Appraisal of E-Learning and students' academic performance: A perspective from secondary schools

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Abstract

This study investigated the effects of electronic learning (e-learning) on the academic performance (AP) of students in selected secondary (high) schools. A cross-sectional survey was used in this study to get data regarding students' AP. The study was limited to three e-learning platforms (Zoom, WhatsApp, and Google Classroom) which were used by the participants in the survey during the COVID-19 pandemic-induced lockdown. A quantitative statistical analysis was carried out on the gathered data using SPSS. Analyses showed that e-learning had a negative effect on the attitudes of students. Furthermore, the analysis revealed that the e-learning systems were not as effective as traditional face-to-face teaching due to factors such as poor network connectivity and lack of collaborative activities. Furthermore, it was discovered that the e-learning materials were not widely available and accessible to the participants. Finally, suggestions that would guide further studies and improve student AP were also recommended.

Keywords: Academic performance, E-learning, Learning, Student, School

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1. Introduction

In today's world, the quest to develop humans' potentials in the cognitive, affective, and psychomotor domains has led to the development of education as a means of socialization. Education today has taken on different dimensions, phases, and spheres (Terziev & Silva Vasileva, 2020). Nowadays, in this twenty-first century classroom, learning where teachers interact face-to-face with students is becoming obsolete in nature (Pei & Wu, 2019). In most civilized societies today, learning has been brought to the individual learners at home or in offices using computers and even mobile devices such as smartphones through the use of the internet (Pei & Wu, 2019; Sangedhi, 2019). This system of education is called electronic learning (e-learning). However, there is no agreed-upon description of what electronic learning is due to its complexity. Because of this, several academics have defined e-learning according to different standards. E-learning, according to Florin et al. (2019), is a type of teaching and learning that largely uses electronic media. It involves the use and application of information and communication technology (ICT) tools, such as computers and internet-enabled devices, to conduct learning between participants in different physical locations. As described by Olojo et al. (2012), distance learning and computer-aided instruction are two separate sub-classes of e-learning. The term "e-learning" can be seen as an umbrella term encompassing things such as distributed learning and online learning. E-learning can therefore be seen as the use of ICTs in different education processes to support, enrich, and enhance learning using the internet and compatible devices as the main medium of communication. E-learning refers to knowledge-sharing that is primarily facilitated by electronic means as it depends on computer networks, both wired and wireless, and internet-enabled devices such as computers, tablets, and internet-enabled mobile devices. E-learning relies heavily on the internet.

When discussing e-learning, the term "distance learning" refers to the method of distributing educational materials over the internet to students who are not present in the same physical location at the time of teaching (Pei & Wu, 2019; Sangedhi, 2019; Keskin & Yurdugül, 2020). Participants can connect with one another via text or live videos while learning takes place in real-time. The Google Classroom suite and the Zoom Meeting app are two prominent examples of the support systems that make learning in this subclass easier (Nwankwo & Ukhurebor, 2020; Nneji, et al., 2022). On the other side, computer-aided instruction is the process of disseminating multimedia learning materials for interested parties to view (Keskin & Yurdugül, 2020). This includes a lot of YouTube lessons and massive open online courses. Regardless of the criteria employed by any researcher, digital devices and the Internet form the foundation of any e-learning platform since they give participants the necessary framework for knowledge sharing (Pei & Wu, 2019; Sangedhi, 2019).

There are different ways of classifying the types of online learning. According to Arkoful & Abaidoo (2014), some classifications are also based on the duration of interaction. They divided e-learning into two basic types: computer-based e-learning and internet-based e-learning. They went on to say that computer-based learning necessitates the use of a variety of ICT tools to aid learning. This type of e-learning can still be subdivided into computer-assisted learning and computer-managed instruction. In computer-assisted learning, computers are used to provide interactive learning content as a means of enriching the lesson within the class or as a means of reinforcing learning outside the class. In computer-managed instruction, the major use of computers is the management of education, which is done by the storage and retrieval of relevant educational information. Internet-based learning, on the other hand, is an improvement on computer-based learning, as it makes content available for learners at a time of their choosing. It has several modes: mixed mode, assistant mode, and fully online mode. The completely online mode, which is the most complete improvement, involves the sole use of

computer networks for learning. They further described the completely online mode as either synchronous or asynchronous. The synchronous system allows learners to discuss with teachers and among themselves by using tools such as video calls and message boards. The major advantage of this is that participants can get instant feedback. The asynchronous mode also allows learners and teachers to exchange ideas, but not at the same time. The main disadvantage of this system is that the learners will not be able to receive feedback instantly from instructors (Pei & Wu, 2019). E-learning is the comprehensive use of contemporary telecommunications technology and ICT resources in the delivery of education. The internet is a global network of communication where computers use network infrastructure to exchange files with one another. ICT includes all digital and multi-media systems that are used to gather, store, process, and disseminate information globally (Arkorful, V, & Abaidoo, 2014). E-learning represents a change from the conventional method of putting the curriculum into practice. E-primary learning's goal is to improve curriculum implementation so that it may better meet the demands of the twenty-first century (Sangedhi, 2019)

