

**NEWPORT INTERNATIONAL JOURNAL OF ENGINEERING
AND PHYSICAL SCIENCES (NIJEP)
Volume 3 Issue 2 2023**

Digital Pathways to Teaching and Learning in the 21st century education in Nigeria. A keynote delivered at the Southeast regional Education conference and Exhibition on the 28th, April, 2023.

¹Godspower I. Akawuku and ²Rapheal O. Okonkwo

^{1,2}Nnamdi Azikiwe University, Awka (NAU).

ABSTRACT

The 21st century has brought a profound shift in the way education is approached and delivered. Technology has opened the door to a variety of digital pathways, allowing educators to engage their students in innovative and meaningful ways. This paper explores the opportunities and challenges associated with digital pathways to teaching and learning in the 21st century. First, we examine the potential benefits of using digital pathways in the classroom. This includes improved access to learning materials, increased student engagement, and the ability to facilitate collaboration between students and instructors. We also explore the impact of digital pathways on student outcomes, with a particular focus on how these pathways can be used to increase student motivation, develop 21st century skills, and support personalized learning. Next, we examine the challenges associated with digital pathways in the classroom. This includes potential issues with digital divide, privacy and security, and how technology may be used to exploit certain populations. We explore some of the strategies that can be employed to mitigate these challenges, including protocols to ensure appropriate use of digital pathways and ethical use of data. Finally, we discuss the implications of digital pathways for the future of education. We explore how digital pathways can be used to support continued professional development of educators and increase access to education for students in underserved communities. Overall, this paper provides insights into the potential of digital pathways to enhance teaching and learning in the 21st century. It also highlights the challenges associated with using digital pathways, and provides potential strategies for overcoming them. With thoughtful implementation and use, digital pathways have the potential to revolutionize education and provide unprecedented levels of access to high-quality learning opportunities.

Keywords: Teaching, Learning, 21st century, Education, Nigeria

Teaching, Learning and Education

Teaching is effectively delivered if the perspective is correct. As teachers we tend to think that teaching is all about teachers and our role; in fact, the most important aspects of the educational process are the students and what they learn [1]. The student-centered perspective is the pedagogy in vogue. According to [2], Learning is about a change: the change brought about by developing a new skill, understanding a scientific law, changing an attitude. The change is not merely incidental or natural in the way that our appearance changes as we get older. Learning is a relatively permanent change, usually brought about intentionally [3]. When we attend a course, search through a book, or read a discussion paper, we set out to learn. Other learning can take place without planning, for example by experience. Generally, with all learning there is an element within us of wishing to remember and understand why something happens and to do it better next time. Learning is a continuous and natural process to which the human

© Akawuku and Okonkwo

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

being is exposed every day of his/her life. This concept is defined by the lasting acquisition of knowledge, behaviors, skills, or abilities through practice, study, or experience. Main Learning Theories are:

- The Behaviorists - (behaviorism: Stimulus – Response)
- The Neo-Behaviorists (Neo-behaviorism: Human Mind)
- The Gestaltists (Insight)
- The Cognitivists (Cognitive development: Learning to think)
- The Humanists (Active nature of Learner) [4].

Teaching is a set of events, outside the learners which are designed to support internal process of learning. Teaching (Instruction) is outside the learner. Learning is internal to learners. You cannot motivate others if you are not self-motivated. Motives are not seen, but Behaviors are seen. Is learning a motive or behavior? Learning is both a motive and behavior but only behavior is seen, learning is internal, performance is external. Role of the Teacher:

Generally, the role of teacher can be categorized into:

- Traditional Role - Teacher Centered
- Modern Role - Facilitator (Student Centered)

There has been a change from the Traditional role to the Modern role in the present context. The learning increases when the teacher builds on the previous experience of the student. However, individual's learning differs and each individual learns at his or her own pace. Identifying the slow learners and individual attention of the teacher may be required. Thus, effective learning is to a great extent based on experiences. Direct experiences are student centered and participation in problem solving. While in indirect experience, the contents are carefully designed and organized by teacher [5].

