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Perceived impact of information and communication technology (ICT) on academic performance of students in senior secondary schools in Rivers State, Nigeria

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Abstract
The study investigated the perceived impact of information and communication technology on academic performance of students in senior secondary schools in Rivers State, Nigeria. To achieve this, three research questions and three hypotheses guided the study. Descriptive survey research design was adopted. Population of the study was 31,996 year two students of the 268 public senior secondary schools in Rivers State. Sample size was 395 which was determined using Taro Yamene's formula. Sampling technique used was multistage. The instrument used for data collection was researchers constructed structured questionnaire. The questionnaire has three sections A, B, and C, each with items of a Likert four points scale type of Very High Extent, High Extent, Low Extent and Very Low Extent. The questionnaire was both face and content validated by experts in the fields of ICT and Statistics. To ensure the reliability of the questionnaire the SPSS Version 23, using Crombach Alpha method to obtain the internal consistency reliability coefficient of 072.for section A; 0.74 for section B; and 0.70 for section C and 0.72 for the entire sections.. Mean and standard deviation were used to answer the research questions while z-test statistics were used to test the hypotheses at 0.05 level of significance. Results showed that: students utilizes ICTs infrastructure for learning in senior secondary schools in Rivers State to a high extent, and ICT has positive impact on students' academic performance in senior secondary schools in Rivers State. It was recommended that schools shouldbe equipped with more ICTs infrastructure to enhance students' access to quality study materials, and that students should utilize e-learning platforms using their android phones to gain knowledge that would improve their performances academically.

Keywords: perceived impact, information and communication technology, infrastructure, computer, internet facility, e-learning, academic performance

Introduction

The issue of academic performance is highly inevitable in schools since it is the major parameter in measuring students' cognitive ability. Academic performance refers to the level or degree at which an individual student can attain or accomplish any given academic task in the school. Babatunde (2015) [4] defined academic performance "as the behaviours exhibited by an individual (student) which is noticeable after undergoing a programme in a school." Students' academic performance is also viewed as "the final grade which students get after a systematic and comprehensive measurement and evaluation of the individual student in a school setting for the purpose of making decision or judgment on his/her cognitive, affective and psychomotor domains" (Ahmodu, Adaramaja & Adeyemi, 2018) [2]. The teacher–made test is always used to measure academic performance of students in a school based tests (internal examinations) and it is usually short in nature while, a standardized test is normally used to measure academic performance of students in external examinations and it is usually medium or long term in nature. According to Ahmodu *et al* (2018) [2], the commonly used method of measuring students' academic performance in school is the consequence of understudies in open assessments, which is utilized to proclaim judgement on the schools and teachers.

Academic performance of students in secondary school determines to some extent the future educational and vocational career aspirations and choices of the students. In order to enhance access for learning materials, knowledge transfer and improvement in academic performance among students, there is need for full integration and adoption of information and communication technology in the school system. This is because according to Eguavoen (2016) [6] "educational activities that involve the use of technology capture the interest of students, which facilitates their understanding of the content and provides a different way of expressing knowledge." Ikwuka and Adigwe (2017) [9] perceived Information and Communication Technology as "an engine for growth and tool for empowerment with profound implications for education, change and socio-economic development." Eguavoen (2016) [6] elaborately defined ICT as an umbrella term which includes the utilization of "any specialized gadget or application, incorporating: radio, TV, phones, PC and organization equipment and programming, satellite frameworks, etc, just as the different administrations and applications related with them, for example, videoconferencing and distance learning." Other forms of ICT infrastructure include wireless communications gadgets, sound conferencing, video tapes, DVDs, and CDROMs which could be utilized to facilitate teaching-learning even across the border without undermining quality of instruction, learning outcomes or certificates obtained. In this 21st century in particular, ICT has become fully integrated and mobilized into the education system in order to aid and enhance the traditional system of instructional delivery, and to meet the demand for both student centered learning and knowledge transfer

among students across the globe. It is therefore important that all levels of schools should make ICT facilities imperative and available for students to access. The reason for the availability and integration of ICT facilities in schools is not far-fetched. As Ikwuka and Adigwe (2017) [9] rightly observed, "the traditional educational practices no longer provide students with all the necessary skills to survive economically in today's learning environment." Thus, according to UNESCO (2002) [14], "many countries now regard the understanding of ICT and the mastering of its basic concepts as part of the core of teaching and learning process of education."