In addition, the COVID-19 pandemic of 2020 has elevated e-learning platforms to the forefront of worldwide educational delivery. Schools have been negatively impacted by restrictions on the number of attendees at public events or outright bans on assembling in public spaces (Armstrong-Mensah, et al., 2020; Amir, et al., 2020; Nneji, et al., 2022). Learning may now go on despite the epidemic and its accompanying mobility restrictions, thanks to e-learning platforms. Prior to the pandemic, most secondary (high) schools in developing countries Nigeria inclusive, largely failed to utilize modern information and communication technology tools. To supplement learning experiences, chalk and board, pictorial charts, drawings, and imaginations were used (Adebayo & Balogun, 2019). The COVID-19 pandemic, notwithstanding of its numerous negative effects (Ukhurebor, et al., 2021; Paladhi, et al., 2022), and alleged few positive effects (Ukhurebor, et al., 2022), on the other hand, has resulted in the acceptance of e-learning strategies to effectively improve the overall performance of students and teachers in schools Armstrong-Mensah, et al., 2020; Coa, et al., 2020; Amir, et al., 2020).

Many different learning approaches exist in the modern world. Learning methods such as e-learning, blended learning, and distance learning make use of information and communication technology (ICT) tools to function. E-learning as an approach has enormous benefits and potential, but technological gaps between developed and developing countries make e-learning costly and difficult to fully implement (Pei & Wu, 2019; Keskin & Yurdugül, 2020; Sangedhi, 2019; Keskin & Yurdugül, 2020).

The majority of learning in Nigeria's educational system still takes place in a traditional setting, and a greater focus is placed on the physical learning environment. The COVID-19 outbreak, however, has highlighted the shortcomings of this approach to instruction (Nneji, et al., 2022). Many of the drawbacks of conventional learning systems are removed by e-learning alternatives. The demands and unique characteristics of learners are disregarded in traditional learning environments, which promote passive learning (Armstrong-Mensah et al., 2020). They hardly focus enough on problem solving and don't do anything to help students cultivate critical thinking abilities. Convenience is one of the main advantages of online education because it is not limited by time or geographical distance (Milovanovic). Even if they are physically separated, the teacher and students can communicate and share knowledge. For the benefit of the students, instructors can at any moment add multimedia learning materials to an e-learning platform. Additionally, evaluations can be performed online. The main advantage of e-learning platforms is that they do away with the requirement that the instructor and the students be present in the same physical space. Students can acquire learning materials from a variety of knowledgeable teachers as a result of e-learning. Even if they are subject to the lock-downs and movement limitations brought on by COVID-19, a person can nonetheless engage in online learning.

The lockdown that was placed on schools in Nigeria has had an impact on primary and secondary (high) education. The robustness of the underlying technological infrastructure required to host the platform is one of the main challenges faced while adopting an e-learning platform (Adebayo & Balogun, 2019). The difficulties encountered are not just technological because e-learning also involves people, which cannot be ignored. The majority of learning that occurs on e-learning platforms is unsupervised because the learner and the teacher are typically geographically apart. Because there are few measures to prevent student cheating, there is a negative impact on the perceived value of the marks obtained in assessments done through e-learning platforms. This is arguably the biggest issue with e-learning systems. Furthermore, the learners' motivation may suffer as a result of physical separation. Pei & Wu (2019), claim that a lack of motivation is the main reason why many students who enrol in online courses fail. Utilizing interactive and captivating features to pique kids' interest is one way to address this issue.

The level of active engagement can also be increased by using interactive discussion forums. Even though some schools have tried different approaches to keep their pupils interested during the lockdown, many students still suffer because of the socioeconomic conditions that are now in place. It's possible that students who lack access to the necessary technological resources won't be able to take part in online learning. Rural residents are particularly impacted because of the extremely low internet connectivity in these locations.

There has been a lot of research into the effectiveness of e-learning as a medium of instruction compared to a traditional classroom environment (Moazami, Bahrampour, Azar, Jahedi, & Moattari, 2014; Soltanimehr, Bahrampour, Imani, & etal, 2019; Pei & Wu, 2019; Sangedhi, 2019). While there is much more work to be done in developing countries, e-learning can become an important tool that will potentially plant the seeds of change, learning, and education into the minds of millions of people (Pei & Wu, 2019). This study is being conducted against this backdrop in order to evaluate e-learning and students' academic performance (AP) in selected secondary (high) schools in Port-Harcourt, Nigeria.

