Students' Motivation towards Biology Learning During COVID-19 Lockdown as a Predictor of Students' Performance in Biology in Lagos State

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Abstract
Using a correlational research design, this study examined students' motivation towards Biology learning during the COVID-19 lockdown as a predictor of students' performance in Biology in Lagos State. From the four Educational Districts that pioneered Lagos State, TV/Radio educational broadcasts as well as fifteen schools and fifteen teachers were purposively selected for the study. The sample size was made up of 218 Senior Secondary Class II Biology students linked via WhatsApp. The data was gathered via two validated instruments: Students' Motivation Towards Biology Learning (SMTBL) and Biology Students' Performance Test (BSPT). The instruments were created using Google Forms, with the link shared via WhatsApp. The study answered three research questions and tested two hypotheses at a .05 level of significance. The data was analysed in terms of mean, standard deviation, t-test and multiple regression. The SMTBL and the independent variables (Self-Efficacy, Active Learning Strategies, Science Learning Value, Performance Goal, Achievement Goal and Learning Environment Stimulation) had significant joint contributions on the dependent variable (Biology Students' Performance) $R^2 = 0.96$, $F(1, 216)=902.63$, $p<.05$. *This accounted for 96.2% of the variation in Biology students' performance. There was a significant influence of gender on students' motivation and performance in biology in favour of the females (*$t(216) =2.76$, $p=.01$*). It is therefore recommended that Biology teachers should use participatory and collaborative strategies to arouse and sustain students' motivation and performance in Biology irrespective of gender during and beyond the COVID-19 lockdown. Also, the factors of motivations should be considered during curriculum planning and implementation of the 21st Century Biology Curriculum.*

Keywords: COVID19, pandemic lockdown, motivation, students' performance in Biology, Lagos State.

Introduction

At present, the educational enterprise worldwide is facing one of the greatest threats to its sustainability, given the impact of the COVID-19 pandemic. On

March 11, 2020, the WHO declared that COVID 19 was caused by a coronavirus, was responsible for illnesses ranging from common cold to more severe diseases and that it had reached the status of a pandemic. Subsequently, many countries all over the world went into a lockdown amidst several other measures to combat the pandemic. Inevitably, schooling was one of the industries affected. By UNESCO estimates, as at April 8, 2020, school closure due to the coronavirus had already occurred in 189 countries, with 1.6 billion children and youths being out of school and 63 million teachers affected globally. To check the stifling of educational aspirations, homeschooling emerged as a means to keep students learning and healthy at home. Many developed nations migrated to online interactions while most developing nations were still struggling to keep students engaged at home. In Nigeria, on March 19, 2020, a circular from the Federal Ministry of Education granted approval for the closure of all schools for one month beginning from March 23, 2020 to prevent the spread of the coronavirus (F.M.E., 2020). This closure meant that 46 million children would be out of school. Moreover, about "400,000 Internally Displaced Persons (IDP) children receiving some education in the camps would be affected if the physical schooling activities are stopped" (F.M.E., 2020). As such, the Federal Government of Nigeria launched free e-learning portals for primary and secondary school students which included the 'Schoolgate and the Mobileclassroom.com.App' (F.M.E. 2020). Lagos State began radio and television broadcasts via the following Channels: Channel 259, GOtv Channel 98, Star Times Channel 195, Mytv Channel 17, Wazobia TV, DStv and the local terrestrial Channel 57. The Lagos State Government subsequently initiated online communications with teachers in its employ via Telegram and Zoom.

The interruption of learning and teaching was a major setback for disadvantaged learners who tend to have fewer educational opportunities outside school. Given the severe impact of the lockdown on institutional learning, it is necessary to examine students' attitude to learning with regard to the new learning platforms, with a focus on Biology.

