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INFLUENCE OF COVID-19 PANDEMIC ON THE MATHEMATICS PERFORMANCE OF STUDENTS IN SENIOR SECONDARY SCHOOL

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Abstract
The purpose of this research was to examine the impact of the COVID-19 pandemic on the mathematical performance of high school students in the Obio-Akpor area of Rivers State. Analytical survey research design was applied in this investigation. 360 students were selected at random for the research. Information was collected with the use of the Promotional Mathematics Performance Score Sheet (PMPSS). To determine PMPSS's reliability coefficient, we used the test-retest method in conjunction with Pearson's Product Moment Correlation (PPMC). This investigation was guided by three hypotheses and six questions. The t-tests for paired and independent samples were used to test the hypotheses, and mean and standard deviation were calculated to answer all the study's questions. Results revealed that students' mathematical performance was very high before the COVID-19 pandemic but dropped drastically during the pandemic and slightly improved after the pandemic. There was a significant difference in students' mathematical performance before and during the COVID-19 pandemic but there was no such difference in performance during and after the outbreak. In addition, there was no obvious difference in performance between the sexes during the pandemic. The study recommended among others that Mathematics teachers should work harder in instructional delivery and also employ diagnostic and remedial instructional strategy to improve the performance of students which has been negatively impacted by the COVID-19 pandemic.

Keywords: Influence, COVID-19, Pandemic, Mathematics, Performance, Students

Introduction

The 2019 Corona Virus Disease (COVID-19) pandemic has caused widespread uncertainty in many sectors of national and international society, including the educational system. The spread of COVID-19 has had a detrimental impact on the classroom. Its devastating effects on education and daily life forced fundamental changes in our culture. The spread of the virus COVID-19 has had a major effect on classroom activities. In schools, the traditional approach of teaching students one-on-one must give way to the more convenient and modern approach of teaching them online. Technology has allowed schools to keep running during the epidemic, but the sudden shift has hampered education. The spread of the COVID-19 virus has impacted several sectors negatively, including education (Nicola, et al., 2020; Jalongo, 2021; Pokhrel & Chhetri, 2021; Agbele & Oyelade, 2020). Schoolchildren in approximately 192 countries experienced disruptions to their schedules due to the temporary or regional closure of schools (UNESCO, 2020). Due to the severity of the COVID-19 threat, the entire planet has been placed on lockdown, with public gatherings, market or commercial transactions, organization activities, all connected social and religious gatherings, and the closure of schools all being prohibited. The closure of schools was one of the measures taken to halt the spread of COVID-19, and it had a significant effect on schools of all levels, including those at the secondary level.

According to the World Health Organization (2020), a new strain of coronavirus called COVID-19 is to blame for this disease. The words "corona" and "virus/illness" are represented by the letters "CO" and "VI," respectively. Once known as "2019 novel coronavirus" (or "2019-nCoV"), this condition is now caused by COVID-19, a new virus that is related to the same viral family that causes SARS and several strains of the common cold. Fever, coughing, and difficulty

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breathing are all symptoms of COVID-19. Pneumonia and other breathing difficulties are possible complications of an infection. Occasionally, the disease might be fatal. These symptoms are similar to those of the influenza virus and the common cold, both of which are much more prevalent than COVID-19. Therefore, testing is required to confirm the presence of COVID-19. The first case of COVID-19 was reported in December 2019 in Wuham, China. By January 2020, the World Health Organization had declared the virus a global health emergency of concern, and by March 2020, it had declared the virus a pandemic (WHO, 2020). The Federal Ministry of Health of Nigeria announced the first case of coronavirus illness on February 29, 2020, in Lagos State. The National Center for Disease Control and Prevention (NCDC) immediately activated its national emergency operations center to counteract the rapid spread of the pandemic. The Federal Ministry of Education approved the closure of all schools on March 19, 2020, with the ineffectual start date of March 23, 2020, in an effort to stop the spread of the COVID-19 virus. One of the newer varieties in France goes by the name Ihu. Viruses are spread through direct contact with respiratory droplets spread by coughing and sneezing. The virus can also spread when a person touches a contaminated surface with their bare hands and then touches their face, specifically the eyes, nose, and mouth.