E-learning is a relatively new phenomenon for many students in Port-Harcourt, Nigeria. Learning in isolation with minimal supervision is also a new development for these students. Consequently, the AP of students will most likely be affected either positively or negatively as the Nigerian educational system has made us use classroom seating as a means of teaching and learning. This study is carried out to investigate the effect of e-learning on students' AP. Hence, this study will find out the effects of deploying e-learning systems on the AP of selected secondary (high) school students by examining some of the potential difficulties in establishing e-learning programs in a setting with limited educational technology resources, reviewing existing literature on the subject matter, finding the extent of progress made in using e-learning, and assessing the availability of e-learning materials among the selected secondary (high) schools.

Haythornthwaite et al. (2007), proposed the "Latent Tie Theory of Online Learning". They proposed that online learning classes have a model that has a time limit and groups with no history. They proposed that students come together and create new ties, which can turn into weak ones (making new acquaintances or getting to know members of the same class). Some of these students can take things further by turning those relationships into close friendships and collaborations, thus creating strong ties. They proposed that the strength of the ties between people determine how well these individuals can connect using different means. People with weak ties keep their association at a generally formal level, such as through scheduled meetings. Individuals with strong ties interact with each other using various means. This could be in the form of a bulletin or message board, chatting, an exchange of e-mail, or even phone calls. In a traditional classroom setting, the shared medium of exchange can be the physical classroom or building. Using e-learning, the medium can be any of the

widely available communication tools such as email, WhatsApp, and educational technology tools such as Google Classroom and Zoom meetings. They proposed that people linked by weak ties maintain their bond primarily through the use of a single medium, whereas those linked by strong ties communicate with one another using any of the resources available to them. In particular, they appear to favour tools that can provide private communication. Although this theory also works for a traditional classroom setting, it is more profound in e-learning because e-learning can make the class more inclusive as it makes active participation by all members possible. Constraints such as time limits on lessons, seating arrangements, and the dominance of the more outspoken students in a class are absent when e-learning takes place. This theory is related to this study because it considers the strength of the interaction of the students with other learners and the learning content, which is crucial in determining the effectiveness of online learning environments. Selected secondary (high) students from Port-Harcourt, Nigeria have implemented different e-learning systems, and this theory is a way of generalizing the impact of e-learning on AP irrespective of the e-learning platform used.

Several scholars have defined and described academic success. AP, according to Narad & Abdullah (2016), is a gauge of how well students achieve their educational objectives over a given time frame. They said that these objectives are assessed through ongoing evaluations or test outcomes. AP gauges how well a school, its teachers, and its pupils have done in meeting their predetermined educational objectives. According to Abaidoo (2018), a student's academic achievement is a quantitative and discernible course of conduct throughout a certain time period. He continued by saying that it consists of a student's results on an evaluation issued by a teacher. This evaluation could take the form of homework assignments, standardized tests, or both internal and external exams. Additionally, AP can be assessed while the subject is being taught. Any definition of academic achievement should be founded on observable results, as shown by the definitions provided by the writers.

There is evidence to support the idea that different teaching delivery methods may be more or less successful when evaluated in terms of student achievement or performance in the classroom (Adebayo & Balogun, 2019). At various educational levels, studies have demonstrated that past academic success can be a significant indicator of future success. Therefore, one of the most important metrics for assessing the success or failure of any technology innovation is student performance.

It is becoming more necessary to evaluate ICT tools' effects on students' academic achievement as they are employed in education more frequently. This is due to the fact that it is crucial to demonstrate the connections between student AP and technology use. Additionally, it must be demonstrated how educational technology enhances instruction, fosters student creativity, and creates competent problem solvers who are prepared for success in the contemporary world. This subject has been the focus of numerous theoretical and empirical academic studies.

The study was guided by the following research questions:

- **Research Question I:** What effect does e-learning have on the AP of students in the selected secondary (high) schools in Port-Harcourt, Nigeria?

- **Research Question II:** To what extent are e-learning systems that have been adopted by selected secondary (high) schools in Port-Harcourt, Nigeria, effective?

- **Research Question III:** To what extent are the e-learning materials accessible to the majority of the selected secondary (high) school students in Port-Harcourt, Nigeria?

- In this study, three different e-learning platforms were investigated. They are the Zoom meeting platform, Google Classroom, and WhatsApp. Each of the platforms used has their respective strengths and weaknesses.

