MANAGEMENT OF HIDDEN COSTS OF TECHNOLOGY IN POST COVID-19 ERA FOR TEACHER ENGAGEMENT IN SENIOR SECONDARY SCHOOLS IN RIVERS STATE, NIGERIA

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Abstract
This study examined the management of hidden costs of technology in post covid-19 twenty-first century for teacher engagement in senior secondary schools in Rivers State, Nigeria. Two research questions and two null hypotheses guided the study. The study adopted descriptive research design. The population comprised all the 7,418 principals and teaching staff in the 276 public senior secondary schools in Rivers State. Out of this population, 276 were principals (179 males and 97 females) while 7,142 were teachers (3,681 males and 3,461 females). Taro Yamane's formula was used to determine a minimum sample size of 380; hence, a. sample of 852 respondents (110 principals and 742 teaching staff), which represents 40% and 10% respectively, was drawn using both simple random sampling and proportionate stratified random sampling techniques. The instrument that was used for data collection was a self-designed 18-item questionnaire entitled: "Management of Hidden Costs of Technology in Post COVID-19 for Teacher Engagement Questionnaire (MHCTPCTEQ)." The questionnaire was structured after the four-point modified Likert rating scale, and was duly validated by three experts. The reliability of the instrument was tested using the Cronbach's Alpha method to establish the internal consistency of the questionnaire items, and the coefficient of 0.87 and 0.91 were obtained for the two clusters respectively. The research questions were answered using mean and standard deviation, while z-test was used to test the null hypotheses at 0.05 level of significance. The findings of the study revealed, among others, that the hidden costs of technology incurred by teachers in public senior secondary schools in Rivers State, Nigeria, included: money spent for purchasing of personal computers, smart phones, printers, etc; costs of data for accessing the Internet; extra time, which is off the contractual teaching hours teachers spent for trainings, workshops, etc on usages of modern technologies for teaching; costs of hiring experts to coach teachers on online

learning platforms. Based on the findings, it was recommended, among others, that external educational stakeholders, including the Rivers State Government should collaborate with teachers by subsidizing laptop computers, data, solar panels, pre-loaded offline educational resources, among others, so as to motivate and engage them more effectively in this technology-driven 21st century.

***Keywords**: Management, Hidden costs, Technology, Post COVID-19, 21st Century, Collaboration, Teacher engagement.*

Introduction

Corona Virus Disease 2019 (COVID-19) has been ravaging the whole world with its first, second and third waves since December, 2019 when it was first discovered in Wuhan, China. The World Health Organisation (2020), in January, declared the COVID-19 a public health crisis and reported it as a global pandemic in March, 2020. Nigeria confirmed the first case of Corona Virus in Lagos State on 27th February, 2020, which gripped the citizenry in great fear. Within a short period of time, the country recorded more active cases. This compelled the Federal Ministry of Education to announce the closure of all schools on 19th March, 2020 so as to prevent the spread of the virus since students are the most vulnerable. The pandemic wreaked havoc in every area of human activities, and education sector is among the sectors with unprecedented impacts of COVID-19 pandemic. The United Nations Educational, Scientific and Cultural Organisation (2020) reported on April 6th, that the impact the pandemic had on learners was so devastated that there were over 1.5 billion students worldwide from primary to tertiary levels who could not attend school. Since the outbreak of COVID-19 in Nigeria, educational managers and stakeholders have been grappling to find alternative measures to ensure that the school academic calendar that has been interrupted, is not lost completely.

During the first wave of COVID-19, Nigeria announced a total shutdown of all human activities in order to curb the spread of the virus. This propelled many sectors to think outside the box, which resulted in working through remote modes or working from home with technological devices. Rivers State was one of the States in Nigeria that embarked on local media channels such as radio and television programmes to keep students busy intellectually. The education sector had no choice than to follow the trend; hence, teachers were encouraged to integrate different digital learning platforms to engage the students who were at home due to the unexpected closure of schools. Zalat, Hamed and Bolbol (2021) asserted that the shutdown of the education system

stimulated the growth of online educational activities. Lending credence to this assertion, Dhawan (2020), emphasized that COVID-19 pandemic has paved way for introducing compulsory digital learning in the classrooms. Hence, with the emergence of COVID-19, which led to total lockdown and closure of schools for months in Nigeria, it becomes exigent to adapt to the new normal – teaching with technologies.

