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Research Article

Analysis of Students' Grades in STEM Subjects at Senior School Certificate Examination Before and During COVID-19 Pandemic in Nigeria

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Abstract: The COVID-19 pandemic has caused a severe global health crisis that has spread to practically all sectors of human life. The education sector has been severely hit due to the closure of schools, alternative learning arrangements and concerns about access to learning by indigent students. It was therefore the purpose of this study to investigate the academic performance of students in STEM subjects of the senior secondary school exams conducted by the National Examination Council (NECO) amid the challenges and issues in teaching and learning in Nigeria caused by the COVID-19 pandemic. Data regarding students' grades in; Mathematics, Biology, Chemistry, Physics, Computer Science, Technical Drawing, Basic Electricity, Auto Mechanics, Home Management, and Food and Nutrition, within four years (2017-2020) were sourced from the National Examinations Council. The study employed a longitudinal technique in an ex post facto research design to look at the grades obtained by candidates that sat for SSCE in STEM subjects in the period. Quite surprisingly, it was found that the students performed better in 2020 when compared to 2017, 2018, and 2019. This was suspected to be attributed to resilience on the part of the students who may have put extra effort to beat the odds introduced by the COVID-19 pandemic.

Keywords: COVID-19, academic performance, examination, grades, Nigeria, STEM

1. Introduction

COVID-19 is an emerging disease with a rapid increase in cases and deaths since its first identification in Wuhan, China, in December 2019 (Rasmussen, Smulian, Lednicky, Wen, & Jamieson, 2020). The symptoms of COVID-19 vary, but in most cases include fever, headache, cough, fatigue, difficulty in breathing, loss of smell and taste. Globally, as of 6:30 pm CEST, 30 July 2021, there have been 196 553 009 confirmed cases of COVID-19, including 4 200 412 deaths, reported to World Health Organization (WHO). As of 29 July 2021, a total of 3 839 816 037 vaccine doses have been administered (World Health Organization, 2021). Due to the rapid spread of COVID-19 WHO declared it a global pandemic in March 2020 (Di Pietro, Biagi, Costa, Karpiński, & Mazza, 2020). Governments around the world including Nigeria responded by imposing a lockdown which brought most economic activities to a standstill. The grounding of activities was hinted by (Onyema et al., 2020) to have had an adverse impact on educational institutions in Nigeria. This was because normal school activities were halted and moved to the electronic space like television, radio and the internet (Yekini, Adigun, & Akinwole, 2020). However, unlike in most advanced countries, this effort was not as effective as face-to-face teacher-student contact due to the massive infrastructural deficit in the country. Such infrastructural deficit includes lack of constant electricity and inaccessibility to internet facilities, both of which are necessary for learners to participate in the radio, television as well as virtual classes that were organized during the lockdown (Obododike & Cokekeokosisi, 2020). The anomaly is even worse among the rural populace, which happen to have the bulk of the Nigerian population that sit for the senior school certificate examination yearly (Nwokoro & Chima, 2017).

Senior School Certificate Examination (SSCE) is the examination taken by students in Nigeria as a milestone indicating their completion of secondary school education. According to (Ogunode, 2020), SSCE is taken by candidates who are in their third year of senior secondary school for the internal version or that have previously sat for the examination but did not meet certain requirements of their higher institutions for the private/external version. In Nigeria, SSCE is conducted by only two examination bodies, are the West African Examination Council (WAEC) and the National Examination Council (NECO) (Olutola, 2017). These two examination bodies examine SSCE candidates in the 76 subjects stated in the National Policy on Education (Federal Ministry of Education, 2014). 76 subjects are categorized into five specific fields of studies namely, technology, humanities, business studies, trade/entrepreneurship and science and mathematics. However, because of the researchers' inclinations, this study will focus on science and mathematics, and technology (STEM).

Science, Technology Engineering and Mathematics (STEM) refers to teaching and learning in the fields of science, technology, engineering, and mathematics. In general, STEM includes educational activities from pre-school to post-doctorate, in both formal and informal settings. Researchers have noted that the workforce related to science, technology, engineering, and mathematics (STEM) fields has become increasingly important (Khalil & Osman, 2017; Siregar, Rosli, Maat, & Capraro, 2019). In fact, (Mutakinati, Anwari, & Kumano, 2018) predicted that jobs in STEM sectors will increase in the next decade more than jobs in other sectors. According to their assertion, in the future, the people will not work based on their educational background but based on their 21st-century skill set, and these skills are provided by STEM. In addition, Tolliver (Tolliver, 2016) noted that students need to possess useful innovation and creativity skills in finding solutions to any related problems. Essentially, in STEM learning activities, students are exposed to contents that they can learn contextually and are assisted to focus on applying the knowledge gained in solving real-life problems (Chen & Lo, 2019). Hence, the integration of STEM in educational activities in today's world is important because among other things; it cultivates the ability to engage in critical thinking in students, helps them to do intelligent analysis and evaluation, make conclusions and arguments correctly and logically about problems to be solved (Siregar et al., 2019). Hence, the performance of candidates at the SSCE level is a source of concern.