Zoom: Zoom is a video and audio technology that is mainly used for video conferences. Zoom's widespread use during the COVID-19 pandemic has ensured that face-to-face interaction can take place between teachers and learners to some extent (Major, 2020). Although many educational software applications are widely available and highly effective, many of them were developed to serve as a supplement to traditional learning environments, and this is the aspect in which Zoom differentiates itself according to the research findings of Ryan & Poole (2019). According to Stefanie (2020), one major issue that is currently faced by teachers, learners, and, indeed, parents as they make use of Zoom is attaining mastery in the usage of the software while still maintaining a high level of teaching. Other challenges faced by users of the Zoom platform include highly limited social interaction and technical constraints such as the time limit on Zoom video sessions. Furthermore, the integrity of the results of assessments cannot be guaranteed because there is no way to fully ensure that students do not receive assistance from an outside source during an assessment. The use of video and audio has helped give the teacher a higher level of supervision, but those features are offset by factors such as network connectivity problems and hardware problems that the learners might experience.

Google Classroom: Google classroom is an e-learning system designed and maintained by google. It is a cloud-based learning system that was developed with the aim of helping teachers upload classwork, projects, and assignments to the platform in order for the students to gain access to them at a convenient time. Any user of the system must have a google account. It is designed to be used only by teachers in schools that have registered for the Google education suite. Apart from uploading assessments for students to the platform, google classroom also creates provision for teachers to host virtual discussions for students. It is very easy to use as it is free and is optimized for usage on both traditional computers and mobile devices such as Android phones. One of the benefits of this tool is that it can be used collaboratively with other groups (Izenstark & Leahy, 2015). Another important benefit is that it increases the ability of the users to achieve efficient online collaboration. Teachers can send messages to their students to begin an e-learning session. Similarly, students have the opportunity to share information and get feedback from their fellow learners by posting messages directly to google classroom (Alim, Linda, Gunawan, & Saad, 2019).

WhatsApp: WhatsApp is a mobile application that is used to share text messages and multimedia files. It was created in 2009 and has grown to become the most popular and one of the most widely used social media applications (Fawzi, 2015). WhatsApp can be installed on a smartphone, tablet, or computer. WhatsApp has many features that make it a very good e-learning platform. Etim et al. (Etim, Udosen, & Ema, 2016), suggested a significant positive influence of WhatsApp on the AP of students as it enabled students to have easy access to the taught subject matter, thus improving their performance. This conclusion is consistent with the findings of Augustine and Nwaizugbu (Augustine & Nwaizugbu, 2018), who posited that WhatsApp made it easier and more affordable for people to engage in e-learning. On the other hand, Mingle & Adams (2015), concluded that WhatsApp had a negative impact on the AP of learners. They went further to suggest that the major issue with WhatsApp as it relates to e-learning is the presence of distractions as a student can have e-learning content sent by the teacher but might instead choose to spend time engaging in personal activities instead of participating in e-learning.

The study was motivated by the use of e-learning as a means of learning during the COVID-19 pandemic that recently affected many parts of the world. This study has great significance, especially

because of the current pandemic. The e-learning systems will show a way of ensuring that teaching and learning continue even with restrictions in movement or physical gatherings that have been put in place by the government. Also, the study will help students and parents better understand e-learning with a view to using it in a more competent manner. Furthermore, the study will help the government and other stakeholders in the education sector formulate policies that can make e-learning an effective means of teaching and learning.

2. Materials and Methods

This section deals with the materials and methods used to gather and analyse data related to the study: research design, population of the study, sampling and sampling techniques, instruments, validity and reliability of instruments, and procedure for data collection and analysis.

2.1. Research Design

Due to the nature of this study, a pure descriptive survey research design was used, which is suitable to investigate the effect of e-learning on the AP of students in selected secondary (high) schools in Port-Harcourt, Nigeria. Nwankwo (1999), noted that pure descriptive survey research is a useful scientific tool to employ when one is interested in finding out the opinions and attitudes of people as well as the relationship of these attitudes to the respondents' overt behaviour. Furthermore, a descriptive research survey does not employ hypotheses.

2.2. Population of the Study

The population of this study comprises fifty-two (52) teachers drawn from six (6) secondary (high) schools within Port-Harcourt, Nigeria, as shown in Table 1.

Table 1. The population of this study.

School Name	Number of Teachers
Inama international college (Amadi-Ama, Port-Harcourt, Nigeria)	7
Kala Stevens Memorial college (Ozuboko, Port-Harcourt, Nigeria)	9
Seacrest Preparatory school (Odili Road, Port-Harcourt, Nigeria)	11
Model Secondary School (Abuloma Road, Port-Harcourt, Nigeria)	10
Greenoak International School (GRA, Port-Harcourt, Nigeria)	8
Brilliant International school (Mile 1, Diobu, Port-Harcourt, Nigeria)	7
Total	52

2.3. Sample and Sampling Techniques

A simple random sample was used in selecting the fifty-two (52) participants in the study. The procedure involves a simple lottery system where "Yes" and "No" are written on small pieces of paper. The prospective participants were then asked to randomly pick one paper. A total of fifty-two (52) participants who picked "Yes" then served as the respondents in the study.