Instructional Technology Vis-à-vis Digital Pathways

Instructional technology is the theory and practice of using technology for education. Encompassing the design, development, use, management, and evaluation of technology in education, instructional technology can take many forms. Anything from electronic whiteboards to online courses or even virtual reality classrooms can be considered instructional technology [6, 7, 8]. While the applications and benefits of instructional technology vary widely, all instructional technology shares one main purpose: to create engaging and effective learning experiences. And many applications of instructional technology have proved effective at achieving this goal. Experts widely agree that instructional technology provides many benefits to the education process, including better access to information, more opportunities for collaboration, and better capabilities for meeting diverse learners' needs. The instruments and equipment which are used to support teaching (including software, programs, and networks, web, video player, data projector, overhead, computer, television monitors, and so forth). The skills needed to produce or apply the tools and equipment effectively. (for example, writing, designing, programming, and production) [9]. An understanding of teaching and learning process and how knowing educational instruments and materials can be chosen and used appropriately to support such processes is paramount.

The Role of Technology in Modern Classrooms

Just a couple of decades ago, teachers used very little (if any) technology in the classroom. Today, technology is a fundamental part of the education process. A recent study conducted at Nnamdi Azikiwe University, Faculty of Education, reports that students complete less than 45% of their work, both in and out of the classroom, using paper and pencil. In addition, the study found that 75% of teachers said that their students use tablets or laptops every day. The increasing prevalence of technology in the classroom reflects a broader paradigm shift. As the modern world becomes more digitized, tech literacy is becoming increasingly important. Teachers who use technology to support learning in meaningful ways can help prepare students for success in this digital era [10].

Potential benefits of using digital pathways in the classroom

Nowadays, the use of information technology has been improved expeditiously. Most of the people use internet and computer to share information, investigation, ideas and so on. Since appropriately used technologies have significant effect on teaching and learning, if they are used inappropriately will hinder the process of learning and teaching. Hence, integrating technology into the classroom is an approach to develop better understanding of basic concepts provided for learning, if it is applied appropriately [11]. Although technology can never replace the human mind, it can intensify it, and increase the pace of learning. Thus, teachers have a critical role in this area – teaching students how to use technology as a tool is to help, rather than hinder, their learning. Students use information and communication technologies to build knowledge and to communicate with others. Equipment and software have improved, so the more complicated technology, such as internet and intranet can support the growth of distributed or asynchronous learning better [12]. Integrating technology into the classroom begins with the teacher preparing lessons that use technology in authentic and meaningful situations. Teachers should use the technology in a way to

© Akawuku and Okonkwo

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

support curriculum rather than prevail it. Technology should help the teacher in creating a cooperative learning environment and help the teacher transition from the role of facilitator to that of a learner, the teacher himself learns as well as helping the students to learn [13]. A major goal of using integrated technology is to prepare a situation that students use technology, deal with real world problems and manipulate them to find different aspects of the problem. Thus, students can imagine the possible consequences when the variables are changed. Therefore, when teachers are trying to combine technology into their classroom lessons, they can demonstrate the basic concepts and then ask the students to work with the computer or other technology. Finally, both teacher and student can take the advantage of using technology if teachers know how to integrate it successfully into the curriculum.

This includes improved access to learning materials

Textbooks are the most visible aspects of a curriculum and are often considered the main script that shapes the teaching and learning processes [14]. Quality textbook development and provision involves four main steps: development (based on curricular frameworks); procurement systems (state or private sector, approved textbooks list); distribution and access (arrival in schools, issuance to students); and storage and conservation. This process chain has been enhanced today by technology. Lecture materials can be developed (or downloaded) by course teachers overnight using online resources available at a click, sold or distributed on an online teaching platform (like google classroom, Microsoft teams, even on WhatsApp group) for students to study. The storage and conservation of same teaching material is sure leveraging on cloud technology.

Teachers' guides support teachers in their teaching practices. Effective teachers' guides should: contain explicit communication of conceptual goals with links to proposed activities, provide knowledge and support to help understand and implement teaching plans, reinforce pedagogical content knowledge, give guidance on the practice and understanding of relevant pedagogical activities, present alternatives and freedom of choice, and engage teachers in ongoing reflection. Obviously, this can be developed using modern technology tools, shared on collaborative online platform for inputs, then adopted.

Supplementary materials include books, newspapers, informational pamphlets, and other materials printed in mother tongue and instructional languages reflecting local customs and concerns. They enrich teaching, engage students in multi-dimensional learning, build students' abilities to apply their knowledge [15], and are thus critical for literacy outcomes [6]. Recently, studies have showed that investments in digital and multimedia materials have greater correlation with increased student achievement than investments in physical hardcopy practices [10].