This 21st century, coupled with the COVID-19 pandemic, has been widely acknowledged as an era of technology because it has become the basis of every nation's socio-economic growth and development. Similarly, the Federal Ministry of Education (2015) advocated for technology-driven classrooms in this 21st century. Technology can be described as machinery and equipment developed from the application of scientific knowledge to achieve specific purposes or to solve real-life problems. Technology can be in form of hardware like: laptop and desktop computers, iPads, notepads, smart phones, projectors, interactive multi-media, interactive smart boards, digital cameras, printers, scanners, audio enhancements, like wireless microphones and head sets, among others. These devices can be applied in schools through e-Learning software packages such as Internet browsers – Google, Firefox, Chrome; digital learning channels – Zoom, Google Classroom, Microsoft Teams, among others. Thus, technology has transformed the nomenclatures in the education system. In recognition of the prominent role of Information and Communication Technology (ICT) in advancing knowledge and skills necessary for effective functioning in the modern world, the Federal Republic of Nigeria (2013) stipulated that modern technologies shall be increasingly used and improved upon at all levels of the education system. Hence, the emergence of COVID-19 has created wide opportunities for educators to integrate technology-supported learning equipment in the teaching-learning process.

Hidden costs can be viewed as all the extra, additional, unanticipated, unbudgeted and unrecorded expenses that are incurred in the course of carrying out a particular task. Kingori, as cited in Kiruru, Mogaka and Pierre (2020) defined hidden costs as expenses on education which are not covered by any policy. Bernard (2020) described hidden costs of technology in education as the time and extra costs incurred by teachers while using technology to facilitate learning either at home or in school. They include but not limited to: the time spent in getting the devices ready for use, money for procurement of personal computers, laptops, iPads, printers, scanners, smart phones, e-Books, data for accessing the Internet, Wi-Fi routers, organising

Zoom classes, Webinar, Google Classroom, e-Libraries; money to pay electricity bills, servicing and repairing of the technological devices, among others. Bacsich and Ash (2002) emphasized that the extra time that are off the contractual teaching hours that teachers spend on meetings, trainings, workshops and seminars are hidden costs of technology. Bernard asserted that the outbreak of COVID-19 has compelled teachers to make unnecessary expenses on retrofitting their sitting rooms to look like a classroom by purchasing cubicle covers that create privacy, screens that divide their rooms, materials to build out spaces, lighting, buying of desks, chairs and countless childcare issues. Parrish, Negi and Mogro-Wilson (2021) observed that hidden costs of technology leave huge financial impacts on teachers who are nursing mothers as they have to pay caregivers to take care of their babies and toddlers during extra school hours' activities. Bacsich and Ash revealed in a study they conducted on the hidden costs of networked learning among lecturers that staff consumable costs, procurement of home computers, bills on Internet connectivity and time spent on research were hidden costs of technology that were absorbed by academic staff. Heggeness (2020) pointed out that these hidden or indirect costs that are being incurred by staff can rise to teacher turnover if Management fails to recognize the long-term impact they have on them financially. Hence, hidden costs of technology have implications on teacher engagement since they are the implementers of the school curriculum.

Investigations have been carried out by various researchers on the impacts of teaching with technologies both at home and in school, especially in this era of COVID-19 pandemic. Rapanta, Botturi, Goodyear, Guardia and Koole (2020) revealed in a study they conducted in Switzerland, Australia, Spain and Canada, that while COVID-19 has altered teachers' pedagogical content knowledge (PCK) both positively and negatively, they (teachers) also feel the weight of the instructional shift not only emotionally and physically but also financially. Kiruru et al. (2020) investigated schooling hidden costs in Rwanda and found out that parents and teachers encounter high positive significant challenges in online learning, home-coaching, school uniforms, school materials and transportation. Van-Deursen and Van-Dijk (2019) discovered in their study that digital-divide, the gap between those who have and do not have access to computers and the Internet due to poverty is a huge factor limiting the feasibility of e-learning in a South African context. In Nigeria, the study that was conducted by Ogunode (2020) revealed that teachers, especially those that teach in private schools suffered untold hardship during the COVID-19 lockdown online lessons as their salaries were not paid by their employers. A major challenge for Nigerian lecturers as observed by Tijani (2020) is the cost

of buying data for uploading and downloading multi-media contents, and also to access the Internet for virtual learning. According to Bacsich and Ash (2002), hidden costs of technology results in lack of planning, and have not formerly been tackled in the educational context. Thus, hidden costs of technology, if not properly addressed, can pose a cog in a wheel in teacher engagement for optimum productivity.