It is evident that the advent of information and communication technology has achieved huge tremendous innovations not only to the teaching-learning process, but the educational industry generally. Ghavifekr and Rosdy (2015) [7] perceived that ICT integration in education intently identifies with the usage of learning innovations in schools. ICT is a significant device which could enhance the scholastic performance of understudies at all levels of education. Ameen, Adeniji and Abdullahi (2019) [3] reported that science instructors and understudies used ICT apparatuses for teaching and learning math. In his study, Adegbite (2017) [1] reported that ICT fundamentally affects performance of Students in Secondary Schools in Oyo State. In the same vain, Eguavoen (2016) [6] found a connection between PC use at school and scholastic performance. Eguavoen went further to explain that although, over the top utilization of the PC as a methods for diversion can decrease individual time understudies devote to concentrate outside of school, errands, for example, searching for data on the web or imparting by means of the web indirectly improve performance.

From the foregoing, it is evident that the ICTs infrastructure could have considerable impacts not only on students' learning participation and outcomes, but teachers' competence and pedagogical approach. Hence, adequate provision and utilization of ICTs infrastructure for teaching and learning in secondary schools are necessary for enhanced academic performance among the students. However, despite the importance of ICT in teaching and learning, its literature search revealed that in Rivers State scanty empirical studies exist on the impact of ICT on academic performance among the students, hence the need for this study. This study therefore, attempts to fill the gap by assessing impact of Information and Communication Technology on academic performance of students in selected senior secondary schools in Rivers State.

Review of Literature

Concept of ICT and its Importance in Education

Information and Communication Technology could be viewed as the technology used to handle telecommunications, broadcast media, intelligent building management systems, audio-visual processing and transmission systems, and network based control and monitoring functions (Techopedia, 2016) [13]. In fact, ICT tends to have become a major pillar supporting human capacity as well as mobilizing resource materials for quality educational delivery. ICT enhances worldwide accessibility to education, educational equality, broadcasting of quality teaching learning programmes, teachers' professional growth and to help in obtaining a more effective educational management (Hussain, Suleman, Din, & Shafique, 2017) [8].

ICT is also viewed as capable of transforming procedures of instructional process by contributing components of strength to learning situations involving virtual environment (Ikwuka & Adigwe, 2017) [9]. With the advent of Information and Communication Technology, the trends of teaching and learning seem to be easier and better as every resource material including improvised ones needed for quality teaching and learning are readily available in the internet. ICT in education is necessary to supplement the traditional educational means since according to Ikwuka and Adigwe (2017) [9] traditionally educational practices no longer provide students with all the necessary skills to survive economically in today's world of work. As enumerated by Saverinus (2008) [13], the objectives of ICT in schools are to:

1. implement the principles of life-long learning and education,
2. increase a variety of Educational services and methods/ media,
3. promote equal opportunities to obtain education and information,
4. develop a system of collecting and disseminating Educational information,
5. promote technology literacy of all citizens, especially for students,
6. developing Distance Education with national contents,
7. promote the culture of learning at school,
8. Support schools in sharing experience and information with others.

According to Salehi and Salehi (2012) as cited in Hussain *et al*. (2017) [8], the incorporation of ICT in instructional process is believed to be a medium in which a number of methodologies and pedagogical theories might be implemented; however, ICT as a teaching aid is more difficult and multifaceted as it needs positive attitude from the educators. However, it should be noted that students' use of ICT tools has expanded to internet, e-mail, chat, programming, graphics, spreadsheet, online shopping, online literature searching, and other educational materials. (Eguavoen, 2016) [6].

ICT and Students' Performance.