2.4. Instrument

The instrument used for this study is a close-ended questionnaire titled "Effects of E-learning on Students' AP (EOELOSAP)". The questionnaire is made up of two parts: Part A and Part B. Respondents are required to fill out their biodata in Part A, while Part B contains the various questions that will help gather data for the statistical analysis. There are 20 items on the questionnaire arranged according to the research questions. A 5-point Likert scale of Strongly Agree (SA) = 5 points, Agree (A) =

4 points, Neither Agree nor Disagree (N) = 3, Disagree (D) = 2, and Strongly Disagree (SD) = 1 point interpretatively, SA and A represent positive responses while D and SD represent negative responses. The questionnaire contains 20 items.

2.5. Validity and Reliability of Instruments

This instrument was subjected to face-and-content validity. This was done to ascertain the validity of the questionnaires to be administered. An initial draft of the questionnaire was vetted and corrected accordingly. The feedback was used to restructure and modify the questions before the final questionnaire was generated and administered to the respondents. The reliability of the instrument was ascertained using the split-half reliability index together with the coefficient alpha index of 0.05 significance.

2.6. Procedure for Data Collection and Analysis

The questionnaires were directly administered to the respondents in August 2022. Each respondent was given a period of one week to fill out the questionnaire, after which they were retrieved for statistical analysis.

Numeric data from the questionnaires was gotten using the 5 points on the Likert scale. The mean (*X*) of the collected data was then calculated. All calculated *X* values above or equal to 3.0 indicated positive responses, while values below this threshold represent negative responses. Furthermore, the Spearman's rank correlation coefficient for the data set was calculated to determine if a correlation exists between student AP and e-learning. The Spearman's Rho, Rs, is calculated using Eqn. (1):

$$R_s = 1 - \frac{6\sum d^2}{n(n^2-1)} \tag{1}$$

3. Data Analysis, Presentation and Discussion of Results

This section provides information about the various groups that were involved in the questionnaire, the sex of the respondents, the ages of the respondents, and the number of years of service of each respondent. Information for each category is presented in tables and illustrated graphically using bar charts.

3.1. Analysis of the Demographic Data

Table 2 gives a breakdown of the number of females and males that participated in the research survey. The table shows that a total of 30 females were involved in the study, while 22 males were involved in the study (see Table 2). All the questionnaires were valid, and this gives valid percentages of 58.00% and 42.00% for females and males, respectively.

Table 2. Gender of the respondents.

		Frequency	Percentage (%)	Valid percentage (%)	Cumulative percentage (%)
Valid	Female	30	58.00	58.00	58.00
	Male	22	42.00	42.00	100.00
	Total	52	100.00	100.00	

It can be seen from the data values (Table 3) that the age bracket most clearly represented in the survey is the 41–50 range with 19 respondents. It is closely followed by the 31–40 age range with 15 respondents. The 21–30 age range supplies 11 respondents, while the 51–65 age range has the least number of participants in the study with just 7 respondents (see Table 3).

Table 3. Age of the respondents.

		Frequency	Percentage (%)	Valid percentage (%)	Cumulative percentage (%)
Valid	21 – 30 years	11	21.00	21.00	21.00
	31 – 40 years	15	29.00	29.00	50.00
	41 – 50 years	19	37.00	37.00	87.00
	51 – 65 years	07	13.00	13.00	100.00
	Total	52	100.00	100.00	

Table 4 shows the years of service of the respondents. It can be seen that only 10 of the respondents have less than 4 years' teaching experience. A further 13 have between 4- and 6-years teaching experience, and there were 10 respondents who had between 7- and 9-years teaching experience. The largest group of respondents were those who have taught for more than 9 years, as 19 of them took part in the survey (Table 4). The responses to the survey were collected using a 5-point Likert scale.

Table 4. Years of experience of the respondents.

		Frequency	Percentage (%)	Valid percentage (%)	Cumulative percentage (%)
Valid	1 - 3 years	10	19.00	19.00	19.00
	4 – 6 years	13	25.00	25.00	44.00
	7 – 9 years	10	19.00	19.00	63.00
	Over 9 years	19	37.00	37.00	100.00
	Total	52	100.00	100.00	

3.2. Analysis of the Research Questions

Research Question I: What effect does e-learning have on the AP of students in the selected secondary (high) schools in Port-Harcourt, Nigeria?