The Nigerian secondary school system stipulates STEM to consist of 17 subjects. They are Biology, Chemistry, Physics, Further Mathematics, General Mathematics, Health Education, Agricultural Science, Physical Education, Computer Studies, Technical Drawing, General Metalwork, Basic Electricity (Applied Electricity), Electronics, Auto mechanics, Building Construction, Woodwork, Home Management, and Food and Nutrition (FRN, 2014). Going forward, the grades obtained by candidates at SSCE is central to shaping the trajectory and narrative of their lives. Essentially, whether they further their education and carve a career niche for themselves, rests hugely on the quality of the grades they made in their SSCE (Adekitan & Noma-Osaghae, 2019). Grades in education are means by which standardized measurements of varying levels of achievement based on assessment tools such as tests, quizzes, projects, examinations, term papers, and essays in a course for communication to students, parents, teachers, administrators, and counsellors. According to the Faculty of Education, Queens' University (FEQU) (2019), grading is the process of summarizing student's achievements using a numerical or ordinal scale. Additionally, grading is a complex evaluative practice that requires teachers to make judgments about student learning. FEQU further explained that grading is one of the most high-stakes classroom assessment practices, with significant consequences for student self-perception, motivation for learning, and prioritization of certain curriculum expectations, parental expectations, and social relationships. Therefore, it is probable that the sudden lockdown may have some form of effect on the quality of the grades made by candidates on a scale of the performance of their predecessors taught by the same teachers having studied under similar conditions.

2. Literature Review

A review of related literature revealed that the COVID-19 pandemic has so far negatively impacted education ad many sectors of the human endeavour around the world. Some of the other sectors affected include banking services, healthcare services, transportation, and public services, and others. For instance, it has been reported that for banks, in particular, the pandemic has so far generated multifaceted crises, mostly through increases in default rates, non-performing loans, reduction in cash flow, reduction in deposits, and liquidity strain (Barua & Barua, 2021; Wójcik & Ioannou, 2020). Concerning healthcare services, the COVID-19 pandemic occasioned catastrophic financial challenges in healthcare facilities (Kaye et al., 2020), many healthcare workers lost their lives most and healthcare services were not available to non-COVID-19 patients during lockdown (Bandyopadhyay et al., 2020) (Bandyopadhyay, 2020), overcrowding of medical facilities (Af Ugglas, Skyttberg, Wladis, Djärv, & Holzmann, 2020). There was a restriction on vehicular movement as well as the grounding of flights (Nwaeze, 2020).

In Nigeria, Most public servants were directed to work from home, hence people had near-zero access to public services (Sodipe, Alabi, Bewaji, & Yusuf). In all of these, the educational sector was not spared. It has also been reported that the COVID-19 pandemic has had adverse effects on the educational sector in many ways. For instance, the COVID-19 pandemic was reported to have impacted students in terms of; mental health, anxiety levels and access to information (Pragholapati, 2020). In Nigeria, (Ogunode, 2020) hinted that the COVID-19 pandemic led to the suspension of; internal and external examinations, teaching and learning, all extra-curricular activities as well as disruption of the academic calendar. From the foregoing, with incomplete learning schedules due to disruption of the academic calendar, STEM students at secondary schools could have been the worst hit. The reason for this is not far-fetched, based on the fact that STEM subjects require the attention of teachers on face-to-face contact and practical sessions unlike in other subjects (Nguyen, Nguyen, & Tran, 2020). This coupled with the poor state of infrastructural facilities in the country, making it difficult for most students to follow learning activities on radio and television and online where available. Hence, only a thorough statistical analysis of the results will unravel the impact of the pandemic on key areas like STEM subjects.