Teachers are the most critical and important assets of the school organisation. They are the major actors in any educational reform (Obanya, 2014). Teachers' roles in the teaching-learning process are multi-faceted: they are the instructional facilitators, the curriculum implementers, the counselors, the classroom managers, among others. Because of the numerous roles teachers play in achieving educational objectives and goals, their engagement in qualitative education delivery is critical. Engagement at work has been described by Kirkpatrick, as cited in Onyeagbako and Adieme (2018) as an employee's interest in, enthusiasm for and investment in the job. Cardwell (2011) also defined engagement as a positive, fulfilling, work-related state of mind that is characterized by vigour, dedication and absorption. Armstrong (2012) posited that engagement occurs when employees are committed to their work in an organisation, and motivated to achieve high levels of performance. Tyler and Boelter (2008) opined that engaged teachers search for new ideas, implement best teaching practices, modify instruction to meet the instructional needs of their students, have high expectations for their students, frequently monitor students' progress, provide students with feedback, and actively taking opportunities to discuss work-related improvements with their colleagues at work. In other words, engaged teachers are concerned about the quality of education they deliver to learners, and how to do it better. Hence, teacher engagement in teaching with technologies can be enhanced through effective management.

Management is the systematic planning, organizing, coordinating and controlling of available human and material resources to efficiently and effectively achieve organisational goals. In school organisation, the management lies solely on the school administrators who manage the school and harness the human resource (teaching and non-teaching staff) in order to attain the educational goals and objectives. Nwideeduh and Adieme (2021) posited that school managers, as change agents are charged with the inundate tasks of adapting and adopting innovations that are geared at meeting the demands of globalisation and societal expectations of schools. For the hidden costs of technology to be effectively managed in Nigerian public secondary

schools in the post COVID-19 era, policies must be formulated and implemented to redress the challenges. Mpungose (2020) noted that South Africa has developed policies which mandate universities to provide both lecturers and students with free laptops and Wi-Fi access within their perimeters and residences in order to solve the existing social inequalitie., Eze., Sefotho, Onyishi and Eseadi (2012) postulated that the Nigerian government can provide supports such as solar-powered educational devices, pre-loaded offline academic resources and solar panels to solve the issue of lack of electricity or epileptic power supply experienced in some parts of the country, and also to save costs. Similarly, Ogunode (2020) recommended in his study that Nigerian Government should authorise the Central Bank of Nigeria to design low-interest loan facilities for all private school teachers to enable them to own personal computers that will facilitate online learning. Parrish et al. (2021) posited in their study on the hidden costs of care giving during the pandemic, that policies that help to facilitate a culture of support and care should be developed and implemented in teaching and research so as to create an academic environment that is more sustainable and humane. Hence, educational planners in Nigeria should formulate policies that will empower school managers to include the hidden costs of technology incurred by teachers and other school personnel in their budgets.

School managers are expected to adequately plan for post COVID-19 technology-driven classrooms. Phelps and Sperry (2020) noted that the pandemic caught the education sector unaware; hence, there are no guidelines for planning and delivering online learning for primary and secondary schools. Thus, this calls for adequate planning and integration of modern technological resources into the school curriculum to streamline the instructional activities and guide teachers. Hodge (2020) corroborated that some forms of emergency online learning are being criticized for failing to adhere to sound pedagogical principles and best practices. UNESCO (2020) asserted that transitioning learning from classrooms to homes need adequate planning and a period of preparation in making available the enabling technologies. In the same vein, Maduakolam (2020) maintained that schools need adequate budgeting and financial resources to purchase hardware and software, wire their buildings to network computers and other information and communication devices, and connect to the Internet to provide students, teachers, and other school personnel with adequate access to technology. Hence, for effective collaborative learning experiences to be achieved, adequate financial support and access to the Internet and technological resources should be made available to teachers who implement the curriculum in the classrooms.