On the relationship between ICT and student's performance, many reports have been provided. For instance, Jamieson-Procter *et al*. (2013) [10] observed that the use of ICT in teaching will enhance the learning process and maximizes the students' abilities in active learning. It was also observed that the infusion of technology into educational environments in social studies aligned with constructivist pedagogy bears the potential to inspire new ways of teaching and learning (Ayas, 2006 cited in Adegbite, 2017) [1]. Kashif, Nor, Fadhilah, Adnan and Mustansar (2020) [11] who conducted "a study on the impact of ICT on students' academic performance in public private sector universities of Pakistan revealed among others that many students used ICTs to improve their essential skills and to carry out their learning effectively with much participations, and that the productive use of ICTs has had a substantial significant impact on the students. Eguavoen (2016) [6] argued that undue use of the computer as a means of entertainment can reduce personal time students dedicate to study outside of school, tasks such as looking for information online or communicating via the internet improve performance indirectly. However, Papanastasiou, Zemblyas & Vrasidas

(2003) [12] discovered in their study that "it is not the computer use itself that has a positive or negative effect on achievement of students, but the way in which computers are used." White (2010) [16] noted that "the use of ICT has changed the conventional ways of learning and proposes the need to rethink education in terms of a more current context. Generally, ICT has a positive impact on learning" (Eguavoen, 2016) [6].

Statement of the Problem.

The advent of ICT and its subsequent incorporation into the education industry could have in no small measure changed the narratives in schools' record keeping, admission process, teaching and learning processes and many more all over the world. It is thus expected that with the provision of ICTs infrastructure both in school and at home, students' learning outcomes could improve. This is because ICT will improve the learning interaction and expands the understudies' capacities in dynamic learning (Jamieson-Procter *et al*, 2013) [10]. Also, the reason for the availability and integration of ICT facilities in schools may not be far from the observation of Ikwuka and Adigwe (2017) [9] that "the traditional educational practices no longer provide students with all the necessary skills to survive economically in today's workplace." However, despite the importance or roles of ICT in facilitating teaching and learning processes and enhancement of learning outcomes, WAEC Chief Examiner's report (2008) [15] "showed a decline in academic performance of students in Nigeria." Could this ugly situation be attributed to poor access or utilization of ICT in learning among students? This calls for research attention. Unfortunately, it seems that not many studies have been done on the impact of ICT on students' academic performance in secondary schools in Rivers State, hence the need for this study.

Purpose of the Study

The main purpose of the study was to ascertain the perceived impact of ICT on academic performance of students in senior secondary schools in Rivers State. Specifically, the study investigated the:

1. Extent to which ICTs infrastructure are available for enhancing students' learning in senior secondary schools in Rivers State.
2. Extent to which students utilize ICTs infrastructure for learning in senior secondary schools in Rivers State.
3. Extent to which ICT has positively impacted on students' academic performance in senior secondary schools in Rivers State.

Research Questions

The following research questions were answered:

1. To what extent are ICTs infrastructures available for enhancing students' learning in senior secondary schools in Rivers State?
2. To what extent do students utilize ICTs infrastructure for learning in senior secondary schools in Rivers State?
3. To what extent has ICT positively impacted on students' academic performance in senior secondary schools in Rivers State?

Hypotheses.

The following null hypotheses were tested at 0.05 level of significance:

1. There is no significant difference in the mean ratings of male and female students on the extent ICTs infrastructures are available for enhancing students' learning in senior secondary schools in Rivers State.
2. There is no significant difference in the mean ratings of male and female students on the extent students utilize ICTs infrastructure for learning in senior secondary schools in Rivers State.
3. There is no significant difference in the mean ratings of male and female students on the extent ICT has positively impacted on students' academic performance in senior secondary schools in Rivers State.

Method and Materials

The study adopted the descriptive survey research design to investigate perceived impact of Information and Communication Technology (ICT) on academic performance of students in Senior Secondary Schools in Rivers State, Nigeria. The population of the study comprised 31,996 (15217 males and 16779 females) year two students in the 268 public Senior Secondary Schools. Out of this population. A sample of 395 (190 males and 205 females) was drawn by multistage sampling technique.

The instrument used for data collection was a researchers constructed questionnaire. The questionnaire has three sections, A, B, and C; each with a Likert type four points scale of Very High Extent (VHE) 4 points; High Extent (HE) 3 points; Low Extent (LE) 2 points; and Very Low Extent (VLE) 1 point. The questionnaire, before used was validated by experts in ICT and Statistics. With the aid of the SPSS version 23, the Cronbach Alpha method was used to obtain the internal consistency reliability coefficients of 0.72 for cluster A; 0.74 for cluster B and 0.70 for cluster C, and 0.72 for the entire questionnaire sections.

