



Wait-Time and Questioning Frequencies of Teachers as Correlates of Performance among Biology Students in Zaria, Kaduna State, Nigeria

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Abstract

Time is known to be a universal quantity that affects almost (if not all) live events that concerns human existence. Similarly, questioning have been found to be another variable that led to today's breakthrough in the areas of science and technology as man is often beclouded by series of questions which demand answers. Thus, often times when questions are asked it is expected an amount of time be allowed to think and provide response(s) to the question asked and this is called wait-time. In education, Wait-time and questioning have been identified as significant variables affecting the learning process in the classroom, but studies on these variables which relate to performance in biology have not received serious consideration. The objective of this study therefore was to find out if Wait-time and questioning frequencies of teachers will correlate with performance of biology students at secondary school level. The population of the study comprised of 28 public secondary schools; 58 biology teachers and 4,390 SSII Biology students. A sample size of 26 schools, 26 biology teachers and 765 students were selected using proportionate stratified sampling technique. Causal and correlational research designs was used for the study. The instruments used for data collection were Eggleston's Science Teaching Observation Schedule (ESTOS) and Biology Performance Test (BPT). The study was guided by two objectives. Based on the objectives, two research questions and two null hypotheses. The two null hypotheses were tested using multiple regression analysis. One of the findings showed that the performance of students was better when taught biology concepts using high level mean wait-time. It was recommended that the Kaduna state government through the Ministry of Education should organize training workshops for science teachers to take cognizance of wait-time phenomenon during questioning.

Keywords: Wait-time, Questioning and Performance



Introduction

The need for science education for national development has become imperative in view of the current trend of global technological advancement. Science is important to national development because it prepares students to enter the workforce, pursue occupation and take up careers; it determines the place of a nation in the global economy and political power among others. Over the years, the efforts of science educators have been directed towards understanding the nature of science learning at senior secondary school level with a view to providing the students with aptitude and science, a sound foundation for further work in science and making students scientifically literate (Ibrahim, 2018).

A number of science educators such as (Nsofor, 2016; Oloyede & Zayun, 2016) have reported the downward trend in the performance of Nigerian students in science subjects at the Senior Secondary Certificate Examination attributed to students' poor performance in Biology at public examinations according to (Ibrahim, 2018; Lawal, 2010) is due to the use of wrong methods of instructional strategies. The search for factors influencing the teaching and learning of science has led to the identification of several variables such as Wait-time, culture, teacher factor among others (Rowe 1974a & 1974b; Moriber 1971; Olajide 2002; Iksan & Daniel 2016).

Wait-time is the amount of time the teacher waits after an initial question is posed before the teacher answers the question himself or herself, repeats, rephrases, or adds further information to the question, or accepts an answer from a student (Rowe, 1974 & Olajide 2012). There are two types of wait-time, wait-time I and wait-time II. Wait-time I according to Rowe (1974) is defined as the length of time a teacher pauses after a question. It normally begins when the teacher stops speaking and terminates when a student responds or the teacher speaks again. While wait-time II is defined as the length of time a teacher waits after a pupil's response to either comments or asks another question. Wait-time is calculated by taking the sum total of all the student's pauses and terminates when he/she speaks, this is done using a stop watch. Wait-time is central to instructions as it focuses on questioning and exerts control on the pace and manner of discourse and the interaction pattern within the classroom.

Research findings by (Rowe 1974, Winterton, 2019), have shown that when teachers were trained to increase their wait-time from one second to 3-5 seconds, several positive changes occurred in students' behaviors such as lengths and number of unsolicited responses increased; failures to respond decreased; and the incident of student-student comparison of data increased; equitable distribution and participation from minority students improved (Rowe, 1974 and Tobin 1987). A question is any sentence which has an interrogative form or function. In classroom setting, questions are defined as an instructional cues or stimuli that conveys to students the content element to be learned and direction for how they are to do them (Brad Mueller and Egan 2019). Questioning frequencies is the art of asking more questions in order to seek for more explanation by the listener or the speaker or writer to make sense of what is being said or communicated based on the questioner's knowledge Shameem (2018). Questioning frequencies is defined as the total number of questions asked by the teacher within the period of 40 minutes allotted for a lesson. The researcher adopted the categorization of teachers questioning frequencies into high, medium and low levels as categorized by Eggleston (1983). According to Eggleston (1983) teachers that ask less than 50% out of the expected questions were categorized as low; those teachers that asks questions of between 50-59% were categorized as medium while those teachers that ask between



