EFFECTS OF TEACHER-STUDENT VERBAL INTERACTIONS LEVELS ON PERFORMANCE IN GENETICS AMONG SECONDARY SCHOOL STUDENTS IN FUNTUA EDUCATION ZONE, KATSINA STATE, NIGERIA

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Abstract

This study investigated the Effects of Teacher-Student Verbal Interactions on Performance and Interest in Genetics among Secondary School Students in Funtua Education Zone, Katsina State. Nigeria. The study was necessitated due to persistent poor performance in Genetics concepts which is as a results of teachers' inability to consider students levels of interactions when using conventional method of teaching. The study adopted pretest, posttest quasi-experimental and control group design. A total number of 265 students from three schools constituted the sample size out of a population of 3625 in 18 secondary schools in Funtua Education Zone. Four schools sampled were randomly assigned experimental 1, 2,3 and control groups. Two objectives, two research questions and two null hypotheses guided the study. The four research questions were answered using descriptive statistics in form of mean and standard deviation while the null hypotheses were tested at p≤0.05 level of significance using ANOVA. The participants in the experimental groups were taught using high, medium and low level verbal interaction while the control group was exposed to Conventional method for a period of six weeks. Biology Performance Test (BPT) was validated and found to be reliable with r-value of 0.70. The major findings from the study are; Students taught using different levels of teacher-student verbal interactions performed better than those taught using conventional method (mean: HVI=56.45, MVI=50.54, LVI=43.34 with p=0.001 (less than 0.05 level of significant). Gender factor had no effect on performance towards genetics concepts when taught using different levels of verbal interaction. This shows that teaching genetics concepts using different levels of verbal interaction is gender friendly. Number of recommendations were made among which are that Biology teachers should make use of high and medium level teacher- student verbal interactions to teach biology in secondary schools.

Introduction

The increasing demand for scientific and technological advancement globally has

made effective science education essential for national development. Science education equips learners with the knowledge, skills, and competencies needed to function in a technologically driven society. In Nigeria, science education at the secondary school level provides the foundation for higher education in science-related disciplines and careers. According to Ibrahim (2019), science educators have continued to explore effective strategies that can enhance students' understanding of science at the senior secondary school level. These efforts are aimed at developing students' scientific aptitude, strengthening their preparation for tertiary education, and promoting scientific literacy in society. Science is broadly categorized into Chemistry, Physics and Biology.

Biology is one of the core science subjects offered at the senior secondary school level in Nigeria. The term Biology is derived from the Greek words bios meaning life and logos meaning study. Raven (2016) defined Biology as the branch of science concerned with the study of living organisms and their interactions with the environment. Similarly, Olajide (2012) described Biology as a practical science that equips learners with relevant knowledge and skills necessary for solving everyday life problems. Biology also serves as a foundational subject for many professional disciplines such as medicine, pharmacy, nursing, agriculture, and biochemistry. Consequently, a credit pass in Biology at the SSCE level is often a requirement for admission into many science-related programmes in tertiary institutions.

Despite the importance of Biology, students' academic performance in the subject has remained unsatisfactory over the years. Several science education researchers have reported persistent poor performance among secondary school students in Biology examinations. For instance, Nsofor (2019) and Oloyede and Zayun (2020) observed that many students perform poorly in Biology in external examinations such as the SSCE. According to Wakili (2017), this persistent trend of low academic achievement has become a major concern to educators, curriculum planners, parents, and other stakeholders in the education sector because it limits students' opportunities to pursue science-related careers.

Educational researchers have therefore emphasized the importance of adopting instructional strategies that encourage active participation and meaningful interaction during classroom instruction. Nneka and Phyllis, (2019) and Dahiru (2020) suggested several approaches that can improve science teaching and learning. These include inquiry-based learning, guided discovery, laboratory activities, project work, field trips, cooperative learning, and effective classroom communication strategies. These approaches promote active student involvement in the learning process and encourage dialogue between teachers and students. Since Biology is a core science subject in the secondary school curriculum, research aimed at improving the teaching and learning of Biology remains highly relevant.

Classroom interaction is widely recognized as an essential component of effective teaching and learning. Educationists have emphasized that the effectiveness of instruction

depends largely on the quality of communication and interaction between teachers and students in the classroom. Nneka and Phyllis, (2019) described interaction as a process of reciprocal communication between individuals, which may occur through verbal or non-verbal means. Verbal interaction involves the use of spoken or written language to communicate ideas, while non-verbal interaction includes gestures, facial expressions, eye contact, posture, and other forms of physical communication.