Jacob et al. (Jacob, Abigeal, & Lydia, 2020) noted that the coronavirus pandemic has disrupted higher education, reduced international education, disrupt academic calendar and reduced man power due to death of personnel. Many local and international conferences were cancelled, and the higher education budget was reduced. The authors urged the government to increase funding for higher education to enable universities to manage the pandemic rather than shutting it down so that the teaching and learning gap created by the pandemic can be mended. (Abidah, Hidaayatullaah, Simamora, Fehabutar, & Mutakinati, 2020) stated that the pandemic has greatly imparted the domain of education in Indonesia. The government has ordered schools to shut down and for individuals to observe physical and social distancing and self-quarantine. There is a migration from the traditional learning and teaching methods to an online system. Physical interactions between students and teachers are replaced with distance learning. Though the new development is a future to be executed during the industrial revolution era, because it's not limited by space or time, it has a less impact on humanism.(Rulandari, 2020) investigated government policies in confronting educational problems caused by COVID-19 in order to come up with working policies that the government can imbibe and enforce to ensure that teaching and learning are carried out effectively irrespective of the shutdown. He also examined communication strategies for the delivery of online education so that students can easily understand lecture materials. From his result, he opined that home learning is advantageous because it saves time and space, but it should be monitored by the government, parents and teachers to ensure its effectiveness. (Kapila, Corthals, Langhendries, Kapila, & Everaert, 2020) examined the perspective of students on the impact of COVID-19 on education. They stated that the pandemic has impacted students' learning experience because it has necessitated a change in the learning environment and instructional techniques. As a future action plan, the authors encourage teachers to see the need to create meaningful activities online and increase teacher-student interaction via online learning platforms. They also encourage the use of audio and videos for webinars to create a better connection with students. Kwakye et al. (Kwakye, Kibort-Crocker, Lundgren, & Pasion, 2021) reported a fall in enrolment of students for postsecondary education in Washington. They highlighted that the pandemic is a threat to higher education and has increased the risk of unemployment. Their results showed that enrollment to community colleges has dropped drastically in Washington and the USA at large. They urged that; measures must be put in place to ensure that access to higher education is uninterrupted. Owusu-Fordjour et al. (Owusu-Fordjour, Koomson, & Hanson, 2020) investigated the impact of COVID-19 pandemic on learning in Ghana using questionnaire. From the responses of 214 respondents, it was found that the online learning due to the lockdown was not effective because students were unable to study effectively from home. Also, some parents were unable to facilitate their wards to access the learning platforms neither were they able to supervise the learning process. The pandemic impacted negatively on learning because students are not disposed to learning on their own. The limited access to the internet and lack of technical know-how were also a bottleneck to accessing the learning platforms by Ghanaian students. The authors recommended the introduction of innovative and offline learning platforms as an addendum to the online platforms so that students without internet access may not lose out completely. (Kuhfeld et al., 2020) studied the impact of school closures on academic achievement. Students are likely to return with variable academic skills after the lockdown. Educators and policymakers will have to prepare for students who are behind academically due to school closure. They stated that a post COVID-19 educational recovery plan is needed to compensate for the learning loss due to the pandemic. (Upoalkpajor & Upoalkpajor, 2020) investigated the effect of the COVID-19 pandemic on Ghana's education. Their goal was to investigate COVID-19 awareness among students, how much the pandemic affected the educational system in Ghana and post COVID-19 effect impact on education in Ghana. Analysis of research data obtained via questionnaire from 100 teachers and students at some high schools in Tamele City, Ghana revealed that the pandemic led to academic loss in the city. The authors opined that schools need to be funded to recover from this loss.(Ebohon, Obienu, Irabor, Amadin, & Omoregie, 2021) examined student and teacher experience from the online virtual learning platform adopted in Nigeria during the lockdown due to the COVID-19 pandemic. From their studies, responses from 703 students and 60 teachers, more than 50% of the respondents had difficulties with internet connectivity, 67% of students and 59% of teachers agreed that teacher-student interaction was poor, this resulted in low students' utility. 63% of teachers believed online learning is more suitable for assignment and oral examination while most of the teachers (66%) agreed that it was difficult assessing students' abilities via the online platform. 84% of the teachers believed that there is a high probability of malpractice in online assessment. 83% of teachers admitted that it was not easy explaining complex concepts to students online. An increase in student's performance was observed during the online assessment. Onyema et al. (Onyema et al., 2020) stated that about a billion students were out of school due to COVID-19 lockdown globally In their work, questionnaires were administered to 200 respondents including students, parents, teachers and policymakers from different countries. Their analysis and results showed that the pandemic impacted negatively on education. The pandemic led to disruption of learning, reduced access to learning and research opportunities. Though online learning platforms were used as a substitute for traditional learning, issues such as power, internet connectivity, lack of digital skills and lack of finance to pay for internet connection confronted the success of online learning in Nigeria during the lockdown. Their studies buttressed the need for learning institutions, students, and teachers to arm themselves with the digital skills needed to survive should a similar occurrence reoccur. The impact of COVID-19 pandemic was also presented by (Di Pietro et al., 2020) of the European Commission. From their technical report,

the authors spelt out the following as practical measures that must be put in place to ensure the success of online learning. 1. Access to internet and the provision of computers, laptops or tablets by the government must be guaranteed, 2. user friendly learning platforms should be used, 3. education can be broadcasted on national televisions 4. students with special needs should be provided with learning technology to ensure digitally inclusive education, 5. and support for teachers and parents.