The Federal Ministry of Education (2014) lists the following objectives in its curriculum for Biology: acquisition of adequate laboratory and field skills, meaningful and relevant knowledge in biology, ability to apply scientific knowledge to everyday life in matters of personal and community health and agriculture, and reasonable and functional scientific attitude. However, the performance of students in Biology in the senior school certificate examination has been a source of concern to all stakeholders (Oladipo, 2009; Ogundiwin &

Oladipo, 2018). This observation is reflected in students' poor performance as reported by the West African Examinations Council (see Table 1).

Table 1: Candidates' performance in May/June Senior School Certificate Examination in Biology in Nigeria from 2007 – 2018

Year	Total Sat	Credit Passes	%
2007	1,238,163	413,211	33.37
2008	1,259,964	427,644	33.94
2009	1,903,552	644,733	33.87
2010	1,300,418	427,644	33.90
2011	1,505,199	579,443	38.50
2012	1,646,150	587,044	35.66
2013	1,648,363	854,743	51.73
2014	1,365,384	766,971	56.17
2015	1,390,234	798,246	57.42
2016	1,200,367	740,345	61.68
2017	1,544,334	923,486	59.21
2018	1,572,396	786,016	49.99

In the early stages of science education, considerable research effort was focused on the cognitive domain and the development of instructional strategies and techniques as solutions to the repeated low performance in Biology (Oladipo & Ihemedu, 2016; Ogundiwin & Oladipo, 2018; Oladipo, Adewumi & Ogundiwin, 2019). Later on, the emphasis was shifted to the affective domain, which has not only been accepted as a relevant part of education but has also become the focus of substantial research (Ranal, Mahmood & Reid, 2015). Accordingly, motivation, which is a factor in the affective domain, is now the subject of constant inquiry. In learning, motivation is the most important variable that influences students' academic achievements (Cavas, 2011; Rana1, Mahmood and Reid; Chan and Norlizah, 2017). From a sociocognitive perspective, Bandura (2001) noted that students' learning activities and experiences vary from one circumstance to another and contribute to their motivation.

Previous studies have examined learners' motivation using distinctive assessment instrument tools for general and specific fields of science (Tuan, Chin & Shieh, 2005; Ranal, Mahmood & Reid 2015; Chan & Norlizah, 2017). An empirical study conducted by Patric, Kpangban and Chibueze (2007) on 600 senior secondary school Science students found that motivation significantly contributed towards variation in the students' test results. Tuan et al. (2005) developed a questionnaire named 'Students' Motivation Towards Science Learning' (SMTSL) which had six motivation factors that were observed to be connected to studying science in

senior secondary schools. In the present study, the six factors (self-efficacy, active learning strategies, Science learning value, performance goal, achievement goal, and learning environment stimulation) were examined in the context of the COVID-19 pandemic in a bid to determine Biology students' motivation towards Biology learning as predictors of Biology performance. Therefore, the self–efficacy factor refers to Biology students' confidence level in relation to mastering Biology learning tasks and producing positive outcomes. The active learning strategies factor refers to the ability of the Biology student to assume responsibility for their learning. The Science learning value factor focuses on Biology students' views on the values of Biology learning. The performance goal factor was viewed by Biology students in terms of high attainment in Biology learning. The achievement goal factor refers to the positive affective values which Biology students intend to gain by learning Biology, while the Learning Environment Stimulation factor refers to Biology content and teacher's pedagogical styles during the COVID-19 pandemic.

The literature also contains inconsistent findings about gender differences in students' motivation towards Science learning. Akbaş and Kan (2007), Albert (2010), Zeyer and Wolf (2010), Karaarslan and Sungur (2011) and Mustafa (2012), as well as Sarwat, Safia and Col (R) (2013), have observed no gender differences on students' motivation towards Science learning. Some studies found differences in students' motivation towards Science learning based on gender. Simpson and Oliver (1985), Zamrud (2008), Ikhwan et al. (2009), Güvercin et al. (2010), Cavas (2011) as well as Chan and Norlizah (2015) found that female students have higher motivation towards learning Science than male students. However, some studies also found that male students are, on average, more motivated to learn Science than female students (Albert Zeyer, Ayla Çetin-Dindar, Ahmad Narulazam, Mojca Juriševič, Iztok Devetak & Freia Odermatt, 2011; Cavallo, Potter, Rozman, 2004). On gender differences in students' motivation towards Science learning, there are mixed results in the literature, hence the need for further investigation. Consequently, this study focuses on students' motivation towards Biology learning during the COVID-19 pandemic lockdown as a predictor of students' performance in Biology.

