

Analyzing the Effect of COVID-19 Pandemic Lockdown on Students' Retention Ability in Selected Science Subjects

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Abstract This research was aimed at determining the retention ability of students in science subjects in secondary schools during the COVID-19 lockdown. Three hypotheses were tested. Descriptive research design was used in this study. The population of the study comprised senior secondary school mathematics students in SS 3 in some selected secondary schools in Delta and Lagos States. The sample used for this study was 125 science students from selected secondary schools, who were willing to take part in the study. The instrument used for this study is the Science Retention Test (SRT). Data obtained were analyzed using SPSS version 25. The Bayesian Statistics was used to test the hypotheses stated for the study. Results obtained showed that the mean and standard deviation of student scores in mathematics, biology and chemistry before the COVID-19 lockdown was 69.50 ± 17.40 , while at resumption, their mean and standard deviation score stood at 53.29 ± 17.46 , with Bayes value of 4.0, which indicated that the student's scores before COVID-19 lockdown were higher than their retention scores and significantly differed. There was however no significant difference in the retention scores of male and female students in the study area. The mean and standard deviation of the retention score for private school students was 55.4 ± 11.38 , while that of the public school students was 51.93 ± 20.41 , with

Bayes Factor of 4.03 approximately 4.0, which indicated a moderate evidence for the null hypothesis, which stated that there was no significant difference in the retention score of students from public and private secondary schools. Although the lockdown was inevitable, it is recommended that measures be taken to remedy the situation by providing necessary internet devices for the students, so that those from less financially capable homes will be afforded the opportunity to study online in order to help in their retention ability.

Keywords COVID-19, Achievement, Retention, Students, Lockdown, Pandemic

1. Introduction

COVID-19 is an infectious disease that is caused by a virus known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), and is mainly transmitted via droplets and contact. COVID-19 has been described as a global public health emergency by the WHO [1]. It is an infectious disease indicated by a respiratory illness which ranges from mild to serious symptoms, and can also lead to

death [2]. More than 12 million patients worldwide have contracted SARS-CoV-2, the consequence of which is the illness known as COVID-19 [3].

The Covid-19 pandemic is a disease that disrupted all activities around the globe at inception. The educational sector of all nations was greatly affected. The result of the pandemic was a long break; as all schools across the globe were forced to shut down to contain the spread of the disease. As a result of the shutdown, most schools adopted alternative means of teaching/ learning such as online teaching. In Nigeria, not all secondary schools were involved in online teaching, hence the students from such schools were left to study on their own. During the confinement, classes in higher institution of learning were held via various e-learning platforms. This enabled interaction between teachers and students, and in some cases, with the help of national television shows or social media platforms [4].

It has been stated that the divide in Nigeria secondary school educational system has been exposed by COVID-19, as children in some communities, especially in rural areas of Nigeria are being left behind, because they were not privileged to have internet surfing tools that will help them transit to the new methods of teaching [5]. Although most states and ministries of education released a schedule of lessons in Television and radio stations, especially for students in government owned schools; it is worthy of note that most families live below the standard one dollar per day, and due to the reality of the lockdown, most people could not afford Televisions or radio. The issue of poor or absence of electricity supply is also another barrier to access such television programme by students from rural communities. Hence, the students have no choice but to study on their own. For students who may not be able to keep up with their peers due to their inability to access internet facilities, a major setback is that they may never be able to breach the gap created by the lockdown [5].

Retention is the ability to recall what has been taught after a specific time. A research conducted on the effect of summer vacation on achievement test scores, reviewed 39 studies that indicated that test scores declined after summer breaks. They found that the effect of the break was more detrimental on Mathematics and Science subjects than Art or Social science subjects. They also found that gender did not significantly moderate the difference in the achievement scores of the students [6].

Some researchers also studied the effect of Long Term vacation on academic performance of secondary school students in mathematics in Port-Harcourt City Local Government Area in Rivers State, Nigeria. The study focused on JSS 3 students, and the researchers used a sample of 58 students. The result obtained in their study revealed that long term break had a significant effect on the student achievement scores, as the students' scores had a continual decline from week one to week five [7]. The result however revealed that there was a difference between male and female students achievement scores, and

male students had higher achievement scores than their female counterparts.

The closure of secondary schools in Nigeria has led to a situation where most students stay at home for about four months and on August 4th 2020; students in their terminal classes (SS 3 students only) were made to resume school to take their Terminal Examinations. Two weeks were given by the government for the teachers to quickly take revision classes before the exam commences. Since students achievement often decline during the long term or summer break, it is therefore necessary to determine how well students are able to retain what was taught before the pandemic, as the lockdown has spanned longer than any summer break [6,7,8].

Objective

To determine the retention ability of students in secondary during the 2020 COVID-19 lockdown.