(Pokhrel & Chhetri, 2021) reported that in the whole history of the human race, the COVID-19 pandemic disrupted is known to have disrupted the educational system the most. The pandemic has charted a new course for digital learning; thus, the development of effective pedagogical techniques is needed to ensure the success of digital learning. (Kim, Krishnan, Law, & Rounsaville, 2020) examined the impact of the COVID-19 pandemic on US higher education and discussed some of the challenges faced by students and teachers during the lockdown and the way forward. From their work, only 40% of students from low-income household could participate in online learning compared with 70% from high-income homes. In the same vein, 56% of students from low-income households had access to good internet connection while only 45% reported that their community supported online learning compared with 77% and 64% of students from high-income homes. Their results imply that free and reliable internet access and learning gadgets such as laptops, tablets are needed by all students to enable them to participate in online learning to avoid depriving the less privileged of education due to lockdown. (Mwila, Kalolo, Mudenda, & Hikaambo, 2021) studied the impact of the COVID-19 pandemic on the academics of final year nursing students in Lusaka and Mufulira Districts (Zambia). From their analysis of responses from 196 final year nursing students, 32.7% strongly agreed while 20.4% agreed that they couldn't complete their course work due to poor learning.86.1% complained that their final exams were delayed 51.5% opined that they didn't do their internship, 40.3% complained that they had poor internet service in school and 40.3% missed the online lessons and assessment. Their results showed that the pandemic negatively impacted the educational system of Zambia. The authors urged the ministry of education to put measures in place to mitigate the impact of the pandemic on education.(Mahdy, 2020) studied the impact of the pandemic on the performance of veterinary medicine from 92 countries. A total of 1 392 respondents participated in the survey. Their results showed a decline in the academic performance of students. The author opined that online education for medical students should be more interactive and medical procedures should be shown, concise information should be provided, and 3D tools should be used to simulate real situations. (Kuhfeld et al., 2020) explained the effect of the pandemic on learning. From their survey of students in grades 3-8, it was found that most of the students made good progress in reading during the pandemic but performed poorly in mathematics and advice on resource support for mathematics to enable students to get back on track. They also stated that some students left because they don't have the technology to participate in online learning. (Jena, 2020) provided a report on the impact of COVID-19 on education in India. They found that the pandemic created opportunities for different instructional techniques and brought online education to the limelight. The author stated that the pandemic may encourage individual learning, cause in decline in student attendance, and mobility for national and international education, learning with social distance may continue, the institution may run with different shifts per day, the gap between high-income and low-income students may increase, assessment systems may be changed, demand for distance learning may increase, blended learning may take the lead, students' debt may increase, and unemployment may rise. Kaushal et al. (Kaushal & Kaushal, 2021) presented descriptive and analytical studies on the impact of the COVID-19 pandemic in India. They concluded that the pandemic has affected the socioeconomic status of individuals and schools in India. Measures must be taken quickly to avert the negative effect of the pandemic. These measures include public-private partnership on education, more funding on the educational sector, infrastructural development, support for digital learning, motivation and welfare programs for students, provisions of online learning facilities, etc. Richter (Zawacki-Richter, 2021) investigated the impact of COVID-19 on digital higher education in Germany. He posited that the demand for online learning tools declined before the pandemic, there has been a massive increase in online education due to the pandemic and that the pandemic will positively affect digital innovations in learning among universities in Germany. Students' learning life was investigated by (Al-Kumaim et al., 2021) in different universities in Malaysia. A survey of 486 students revealed that many students encountered difficulties in the online learning system. Overload of assignment from instructors, difficulty to adapt with the new learning environment, health challenges due to stress and anxiety. The authors developed a conceptual motivational framework to make online education successful. (Schleicher, 2020) stated that the outbreak of the pandemic has shown how vulnerable we are to crises and how inchoate the economies we have built for ourselves can be. Students from high-income homes continued their education because of the support they got from their parents while those from less privileged homes got shut out during the lockdown. We need to develop the skills we need to survive tomorrow, and the educational system must be the heart of the planning. (Mahaye, 2020) investigated the impact of COVID-19 pandemic on education and discussed the way forward for the pedagogy of blended learning. He posited that online education which came out in full force as a necessary option drive education can only be effective in digitally developed society. Due to poor technological supply and technical know-how, schools in rural area will suffer except the schools, teachers and students are equipped and trained with the knowledge and technology needed to adapt with the changing educational system brought about by the pandemic.

In general, a survey of the technical literature showed various effects of the pandemic on the education industry. It was therefore the purpose of this study to analyze students' grades in STEM subjects at senior school certificate examination from 2017 to 2020 in Nigeria with a view of understanding if the COVID-19 pandemic had an impact on them. The results of this study will be beneficial to the government, policymakers, educational researchers and test assessment and measurements experts.