Ever since the emergence of COVID-19 pandemic, educational managers and external stakeholders have been grappling with the unprecedented impacts on education. This resulted in adapting to the new normal – using and integrating technological devices into the classrooms. Technology, in as much as it helps us to solve plethora of problems in the education sector, has many hidden costs accrued to it. Prior to the COVID-19 pandemic, most Nigerian teachers lacked the basic technological resources like computers, smart phones, among others, and also skills needed to facilitate online learning. This challenge made them depend so much on the traditional chalk and talk, chalkboard and book teaching methods. The seismic shift from the traditional face-to-face instructional delivery method to online learning during the COVID-19 pandemic compulsory lockdown, has propelled teachers to incur extra costs from their meagre salaries to purchase personal technological devices such as: laptop computers, smart phones, data for accessing the Internet, paying of electricity bills that skyrocketed due to frequent online lessons, buying of generators and fuel (as the case may be), hiring of IT experts to put them through on how to use the devices effectively to teach an online class via Zoom, Google Classroom, Microsoft Teams, among others. In fact, the cost burdens of school closures and post COVID-19 have fallen heavily on teachers who are struggling to survive in this economic crunch.

However, it is pertinent to note that for any reform in education to be effective, it must address fundamental issues and pay attention to the teacher factor. As technologies are being adopted and integrated into the teaching-learning process, the researchers are worried about how to adequately plan and manage the financial impacts of hidden costs of technology on teachers so as to engage them to perform optimally, and achieve the educational objectives and goals. Hence, this is what underscored the problem of this study.

The aim of this study was to investigate how hidden costs of technology are managed in post covid-19 twenty-first century for teacher engagement in senior secondary schools in Rivers State, Nigeria. Specifically, the study sought to:

1. determine the hidden costs of technology incurred by teachers in post COVID-19 twenty-first century for teacher engagement in senior secondary schools in Rivers State, Nigeria; and
2. highlight ways hidden costs of technology can be managed in post COVID-19 twenty-first century for teacher engagement in senior secondary schools in Rivers State, Nigeria.

The following research questions and hypotheses guided the study:

1. What are the hidden costs of technology incurred by teachers in post COVID-19 twenty-first century for teacher engagement in senior secondary schools in Rivers State, Nigeria?

2. In what ways can hidden costs of technology be managed in post COVID-19 twenty-first century for teacher engagement in senior secondary schools in Rivers State, Nigeria?

3. Two hypotheses guided the study:

   Ho_1: There is no significant difference between the mean ratings of principals and teachers on the hidden costs of technology incurred in post COVID-19 twenty-first century for teacher engagement in senior secondary schools in Rivers State, Nigeria.

   Ho_2: There is no significant difference between the mean ratings of principals and teachers on ways hidden costs of technology can be managed in post COVID-19 twenty-first century for teacher engagement in senior secondary schools in Rivers State, Nigeria.

Method

This study adopted descriptive research design. The population comprised all the 7,418 principals and teaching staff in the 276 public senior secondary schools in Rivers State. Out of this population, 276 are principals (179 males and 97 females) while 7,142 are teachers (3,681 males and 3,461 females, Rivers State Ministry of Education, 2020). Taro Yamane's formula was used to determine a minimum sample size of 380; hence, a. sample of 852 respondents (10 principals and 742 teaching staff), which represents 40% and 10% respectively, was drawn using both simple random sampling and proportionate stratified random sampling techniques. The instrument that was used for data collection was a self-designed 18-item questionnaire entitled: "Management of Hidden Costs of Technology in Post COVID-19 for Teacher Engagement Questionnaire (MHCTPCTEQ)." The questionnaire was structured after the four-point modified Likert rating scale of Strongly Agree = 4, Agree = 3, Disagree =2 and Strongly Disagree = 1, and it was duly validated by three experts in Test and Measurement Department and Educational Management Department of Faculty of Education, University of Port Harcourt respectively. The reliability of the instrument was tested using

the Cronbach's Alpha method to establish the internal consistency of the questionnaire items, and the coefficient of 0.87 and 0.91 were obtained for the two clusters respectively; hence, they were adjudged to be reliable for the field study. The research questions were answered using mean and standard deviation while z-test was used to test the null hypotheses at 0.05 level of significance.