Hypotheses

HO₁ There is no significant difference in student academic performance before and after the COVID-19 pandemic break

HA₁ There is a significant difference in student academic performance before and after the COVID-19 pandemic break

HO₂ There is no significant difference in the retention score of male and female students in the study area

HA₂ There is a significant difference in the retention score of male and female students

HO₃ There is no significant difference in the retention score of students from public and private secondary schools

HA₃ There is a significant difference in the retention score of students from public and private secondary schools

2. Materials and Methods

The research design used in this study was the descriptive research design. The population of the study comprised senior secondary school science students in SS 3 in some selected secondary schools in Delta and Lagos States. The sample used for this study was 125 science students in selected secondary school who were willing to partake in the study. The instrument used for this study is the Science Retention Test (SRT) which was administered to the students as their last test before the COVID-19 pandemic lockdown, and the same was administer to the same students after resumption, in preparation for their WASSCE. The research duration was 6 months.

Method of Data Collection

The data used for this study were obtained by visiting certain secondary schools that have resumed in Delta and

Lagos States. The previous test scores for the different subjects were collected from the school authorities through the various subject teachers, while the teachers aided the researchers in administering same test to the students again. The scripts were marked by the various subject teachers and results of the test were handed to the researchers for further compilation and analyses.

Method of Data Analysis

Data obtained were collected and collated by the researchers. The data obtained were analyzed using SPSS version 25. The Bayesian Statistics was used to test the hypotheses stated for the study.

3. Result

The Bayesian Statistics was used to test the hypotheses stated for this study. One major methodology in Bayesian inferences is estimating the Bayes factor, which constitutes a ratio to compare the marginal likelihoods between the null and alternative hypothesis (B01) [9]. The IBM Knowledge Centre commonly used threshold to interpret the Bayes factor and defining significance of evidence is presented in Table 1.

Hypothesis One

HO₁ There is no significant difference in academic

performance before and after the COVID-19 pandemic break

HA₁ There is a significant difference in academic performance before and after the COVID-19 pandemic break

To test the hypothesis, a Bayesian related sample t-test was conducted. The mean score before the COVID-19 lockdown and after COVID-19 lockdown was computed. Also the Bayes factor was also computed to determine the likelihood of accepting the null hypothesis over the alternative. The credible interval values were also computed at 95% credibility. The summary of the result output is presented in Table 2.

Table 2 shows that the mean and standard deviation of scores in mathematics, biology and chemistry before the COVID-19 lockdown is 69.50±17.40, while at resumption their mean and standard deviation score is 53.29±17.46. The mean difference before the lockdown and at resumption of school activities for the Sampled SS3 student is 12.85. The credible interval values indicate that there is 95% certainty that the difference in the mean scores before the COVID-19 lockdown and their retention score at resumption of school is between 13.19 and 18.50 (indicating that if samples like this are drawn several times, the true difference in the score will be between these two values 95% of the time). The Bayes Factor of 0.00 indicates an extreme evidence for the alternative hypothesis.

Table 1. Bayes Factors

Bayes Factor (B ₀₁)	Evidence Category
>100	Extreme evidence for null hypothesis
30 – 100	Very strong evidence for null hypothesis
10 – 30	Strong evidence for null hypothesis
3-10	Moderate evidence for null hypothesis
1-3	Anecdotal evidence for null hypothesis
1	No evidence for null hypothesis
1/3 – 1	Anecdotal evidence for alternative hypothesis
1/10 -1/3	Moderate evidence for alternative hypothesis
1/30- 1/10	Strong evidence for alternative hypothesis
1/100- 1/30	Very strong evidence for alternative hypothesis
<1/100	Extreme evidence for alternative hypothesis

Table 2. Descriptive Statistics and Bayes Factor Related Sample T-test before COVID-19 lockdown and retention score at resumption

Variables	Descriptive Statistics			Bayes Factor Related sample t-test						
	N	Mean score	SD	Mean Difference	Standard deviation	BF ₀₁	T	df	95% Credible Interval	
									Lower bound	Upper bound
Before lockdown	125	69.50	17.40	16.21	12.85	0.00	14.10	124	13.91	18.50
At resumption (Retention Score)	125	53.29	17.46							

Table 3. Descriptive Statistics and Bayes Factor Independent Sample T-test for the Retention Score of male and Female Students

Variables	Descriptive Statistics			Bayes Factor Independent sample t-test						
	N	Mean score	SD	Mean Difference	Standard Error difference	BF ₀₁	t	df	95% Credible Interval	
									Lower bound	Upper bound
Male	56	51.33	21.68	3.55	3.14	3.92	1.13	123	-3.04	10.14
Female	69	54.88	13.04							

Table 4. Descriptive Statistics and Bayes Factor Independent Sample T-test for the Retention Score of Students in private and public secondary schools

Variables	Descriptive Statistics			Bayes Factor Independent sample t-test						
	N	Mean score	SD	Mean Difference	Standard Error difference	BF ₀₁	T	Df	95% Credible Interval	
									Lower bound	Upper bound
Private school	49	55.41	11.38	-3.47	3.20	4.03	-1.09	123	-9.17	2.21
Public school	76	51.93	20.41							

Hypothesis Two

HO₂ There is no significant difference in the retention score of male and female students in the study area

HA₂ There is a significant difference in the retention score of male and female students

In testing hypothesis 2, a Bayesian independent sample t-test was conducted. The result is presented in Table 3.