3. Research Questions

The following questions guided the study:

1. What is the trend in students' grades in science subjects at senior school certificate examination before and during the COVID-19 pandemic in Nigeria?
2. What is the trend in students' grades in technology and engineering subjects at senior school certificate examination before and during the COVID-19 pandemic in Nigeria?
3. What is the trend in students' grades in senior school certificate examination before and during the COVID-19 pandemic in Nigeria?

4. Methodology

This study followed a qualitative research approach by employing a longitudinal technique to investigate the impact of the COVID -19 pandemic on students' grades in STEM subjects at SSCE. This is essentially an ex post facto research design. An ex post facto design imitates a true experiment in that it makes comparisons between individuals who belong to different groups but have identical backgrounds and different prevalent conditions which are a direct function of their natural histories (Giuffre, 1997). (McMil & Schumacher, 2006) defined ex post facto research design as a study that explores the existence of relationships between variables that the researcher cannot control, since their manifestations already took place, and the study is done after the occurrence of changes in the dependent variable without direct control over the independent variables. This study fits into this design because it assessed the trend in student grades over the three years that predates COVID-19 and in the years it came. The researchers made inferences about the relations observed between the variables, from the simultaneous variation between the independent and dependent variables. No specific data collection instrument was necessary as the data needed for the study were already in existence with NECO. The population was the entire candidates that sat for NECO SSCE from 2017 to 2020 was 4,380,735 as can be deduced from the number of candidates that sat for examination in Mathematics (Table 1).

Table 1: Candidates with Result in Selected STEM Subjects from 2017 to 2020

S/No	Subject	2017	2018	2019	2020	Total
1.	Mathematics	1037401	1029460	1141559	1172333	4380753
2.	Biology	739058	722697	797141	804761	3063657
3.	Chemistry	486468	500481	564912	469574	2021435
4.	Physics	488388	500979	565538	583688	2138593
5.	Computer Science	125013	118711	117849	116822	478395
6.	Technical Drawing	12943	13020	13481	11929	51373
7.	Basic Electricity	1851	1722	1953	1744	7270
8.	Auto Mechanics	286	375	211	204	1076
9.	Home Management	9251	9742	9340	10540	38873
10.	Food and Nutrition	10588	11328	12387	15440	49743

However, only the grades obtained by candidates in 10 STEM subjects were used for the analysis. The subjects that were of interest to the study were Mathematics, Biology, Chemistry, Physics, Computer Science, Technical Drawing, Basic Electricity, Auto Mechanics, Home Management, and Food and Nutrition. Two reasons informed their choice. First, 10 out of 17 subjects is a reasonable sample especially as each unit of STEM was represented where possible (Table 1). Secondly, the subjects with the greatest number of candidates were purposively selected. Table 2 shows the summary of the subjects sampling.

The data for the study was obtained from the National Examinations Council (NECO) which is a government entity saddled with the responsibility of conducting examinations for candidates for the senior school certificate in Nigeria (Uduafemhe, Uwelo, John, & Karfe, 2021). The data were analyzed using percentages. Percentages were used to answer the research question. To (Lavrakas, 2008), percentages are useful when making comparisons between the observations that exist for each data point or grouping of data points. This was seen as fitting this study by the researchers because student grades in STEM subjects over a three-year period (2017-2019) were compared with the grades of 2020. The description of the grades is shown in Table 3

Table 2: Summary of Selected STEM Subjects used for the Study

S/No.	Unit	Subjects in unit	Selected Subjects
1.	Science	Biology, Chemistry, Physics, Health Education, Agricultural Science, Physical Education, Computer Studies,	Biology, Chemistry, Physics, Computer Studies
2.	Technology and Engineering	Technical Drawing, General Metalwork, Basic Electricity (Applied Electricity), Electronics, Automechanics, Building Construction, Woodwork, Home Management, and Food and Nutrition	Technical Drawing, Basic Electricity (Applied Electricity), Automechanics, Home Management, and Food and Nutrition
3.	Mathematics	Further Mathematics, General Mathematics,	General Mathematics,

Table 3: Description of grade ranges used by NECO

Grade	Mark range	Description
A1	90 -100	Distinction
B2	80 - 89	Distinction
B3	70 -79	Distinction
C4	65 - 69	Credit
C5	60 - 64	Credit
C6	50 - 59	Credit
D7	45 - 49	Pass
E8	40 - 44	Pass
F9	0 -39	Fail

5. Results

A summary of the results obtained is presented in Tables 4 – 11. These results are divided according to the research questions.

Research Question One: What is the trend in students' grades in science subjects at senior school certificate examination before and during the COVID-19 pandemic in Nigeria?