Statement of the Problem

School closure during the COVID-19 lockdown represents an unprecedented challenge for the education sector and has created an opportunity to rethink the process of education delivery. Recording and reporting the outcomes of Biology students' motivation during the COVID-19 pandemic could provide a framework for planning, developing and implementing a 21st century Biology curriculum that meets the needs of the times. This framework will in turn equip Biology teachers

with skills for best practices, enhance their performance and eventually increase the interest and motivation of Biology students towards Biology learning.

Research Questions

RQ1. What was the joint contribution of students' motivation factors (Self-Efficacy, Active Learning Strategies, Science Learning Value, Performance Goal, Achievement Goal and Learning Environment Stimulation) to students' Biology performance during the COVID-19 lockdown?

RQ2. What was the relative contribution of students' motivation factors (Self-Efficacy, Active Learning Strategies, Science Learning Value, Performance Goal, Achievement Goal and Learning Environment Stimulation) to students' Biology performance during the COVID-19 lockdown?

RQ3. What was students' performance in Biology during the COVID-19 lockdown?

RQ4. How did senior secondary school students perceive motivation toward Biology learning during the COVID-19 lockdown?

Hypotheses

The following null hypotheses were tested at a .05 level of significance.

HO1: There is no significant difference in motivation towards Biology learning between male and female students during the COVID-19 lockdown.

HO2: There is no significant difference in Biology performance between male and female students during the COVID-19 lockdown.

Methodology

Research Design

The correlational survey research design was used to determine the relationship between SMTBL and performance in Biology tests and to describe the population and situation being studied.

Sample and Sampling Techniques

The population for the study comprised all Senior Secondary Class II students in Lagos State, Nigeria. Out of the six Educational Districts (EDs) four (I, II, IV & V) participated in the study, these being the four EDs that pioneered educational media broadcast through radio and television during the COVID-19 lockdown. One of the researchers was a presenter on the radio and television lesson

programme organised by the Lagos State Ministry of Education. There was a WhatsApp platform for all the presenters in each subject area in the Senior Secondary School (SS) category. Biology, as a subject in the SSS classes, had its own presenters' WhatsApp platform, which included only presenters from the initial 4 EDs who pioneered the radio and television educational media broadcast. These Biology presenters assisted in the dissemination of information about the research to all SSII Biology teachers in their own ED. Fifteen schools in the four 4EDs were purposively selected for the research, with the SSII teachers having established communication links with their students through their parents' phone numbers as retrieved from the students' records. Thereafter, a Google Form link to the questionnaire was released to the presenters in the four 4EDs who then forwarded it to the selected Biology teachers' schools in the first week. The Google Form link for Biology students' performance test was supplied to the Biology presenters in the second week. This arrangement was considered appropriate because, by the second week of the research, the Biology presenters had concluded and revised the selected topics used for items in the performance test.

A total of 218 SSII Biology students were involved in the study. These students were selected using a systematic sampling technique spanning the four EDs; in this case, those selected were the first 20 students from each school who responded to the instruments electronically and fully completed the form. Thus, the total number of students who participated in the study and completed the instrument using the Google Forms links was 218, comprising 180 females and 38 males. The disparity between the number of males and females was due to the COVID-19 lockdown and the online approach adopted, as the researcher had no control over the number of females and males who participated. The choice of SSII students was considered appropriate during the COVID-19 pandemic because they had been exposed to some basic biological concepts and skills and had received instructions on topics listed in the Senior Secondary School Biology curriculum for year one and followed broadcast of same on television and radio. Besides, the students had enough time for the study since they were not preparing for any external examinations.