Multimedia and digital resources are a growing source of knowledge for teachers and learners. Several studies show that greater access to information and communication technologies in schools can help reduce the digital divide between low- and high-income groups [9]. The digital era has challenged conventional textbook practices. Textbooks need updating more frequently against digital resources that enjoys collaborative and interactive pedagogical methods, increased student engagement (Incorporate quizzes, interactive videos, digital completion certificate) and the ability to facilitate collaboration between students and instructors (create group, delegate task for team work) from various regions of the world.

Teachers are continually looking for ways to enhance student collaboration in the classroom. Student collaboration adds much-needed variety to the standard, traditional lecture style of teaching. Classroom collaboration also encourages communication and cooperation among students and in effect allows them to teach one another. In some instances, students actually understand the material better when it is explained by their peers. Another significant benefit of collaborative learning is the positive bonding experience that occurs among the members of each group when everyone is contributing to a common goal.

Impact of digital pathways on student outcomes:

Today, technology is widespread among schools. Access to computers has become so ubiquitous that digital devices are replacing the use of pen and paper in many classrooms. While public opinion on the use of technology in schools has been divided, experts have found that technology has the ability to create profound changes in teaching and learning, creating opportunities for unprecedented collaboration, engagement, and support. The key is knowing how to use technology in meaningful ways—a skill some education degree programs are bringing to the forefront of their curricula. A digital learning object (DLO) is a resource that can be used and re-used to support learning. Digital learning objects offer a new conceptualization of the learning process: rather than the traditional "several hour chunk", they provide smaller, self-contained, re-usable units of learning. By utilizing this process, students' learning power will be enhanced, and they may use other DLOs too for personalized development. The advancement in artificial intelligence technology now allows teachers to differentiate instruction, providing extra support and developmentally-appropriate material to students whose knowledge and skill is far below or above grade level norms. The latest "intelligent" tutoring systems are able to not only assess a student's current weaknesses, but also diagnose why students are making specific errors. These technologies could enable teachers to better reach students who are

further from the average within their classroom, potentially benefiting students with weaker academic preparation (Jacob, 2016). These technologies scale easily so that innovations (or even good curriculum) can reach more students. Much like a well-written textbook, a well-designed educational software application or online lesson can reach students not just in a single classroom or school, but across the state or country. While technologies such as virtual instruction (Real-time video interaction through social networking tools like Zoom, Google Hangouts or Skype) and intelligent tutoring offer great promise and actualization of personal development goals. Therefore, these digital pathways can be used to increase student motivation, develop 21st century skills, and support personalized learning.

Challenges associated with digital pathways in the classroom:

Most schools within Nigeria do not have **IT infrastructure** that can support large-scale eBooks and digital curriculum distribution. As compared to most countries in developed world like the United States that has access to fast and adequate bandwidth internet that can support large data downloads of digital books and online teaching, most of the developing world still struggles with this.

Let's face it, the biggest impediment to technological change has never been technology itself, rather it has been **the people** affected by the change. There are cases where these basic IT infrastructures have been provided by government but the disposition of the people towards the utilization is the challenge. The teachers, administrators, librarians, and parents are all stuck in old ways of teaching and learning. The challenge lies in trying to get them to adapt to digital ways of teaching and learning.

Digital teaching and learning are not limited to **converting existing content and books to digital formats**, then sent to an online platform for students to utilize. In order to have its full effect, digital teaching and learning in schools must be accompanied by dynamic and interactive curated content. This curated content consumes time and effort that are often the reason for the increase in implementation costs. Digital curriculum is not one-time investment. The curriculum needs to be constantly upgraded on the platform(s) as and when technologies change. Technology shifts can have an important impact on existing content. This situation is similar to what corporate organizations had to deal with when device manufacturers stopped supporting their flash-based eLearning content. The gap between people who have access to affordable, reliable internet service (and the skills and gadgets necessary to take advantage of that access) and those who lack it, is a challenging imbalance that hauls the education system in the country. This digit divide poses serious challenge to teaching and learning in this era.

This is an issue within many countries, with rural populations much more likely to be cut off from digital technologies than city residents are. The divide also exists among countries and continents with poor and inappropriate educational policies. Again, among gender demography: In 2021, 62% of the global male population was said to be using the internet, compared with 57% of the female population, a gap that has been narrowing over the past decade.