Results

Table 1: Mean Scores and Standard Deviations on the Opinions of Principals and Teachers on the Hidden Costs of Technology Incurred by Teachers

S/N	Hidden Costs of Technology Incurred by Teachers Include:	Principals = 110		Teachers = 742			Decision
		$\overline{X}_1$	SD_1	$\overline{X}_2$	SD_2	$\frac{\overline{X}_1}{\overline{X}_2}$	
1.	Money spent for purchasing of personal computers, smart phones, printers, etc.	3.12	0.66	3.27	0.25	3.20	Agreed
2.	Costs of data for accessing the Internet.	3.21	0.65	3.29	0.25	3.25	Agreed
3.	Extra time, which is off the contractual teaching hours teachers spend for trainings, workshops, etc on usages of modern technologies for teaching.	3.10	0.66	3.16	0.25	3.13	Agreed
4.	Costs of hiring experts to coach teachers on online learning platforms.	3.07	0.66	3.13	0.25	3.10	Agreed
5.	Money spent on electricity bills to power technological devices, facilitate online learning, etc.	3.14	0.66	3.18	0.25	3.16	Agreed
6.	Buying of fuel/diesel for generators where there is no public utility.	3.17	0.65	3.25	0.25	3.21	Agreed
7.	Fees paid for computer training to acquire computer literacy.	2.89	0.68	2.93	0.26	2.91	Agreed
8.	Paying of caregivers to take care of female teachers'	2.21	0.75	2.37	0.28	2.29	Disagreed

	toddlers during working overtime hours with computers in the school.						
9.	Costs of buying papers for writing, printing, etc.	3.16	0.66	3.14	0.25	3.15	Agreed
10.	Money spent on repairing of damaged technological devices.	2.77	0.69	2.85	0.26	2.81	Agreed
11.	Time spent on researching for Open Educational resources (OERs).	3.09	0.66	3.15	0.25	3.12	Agreed
	Aggregate Mean and SD	**2.99**	**0.67**	**3.07**	**0.25**	**3.03**	

Table 1 shows the mean responses of principals and teachers on the hidden costs of technology incurred by teachers in public senior secondary schools in Rivers State, Nigeria. Both principals and teachers agreed on items: 1, 2, 3, 4, 5, 6, 7, 9, 10 and 11 in the Table with mean scores greater than the criterion mean of 2.50. However, they disagreed on item 8, which is less than the criterion mean of 2.50. Their aggregate mean scores of 2.99 and 3.07 respectively, indicate that they agreed on the items as the hidden costs of technology incurred by teachers in public senior secondary schools in Rivers State, Nigeria. They agreed that the areas where there are hidden costs of technology include: money spent for purchasing of personal computers, smart phones, printers, etc; costs of data for accessing the Internet; extra time, which is off the contractual teaching hours teachers spend for trainings, workshops, etc on usages of modern technologies for teaching; costs of hiring experts to coach teachers on online learning platforms; money spent on electricity bills to power technological devices, facilitate online learning, etc; buying of fuel/diesel for generators where there is no public utility; fees paid for computer training to acquire computer literacy; costs of buying papers for writing, printing, etc; money spent on repairing of damaged technological devices and time spent on researching for Open Educational resources (OERs).