Table 5 shows the *X* value and standard deviation (SD) of the items for research question I on the instrument. The *X* value of question 1 is 5.0, which is expected as a student's AP cannot be measured without evaluation. The *X* value of 4.70 for question 2 shows that it is generally agreed that evaluation via e-learning is more difficult compared to evaluation done in the traditional classroom setting. The majority of the respondents agreed that e-learning made the learning experience more student-centred, as shown from the *X* value of 4.61. A SD of 0.80, however, shows that some of the respondents disagree with this notion. In question 4, the responses gathered indicate that many of the respondents found communication difficult. This situation might occur either directly during teaching or indirectly when assignments and learning activities are not completed or submitted on time by the students. In question 5, the *X* value of 4.65 shows that, in general, all respondents strongly agreed that e-learning had an effect on the motivation of the students. In question 6, with a *X* value of 2.52, which is below the criterion value of 3.0, we can see that the general consensus among the respondents is that the students do not take work done on e-learning platforms as seriously as those given in a traditional classroom.

The responses to question 7 and question 8, with *X* values of 1.80 and 2.14, respectively, show that the majority of the respondents believed that e-learning had a negative effect on the AP of students. This conclusion was reached after the respondents had analysed the results of continuous assessment done by students via e-learning and compared them to the results of continuous assessment done in a traditional classroom setting. The respondents agree completely that e-learning leads to a loss of consistency in teaching. This can be explained by the over-reliance of e-learning on the internet signal strength and electricity supply, which are factors that can hinder the smooth execution of e-learning.

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The responses to question 10 indicate that the teachers are of the opinion that e-learning reduced the students' workload. This is understandable because some important educational content must be taught and learned in a traditional classroom setting. There is a general agreement that e-learning provides a richer learning experience through the use of videos and slides to prepare lessons, and this can be clearly seen from the responses to question 11.

Table 5. The *X* rating and SD of the extent of the impact of e-learning on the AP of students in selected secondary (high) schools in Port-Harcourt, Nigeria.

S/N	Items	N	Sum	X	SD
1	Students are evaluated using e-learning tools	52	260	5.00	0.00
2	Evaluation of students during e-learning is difficult	52	244	4.70	0.43
3	E-learning tools make learning student-centred.	52	240	4.61	0.80
4	E-learning makes communication more difficult	52	225	4.33	0.49
5	E-Learning tools improve student's motivation	52	242	4.65	1.31
6	Students take work sent via e-learning seriously.	52	131	2.52	2.51
7	E-Learning tools improve academic AP	52	160	1.80	0.90
8	E-learning leads to a decline in students' achievement	52	132	2.14	0.50
9	E-learning causes a loss of consistency in teaching	52	146	5.00	0.00
10	E-learning increases the workload of students.	52	63	1.22	3.82
11	E-Learning provides richer learning content	52	260	5.00	0.00

Research Question II: To what extent are e-learning systems that have been adopted by selected secondary (high) schools in Port-Harcourt, Nigeria, effective?

Table 6 shows the *X* value and SD of the responses to the items for research question 2 in the instrument. The responses provided to Question 1 indicate that the students were active in the use of e-learning tools. A SD of 0.00 to the same question further emphasizes this point. There was no general agreement on the complexity of e-learning tools, as shown by the *X* value of 3.22 for responses to question 2. Some respondents are of the opinion that e-learning is a straightforward process, while others completely disagree. The respondents have varying views on the organization of students' work done through e-learning. This can be seen from a SD of 1.98 and a *X* value of 3.69 in question 3. Many respondents could not determine if the students completed e-learning tasks without outside help. This is mainly due to the fact that apart from the schools using the Zoom platforms, most of the work done by the students via e-learning could not be monitored. This situation is clearly shown with a *X* value of 3.08 to question 4. The responses to question 5 show that respondents were unanimous in their belief that e-learning reduces students' teamwork and collaborative efforts. This is understandable as students are generally in different locations when learning using e-learning tools, and this places a severe restriction on the type of collaborative work that can be done. This was a major issue highlighted by this research.

Table 6. The *X* value and SD of the extent to which the e-learning systems adopted by selected secondary (high) schools in Port-Harcourt, Nigeria are effective.

S/N	Items	N	Sum	X	SD
1	Students actively use e-learning tools	52	260	5.00	0.00
2	E-Learning is a complex process	52	220	3.22	2.18
3	Student's work is better organized using e-learning tools	52	192	3.69	1.98
4	Students completed e-learning work without help	52	254	3.08	0.42
5	E-learning reduces teamwork and collaboration among students	52	260	5.00	0.00

Research Question III: To what extent are the e-learning materials accessible to the majority of the selected secondary (high) school students in Port-Harcourt, Nigeria?

Table 7. The *X* rating and SD of the extent to which e-learning materials are accessible to majority of the selected secondary (high) school students in Port-Harcourt, Nigeria.