Standard disinfectants are effective against the COVID-19 virus, despite the virus's ability to survive on surfaces for several hours. People of advanced age and those with preexisting conditions like diabetes and cardiovascular disease appear to be at greater risk for experiencing severe symptoms. So far, only a small percentage of COVID-19 cases have involved minors. Although vaccines exist to protect against COVID-19, the virus itself cannot be treated at this time. Since WHO (2020) asserts that providing all people with equal access to safe and effective vaccinations is crucial to ending the COVID-19 pandemic, the current wave of vaccine development and testing is very promising. Until we get access to more foolproof immunizations, we will still need to take precautions like as wearing masks, washing our hands often, ensuring enough ventilation within buildings, keeping our distance from others, and avoiding crowded areas. Being vaccinated does not imply we can instantly abandon caution and put ourselves and others at risk, since research into how much immunization protect against illness, infection, and transmission is still ongoing (WHO, 2020). In 2020, WHO recommended the following COVID-19 vaccinations: There are a number of different COVID-19 vaccines on the market, including Sinovac-CoronaVac, Pfizer BioNTech (BNT 162b2), Sinopharm, Janssen (Ad26.COV2.S), Oxford/AstraZeneca (ChAdOx1-S), and Moderna (mRNA-1273).

Multiple government interventions have reduced the likelihood that the COVID-19 virus will spread. Travel restrictions, quarantine of arriving passengers, social isolation, bans on public gatherings, company and school closures, work-from-home requests, lockdowns, and curfews are all part of these strategies (Bedford, et al., 2020). Authorities in several countries have instituted lockdowns or curfews in an effort to slow the global spread of the COVID-19 epidemic (Paital, et al., 2020). In 2021, WHO announced the following guidelines to prevent the spread of COVID-19:

(i) Frequently check your body temperature.
(ii) Regularly wash your hands with soap and water.
(iii) Use an alcohol-based sanitizer to disinfect.
(iv) Maintain your physical distance.
(v) Put on a mask.
(vi) If you're ill, stay in bed.
(vii) Quarantine or safe isolation are also required.
(viii) Steer clear of crowded areas.
(ix) Regularly clean and disinfect the surfaces in your surroundings.
(x) Assure ventilation.
(xi) Stay at home if you're unwell.
(xii) When coughing or sneezing, cover your mouth and nose with a flexed elbow or a tissue, and throw away used tissues right away.
(xiii) Assure social seclusion.

Education and other parts of society throughout the globe are suffering because of the methods used to combat the COVID-19 epidemic. Education is a lifelong pursuit that serves a crucial purpose in both personal development and the preservation of cultural traditions. Education in mathematics is highly regarded as a means of improving the caliber of human resources available to a country's economic growth and prosperity. Math is a fundamental subject

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in the classroom. Mathematical literacy is crucial for the development of science, technology, and the economy. According to Zalmon et al. (2020), students will have a better chance of acquiring the mathematical knowledge, skills, and attitudes of precision, accuracy, and perseverance required to succeed in today's data-driven, technology-driven society if the senior secondary mathematics curriculum is implemented effectively. However, teaching arithmetic during a pandemic is a herculean task.

In their research on the effects of the COVID-19 pandemic on education, Pokhrel and Chhetri (2021) identified the following challenges for teaching and learning:

1. Teachers and students alike often run into technological issues while trying to use the many available platforms and online learning tools.
2. Difficulties in e-learning in terms of reach, expense, adaptability, pedagogy, longevity in the classroom, and policymaking for education.
3. In many developing countries, the bandwidth is inadequate, there are not enough access points, and data packages are too expensive concerning the average person's income.
4. Unreliable connectivity to electronic devices and the web.
5. Children from low-income families in many developing countries often lack access to online learning tools and, as a result, may spend too much time in front of screens. Students must now actively engage in learning that occurs outside of the classroom and that is self-directed.
6. The lack of adult supervision, especially for younger students, is a further challenge because both parents must work. The availability of physically accommodating workstations for different pedagogical approaches is a real-world concern.
7. Students who are naturally motivated to learn tend to be less affected by classroom distractions and disruptions because they need less guidance and instruction from teachers.
8. Online education can be out of reach financially and technologically for some academically talented students from low-income backgrounds.
9. Students' academic performance is likely to suffer in the courses held for the year-end assessment and internal examination because of fewer contact hours with the instructor and a lack of instructor advice when encountering learning/understanding challenges.
10. When it comes to online student evaluations, teachers, students, and parents all have a hard time because of the trial-and-error nature of the process, as well as the ambiguity and misunderstanding that abound. How online exams are conducted can vary from one institution to another and from instructor to student.
11. Due to a large number of students, many schools and universities have not yet implemented effective procedures to detect and prevent plagiarism.
12. The lockdown of schools and colleges in the UK has resulted in the cancellation of A levels for the entire cohort, in addition to internal evaluations and exams for major public certificates like the General Certificate of Secondary Education (GCSE). Any scheduled activities may be delayed or cancelled if the lockdown continues for too long.
13. Kids have fun at school, and it also helps them grow in self-awareness and social competence. The social, mental, and financial well-being of students suffers when they miss school.
14. Young people are particularly vulnerable to online harassment since so many of them are taking online courses and spending more time on virtual platforms. Kids nowadays are more likely to be cyber bullied because they spend more of their leisure time exposed to content that might be harmful or dangerous.
15. Due to school closures and strict confinement measures, many families have come to rely on technology and digital solutions to keep their children engaged in learning, entertained, and connected to the outside world. However, not all children have the skills or resources necessary to stay safe while using the internet. The majority of Bhutanese students who participate in online education are children of farmers who lacked access to formal education.
16. Students are assisting their families with farming, livestock care, and housekeeping. The majority of students do not have access to telephones or TVs at home, and Internet connection is poor.

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The following issues of virtual education were highlighted by Agbele and Oyelade (2020) during COVID-19 in Nigeria:

1. The professors' and students' lack of technical expertise.
2. Online education is expensive and time-consuming.
3. Lack of electric supply.
4. Due to Nigeria's extreme poverty, it is hard for all instructors and pupils to have access to the internet, Wi-Fi, and other digital gadgets.
5. Slow learners have a problem because of differences in their degree of capability, confidence, and knowledge.
6. The flexibility of online learning. Due to its flexibility, online education may never be completed by time-poor students.
7. It's challenging to evaluate the kids.
8. Inequity in the work plan.
9. Connectivity issues with networks and the internet.
10. The family atmosphere is not favourable to studying.

During the COVID-19 outbreak, children's education took place not in schools but rather in their homes. Because of this, lessons were dispersed around town rather than all being conducted at the same time and place. Virtual learning, WhatsApp, zoom, television, radio, and other electronic media were the sole options for education in schools. However, the key challenges of employing e-learning for mathematics education are the availability, accessibility, and use of e-learning technologies for efficient learning. This research aims to assess the impact of the COVID-19 pandemic on the mathematical abilities of high school seniors. The purpose of this research is to determine how the COVID-19 pandemic control measures, such as school lock down, school shifting, social distance, movement restriction, online learning, face masking, and many others, have impacted the mathematical performance of senior secondary students in the Obio-Akpor local government area of Rivers State, Nigeria.

Statement of the Problem

Multiple views on education stress the need of interaction with others and exposure to new experiences as crucial to acquiring knowledge. Due to the COVID-19 pandemic's control measures, including as school lockdowns and social isolation, the conventional face-to-face classroom has been replaced with a virtual one, making it difficult for students to learn via direct instruction and contact. The novel coronavirus has had an unprecedented impact on educators and children throughout the globe as schools have been forced to shut owing to a public health emergency. Due to the Ebola virus, nearly an entire school year was lost in Nigeria, with students instead receiving their education online. Given the massive obstacles of virtual learning in a poor nation like Nigeria without appropriate preparation for e-learning program adoption in schools, what effect has the unexpected development of the COVID-19 pandemic had on students' performance in mathematics? Is there a correlation between the spread of COVID-19 and a decline in students' proficiency in mathematics in high school?