The mean and standard deviation were used to answer the research questions, while the hypotheses were tested at 0.05 level of significance using the z-test statistics. To accept or reject the results mean cut-off score was 2.50, hence items the reach criterion mean scores of 2.50 and above were accepted and considered as High Extent, while items with mean scores below 2.50 were not accepted and were considered as low extent.

Results

Research Question 1: To what extent are ICTs infrastructures available for enhancing students' learning in senior secondary schools in Rivers State?

Table 1: Mean Ratings on the Extent to which ICTs infrastructures are Available for Enhancing Students' Learning in Senior Secondary Schools in Rivers State

S/N	Items	Male Students (n = 189)			Female Students (n = 200)		
		$\bar{X}$	SD	Rmks	$\bar{X}$	SD	Rmks
1	There are computers with Microsoft offices in my school for students' use	2.70	0.80	HE	2.64	0.65	HE
2	There is internet facility in my school's computer room which students use	2.45	0.62	HE	2.48	0.68	HE

3	Many students have android phone for browsing of assignments	2.66	0.76	HE	2.70	0.80	LE
4	My school has WhatsApp page for e-learning	2.72	0.82	HE	2.77	0.86	LE
5	Many students have e-mail address which they use for sharing study materials	2.88	0.94	HE	2.79	0.82	HE
6	There are some educational softwares in most schools for students to learn some lessons	2.64	0.70	HE	2.60	0.65	HE
7	There are radio educational programmes by the state government to aid students' learning	2.71	0.74	HE	2.66	0.69	HE
8	Many students have YouTube app in their mobile phone through which they study	2.66	0.70	HE	2.60	0.68	HE
9	Some students have educational apps in their mobile phones	2.71	0.72	HE	2.77	0.78	HE
10	There are educational games for students' use	2.76	0.80	HE	2.71	0.75	HE
	Grand $\overline{X}$	2.69	0.76	HE	2.67	0.74	HE

Source: Field Data, 2021

Table 1 presents the extent to which ICTs infrastructures are available for enhancing students' learning in senior secondary schools in Rivers State. Results in Table 1 showed that out of the ten items; the mean ratings of male and female students on item 2 are 2.45 and 2.48 which are lower than the mean cut-off mark of 2.50 and remarked as low extent, while those of items 1, 3, 4, 5, 6, 7, 8, 9 and 10 are higher than the mean cut-off mark of 2.50 and are remarked as high extent." It was therefore concluded that ICTs infrastructures are available for enhancing students' learning in senior secondary schools in Rivers State to a high extent.

Research Question 2: To what extent do students utilize ICTs infrastructure for learning in senior secondary schools in Rivers State?

Table 2: Mean Ratings on the Extent Students Utilize ICTs Infrastructure for Learning in Senior Secondary Schools in Rivers State

S/N	Items	Male Students (n = 189)			Female Students (n = 200)		
		$\overline{X}$	SD	Rmks	$\overline{X}$	SD	Rmks
11	Students utilize ICT to gain easy access to study materials	2.76	0.82	HE	2.68	0.77	HE
12	Many students learn some lessons through some educational softwares	2.70	0.74	HE	2.62	0.68	HE
13	use internet facilities to do their school works like assignments and projects	2.72	0.76	HE	2.77	0.80	HE
14	Some students use ICT facilities like WhatsApp for sharing of knowledge among themselves	2.73	0.71	HE	2.64	0.65	HE
15	Many students use ICT facilities to learn new skills for solving academic problems	2.88	0.90	HE	2.93	0.94	HE
16	Many students use their android phones to browse problems and solutions in various subject areas	2.80	0.86	HE	2.73	0.80	HE
17	Students utilize computer educational games to improve their computing skills in schools	2.72	0.74	HE	2.77	0.79	HE
18	Students use ICTs infrastructures to improve their communication skills for enhanced learning	2.76	0.80	HE	2.81	0.86	HE
19	Many students gain some knowledge by listening to radio education programmes	2.72	0.76	HE	2.65	0.70	HE
20	Some students type their school projects with computer	2.69	0.71	HE	2.62	0.67	HE
	Grand $\overline{X}$	2.75	0.78	HE	2.72	0.77	HE

Source: Field Data, 2021.