Teacher–student verbal interaction refers specifically to the spoken exchanges that occur between teachers and students during classroom activities. According to Fadahunsi (2013), these interactions include questioning, explanation, feedback, classroom discussion, and instructional dialogue. Verbal interaction plays an important role in facilitating students' understanding of subject matter because it provides opportunities for clarification, explanation, and active engagement in the learning process. When teachers encourage students to ask questions, express ideas, and participate in discussions, the classroom environment becomes more interactive and conducive to learning.

Another variable often considered in science education research is gender differences in students' academic performance. Researchers have examined whether male and female students differ in their achievement in science subjects. Some studies have reported no significant gender differences in science achievement. For example, Ogundare (2019) found that male and female students performed similarly when exposed to certain instructional strategies in science. However, other studies have reported variations in performance between male and female students. Njoku (2017) reported that male students performed better than female students in science, technology, and mathematics subjects, while Campbell (2018) found no significant difference in science achievement among Jamaican students.

Similarly, some studies have reported gender differences in Biology achievement, while others have found no significant influence of gender. For instance, Young and Fraser (2020) reported a significant difference in Biology achievement in favour of male students, whereas other studies reported contrasting findings. The inconsistency in the findings of previous studies indicates that the influence of gender on students' academic performance in science remains inconclusive.

In view of the importance of classroom communication in facilitating effective teaching and learning, it becomes necessary to examine how teacher–student verbal interaction influences students' academic performance in Biology. Understanding the levels of verbal interaction that occur in the classroom may provide insights into how teaching practices can be improved to enhance students' learning outcomes. Therefore, this study investigates the effects of teacher–student verbal interaction levels on students' academic performance in Genetics among secondary school students in Funtua Education Zone of Katsina State, Nigeria.

Statement of the Problem

Biology is one of the core science subjects taught in Nigerian secondary schools and serves as a prerequisite for admission into several science-related disciplines in tertiary institutions. Despite its importance, students' academic performance in Biology in public examinations has continued to fluctuate over the years. Reports from examining bodies such as the West African Examinations Council indicate that a considerable number of secondary school students perform below expectation in Biology at the Senior Secondary Certificate Examination (SSCE). This persistent trend of low academic performance has become a major concern to educators, parents, government, and other stakeholders in the education sector.

Several factors have been identified as contributing to students' poor performance in Biology. According to Zayun (2016) and Ibrahim (2020), factors such as the nature of the Biology curriculum, large class size, and socio-cultural beliefs may influence students' learning outcomes in the subject. In addition, the Chief Examiners' reports of the West African Examinations Council (2017–2023) have consistently highlighted issues such as inadequate practical skills, poor understanding of biological concepts, and the tendency of teachers to rush through topics in order to complete the prescribed syllabus as major challenges affecting students' performance in Biology.

Among the various factors influencing students' academic performance, classroom communication and interaction between teachers and students play a significant role in facilitating effective learning. Teacher–student verbal interaction, which involves the use of questioning, explanation, feedback, and classroom discussion during instruction, can enhance students' understanding of subject matter by promoting active participation in the learning process. When students are actively engaged in classroom dialogue, they are more likely to clarify misconceptions, develop deeper understanding of concepts, and improve their academic performance.

However, in many secondary school classrooms, teaching is often dominated by teacher-centered methods where communication flows mainly from the teacher to the students, with limited opportunities for students to actively participate in verbal exchanges during lessons. Such limited interaction may hinder students' understanding of complex biological concepts, particularly in topics such as Genetics, which require explanation, discussion, and conceptual clarification for effective learning (Ibrahim, 2019).

Genetics is a fundamental component of Biology that deals with heredity and variation among living organisms. Many students find Genetics difficult to understand due to its abstract nature and the complexity of its concepts. Effective teacher–student verbal interaction during instruction may therefore play a crucial role in improving students' comprehension and academic performance in this area of Biology (Dahiru, 2020).

Although several studies have examined factors affecting students' performance in Biology, limited attention has been given to the influence of different levels of teacher–student verbal interaction in the classroom. In addition, existing studies have not adequately examined how variations in the levels of verbal interaction during Biology instruction may affect students' academic performance in Genetics among secondary school students. This gap therefore necessitates an investigation into the effects of teacher–student verbal interaction levels on students' academic performance in Genetics among secondary school students in Funtua Education Zone of Katsina State, Nigeria.

Objectives of the Study

This study was guided by the following objectives, which are to:

1. Determine the effects of high, medium and low level teacher-student verbal interaction on students' performance in genetics concepts
2. Ascertain the effect of different levels of teacher-student verbal interactions on performance in genetics concepts based on gender.

Research Questions

This study answered the following research questions:

1. What is the difference between the academic performance mean scores of students taught genetic concepts using high, medium and low level teacher-student verbal interaction when compared with those taught using conventional method?
2. What is the difference in the academic performance mean scores of students taught genetics concepts using different levels teacher-student verbal interaction based on gender?