S/N	Items	N	Sum	X	SD
1	E-Learning tools are readily available to students	52	260	5.00	0.00
2	Sufficient training is required before e-learning tools can be used	52	201	3.85	1.04
3	Students have stable internet access to aid e-learning	52	94	1.81	0.15
4	E-learning infrastructure is very expensive	52	256	4.92	1.71

Table 7 shows the *X* value and SD for the items on research question III in the instrument. The students had access to e-learning tools, as was expected as participants were selected based on their participation in e-learning. Most respondents were undecided on question 1. On one hand, some respondents found that e-learning was a seamless process that required little training before being implemented successfully. On the other hand, some respondents were of the opinion that a student has to have a significant background using computers and other related mobile devices to effectively participate in e-learning. This situation is captured by the *X* value for responses to question 2. Most respondents disagreed with question 3 as stable internet connectivity is difficult to attain in many parts of Port-Harcourt, Nigeria. This poor signal strength is significantly worse during the rainy season because of heavy rains in Port-Harcourt, Nigeria. The responses to question 4 indicate that the respondents agree that e-learning infrastructure is relatively expensive when compared to traditional classroom learning. The high cost of internet subscriptions and internet-enabled devices is the biggest cause of this situation.

3.3. Bivariate Relationship

Spearman's rank correlation is used to compare the effect of e-learning on the AP of students. The correlation coefficient was calculated using the "Statistical Package for Social Sciences (SPSS) version 20". The results of the analysis are presented in Table 8.

Table 8. Relationship between e-learning and students' AP.

			E-learning	Student's AP
Spearman's Rho	E-learning	Correlation coefficient	1.000	.927
		Sig. (2- tailed)	.	.000
		N	52	52
	Student's AP	Correlation coefficient	.927	1.000
		Sig. (2- tailed)	.000	.
		N	52	52

**Correlation is significant at the 0.01 level (2-tailed)

The Spearman's correlation coefficient, r, is 0.927**, as shown in Table 8. The probability value (PV) is < 0.5 at 95% level of confidence. This highly positive correlation between e-learning and a student's AP shows that the latter is strongly affected by the former. This conclusion reinforces the fact that regardless of the platform used Zoom, WhatsApp, or Google Classrooms), the effect of e-learning on AP is easily noticeable.

3.4. Discussion of Results

Research Question I: What effect does e-learning have on the AP of students in the selected secondary (high) schools in Port-Harcourt, Nigeria?

The results of the analysis of the items related to this question on the research instruments in Table 5 show that e-learning has a very noticeable effect on the performance of students. The results of the students' assessment of learning content taught via e-learning were noticeably poorer than the results of assessment done in a traditional classroom setting. This drop-off in performance can be attributed to several factors, such as the effects of poor internet connectivity on the smooth flow of a lesson and the fact that the teacher has no direct physical contact with the learner to provide better explanation to the student during a lesson. This result is in agreement with Bond (2002), who asserted that e-learning is not the most suitable method to teach certain types of subjects. He opined that the teacher's physical absence will affect the quality of lesson delivery in an e-learning setting in subjects such as music and mathematics. He concluded that these types of subjects are best taught in a traditional classroom.

The responses gathered also indicate that many of the respondents found communication difficult during e-learning. This result is in agreement with the assertions of Olojo et al. (2012), who are of the opinion that communication difficulties might occur either directly during teaching or indirectly when assignments and learning activities are not completed or submitted on time by the students. Furthermore, they emphasized that as a result of communication issues, students do not take work done on e-learning platforms as seriously as work done in a traditional setting. They concluded that AP can also be affected by a loss of consistency during the teaching of e-learning. This is similar to the conclusion reached by Odhiambo (2013), who posited that poor AP by students who participated in e-learning can be explained by the heavy dependence of e-learning on factors that aid the smooth running of an online lesson, such as internet signal strength and quality of electricity supply. He is of the opinion that these hindering factors are absent in a traditional classroom setting, and the contrast in performance between online learners and those in a classroom is very noticeable. These findings are corroborated by the results of Schollie (2001), who investigated students' AP and concluded that e-learning has a negative impact on it, especially when e-learning infrastructure is not properly put in place or used in the correct way. This will affect students' AP seriously.

Research Question II: To what extent are e-learning systems that have been adopted by selected secondary (high) schools in Port-Harcourt, Nigeria, effective?

The results of the analysis of the items related to this question on the research instruments in Table 6 show that factors such as a lack of proctoring tools to comprehensively monitor the work of the students and the psychological effect of the child learning in relative isolation when compared to a traditional classroom setting are serious barriers to the effectiveness of e-learning. These challenges to e-learning were highlighted by Stefanie (2020), who posited that the barriers could affect the AP of students who participate in e-learning negatively. Furthermore, they concluded that the difficulty in performing collaborative tasks effectively and other external factors, such as the strength and availability of e-learning structures such as the internet, computer, and other related devices, disrupt the smooth flow of the teaching and learning process, thus reducing its effectiveness. Regardless of these issues, e-learning systems have been widely adopted by selected secondary (high) schools in Port-Harcourt, Nigeria, due to the COVID-19 pandemic.