Table 3: Summary of Grades Obtained by Students in Selected Science Subjects From 2017-2020

	2017		2018		2019		2020	
Grade	**Number**	**Percent**	**Number**	**Percent**	**Number**	**Percent**	**Number**	**Percent**
Distinction	61757	3.36	81776	4.44	47170	2.31	274680	13.91
Credit Pass	1470538	79.97	1455931	79.00	1675331	81.91	1469571	74.41
Pass	258999	14.08	265354	14.40	271944	13.30	173270	8.77
Fail	47633	2.59	39807	2.16	50995	2.49	57324	2.90

Table 4 shows the summary of grades obtained by students in selected science subjects from 2017-2020. The analysis revealed that for 2017, 2018, 2019 and 2020 respectively, 3.36%, 4.44%, 2.31% and 13.91 of the candidates that sat for examination in Biology, Chemistry, Physics and Computer studies obtained a distinction. Similarly, 79.97%, 79.00%, 81.91% and 74.41% of the candidates obtained a credit pass in the four selected science subjects for the three years before and in the year of the COVID-19 pandemic in Nigeria. Also, the percentage of the candidates that score a pass grade in the years of interest were; 14.08, 14.40, 13.30 and 8.77. In the same vein, 2.59%, 2.16%, 2.49% and 2.90% of the candidates that sat for examination in the four selected science subjects failed. It can be deduced from this table that the percentage of distinctions and credit passes for 2020 (COVID-year) was greater than the preceding years (2017-2019). However, the failure rate was the highest when compared to (2017-2019). This result suggests that academic resilience on the part of the students to overcome the challenges posed by the pandemic.

Table 5: Summary of Distinction and Credit Pass Grades Obtained by Students in Selected Science Subjects in 2017-2019 Combined and 2020

Grade	2017 -2019			2020	
	Number	Average by Number of Years	Percent	Number	Percent
Distinction	190703	63567.67	3.31	274680	13.91
Credit Pass	46011800	796297	79.87	1469571	74.41

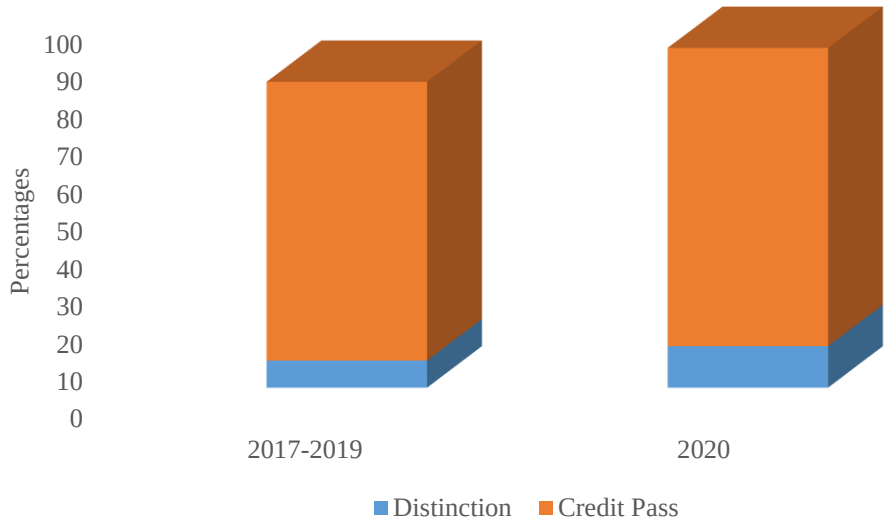

Figure 1: A Bar chart of Distinction and Credit Pass Grades Obtained by Students in Selected Science Subjects in 2017-2019 Combined and 2020

Table 5 shows the summary of distinction and credit pass grades (the two main classes of grades that are desirable in the Nigerian educational system) obtained by students in selected science subjects for 2017-2019 combined and 2020. The results revealed that 83.18% of the candidates that sat for the examination in Biology, Chemistry, Physics and Computer studies obtained a distinction or credit pass in the three years that preceded the COVID-19 pandemic. In the same vein, 88,32% of the candidates that sat for the examination in four selected science subjects obtained a distinction or credit pass in 2020, the COVID-19 pandemic year. Also, figure 1 shows that there is a 5.14% increase in distinction and credit pass grades in 2020 over 2017-2019 combined. This is an indication that the upward trend of student achievement in the subjects was not impacted by the COVID-19 pandemic.

Research Question Two: What is the trend in students' grades in technology and engineering subjects at senior school certificate examination before and during the COVID-19 pandemic in Nigeria?