Null Hypotheses

The following null hypotheses were formulated and tested at $P \leq 0.05$ level of significance:

Ho1: There is no significant difference between the academic performance mean scores of students taught genetic concepts using high, medium and low levels teacher-student verbal interaction when compared with their counterpart taught using conventional method.

Ho2: There is no significant difference between the academic performance mean scores of students taught genetics concepts using different levels teacher-student verbal interaction based on gender.

Methodology

Research Design

This study made use of pretest posttest quasi-experimental and control group design. The design enabled the comparison between treatments versus control conditions. The design was used to examine the effects of the different levels of teacher-student verbal interaction on academic performance and interest towards genetics concepts in both experimental and control groups. In the design, there was high level verbal interaction (HVI), medium verbal Interactions (MVI) and low level verbal interaction (LVI). The four schools were exposed to the same content of the curriculum except the teaching approach and the teachers engaged. The four schools were located far apart from each other to avoid interaction of subjects. The experimental groups were designated as EGI for high level verbal interaction (HVI), EG2 for medium level verbal interaction (MVI), EG3 for low level verbal interaction (LVI), and control group (CG) respectively.

Population of the Study

The target population for this study comprised of all Secondary Schools Biology SSII students in Public schools in Funtua Education Zone, Katsina State, Nigeria. There are eighteen (18) both single sexes and co-educational schools in Funtua Educational Zone with a total of 3,625 (2,390 males and 1,235 females) students.

Sample and Sampling Technique

From the entire population of the schools, six schools were purposively selected and pretested using Genetics Performance Test (GPT). The reason for using purposive sampling technique was to ensure that only coeducational schools were included in the sample. The results obtained were subjected to Analysis of Variance. A significant difference was found to exist between the six schools. The results were further subjected to Scheffe's test, the schools that were found not have significant difference were then selected and used for as sample for the study. The schools were designated as EG, (high level interaction), EG2 (medium level interaction), EG3 (low level interaction) & CG respectively. From each of the three schools selected as experimental groups, one biology classroom teacher was trained to teach the students using one of the levels of teacher-student verbal interaction while the biology teacher in the control group taught the students using lecture method (without observing the levels of interaction). The sampled students were from intact classes selected from coeducational schools as presented in the Table 1, below.

Table 1: Sample of the Study

S/No	Name of Schools	School Type	Males	Females	Total
1.	EG1	Coeducational	45	30	75
2.	EG2	Coeducational	35	30	65
3.	EG3	Coeducational	40	20	60
4.	CG	Coeducational	45	20	65
	Total		**165**	**100**	**265**

Instrumentation

This study used Genetics Performance Test (GPT) to measure students' performance in Genetics which had a reliability coefficient of 0.76.

Results and Findings

The research hypotheses were tested using Analysis of Covariance (ANCOVA) and t-test statistics at a 0.05 level of significance ($P \leq 0.05$). All statistical analyses were carried out using the Statistical Package for Social Sciences (SPSS), version 21.

Ho1: There is no significant difference between the performance mean scores of students taught genetic concepts using high, medium and low levels teacher-student verbal interaction when compared with their counterpart taught using Conventional method.

To test null hypothesis one, the mean scores of senior secondary Biology students taught using high level verbal interaction (HVI), medium level of verbal interaction (MVI) low level verbal interaction (LVI) and Conventional Method were subjected to Analysis of Variance (ANOVA). The result is shown in Table 2.

Table 2: Summary of ANOVA for Performance Scores of Students in Experimental and Control Groups

Source of Variance	Sum of Squares	Df	Mean Square	F	P	Remark
Between Groups	160.77	3	230.14	5.70	.001	Significant
Within Groups	4471.20	262	37.17			
Total	4631.97	265				

Significant at p≤ 0.05 level

Table 2 reveals that the effect of treatment on senior secondary Biology students' performance is statistically significant, the significance value is 0.001(i.e. p=.001), which is below 0.05. Therefore, there is a statistically significant difference between the mean performance scores of senior secondary Biology students taught using different levels of teacher-student verbal interaction and those taught using Lecture Method. The null hypothesis which states that there is no significant difference between the performance mean scores of students taught genetic concepts using low, medium and high levels teacher-student verbal interaction when compared with their counterpart taught using lecture method is therefore rejected. This is because the p-value 0.001 is less than 0.05 level of significance. This implies that teaching genetics concepts using different levels of teacher-student verbal interaction significantly affect the performance of senior secondary Biology students. Turkey's post-hoe test was carried out in order to know where the differences lie. The result is shown in Table 3.