Instrument of Data Collection

Two instruments were used for data collection for the study.

1. Students' Motivation towards Biology Learning (SMTBL).
2. Biology Students' Performance Test (BSPT)

The Instrument: Students' Motivation towards Biology Learning

Students' Motivation Towards Science Learning (SMTSL), an instrument designed by Tuan et al. (2005), was adapted for the study. The original instrument contains 35 items which are categorised into six scales, viz: self-efficacy (items 1–7), active learning strategies (items 8–15), science learning value (items 16–20), performance goals (items 21–24), achievement goals (items 25–29), and learning environment stimulation (items 30–35). However, for their adaptation, the researchers reduced the 25 items to 20. Items 2, 6 and 7 were removed from the self-efficacy scale, 11 and 15 from active learning, 19 and 20 from Science learning values, 22 and 24 from Performance goal, 27, 28, 29 from achievement goal, and 32, 33 & 35 from learning environment stimulation. These items were removed because they demanded activities from teachers and students as they would occur in a physical classroom. Also, the word 'Science' in the original instrument was replaced with 'Biology', hence the researchers' term reads Students' Motivation Towards Biology Learning (SMTBL).

A four-point Likert-type scale excluding 'No Opinion' from the original five-point Likert-type by Tuan et al. (2005) was also used owing to the fact that use and interpretation of the 'No opinion', 'Undecided' or 'Neutral' raises problems (Nworgu, 1986). Therefore, respondents rated their agreement for each statement as follows: 4-strongly agree, 3-agree, 2-disagree and 1-strongly disagree. A mean score of 2.5 on the 4-point Likert scale was used to make a decision. The instrument was given to two experienced Biology teachers, who gave advice on what to add to the items. Also, using the Cronbach Alpha, the reliability and internal consistency of the items was determined, giving a reliability index of .81.

Biology Students' Performance Test (BSPT)

The instrument was divided into sections A and B. Section A elicited respondents' personal data, including gender, name, school and class. Section B consisted of twenty (20) multiple-choice items. The **BSPT**, which had a 20-item multiple-choice questions with four options (A, B, C, D), was constructed by the researchers to measure students' cognitive performance in Biology and to measure the acquisition/level of students in some selected topics/concepts in Biology on the topics that were taught for the first six weeks on radio and television. The topics were digestive system, transport system, respiratory system, excretory system as well as terrestrial and aquatic habitats in the SSII scheme of work. The instrument was subjected to face and content validity by exposing it to seasoned and experienced Biology teachers and WAEC markers. They were asked to determine its suitability for the target population as well as its validity in

terms of clarity, coverage and language. Out of the 38 items proposed for assessment, only 20 items survived the scrutiny and were judged to be content- and face-valid. For item analysis, a table of the specification was developed using Bloom's Revised Taxonomy by Anderson et al. (2001), as shown in table 3. The BSPT was administered on a sample of 25 SSII students via WhatsApp using Google Forms in a school that was not part of the study but whose students were similar in age and class to the students involved in the study. The trial-tested result provided the basis for determining the discriminating power and difficulty index of each item. A difficulty level of range of 0.35 (35%) to 0.75 (75%) was adopted, meaning that only items of moderate difficult levels were selected for the test. From the students' responses, a reliability coefficient of 0.80 was obtained using Kuder Richardson 20 (KR20).

Table 2: Table of specifications for Biology Students Performance Test (BSPT)

Topic /System	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation	Total
Digestive	1 (1)	1(4)	1 (2)	1(3)	-	-	4
Transport	3(6,7,8,)	1(5)	-	-	-	-	4
Respiratory	1 (9)		3(10,11,12)		-		4
Excretory	3(13,14,16)	-	-	1(15)		-	4
Terrestrial and Aquatic Habitats	2(18,19)	1(17)		1(20)			4
Total	10	3	4	3	-		20

Note: Figures in parentheses are items numbers.