Table 6: Summary of Grades Obtained by Students in Selected Technology and Engineering Subjects From 2017-2020

Grade	2017		2018		2019		2020	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Distinction	1856	5.32	2009	5.55	1796	4.81	10478	26.29
Credit Pass	26934	77.13	27373	75.64	2905	77.73	25656	64.37
Pass	4882	13.98	5696	15.74	5129	13.72	3240	8.13
Fail	1247	3.57	1109	3.06	1396	3.74	483	1.21

The summary of grades obtained by students in selected technology and engineering subjects from 2017-2020 is presented in Table 6. The analysis shows that for 2017, 2018, 2019 and 2020, the percentage of the candidates that obtained a distinction in Technical Drawing, Basic Electricity (Applied Electricity), Auto mechanics, Home Management, and Food and Nutrition were 5.32, 5.55, 4.81 and 26.29 respectively. Further, 77.13%, 75.64%, 77,73% and 64.37% obtained a credit pass in the five subjects in 2017, 2018, 2019, and 2020 respectively. Similarly, the candidates that scored a pass grade in the selected technology and engineering subjects for the four years were 13.98%, 15.74%, 13.72% and 8.13% respectively. In the same fashion, the percentage of the candidates that failed

the subjects in 2017, 2018, 2019, and 2020 were 2.57, 3.06, 3.74, and 1.21 respectively. Like Table 5, it appears as if the COVID-19 did not have any effect on the academic performance of the students.

Table 7: Summary of Distinction and Credit Pass Grades Obtained by Students in Selected Technology and Engineering Subjects in 2017 - 2019 Combined and in 2020

	2017 - 2019			2020	
Grade	**Number**	**Average by Number of Years**	**Percentage**	**Number**	**Percentage**
Distinction	5 661	1 887	5.18	10 478	26.29
Credit Pass	83 358	27 786	76.31	25 656	64.37

The summary of distinction and credit pass grades obtained by students in selected technology and engineering subjects in 2017-2019 combined and 2020. From the result, the percentage of the candidates that sat for the five technology and engineering subjects and had distinction and credit pass, the two main desirable grades in the Nigerian educational system, were 81.49% for 2017 to 2019 combined and 90.66% for 2020 the COVID-19 pandemic year.

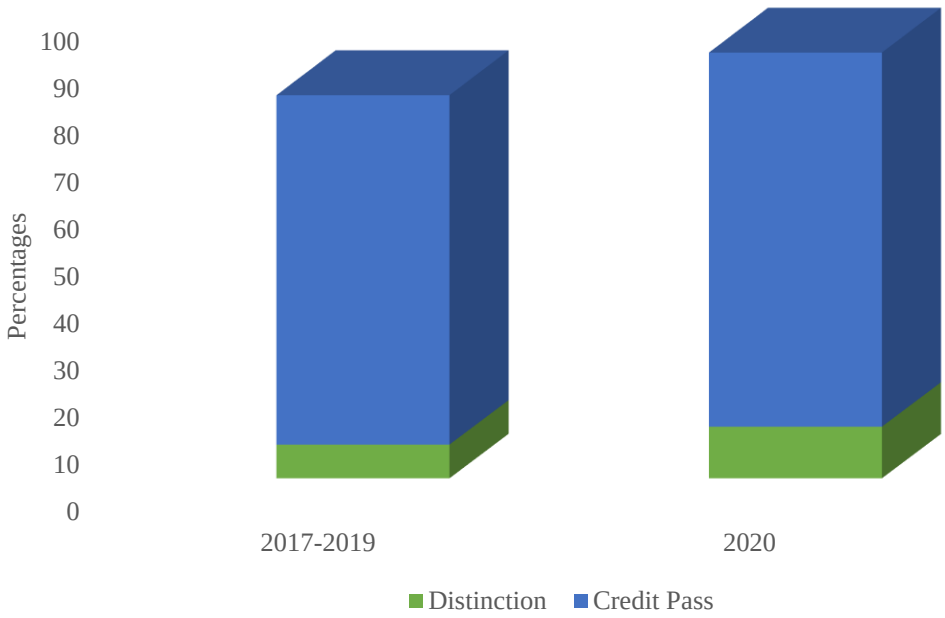

Figure 2: A Bar chart of Distinction and Credit Pass Grades Obtained by Students in Selected Technology and Engineering Subjects in 2017-2019 Combined and 2020

In addition, Figure 2 presents the analysis in a bar chart, and it reveals that there is a 9.17% increase in distinction and credit pass grades in 2020 in comparison with their performance in 2017-2019 combined. This connotes that there was consistency in the upward trend in terms of student achievement in the subjects even though was a COVID-19 pandemic and the consequential lockdown.

Research Question Three: What is the trend in students' grades in mathematics at senior school certificate examination before and during the COVID-19 pandemic in Nigeria?