Table 2 presents the extent students utilize ICTs infrastructure for "learning in senior secondary schools in Rivers State. Table 2 revealed that the mean ratings of male and female students on all the items (items 11 to 20) are higher than the mean cut-off mark of 2.50 and are remarked as high extent. This shows that: students utilize ICTs infrastructure for learning in senior secondary schools in Rivers State to a high extent.

Research Question 3: To what extent has ICT positively impacted on students' academic performance of students in senior secondary schools in Rivers State?

Table 3: Mean Ratings on the Extent ICT has Positively Impacted on Students' Academic Performance in Senior Secondary Schools in Rivers State

S/N	Items	Male Students (n = 189)			Female Students (n = 200)		
		$\overline{X}$	SD	Rmks	$\overline{X}$	SD	Rmks
21	ICT enables students to gain more knowledge about some subjects in school	2.90	0.82	HE	2.84	0.77	HE
22	ICT helps students to do well in their home works	2.87	0.84	HE	2.82	0.80	HE
23	ICT improves students' participation in class activities	2.79	0.76	HE	2.73	0.71	LE
24	ICTs infrastructure improves students' grades	2.89	0.83	HE	2.82	0.79	HE
25	ICT enhances students' learning opportunities for improved academic performances	2.98	0.76	HE	2.93	0.71	HE
26	ICT increases students' engagement in learning for enhanced academic performance	2.79	0.75	HE	2.85	0.81	HE
27	Radio educational programmes contribute to the improvement of students' academic performance in school	2.70	0.73	HE	2.77	0.80	HE
28	ICT helps to increase students' learning motivation for improved academic performance	2.76	0.74	HE	2.72	0.70	HE
29	ICTs infrastructure improves students' learning skills for better academic performance in school	2.80	0.84	HE	2.75	0.77	HE
30	Computer educational games help to improve students' computing skills for better performance, especially in numerical subjects	2.77	0.81	HE	2.70	0.74	HE
	Grand $\overline{X}$	2.83	0.79	HE	2.79	0.76	HE

Source: Field Data, 2021.

Table 3 presents the extent to which ICT has positively impacted academic performance of students in senior secondary schools in Rivers State. Results in Table 3 revealed that the mean ratings of male and female students on all the items are higher than the mean cut-off mark of 2.50. This implies that ICT has, impacted positively on students' academic performance in senior secondary schools in Rivers State to a high extent."

Hypotheses Testing

HO 1: There is no significant difference in the mean ratings of male and female students on the extent ICTs infrastructures are available for enhancing students' learning in senior secondary schools in Rivers State.

Table 4: Z-Test Analysis of Difference in Mean Ratings of Male and Female Students on the Extent to which ICTs infrastructures are Available for Enhancing Students' Learning in Senior Secondary Schools in Rivers State

Respondents	N	$\bar{X}_{SD}$	Df	z-cal	z-crit	α	Remark
Male students	189	2.69	0.76				
			387	0.250	1.960	0.05	Not Sig.
Female students	200	2.67	0.74				

Source: Field Data, 2021.

Table 4 revealed that "at 0.05 level of significance and 387 degree of freedom, z-calculated value = 0.250 and z-critical value = 1.960. Since the z-calculated value of 0.250 < z-critical value of 1.960, the null hypothesis that there is no significant difference in the mean ratings of male and female students on the extent ICTs infrastructures are available for enhancing students' learning in senior secondary schools in Rivers State is therefore not rejected." This implies that male and female senior secondary school students in Rivers State are in agreement that ICTs infrastructures are available for enhancing students' learning to a high extent.

HO 2: There is no significant difference in the mean ratings of male and female students on the extent students utilize ICTs infrastructure for learning in senior secondary schools in Rivers State.

Table 5: z-Test Analysis of Difference in Mean Ratings of Male and Female Students on the Extent Students Utilize ICTS Infrastructure for Learningin Senior Secondary Schools in Rivers State

Respondents	N	$\bar{X}_{SD}$	Df	z-cal	z-crit	α	Remark
Male students	189	2.75	0.78				
			387	0.375	1.960	0.05	Not sig.
Female students	200	2.72	0.77				

Source: Field Data, 2021.