Aim and Objectives

The focus of this research is on the effect of the COVID-19 program on mathematics proficiency amongst graduating high school seniors in the Obio-Akpor local government area. This research intends to:

1. Ascertain the students' Mathematics proficiency before the COVID-19 pandemic.
2. Determine how well learners performed in Mathematics during the COVID-19 pandemic.
3. Assess students' Mathematics performance after the COVID-19 pandemic.
4. Examine how students performed in Mathematics before and during the COVID-19 pandemic.
5. Examine how students performed in Mathematics during and after the COVID-19 pandemic.
6. Compare how the male and the female students performed in Mathematics during the COVID-19 pandemic.

Research Questions

1. Determine the Mathematics performance of students before COVID-19 pandemic?
2. Ascertain the Mathematics performance of students during COVID-19 pandemic?
3. Examine the Mathematics performance of students after the COVID-19 pandemic?

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4. Compare the Mathematics performance of students before and during COVID-19 pandemic?
5. Compare the Mathematics performance of students during and after COVID-19 pandemic?
6. Compare the Mathematics performance of the male and female students during COVID-19 pandemic?

Research Hypotheses

$H_0$1: There is no significant difference between the Mathematics performance of students before and during the COVID-19 pandemic.

$H_0$2: There is no significant difference between the Mathematics performance of students during and after the COVID-19 pandemic.

$H_0$3: There is no significant difference between the Mathematics performance of the male and female students during the COVID-19 pandemic.

Materials and Methods

Due to the hypothesis-testing nature of this investigation, an analytical survey research strategy was used for this study. Students in Rivers State's Obio-Akpor LGA's 21 public secondary schools (15,363 male and 20,869 female) make up the study's sample size of 36,232 (Rivers State Senior Secondary Schools Board, 2021). 360 students were selected at random for the research. Information was collected with the use of the Promotional Mathematics Performance Score Sheet (PMPSS). The Promotion Test Results of Senior Secondary Class Two Students in Mathematics for 2018/2019, 2019/2020, and 2020/2021 Academic Sessions were collected as part of the PMPSS to provide a representative sample of student performance before, during, and after the COVID-19 outbreak. Face validation was used on the study's instrument. Face validation evaluates the questionnaire items for appropriateness. The test-and-retest process was used to assess the instrument's reliability. The PMPSS was used to collect test and retest results for the Mathematics promotion exam taken by students in the second year of high school from schools that did not take part in the study. With the use of Pearson's Product Moment Correlation (PPMC), we were able to calculate a reliability coefficient for the PMPSS of 0.86. The gadget was used, with permission from the school administration, to collect students' Mathematics test scores on the third-term promotion examination. The t-tests for paired and independent samples were used to examine the hypotheses, and mean and standard deviation were calculated to answer all other research questions.

Results

Research Question One: What is the Mathematics performance of students before the COVID-19 pandemic?

Table 1: Mean (M) and Standard Deviation (SD) of the Mathematics performance of students before the COVID-19 pandemic

COVID-19	n	Mean	SD	Remark
Before pandemic	120	55.17	16.22	High

Before the COVID-19 pandemic, students had good Mathematics performance as seen in Table 1 (M = 55.17, SD=16.22).

Research Question Two: What is the Mathematics performance of students during the COVID-19 pandemic?

Table 2: Mean (M) and Standard Deviation (SD) of the Mathematics performance of students during the COVID-19 pandemic

COVID-19	n	Mean	SD	Remark
During pandemic	120	46.39	15.05	Low

Table 2 demonstrates that students' Mathematics performance during the COVID-19 pandemic was poor (M= 46.39, SD= 15.05).

Research Question Three: What is the Mathematics performance of students after the COVID-19 pandemic?

Table 3: Mean (M) and Standard Deviation (SD) of the Mathematics performance of students before the COVID-19 pandemic

COVID-19	n	Mean	SD	Remark
After pandemic	120	49.21	13.91	Low

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Table 3 demonstrates how poorly students performed in Mathematics after the COVID-19 pandemic (M= 49.21, SD= 13.91).