Procedure for Data Collection

Approval for the study was received from the school's counsellors and principals, who were the administrators of most of the online platforms before the study commenced. The Google Forms for the two instruments were shared on the WhatsApp platforms of the target sample. The participants responded to the two instruments online in two weeks.

Methods of Data Analysis

Data collected were analysed using regression analysis to determine the joint contribution of the independent variables, while also determining which of the motivation variables predicted students' performance in Biology. Mean and standard deviation were used as descriptive statistics to determine the level of Biology students' performance. Also, a t-test was used to test the hypothesis at a .05 level of significance.

Results

Research Question 1: What was Biology students' performance during the COVID-19 lockdown?

Table 3: Students' performance in Biology during the COVID-19 lockdown

	N	Minimum	Maximum	Mean	SD	Skewness
Students' Performance in Biology	218	5.00	20.00	13.52	2.16	-2.190

As reported in Table 3, the average Biology students' performance during the COVID-19 lockdown was 13.53 or 67.6%, with a minimum score of 5 or 20% and a maximum score of 20 or 100%. This result is negatively skewed. By implication, Biology students' performance during the COVID-19 lockdown was above the average.

Research question 2: How did Senior Secondary School students perceive motivation towards Biology learning during the COVID-19 lockdown?

Table 4: Students' perception of motivation towards Biology learning during the COVID-19 lockdown

Items	Mean	SD	Remark
Self-Efficacy			
Understanding difficulties in Biology.	3.13	0.66	Agreed
Ability to do well in Biology	3.08	0.69	Agreed
No matter the effort, I cannot learn Biology.	1.68	0.69	Disagreed
Giving up on difficult tasks in Biology	2.38	0.86	Disagreed
Sub-mean	2.57	0.73	Agreed
Active Learning Strategies			
Understanding new concepts in Biology	3.25	0.69	Agreed
Connecting to previous experiences	3.13	0.73	Agreed
Finding relevant sources that will help to understand Biology concepts	3.04	0.79	Agreed
Attempting to make connections between the concepts learnt	3.08	0.69	Agreed
Finding ways from the mistake	3.15	0.72	Agreed
Trying to learn a new concept in Biology	3.10	0.72	Agreed
Sub-mean	3.13	0.72	Agreed
Science Learning Value			
Importance of Biology in daily life	3.32	0.78	Agreed
Learning Biology stimulates thinking	3.07	0.87	Agreed
Biology learning helps in solving problems	2.96	0.82	Agreed

Sub-mean	3.12	0.82	Agreed
Performance Goal			
Participating in Biology to get good grades	2.94	0.89	Agreed
Students think that they are smart for learning Biology	1.97	0.74	Disagreed
Sub-mean	2.46	0.82	Disagreed
Achievement Goal			
Feeling most fulfilled when attaining good scores in Biology	3.32	0.84	Agreed
Feels confident about the content in Biology	3.19	0.81	Agreed
Sub-mean	3.26	0.83	Agreed
Learning Environmental Stimulation			
Biology contents are exciting and changeable	3.07	0.84	Agreed
Willingness to participate in Biology because it is challenging	3.00	0.89	Agreed
Willingness to participate in Biology teacher uses a variety of teaching methods	2.77	0.95	Agreed
Sub-mean	2.95	0.89	Agreed
Grand mean	2.92		

Criterion mean =2.50

As reported in Table 4, the grand mean of 2.92 is greater than the criterion mean of 2.50. This implies that Biology students generally had a positive perception of motivation towards Biology learning during the COVID-19 lockdown. Also, most of the Biology students agreed that whether the Biology content was difficult or easy, they were sure that they could understand it (Mean=3.13, SD=0.66) and do well in Biology tests (Mean=3.08, SD=0.69). On the other hand, majority of the Biology students reported that no matter how much effort they put in, they could not learn Biology (Mean=1.68, SD=0.69) and that when Biology activities were too difficult, they would give up or do only the easy part (Mean=2.38,SD=0.86). The grand mean of 2.57, SD=073 shows that majority of the students agreed that self-efficacy is an important motivating factor for learning Biology.