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60%-100% were categorized as high level respectively. Eggleston discovered that the performance of students was better when taught using medium and high levels of questioning frequencies. This study also adopted the categorization of wait-time into three as categorized by Olajide (2012). Olajide (2012) also categorized wait-time I into high (above 3.50 seconds), medium wait-time (between 2.60 and 3.50 seconds) and low wait-time I is below 2.60 seconds.

Over the years, the performance of students in Biology in public examination has been fluctuating. Nsofor (2016) observed that the poor academic performance of students in Biology has been a major concern to parents, teachers, government and the general public. In spite of the relevance of Biology as one of the major science subjects whose pass at credit level determines to a large extent whether students would be admitted or not to take up any carrier in science based courses at the university, yet students still perform poorly (Lawal, 2010). The need to find out causes and possible solutions to students' low performance is therefore imperative. Some of the factors identified to be responsible for students' low performance in biology according to Zayun, (2016) include among others the nature of the curriculum, cultural beliefs as well as class size. Results of various studies conducted in Biology such as Ibrahim (2018) and Olajide (2012), reported that teacher-student verbal interaction influences academic performance. However, most of the studies verbal interaction were foreign while those conducted in Nigeria did not observe the significance of the levels of teacher wait-time I and their questioning frequencies as determinants of students' performance in biology at secondary school level which is the focus of this study.

Objectives of the Study

This study was guided by the following objectives:

1. Examine the relationship between high, medium and low levels teacher' questioning frequencies on students' performance in biology
2. Investigate the relationship between high, medium and low levels of teachers mean wait-time I on students' performance in biology.

Hypotheses

1. There is no significant relationship between high, medium and low levels teacher' questioning frequencies and students' performance in biology
2. There is no significant relationship between high, medium and low levels of teachers mean wait-time I relate with students' performance in biology.

Methodology

This study employed two research designs. The first, an observational design was employed to obtain teachers' questioning frequencies and wait-time I. There, the researcher went round classrooms and tape record the lessons using a tape recorder and observed teachers as they teach and took their questioning frequencies using (ESTOS). Secondly, a correlational research design was employed to correlate students' performance against teachers' levels of questioning frequencies and wait-time I. The population of the study comprised all 28 public secondary schools; 58 biology teachers and 4,390 SSII Biology students in Zaria Kaduna state. A sample size 26 biology teachers and 765 SSII Biology students were selected proportionate sampling



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technique. The instruments used for data collection were Eggleston's Science Teaching Observation Schedule (ESTOS) and Biology Performance Test (BPT). Data collected from the pilot study was used to establish the reliability of the instruments while their validity were ascertained by three experts who are PhD holders in the Department of Science Education, ABU Zaria.

Data were collected by observing all the 26 biology teachers sampled while their questioning frequencies and wait-time were also determined under normal classroom setting. In the same way all the sampled students were post tested using the same instrument, BPT. Thus, owing to the nature of this designs (observational and correlational), there was no special treatment administered to any school or group of schools, teachers or students throughout the study. The data collected were analyzed using descriptive and inferential statistical tools of mean scores; standard deviation; Pearson's Product Moment Correlation Coefficient (PPMC) and Multiple Regression Analysis were used for data analysis.

Results

Hypothesis 1

There is no significant relationship between high, medium and low levels teacher' questioning frequencies and students' performance in biology.

Table 1: Summary of Multiple Regression Analysis of High, Medium and Low Levels Teachers' Questioning Frequencies and Student's Performance in Biology.