Research Question Four: What is the difference between the Mathematics performance of students before and during the COVID-19 pandemic?

Table 4: Mean and standard deviation of the Mathematics performance of students before and during the COVID-19 pandemic

				Difference	
				Mean	SD
COVID-19	**n**	**Mean**	**SD**		
Before pandemic	120	55.17	16.22	8.78	3.26
During pandemic	120	46.39	15.05		

According to Table 4, students' Mathematics performance before and during the COVID-19 pandemic differed by (M= 8.78, SD= 3.26) in favour of their pre-pandemic performance.

Research Question Five: What is the difference between the Mathematics performance of students during and after COVID-19 pandemic?

Table 5: Mean and standard deviation of the Mathematics performance of students during and after COVID-19 pandemic

				Difference	
COVID-19	**n**	**Mean**	**SD**	**Mean**	**SD**
During pandemic	120	46.39	15.05	2.82	1.14
After pandemic	120	49.21	13.91		

Table 5 demonstrates that students' Mathematics performance during and after the COVID-19 pandemic differed by (M= 2.82, SD= 1.14) in favour of their post-pandemic performance.

Research Question Six: What is the difference between the Mathematics performance of the male and female students during the COVID-19 pandemic?

Table 6: Mean and standard deviation of the male and the female Mathematics performance of students during the COVID-19 pandemic

					Difference	
COVID-19	**Gender**	**n**	**Mean**	**SD**	**Mean**	**SD**
During pandemic	Male	61	47.87	16.22	3.01	3.42
	Female	59	44.86	13.20		

According to Table 6, there was an advantage for male students in their performance in Mathematics during the COVID-19 pandemic (M= 3.01, SD= 3.42).

$H_0$1: There is no significant difference between the Mathematics performance of students before and during the COVID-19 pandemic.

Table 7: Paired samples t-test analysis of the difference between the Mathematics performance of students before and during COVID-19 pandemic

				Difference					
COVID-19	**n**	**Mean**	**SD**	**Mean**	**SD**	**t**	**df**	**Sig.**	**Remark**
Before	120	55.17	16.22	8.78	3.26	4.338	119	.000	S
During	120	46.39	15.05						

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The results of the Mathematics tests taken by students before and after the COVID-19 pandemic is significantly different, as shown in Table 7 ($t(119, 0.05)) = 4.338$; $p<0.05$).

$H_0$2: There is no significant difference between the Mathematics performance of students during and after the COVID-19 pandemic.

Table 8: Paired samples t-test analysis of the difference between the Mathematics performance of students during and after COVID-19 pandemic

				Difference					
COVID-19	**n**	**Mean**	**SD**	Mean	SD	t	df	Sig.	Remark
During	120	46.39	15.05	2.82	1.14	-1.577	119	.117	NS
After	120	49.21	13.91						

The results of the Mathematics tests taken by students before and after the COVID-19 pandemic is not significantly different, as shown in Table 8 ($t(119, 0.05) = -1.577$; $p>0.05$).

$H_0$3: There is no significant difference between the Mathematics performance of the male and female students during the COVID-19 pandemic.

Table 9: Independent sample t-test analysis of the difference between the Mathematics performance of the male and the female students during the COVID-19 pandemic

					Difference						
COVID-19	**Gender**	**n**	**Mean**	**SD**	**Mean**	**SD**	**F**	**t**	**df**	**Sig**	**Remark**
During	Male	61	47.86	16.62	3.01	3.42	6.254	1.094	118	.276	NS
	Female	59	44.86	13.20							

According to Table 9 ($t(118, 0.05) = 1.094$; $p>0.05$), there is no significant difference in the Mathematics performance of the male and the female students during the COVID-19 pandemic.

Discussion of Findings

Students' Mathematics performance prior to the spread of the COVID-19 pandemic was good as seen in Table 1. The results of this research corroborated with that of Isiaka (2021), who had shown that students had performed well in Mathematics in WASSCE tests taken before COVID-19.