Moreover, many of the participants agreed that when learning new Biology concepts, they attempted to understand them (Mean=3.25, SD=0.69) or connect their learning to previous experience (Mean=3.13, SD=0.73). When they did not understand a Biology concept, they found relevant resources that would help them (Mean=3.04, SD=0.79). Besides, most of the Biology students agreed that during the learning processes, they attempted to make connections between learned concepts (Mean=3.08, SD=069). When they made a mistake, they tried to find out why (Mean=3.15, SD=0.72) and when they came across new Biology concepts that they do not understand, they still tried to learn them (Mean=3.10, SD=0.72).

Overall, the grand mean =3.12, SD= 0.72 indicates that most of the students agreed that active learning strategies were crucial in motivating them to understand Biology concepts.

Furthermore, many of the Biology students agreed with 'I think that learning Biology is important because they can use it in their daily life' (Mean=3.32, SD=0.78), as well as with the statement that learning Biology is important because it stimulates their thinking (Mean=3.07, SD=0.87) and that it is important to learn to solve problems (Mean=2.96, SD=0.82). The grand mean =3.12 SD= 0.82 implies that many of the students agreed that the Science value factor is essential in motivating them to learn Biology. Besides, majority of the Biology students agreed that they participated in Biology courses to get good grades (Mean=2.94, SD=0.89) but disagreed that they participated in Biology courses so that other students would think them smart (Mean=1.97, SD=0.74).

Furthermore, most of the Biology students agreed that during a Biology course they felt most fulfilled on attaining a good score in a test (Mean=3.32, SD=0.84) and felt most fulfilled when they felt confident about the contents of a Biology course (Mean=3.19, SD=0.81). The grand mean of 3.26, SD=0.83 is an indication that majority of the students agreed that the achievement goal is a vital factor which motivates them in Biology learning.

In the same vein, the majority of the Biology students agreed that they were willing to participate in the Biology course because the content was exciting and changeable (Mean=3.07, SD=0.84). They were also willing to participate in a Biology course because it was challenging (Mean=3.00, SD=0.89) and willing to participate in a Biology course because the teacher used different teaching methods (Mean=2.77, SD=0.95). The grand mean of 2.95, SD=0.89 suggests that many of the students agreed that the learning environment stimulation is an important factor that motivates them towards Biology learning.

Research Question 3: What was the joint predictive ability of students' motivation factors (Self -Efficacy, Active Learning Strategies, Science Learning Value, Performance Goal, Achievement Goal and Learning Environment Stimulation) to their Biology performance during the COVID-19 lockdown?

To determine the joint predictive ability of the independent variables (Self-Efficacy, Active Learning Strategies, Science Learning Value, Performance Goal, Achievement Goal and Learning Environment Stimulation) on the biology

performance of students, the researchers adopted multiple regression analysis. The predictive ability is presented in Table 2.

Table 5: Regression analysis of predictors of SMTBL on Biology performance

Model 1

Predictor Variable	B	β	SE	T	P-value
Self-efficacy	1.06	0.86	0.02	45.32	0.00
Active Learning Strategy	0.18	0.28	0.02	18.80	0.00
Science Learning Value	0.56	0.36	0.03	12.89	0.00
Performance goal	0.37	0.27	0.01	24.73	0.00
Achievement Goal	0.43	0.34	0.02	14.87	0.00
Learning Environment Stimulation	0.24	0.29	0.01	26.64	0.00
R^2	0.962				
AdjR^2	0.961				
F	902.63, df(6,220) p=0.00				

Table 5 indicates the coefficient of determination as (R^2) = 0.962 (96.2%) for the model. This implies that the independent variables (Self-Efficacy, Active Learning Strategies, Science Learning Value, Performance Goal, Achievement Goal and Learning Environment Stimulation) accounted for 96.2% of the variance in the dependent variable (Biology Students' Performance). As such, the joint effect of the independent variables is significant in Biology performance R^2= 0.96, F (1, 216) = 902.63, p < .05.