Table 2: Mean Scores and Standard Deviations on the Opinions of Principals and Teachers on Ways Hidden Costs of Technology can be Managed

S/N	Ways Hidden Costs of Technology can be Managed Include:	Principals = 110		Teachers = 742			
		$\overline{X}_1$	SD_1	$\overline{X}_2$	SD_2	$\frac{\overline{X}_1}{\overline{X}_2}$	Decision
12.	External educational stakeholders should collaborate with teachers by providing them with free laptops, Wi-Fi access, etc.	3.17	0.65	3.22	0.25	3.20	Agreed
13.	Rivers State Government should include Internet Data Allowance in teachers' salaries.	3.12	0.66	3.18	0.25	3.15	Agreed
14.	Ministry of Education should support schools by providing them with solar-powered educational devices.	3.18	0.65	3.15	0.25	3.17	Agreed
15.	Principals should make adequate budgeting for pre-loaded offline educational resources.	3.09	0.66	3.12	0.25	3.11	Agreed
16.	Non-governmental Organizations (NGOs) should partner with schools by providing them with solar panels so as to solve the issue of power outage or lack of power supply.	3.24	0.64	3.13	0.25	3.19	Agreed
17.	Policies that help to facilitate financial support for teachers after trainings, workshops, seminars, etc should be formulated/implemented.	3.10	0.66	3.15	0.25	3.13	Agreed
18.	Central Bank of Nigeria (CBN) should design low-interest loan facilities for teachers in order to enable them to own the necessary technological resources for online learning.	3.18	0.65	3.27	0.25	3.23	Agreed
	Aggregate Mean and SD	**3.15**	**0.66**	**3.17**	**0.25**	**3.17**	

Table 2 displays the mean responses of principals and teachers on the ways hidden costs of technology can be managed in post COVID-19 twenty-first century for teacher engagement in senior secondary schools in Rivers State, Nigeria. Both respondents agreed on all the items with mean scores greater than the criterion mean of 2.50. Their aggregate mean scores of 3.15 and 3.17 respectively, reveal that they agreed on the items as ways hidden costs of technology can be managed in post COVID-19 twenty-first century for teacher engagement in senior secondary schools in Rivers State, Nigeria. These include: external educational stakeholders should collaborate with teachers by providing them with free laptops, Wi-Fi access, etc; Rivers State Government should include Internet Data Allowance in teachers' salaries; Ministry of Education should support schools by providing them with solar-powered educational devices; principals should make adequate budgeting for pre-loaded offline educational resources; Non-governmental Organizations (NGOs) should partner with schools by providing them with solar panels so as to solve the issue of power outage or lack of power supply; policies that help to facilitate financial support for teachers after trainings, workshops, seminars, etc should be formulated/implemented and Central Bank of Nigeria (CBN) should design low-interest loan facilities for teachers in order to enable them to own the necessary technological resources for online learning.

Table 3: z-test on the Difference between the Mean Ratings of Principals and Teachers on the Hidden Costs of Technology Incurred in Post COVID-19 Twenty-first Century for Teacher Engagement in Senior Secondary Schools in Rivers State, Nigeria

Status	N	$\overline{X}$	SD	Df	z-cal	Critical Value	Remarks
Principals	110	2.99	0.67	850	-1.24	±1.96	Not Significant
Teachers	742	3.07	0.25				

P< 0.05

Table 3 reveals the z-test analysis on the difference between the mean ratings of principals and teachers on the hidden costs of technology incurred in post COVID-19 twenty-first century for teacher engagement in senior secondary schools in Rivers State, Nigeria. The result shows that z-calculated value of -1.24 is less than the critical value of ±1.96; therefore, the null hypothesis is accepted at 0.05 alpha level. Thus, there is no significant difference in the

mean ratings of principals and teachers on the hidden costs of technology incurred in post COVID-19 twenty-first century for teacher engagement in senior secondary schools in Rivers State.

Table 4: z-test on the Difference between the Mean Ratings of Principals and Teachers on Ways Hidden Costs of Technology can be Managed in Post COVID-19 Twenty-first Century for Teacher Engagement in Senior Secondary Schools in Rivers State, Nigeria

Status	N	$\overline{X}$	SD	Df	z-cal	Critical Value	Remarks
Principals	110	3.15	0.66	850	-0.31	±1.96	Not Significant
Teachers	742	3.17	0.25				

P< 0.05

Table 4 reveals the z-test analysis on the difference between the mean ratings of principals and teachers on ways hidden costs of technology can be managed in post COVID-19 twenty-first century for teacher engagement in senior secondary schools in Rivers State, Nigeria. The result reveals that z-calculated value of -0.31 is less than the critical value of ±1.96; therefore, the null hypothesis is accepted at 0.05 alpha level. Thus, there is no significant difference in the mean ratings of principals and teachers on ways hidden costs of technology can be managed in post COVID-19 twenty-first century for teacher engagement in senior secondary schools in Rivers State, Nigeria.