According to this finding, the cumulative effect of using e-learning systems while grappling with some of the previously mentioned challenges is that the e-learning systems are not as effective as

traditional classroom learning. Another important learning factor highlighted in this research is the absence of collaboration during e-learning when compared with a traditional classroom. This result is consistent with the findings of Johnson (2005), who studied the effects of student alienation on AP and concluded that students that learn in relative isolation have lower academic achievement than those that participate in collaborative tasks. The questionnaire data also showed that proper monitoring of students was not possible via e-learning, and this affected the quality and integrity of the assessment and evaluation given to the students. This is in line with the assertions of Appana (2008), who posited that evaluation of students, which is one of the cornerstones of education, cannot be properly done via e-learning because of the unique characteristics of e-learning. He further explained that evaluation types are severely restricted on e-learning platforms.

Research Question III: To what extent are the e-learning materials accessible to the majority of the selected secondary (high) school students in Port-Harcourt, Nigeria?

The results of the analysis of the items related to this question on the research instruments in Table 7 show that the e-learning contents were shared via e-learning platforms that were widely and easily accessible to the students whose teachers were involved in the study. The prevailing socioeconomic conditions were put into consideration before each of the schools decided on the e-learning platform to use, and the most affordable option was chosen for use. However, many students could not participate in e-learning because of a lack of internet-enabled devices. Internet service fluctuations caused by the internet service providers also negatively affected some students who had access to laptops, Android phones, and tablets. This result is in corroboration with O'Donoghue et al. (2004), who posited that lack of access to internet-connected devices like smartphones and computers will leave some students at a disadvantage as their lack of access to those devices means that, invariably, they cannot fully participate in e-learning. They suggested that the financial constraints are not limited to just the devices, as their effects are also felt when it comes to subscribing for internet bundles using internet service providers or mobile network operators. Andersson (2008), who addressed the role of affordability in e-learning extensively by suggesting that e-learning systems must be affordable for effective teaching and learning to take place, concluded that the absence of e-learning support systems will have a negative impact on e-learning, which will lead to lower AP of students.

4. Conclusion and Recommendations

The study investigated the effect of e-learning on the AP of students from selected secondary (high) schools in Port-Harcourt, Nigeria, during the ongoing COVID-19 pandemic. The study was conducted using a correlational research design. The target population comprised fifty-two (52) secondary (high) school teachers. A questionnaire based on the 5-point Likert scale with points "Strongly Agree", "Agree", "Unsure", "Disagree", and "Strongly Disagree" was used to collect responses from the participants in the study. The gathered data was analysed, and the results were presented in tables. Statistical analysis of the gathered data was performed, and the following findings were made from the study:

- E-learning had a highly negative impact on the AP of students from selected secondary (high) schools in Port-Harcourt, Nigeria.

- E-learning tools adopted by selected secondary (high) schools in Port-Harcourt, Nigeria, were not as effective as traditional classroom learning.

- E-learning tools are widely available to students at selected secondary (high) schools in Port-Harcourt, Nigeria.

The implication of the study is that e-learning cannot currently replace traditional face-to-face learning as the benefits of e-learning do not outweigh its disadvantages, especially its negative effect on the AP of students. Furthermore, this study found that technological barriers, such as a lack of a strong internet connection or difficulty in getting computers or an internet-enabled device, make it almost impossible for certain students to participate in e-learning. The study also showed that e-learning leads to learning in relative isolation and limits the amount of collaborative work that can be done when compared with a traditional class, and this isolation has a negative impact on the student.

Consequently, it is concluded that e-learning has a negative effect on the AP of students from selected secondary (high) schools in Port-Harcourt, Nigeria. This is due to the fact that regardless of the e-learning platform used, some issues such as poor internet connectivity, a lack of proper supervision, and the absence of the teacher's physical presence are constant. These issues therefore reduce the effectiveness of e-learning when compared to the traditional classroom experience. E-learning platforms, such as Zoom, offer live lessons, but the distance barrier still affects the learning process negatively. Other e-learning platforms, such as WhatsApp and Google Classroom, make the taught content available to students at any time, but this is insufficient to replace physical interactions between student and teacher.

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

- The subject matter taught via e-learning during the COVID-19 lockdown is revisited with the students to aid their understanding, and this will lead to better APs.

- It is also recommended that e-learning should be introduced gradually to the students so that they can master its use and take advantage of its potential benefits.

- The government and other stakeholders in the educational sector should create ways to ensure that all students can successfully participate in e-learning by providing students with smartphones and computer devices.

- Further research can be undertaken to investigate the factors that reduce the effectiveness of e-learning with a view to suggesting possible measures to improve the impact of e-learning on students' AP both in Port Harcourt secondary (high) schools and other states in Nigeria as well as other regions of the world.

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