Research Question 4: What was the relative contribution of students' motivation factors (Self-Efficacy, Active Learning Strategies, Science Learning Value, Performance Goal, Achievement Goal and Learning Environment Stimulation) to Biology performance during the COVID-19 lockdown?

Table 5 shows the relative contribution of the independent variables to the dependent variable. The data showed that Self-Efficacy (*B*= 0.86, t (216) =45.32, p< .05), Active Learning Strategy (*B*= 0.28, t(216) = 18.80, p<.05), Science Learning Value (*B*= 0.36, t(216) =12.89, p<.05), Performance Goal (*B*=0.27, t(216) =24.73 p<.05), Achievement Goals (*B*=0.34, t(216)=14.87, p< .05) and Learning Environment Stimulation (*B*=0.29, t(216)=26.64, p< .05) contributed positively and significantly to students' performance in Biology. Overall, Self-Efficacy significantly predicted Biology performance scores (*B*= 0.86, t(216)

=45.32, p< .05). This was followed by Learning Environment Stimulation (*B*=0.29, t(216)=26.64, p< .05) and Performance Goal (*B*=0.27, t(216) =24.73, p<.05).

Null Hypothesis One: There is no significant difference in SMTBL between male and female students during the COVID-19 lockdown.

Table 6: An independence t-test showing the difference in Biology students' perception of motivation toward Biology learning during the COVID-19 lockdown

	Sex	**N**	**Mean**	**SD**	**df**	**Mean difference**	**t-value**	**Sig.P.**
Self-Efficacy	Male	38	9.68	2.77				
	Female	180	10.49	1.17	216	-.80	-2.874	.004
Active Learning Strategies	Male	38	16.95	5.51				
	Female	180	19.33	2.07	216	-2.39	-4.521	.000
Science Learning Value	Male	38	7.74	3.04				
	Female	180	9.81	1.42	216	-2.07	-6.430	.000
Performance Goal	Male	38	4.34	1.63				
	Female	180	5.08	1.16	216	-.74	-3.297	.001
Achievement Goal	Male	38	5.66	2.26				
	Female	180	6.76	1.04	216	-1.10	-4.625	.000
Learning Environment Stimulation	Male	38	7.55	2.86				
	Female	180	9.20	1.68	216	-1.65	-4.765	.000

As observed from Table 6, a significant difference is reported in Self-Efficacy at t(216)=2.88, p<.05), Active Learning Strategies at t=(216)=4.52, p<.05) and Science Learning Value at t=(216)=2.07, p<.05) of male and female Biology students during the COVID-19 lockdown. Besides, a significant difference is reported in Performance Goal at t=(216)=3.30, p<.05), Achievement Goal at t(216)=4.63, p<.05) and Learning Environment Stimulation of male and female Biology students at t(216)=4.77, p<.05). By implication, there is a gender difference effect in favour of the females in the Biology students' perception of motivation toward Biology learning during the COVID-19 lockdown. Therefore, the hypothesis was rejected. Thus, there was a significant difference in the motivation towards Biology learning between male and female students during the COVID-19 lockdown.

Null Hypothesis Two: There is no significant difference in Biology performance between male and female students during the COVID-19 lockdown.

Table 7: An independence t-test analysis of difference in the performance in Biology between male and female students

	Sex	N	Mean	SD	Mean difference	t-value	Df	P-value
Achievement	Male	38	12.79	3.62	-.972	2.76	216	0.01
	Female	180	13.76	1.42				

Table 7 shows a significant difference in Biology performance in favour of the female students at t(216)=2.76, p=.01). This leads to rejection of the null hypothesis. It is therefore concluded that there was a significant difference in the Biology performance between male and female students during the COVID-19 lockdown. Also, as reported in Table 6, the average performance of females in Biology of 13.76 (68.80%) was more than that of the male students at 12.79 (63.95%).