As shown in table 3, the Mean and standard deviation of the retention score for male students is 51.33±21.68, while that of the female students is 54.88±13.04. The mean difference in the retention between the male and female students is 3.55. The 95% credible interval is between -3.04 and 10.14 of which the mean difference of 3.55 between the male and female student lies within. The Bayes Factor is 3.93 approximately 4.0 (which is the ratio of likelihoods given the null versus the alternative hypothesis). From the Bayes value of 4.0, there is a 4:1 likelihood of the null hypothesis than the alternative hypothesis. There is a moderate evidence for the null hypothesis 2 (the Bayes factor indicates that there is no significant difference in the retention score of male and female students in the study area).

Hypothesis Three

HO₃ There is no significant difference in the retention score of students from public and private secondary schools

HA₃ There is a significant difference in the retention score of students from public and private secondary schools

Table 4 shows that the Mean and standard deviation of the retention score for private school students is 55.4±11.38, while that of the public school students is

51.93±20.41. The mean difference in the retention score of students in the school type is -3.55. The 95% credible interval is between -9.17 and 2.21. The Bayes Factor is 4.03 approximately 4.0 (which is the ratio of likelihoods given the null versus the alternative hypothesis). From the Bayes value of 4.0, there is a 4:1 likelihood of the null hypothesis than the alternative hypothesis (in favour of the null hypothesis). There is therefore a moderate evidence for the null hypothesis which states that there is no significant difference in the retention score of students from public and private secondary schools.

4. Discussion

This study reveals that the student’s scores before COVID-19 lockdown were higher than their retention score and significantly differs from each other. The findings of this study revealed that there was a decline in the achievement scores of students in Biology, Chemistry and Mathematics. Several studies have shown similar result. The Oxford Learning in their article on how to take study breaks that actually works were of the opinion that to help maintain performance, the break time should not be long. This is because a shorter break will help students retain information they learn better [10]. A similar opinion was further buttressed by another study [11]. While stating the advantages and disadvantage of year round school, the findings of a study revealed that many students find themselves showing a strong achievement decline throughout their break especially summer break, and further stated that some low income students may even find themselves losing grounds they gained academically during the previous academic session [11]. A researcher in

his study found that during the COVID-19 pandemic, students in the US may come back a full year behind in mathematics. In addition, the researcher added that in the study of previous summer breaks, it was found that most students' achievement scores were poor after the break [12]. The findings of the present study are in agreement with the reports of other researchers who found that summer break affected student's achievement scores negatively [8].

The decline in the achievement scores of the students in this study could be due to some identified factors [13]. A study on the likely effect of COVID-19 on student's education, found that during this period of school closure, students spent less time studying, suggesting that in actual fact, most students learning actually take place in the school, and not at home [13], and since the school were closed and most schools adopted an alternative approach to learning. It was difficult for some of them to cope during the period. Also the less time spent in online teaching for schools (that's for schools that did it) also contributed to learning loss. Attendance to school had a significant positive impact on students' achievement scores in science subjects [14]. This could possibly explain why the students had a lower achievement score in the present study. Other reasons for decline in achievement score during the COVID-19 as suggested are changes in the way students interact (most students could not see themselves study together and learn from one another), lack of motivation to learn as they could not tell how long they would remain at home, most students could not afford the digital resources needed to study at home, as only student from a more financially advantaged home could afford all they needed to attend online classes [13].

In comparing the retention ability of male and female students, the study revealed that there was a higher likelihood that there is no significant difference in the retention achievement score of male and female students after the COVID-19 lockdown. This finding is similar to the report in a study carried out in Ogun State, Nigeria, where the researcher found that there was no significant difference in the achievement school between male and female students [15]. Other researchers' findings were also similar to that in this study, in that after the summer break there was no significant difference in the test achievement score of male and female students [6].

The retention scores for the school type sampled were also compared. The study revealed that there was a moderate evidence that there is no significant difference in the retention score of students from public and private secondary schools. The findings reveals that the retention score for private secondary schools sampled was higher than the retention score for public secondary school. This finding contradicts the report of a study carried out in Katsina State, Nigeria, which was a comparative study of public and private senior secondary school students' achievement in science subjects. The study reported that there was no significant difference in achievement between

private and public schools in biology and chemistry, but found a significant difference in the achievement scores in physics [16]. In the findings of another study, there was no significant difference in the achievement score between private and public secondary schools, which is in line with the findings of the present study [17].

5. Conclusion and Recommendations

Based on the findings of this study it was therefore concluded that COVID-19 had a negative impact on students' retention ability in their science subjects (Mathematics, Biology and Chemistry). Although the lockdown was inevitable, it is recommended that measures should be taken to address the situation by providing necessary devices for the students, so that those from less financially capable homes will be afforded the opportunity to study online also. Electricity power supply should also be improved upon, so that the student's devices could be powered continuously for study. Also, at resumption of schools, make up classes should be organized so that students can cover up for the lost time during the lockdown.

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