education. The finding also provides support to the research findings of Jafar (2025) that students exhibited significant enhances interest as a result of treatment with Scaffolding Instructional Strategy as compared to the lecture method.

From the findings in Table 3 and 4, it was revealed that no significant difference in the interest of male and female students when exposed to Concept mapping Strategy. This showed that the strategy is gender friendly in terms of interest. This is in harmony with the findings of Shehu (2021) and Jafar (2025) who found that boys in heterogeneous groups do not dominate their

female counterparts in interest, while it disagree with the work of Nworgu (1990) in Obeka (2009) who reported that girls performed better academically in social sciences and science. It also disagreed with the work of Crookal, Saunders and Oxford (1987) in Obeka (2009) who reported that boys performed better in science and social sciences concept academically than girls, because they were involved in role/games activities while girls are more into domestic activities.

Conclusion

From the results and findings of this study, it was concluded that the use of concept mapping instructional strategy significantly enhanced the interest of secondary school students in genetics concepts. The findings further revealed that students exposed to concept mapping demonstrated greater enthusiasm, participation, and willingness to learn genetics concepts compared to those taught using conventional teaching methods. In addition, the study established that concept mapping instructional strategy is gender-friendly, as it proved effective in improving the interest of both male and female students without discrimination. Therefore, the study affirmed that concept mapping is an effective and innovative instructional strategy for promoting students' interest and active engagement in the learning of genetics concepts at the senior secondary school level.

Recommendations

Based on the findings of this study, the following recommendations are made:

1. The teaching of genetics concept should be carried out by biology teachers with tasks that involve using concept mapping that promotes interaction among students and teachers.
2. Professional bodies like STAN in collaboration with the federal and state ministries of education should embark on nationwide re-training of secondary school biology teachers to design and implement classroom instructions based on the concept mapping strategy through regular national, state and local seminars, workshops and conferences.

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