Table 3: Result of Post-Hoc test for Performance Scores of Multiple Comparisons between Experimental and Control Groups

(I) Groups	(J) Groups	Mean Difference (I-J)	Std.Error	p.value	Remark
HVI	HVI	2.83	0.99	0.01	Sig.
	Conventional	0.57	0.97		
MVI	MVI	2.83*	0.99	0.01	Sig.
	Conventional	0.57	0.97		
LVI	LVI	0.87	0.97	0.77	Not Sig.
	Conventional	0.57	0.97		

Significant at P≤0.05 level of significance

A post-hoc test in Table 4.3 shows a p-values of 0.01 between high level verbal interaction, medium level of verbal interaction and lecture method indicating that a significant difference in terms of students' performance exist since 0.01 is less than 0.05 level of significance. However, there was no significant difference in academic performance of students taught using low level verbal interaction and those taught using lecture method as indicated by the p-value of 0.77 which is greater than 0.77 at alpha level of 0.05. This could be as a result of the fact that the teacher dominated the class with much talk when using low level verbal interaction which is similar to the classroom lecture method of teaching.

Ho2: There is no significant difference in the performance mean scores of students taught genetics concepts using high, medium and low level teacher-student verbal interaction based on gender.

To test the null hypothesis, one-way Analysis of Variance (ANOVA) was used and the result is shown in Table 4.4.

Table 4.4: Summary of ANOVA for Performance Scores of Senior Secondary Biology Students in Based on Gender

Source of Variance	Sum of Squares	df	Mean Square	F	P	Remark
Between Groups	160.77	2	130.14	35.70	.151	Not Sig.
Within Groups	1471.20	208	37.17			
	1631.97	210				

Signficant at p≤ 0.05 level

Table 4.10 reveals that the effect of treatment on senior secondary Biology students' academic performance is not statistically significant, the insignificance value is 0.151 (p=.151) which is greater than 0.05. Therefore, there is no statistically significant difference between the academic performance mean scores of senior secondary Biology students taught using different levels of teacher-student verbal interaction based on gender. The null hypothesis which states that there is no significant difference between the academic performance mean score of students taught genetics concepts using high, medium and low levels teacher-student verbal interaction based on gender was retained. This implies that gender has no effect on performance in genetics concepts when taught using different levels of teacher-student verbal interaction.

Discussion of Results

Result of analysis in Table 2, revealed that Students taught using different levels of teacher-student verbal interaction performed better than those taught using lecture method. The effect of the interaction was also statistically significant in favour of the experimental group. When the Post Hoc test using Turkey's Post Hoc test in Table 3, revealed that the performance of students was better when taught genetics concepts using high level of interaction in Funtua Education Zone, Katsina State, Nigeria. This result agreed with the findings of Ibrahim (2019) who found out that high-level of teacher-student verbal interaction in biology was important for effective learning of evolution concepts. The result also tallied with that of Wakili (2017) who found out that the performance of students in Basic Science was better when the teachers use high-level of

teacher-student verbal interaction. The finding of this study however differed from that of Ogundare (2019) who found that teacher-student interaction had no contribution in science teaching. The reason for high performance of students taught using high level of teacher-student verbal interaction could be that students were allowed to expressed themselves, ask questions and exchange ideas which enhances better understanding of genetics concepts that led to better performance.

Result of analysis in Table 4 revealed that differences do not exist in the mean score performance of male and female students taught using different levels of verbal interaction. This result is in agreement with those of Dhinsa and Chung (2019). Miller, Lietz and Kotte (2018) and Hacienmilogy (2015) who in their separate studies reported that there is no significant difference between male and female with respect to their performance in science classrooms interaction. This means that teaching using different levels of verbal interaction has no effect on the interest of male and female students in the experimental group hence the approach is gender friendly in teaching genetics concepts. The result of this study also showed that the academic performance of male and female students was not influenced by the use of different levels of interaction to teach genetics concepts. This result is different from that of Okley (2019) and Ogundare (2019) who state that gender plays an important role in improving students' performance in science. This means that the approach of us in different levels of teacher student verbal interaction has no effect of performance among males and female students, hence the strategy is gender friendly in teaching genetics concepts.

Conclusion

The following conclusions were drawn from the study: Students taught using different levels of teacher-student verbal interaction performed better than those taught using lecture method. The difference is as a result of the treatment given to the experimental groups which were exposed to different levels of verbal interactions. The use of different levels of teacher-student verbal interaction increases interest of students when taught genetics concepts using different levels of verbal interaction when compared to their counterparts who were taught using Conventional method. The performances of male and female students was not affected by the use of different levels of verbal interaction in teaching genetics concepts. This means that teaching using different levels of verbal interaction is gender friendly.

Recommendations

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

i. Biology teachers should make use of high and medium level teacher-student verbal interaction to teach biology in secondary schools. Ministries of Education.

Curriculum Planners, National Education Research and Development Council and National Teachers Institutes should champion this course.

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