Students' abysmal Mathematics performance during the COVID-19 pandemic is seen in Table 2. Isiaka investigated the effect of COVID-19 on students' performance in Mathematics on the WASSCE in the Ilorin West LGA of Kwara State (2021). This research aims to answer the question, "Do students perform better during COVID-19?" by analyzing the impact of COVID-19 on students' WASSCE scores in the Ilorin West LGA of Kwara State. Isiaka (2021) claimed that COVID did not improve student performance over that of the years prior to COVID-19. Hashemi (2021) investigated how COVID-19 affected the academic performance and happiness of Afghan students taking classes online. The findings revealed that COVID-19 negatively affected the academic achievement of Afghan students and that the students were very unsatisfied with online education during this pivotal moment. A correlation between Afghan students' academic performance and their level of satisfaction with online education was found during the COVID-19 pandemic.

Students' poor mathematical performance after the COVID-19 pandemic is seen in Table 3. According to Oyinloye (2020), who looked at how COVID-19 could affect scientific instruction in Nigeria's high schools, these findings corroborate his findings. Oyinloye (2020) found that there is a possibility that this year's pass rate for high school students taking external exams would continue to fall.

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As shown in Table 4, students' mathematical proficiency before the COVID-19 pandemic was higher than that of their classmates during the pandemic. Comparing the Mathematics scores of students before and after the COVID-19 outbreak in Table 7, the difference was not significant. Thomas and Pius (2021), who studied the effect of the COVID-19 pandemic measures on secondary school students' academic development in the Calabar South local government region of Cross River State, Nigeria, came to similar conclusions. They found that the COVID-19 pandemic measures significantly hampered the academic development of secondary school students. Isiaka (2021) came to similar conclusions, stating that the performance of students during COVID-19 was not higher than that of students before COVID-19. According to Aji (2021), COVID-19 also had a major effect on students' Chemistry grades at the secondary school level in Gashua town, Bade local government area, Yobe State, Nigeria (2021). The SS1 and SS2 test scores of students were collected before and during the COVID-19 period. The data shows that every institution disproved the various hypotheses.

Table 5 shows that there was a small but positive shift in students' performance in mathematics before and after the COVID-19 outbreak. Table 4.8 shows that there was no significant change in children's arithmetic scores either before or after the COVID-19 pandemic. This study's findings corroborate those of Sakpere et al. (2021). The impact of COVID-19 on students' academic performance was the focus of psychosocial research done by Sakpere et al. (2021) using an association and regression model. The findings of this study showed that the pandemic not only posed logistical, technical, and financial challenges to Nigerian students' education, but also psychosocial challenges (such as despair and a high level of mistrust for the current educational systems), all of which could have an effect on how students engage with and commit to their education in the post-pandemic world.

It can be shown in Table 6 that male students fared somewhat better than female students in Mathematics during the COVID-19 pandemic. Table 9 shows that throughout the COVID-19 outbreak, there was no significant difference in Mathematics examination results between the male and the female students. This study's findings conforms with that of Bhairab (2017), who found no statistically significant gender or social group differences in Mathematics aptitude among class X secondary school students.

Conclusion

The purpose of this study was to investigate the impact of the COVID-19 pandemic on the mathematical abilities of high school students. There was a significant difference between the Mathematics performance of students before and during the pandemic but there was no significant difference in students' Mathematics performance before and after the COVID-19 pandemic, suggesting that the pandemic had a long-lasting negative effect on learners' mathematical abilities.

Recommendations

Based on the study's findings, the following suggestions were made:

1. Mathematics instructors should put more effort into their instructional delivery to help students whose performance has been negatively impacted by the COVID-19 pandemic.
2. Mathematics teachers should utilize diagnostic and remedial teaching strategies to help students overcome the poor performance patterns in Mathematics brought on by the COVID-19 pandemic.
3. Students who have had their grades impacted by the COVID-19 pandemic should adopt a more optimistic and enthusiastic outlook on Mathematics study to make up for lost ground.
4. Proprietors of schools affected by the COVID-19 pandemic should provide enough learning tools and a supportive atmosphere for effective Mathematics teaching and learning in order to reverse the deteriorating trends in students' academic performance.
5. To promote gender equality in Mathematics education, teachers should employ interactive, student-centered, and innovative strategies.

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