Discussion

This study investigated students' motivation towards Science learning during the COVID-19 lockdown as predictors of students' performance in Biology. The results revealed that the independent variable (i.e. SMTBL) predicted students' performance in Biology (BSPT) during the COVID-19 lockdown. This result is consistent with Olatoye and Ogunkola (2000), Cavas (2011), Ranal, Mahmood and Reid (2015), as well as Chan and Norlizah (2017), who reported a positive relationship between motivation and academic achievement. Similarly, the positive relationship exhibited in this present study implies that despite the pandemic lockdown, SS II Biology students' motivation contributed very significantly to their performance in Biology. Also, the relative contributions of each scale on the SMTBL revealed that Self-Efficacy and Science Learning Value, followed by Achievement Goal, Performance Goal and Learning Environment Stimulation accounted more significantly toward Biology performance. However, Active Learning Strategies accounted for the least contribution to SMTBL. In line with this are studies by Ranal, Mahmood and Reid (2015), as well as Dermitzaki, Stavroussi, Vavougios and Kotsis (2012), which showed that the six factors proposed by Tuan et al. (2005) on the SMTSL largely contributed in determining the motivation to learn Biology and also applied even in a different cultural setting. However, Self-Efficacy and Science

Learning Values, which were statistically strong determinants of motivation towards Biology learning in this study, were proof that SSSII Biology students were well motivated and had confidence in themselves to apply the values of Biology in their daily life during the COVID-19 lockdown. On the other hand, Learning Environment Stimulation and Active Learning Strategies were weak determinants, thus suggesting that the teachers did not use a variety of teaching strategies to induce motivation and so the students were not properly positioned to be responsible for their learning in a constructivist manner.

The findings from this research also revealed a gender difference in favour of the females in Biology students' perception of motivation toward Biology learning during the COVID-19 lockdown. Although this finding is congruent with previous studies by Chan and Norlizah (2017) as well as Mahanti and Sarkar (2018) which showed gender differences in favour of female students in their motivation towards Science learning, some other studies found no gender differences on students' motivation towards Science learning, such as Albert (2010), Karaarslan and Sungur (2011) and Mustafa (2012). Similarly, the female students expectedly performed better than their male counterparts in the Biology students' performance test, as they were more motivated towards Biology learning during the COVID-19 lockdown. Discussions with the teachers revealed that female students had always been more responsive to assessments and assignments than their male counterparts. The probable reason for this may be that girls are more interested in, and encouraged to study, Biology. Therefore, there is need for concerted efforts aimed at closing the gender gap in Biology learning, especially in order to encourage those males who may want to study the biological and medical sciences.

Recommendations

This study has shown that Biology students' motivation can be improved using appropriate motivational strategies. As such, efforts should be made to arouse and sustain both male and female students' motivation towards Biology learning through participatory and collaborative teaching approaches. In line with best practices, modelling and mentoring—which could include presentation of lessons by resource practitioners—should be explored and included in the scheme of work for online or TV/radio learning. Such participation of experts or professionals will go a long way to correct any misconception male students may have about Biology as a subject. It is equally important that training and retraining of teachers, particularly on ICT, should consistently be organised for Biology teachers to enhance and update their knowledge and skills in e-learning

and online pedagogy. Finally, factors of motivation should be considered during curriculum planning and implementation of the Biology curriculum during and beyond the COVID-19 lockdown.

Conclusion

The study was carried out to determine students' motivation towards Biology learning during the COVID-19 lockdown as predictors of students' performance in Biology. The study found, among other things, that Biology students' performance correlated with their motivation towards Biology learning. The study revealed that female Biology students were more motivated towards Biology learning and performed better than their male counterparts during the COVID-19 lockdown. This revelation, therefore, calls for concerted efforts on the part of teachers who engage students on TV/Radio broadcasts to use innovative and variety of pedagogies/ teaching styles, which will motivate both the female and male students towards Biology learning and develop in them the love for further learning in Biology. Teachers should be engaged in workshops on 21st century best educational broadcast and online practices to make both content and learning interesting to Biology students and as a measure to maintain teaching and learning engagements possible even in a pandemic.

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