Discussion

The study revealed that the hidden costs of technology incurred by teachers in public senior secondary schools in Rivers State, Nigeria include: money spent for purchasing of personal computers, smart phones, printers, etc; costs of data for accessing the Internet; extra time, which is off the contractual teaching hours teachers spend for trainings, workshops, etc on usages of modern technologies for teaching; costs of hiring experts to coach teachers on online learning platforms; money spent on electricity bills to power technological devices, facilitate online learning, etc; buying of fuel/diesel for generators where there is no public utility; fees paid for computer training to acquire computer literacy; costs of buying papers for writing, printing, etc; money spent on repairing of damaged technological devices and time spent on

researching for Open Educational Resources (OERs). This implies that the cost burdens of using technology for teaching-learning falls heavily on teachers. The finding agrees with Kingori, as cited in Kiruru et al. (2020); Bernard (2020); Rapanta et al. (2020); Parrish, et al. (2021), who observed in their various studies that hidden costs of technology leave huge financial impacts on teachers. The finding is also in line with Bacsich and Ash (2002), who revealed in a study they conducted on the hidden costs of networked learning among lecturers, that staff consumable costs, procurement of home computers, bills on Internet connectivity and time spent on research were hidden costs of technology that were absorbed by academic staff. Hence, hidden costs of technology have implications on teacher engagement since they are the implementers of the school curriculum. The educational planners have to systematically formulate policies that can address this issue in the education system.

The study also revealed ways hidden costs of technology can be managed in post COVID-19 twenty-first century for teacher engagement in senior secondary schools in Rivers State, Nigeria. These include: external educational stakeholders should collaborate with teachers by providing them with free laptops, Wi-Fi access, etc; Rivers State Government should include Internet Data Allowance in teachers' salaries; Ministry of Education should support schools by providing them with solar-powered educational devices; principals should make adequate budgeting for pre-loaded offline educational resources; Non-governmental Organizations (NGOs) should partner with schools by providing them with solar panels so as to solve the issue of power outage or lack of power supply; policies that help to facilitate financial support for teachers after trainings, workshops, seminars, etc should be formulated/implemented and Central Bank of Nigeria (CBN) should design low-interest loan facilities for teachers in order to enable them to own the necessary technological resources for online learning. This finding is in agreement with Mpungose (2020); Parrish et al. (2021), who recommended policy formulations to address the issues of hidden costs of technology. It is also in consonance with Eze et al. (2021); Ogunode (2020), who maintained that the Nigerian government can provide supports such as soft loans to teachers to enable them to own personal computers that will facilitate online learning; solar-powered educational devices, pre-loaded offline academic resources and solar panels to solve the issue of lack of electricity or epileptic power supply experienced in some parts of the country, and also to save costs. Thus, for hidden costs of technology to be effectively managed in Nigerian

public secondary schools in the post COVID-19 era, policies must be formulated and implemented to redress the challenge.

Conclusion

From the findings of this study, it can be deduced that principals and teachers do not differ in their opinions that there are hidden costs of technology in post COVID-19, twenty-first century teacher engagement in secondary schools. They both also agreed on ways the hidden costs can be managed. It can therefore be concluded that the hidden costs of teaching with technologies in the classrooms fall heavily on teachers, who are managing their meagre salaries to take care of their families, and survive in this economic crunch. Thus, the seismic shift to digital learning has to be adequately planned and managed effectively so as to engage teachers to perform optimally in the education system.

Recommendations

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

1. Educational planners should formulate policies that will mandate the government to increase teachers' salaries so as to enable them to cater for all the additional-unbudgeted expenses that are accrued to teaching with technologies.

2. External educational stakeholders, including the Rivers State Government should collaborate with teachers by subsidizing payments for laptop computers, data, solar panels, pre-loaded offline educational resources, among others, so as to motivate and engage them more effectively in this technology-driven 21st century.

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