Table 8: Summary of Grades Obtained by Students in General Mathematics From 2017-2020

	2017		2018		2019		2020	
Grade	**Number**	**Percent**	**Number**	**Percent**	**Number**	**Percent**	**Number**	**Percent**
Distinction	91532	8.82	79628	7.73	64058	5.61	129335	11.03
Credit Pass	757803	73.05	770703	74.86	890341	77.99	930765	79.39
Pass	160590	15.48	149222	14.50	153712	13.47	83260	7.10
Fail	27476	2.65	29907	2.91	33448	2.93	28973	2.47

The summary analysis of grades obtained by students in general mathematics from 2017-2020 is presented in Table 8. The analysis revealed that in General Mathematics and in the four years that of interest to this study, the percentage of the candidates that obtained distinction were 8.82, 7.73, 5.61, and 11.03. similarly, 73.05% in 2017, 74.86% in 2018, 77.99% in 2019, and 11.03% in 2020 obtained a credit pass in the selected technology and engineering subjects. Also, in the four years in focus, 15.48%, 14.50%, 13.47% and 7.10% obtained pass grade in the subjects. Further, 2.65%, 2.91%, 2.93% and 2.47% of the candidates obtained a failure grade in 2017, 2018, 2019, and 2020 respectively. The trend found in this table is like other tables.

Table 9: Summary of Distinction and Credit Pass Grades Obtained by Students in General Mathematics in 2017-2019 Combined and 2020

Grade	2017 -2019			2020	
	Number	Average by Number of Years	Percent	Number	Percent
Distinction	235218	78406	7.21	129335	11.03
Credit Pass	2418847	806282.3	74.18	930765	79.39

In Table 9, the summary of distinction and credit pass grades obtained by students in general mathematics in 2017-2019 combined and 2020 was presented. The result of the analysis revealed that 81.39% of the combined number of candidates that sat for examination in General Mathematics from 2017 to 2019 obtained distinction and credit pass. In the same vein, 90.42% of the candidates for the same subject in 2020, the COVID-19 pandemic year, got distinction and credit pass. Further, figure 3 presents a bar chart of distinction and credit pass grades obtained by students in general mathematics in 2017-2019 combined and 2020. The chart revealed that candidates results gained 9.03% in 2020 despite the COVI-19 pandemic lockdown.

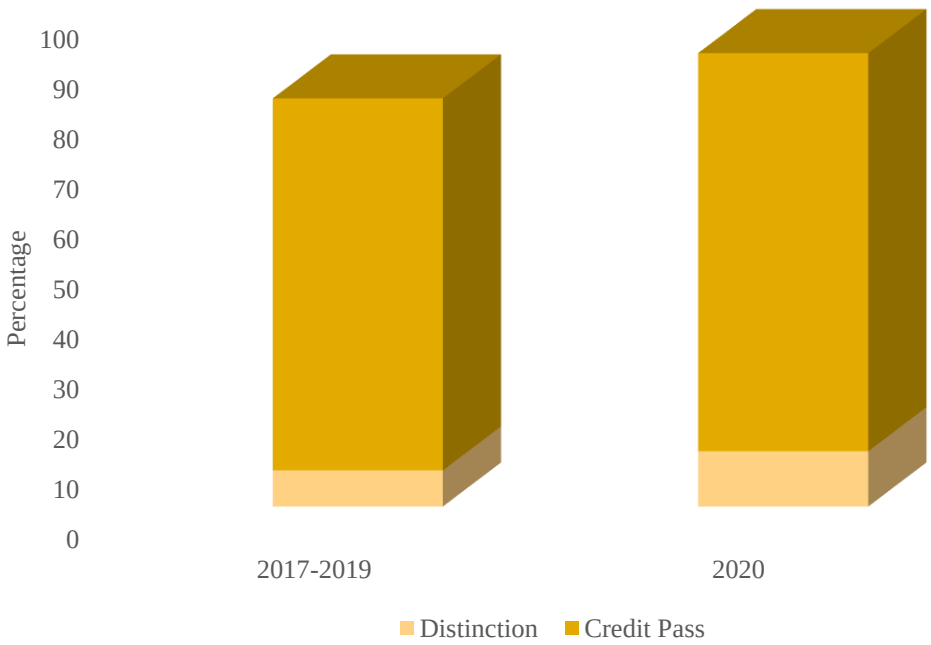

Figure 3: A Bar chart of Distinction and Credit Pass Grades Obtained by Students in General Mathematics in 2017-2019 Combined and 2020

6. Conclusion

An analysis of the results of students in the senior secondary school examinations conducted by the NECO was carried out. The aim was to find out the trend of results from 2017 to 2020. Results of students' grades within four years (2017-2020) were sourced from the National Examination Council. The study employed a longitudinal technique in an ex post facto research design to look at the grades obtained by candidates that sat for SSCE in STEM subjects in the period. Quite surprisingly, it was found that the students performed better in 2020 when compared to 2017, 2018, and 2019. Further studies will qualitatively seek to understand why this trend was found. This was

suspected to be attributed to resilience on the part of the students who may have put extra effort to beat the odds introduced by the COVID-19 pandemic.

Conflict of interest

The authors declare no conflict of interest.

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