Variable	No. of teachers	Mean	SD	(r)	r ²
Low	12	32.69	10.43	-0.331	0.711
Medium	5	71.79	0.01	0.938	0.001*
High	9	53.84	8.60	0.687	0.064

*Significant at $p \leq 0.05$ level of significance

From Table 1, teachers with high, medium and low level questioning frequencies had a regression coefficient (r^2) of 0.064, 0.001 and 0.711 respectively. from the result the relationship between teachers with high and low level questioning frequencies (0.064 and 0.711) and students' performance was not significant at significant at $p \leq 0.05$ probability threshold for decision making. On the other hand, the regression coefficient for teachers with medium questioning frequencies indicated Regression Coefficient (r^2) 0.001 which is significant at $p \leq 0.05$ probability threshold for decision making. Therefore, a significant relationship implies rejection of null hypothesis and retaining alternate hypothesis. Consequently, the null hypothesis which states that there is no significant relationship between teachers; levels of questioning frequencies and students' performance in biology was rejected. Thus, medium level of teachers' questioning frequency favoured students' performance when compared to high and low levels of questioning frequencies.

Hypothesis 2

There is no significant relationship between high, medium and low levels teachers' mean wait-time and students' performance in biology.



Table 2: Summary of Multiple Regression Analysis of High, Medium and Low Levels Teachers' Mean Wait-Time and Student's Performance in Biology.

Variable	No. of Teachers	Mean	SD	r	r ²
Low	9	2.00	0.28	-0.486	0.281
Medium	10	2.96	0.14	0.727	0.014*
High	7	6.71	1.23	0.818	0.012*

***Significant at $p \leq 0.05$ level of significance**

From Table 2, teachers with high mean wait-time I had a mean scores of 6.71 and a standard deviation of 1.23. When the teachers' mean scores of high level mean wait-time I was correlated with that of students' performance, a correlation coefficient of 0.816 was observed, indication a strong relationship between teachers' high level of mean wait-time I and students' performance. Still in Table 1 teachers with the medium level of mean wait-time I had a mean score of 2.96 with a standard deviation of 0.14. The result in Table 2 also indicated that teachers with low level mean wait-time had a negative correlation coefficient (-0.486) indicating a negative correlation between teachers' low level of mean wait-time I and students' performance in biology this results therefore provided answers to the research question 2.

Discussion of Findings

The objectives of this study was to find out the relationship between teachers' levels of questioning frequencies, mean wait-time and students' performance in biology. Thus, the results obtained from research question indicated that the performance of students in biology was better when taught using medium and high levels of teachers' questioning frequencies with the correlation coefficients of 0.938 and 0.687 respectively. This result is in line with that of Eggleston (1983) and Willen (2019) who found that teachers' questioning frequencies were positively related to students' performance at it enhanced students' performances.

The results of Table 2 indicated that the performance of students taught biology concepts with medium and high levels of mean wait-time I was better when compared with their counterpart taught same concepts using low level mean wait-time I. This result was in agreement with the findings of (Olajide & Adeoye 2010) who found that when wait-time was extended to about 5 seconds, the performance of students improved. The result was also in line with that of Mohammed (1999) who found that the performance of Food and Nutrition students was enhanced when taught by observing a wait-time duration of 3-5saconds.

Conclusion

It can be concluded from the outcome of this study that learning can be improved when teaching is done by observing the variable of wait-time. This is owing its pivotal role in teaching and learning process. Furthermore, questioning is of paramount important at the course of teaching and learning which must be handled with high level of technicality.

Recommendations

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



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1. The Federal and State Ministries of Education through their agencies like State Ministry of Education should organize special training workshops and seminars on questioning techniques such as wait-time and questioning frequencies and their implementation.
2. Secondary school science teachers in Kaduna State should try through regular practice to increase their wait-time I from 3.06 seconds to about 5 seconds which have found to be the determining wait-time I category at which science students performed better

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