From the results in Table 5, "it can be observed that at 0.05 level of significance and 387 degree of freedom, z-calculated value = 0.375 and z-critical value = 1.960. Since the z-calculated value of 0.375 < z-critical value of 1.960, the null hypothesis that there is no significant difference in the mean ratings of male and female students on the extent students utilize ICTs infrastructure for learning in senior secondary schools in Rivers State is therefore accepted." This indicates that male and female senior secondary school students in Rivers State are in agreement that students utilizes ICTs infrastructure for learning in senior secondary schools in Rivers State to a high extent.

HO 3: There is no significant difference in the mean ratings of male and female students on the extent ICT has positively impacted on students' academic performance in senior secondary schools in Rivers State.

Table 6: z-Test Analysis of Difference between the Mean Ratings of Male and Female Students on the Extent ICT has Positively Impacted on Students' Academic Performance in Senior Secondary Schools in Rivers State

Respondents	N	$\bar{X}_{SD}$	Df	z-cal	z-crit	α	Remark
Male students	189	2.89	0.79				
			387	0.500	1.960	0.05	Not sig.
Female students	200	2.79	0.76				

Source: Field Data, 2021.

Results in Table 6 revealed that, at 0.05 level of significance and 387 degree of freedom, z-calculated value of 0.500 < z-critical value of 1.960. Since the z-calculated value (0.500) < z-critical value (1.960), the null hypothesis that there is no significant difference in the mean ratings of male and female students on the extent ICT has positively impacted on students' academic performance in senior secondary schools in Rivers State is therefore not rejected. This implies that male and female senior secondary school students in Rivers State are in agreement that ICT has, to a high extent, positively impacted on students' academic performance in senior secondary schools in Rivers State.

Discussion of Findings

The study revealed that ICTs infrastructures are to a high extent, available for enhancing students' learning in senior secondary schools in Rivers State, and that there is no significant difference in the mean ratings of male and female students on the extent ICTs infrastructures are available for enhancing students' learning in senior

secondary schools in Rivers State." This clearly shows that the adoption and integration of ICT in schools is paramount since effective teaching and learning in this computer age requires the combination of traditional method and computer mediated classroom environment. The reason for the availability and integration of ICT facilities in schools is not far-fetched as Ikwuka and Adigwe (2017) [9] rightly observed that, the traditional educational practices no longer provide students with all the necessary skills to survive economically in today's workplace. In addition, many countries regard the understanding of ICT and the mastering of its basic concepts as part of the core teaching and learning processes of education as observed by UNESCO (2002) [14].

Results also showed that students utilize ICTs infrastructure for learning in senior secondary schools in Rivers State to a high extent, and that there is no significant difference in the mean ratings of male and female students on the extent students utilize ICTs infrastructure for learning in senior secondary schools in Rivers State. This is because this 21st century is technology-based in which students are familiar with technology and are bound to utilize the ICT facilities to better their learning capacities and outcomes. "ICT integration in education which means technology-based teaching and learning process closely relates to the utilization of learning technologies in schools" (Ghavifekr & Rosdy, 2015) [7]. Ameen, Adeniji and Abdullahi (2019) [3] "found that mathematics teachers and students utilized ICT tools for teaching and learning mathematics."

It was also found that "ICT has positive impact on students' academic performance in senior secondary schools in Rivers State to a high extent, and that there is no significant difference in the mean ratings of male and female students on the extent ICT has positively impacted on students' academic performance in senior secondary schools in Rivers State." Jamieson-Procter *et al* (2013) [10] corroborates this finding when they opined that "the use of technology in education contributes a lot in the pedagogical aspects in which the application of ICT will lead to effective learning." Kashif, Nor, Fadhilah, Adnan and Mustansar (2020) [11] observed that "many students used ICTS to improve their essential skills and to carry out their learning effectively with much involvement, and that the productive use of ICTs has had a substantial significant impact on the students." In support, Adegbite (2017) [1] found that "ICT has positive significant impact on performance of Students in Secondary Schools in Oyo State." Also, Eguavoen (2016) [6] revealed a relationship between computer use at school and academic performance.

Conclusion

Findings of the study show that students utilize various ICTs infrastructure for learning. Therefore, it can be concluded that ICT has positive impact on the academic performance of students in senior secondary schools in Rivers State.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. Schools should be equipped with ICTs infrastructure to enhance students' access to quality study materials.
2. Students should utilize e-learning platforms in their android phones to gain knowledge that would improve their performances academically.

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