Teachers, instructors and students need a private place to work online. Instructors want to be able to criticize politicians or corporations without fear of reprisal; students may want to keep rash or radical comments from going public or will want to try out perhaps controversial ideas without having them spread all over Facebook. Institutions want to protect students from personal data collection for commercial purposes by private companies, tracking of their online learning activities by government agencies, or marketing and other unrequested commercial or political interruption to their studies. In particular, institutions want to protect students, as far as possible, from online harassment or bullying. Creating a strictly controlled teaching and learning environment enables institutions to manage **privacy and security** more effectively.

Learning management systems (LMS) provide password protected access to registered students and authorized instructors. Learning management systems were originally housed on servers managed by the institution itself. Password protected LMSs on secure servers have provided that protection. Institutional policies regarding appropriate online behavior can be managed more easily if the communications are managed 'in-house.'

However, in recent years, more and more online services have moved 'to the cloud', hosted on massive servers whose physical location is often unknown even to the institution's IT services department. Contract agreements between an educational institution and the cloud service provider are meant to ensure security and back-ups.

Although there may be some areas of teaching and learning where it is essential to operate a certain level of privacy and security, such as in some areas of medicine or areas related to public security, or in discussion of sensitive political or moral issues, in general though there have been relatively few privacy or security problems when teachers and instructors have opened up their courses, have followed institutional privacy policies, and above all where students and instructors have used common sense and behaved ethically. Nevertheless, as teaching and learning becomes more open and public, the level of risk does increase.

Strategies that can be employed to mitigate these challenges

According to [8], one of the chief internet adoption barriers in both developed and developing countries in the world is affordability. Most teachers cannot access the internet because of the high costs involved to purchase the gadgets or data bundle. The cost of smartphones, Projectors, laptop computers are expensive, despite technology being a basic tool in an online teaching and learning environment. Taxes, VAT, patent fees and electricity are contributors to the high prices of technology. To help this, administrator and managers of our educational setups can offer financing to help lower income earners afford new technology. Governments can give tariff subsidies to encourage them to buy these digital tools.

Empowering users: To see the full potential of the internet and its impact on the world, we must take advantage of its capabilities. Most teachers and even students who use the internet have a limited understanding of some of its use cases. For instance, Google helps people find information that they would not have access to. An issue that broadens the digital divide is 'participation inequality' where users lack the skills to use it. Since user data is used in decision-making, the data collected may not be suitable enough for proper decision making hence leading to poor decisions that may lead to huge consequences. To avoid this, teachers and stake holders in the academics need to be educated on the benefits and value of utilizing the internet and the various resources within it to achieve economic and social growth. Furthermore, teachers should be encouraged to share opinions and any other relevant user data online to aid the government and other organizations make informed decisions that serve the student needs better.

Improve the relevance of online content: According to research, the top barrier to internet penetration in developing countries is relevance. This is because, in most cases, people cannot find content, online services or web and mobile applications in their primary language. Moreover, most people in rural areas lack the necessary prerequisite education to understand a lot of online content. To encourage internet adoption in such places, local content and applications need to be developed in local languages that can be understood by the local populace. Besides to this, privacy, trust, and data security issues that tend to scare away many potential users need to be addressed by formulating policy frameworks that ensure online websites protect their users' data and online activity.

Internet infrastructure development: The internet relies on infrastructure to relay information between two or more computers located in different parts of the world. Lack of proper internet infrastructure, which is the case in many 3rd world countries, means either poor internet connection or no internet connection at all in those parts of the world. With the inception of the broadband internet which is much faster and reliable than the traditional dial-up connection, this challenge has become even more pronounced especially in rural areas. This is because of the costly nature of the systems and technologies that relay broadband internet making it uneconomical to establish in rural areas. Luckily, large-scale cost-effective solutions that are suited for rural environments have been developed such as the use of satellite broadband technologies, drones, and earth-orbiting balloons.

Address gender gap in internet access: Statistics on internet usage carried out in 2016 showed that there are 250 million fewer women online than men. The majority of these women live in Africa and the Arab states. This means that in order to overcome the digital divide, a special focus has to be placed on women to bring their usage closer to or at par with that of men. The fact that in low and middle-income countries there are more women without mobile phones than men. The effort to close this gender gap lies squarely on both government and non-governmental organizations which must partner up and work together. Addressing the issues of poverty, relevance and public awareness will also considerably address the plight of women without access to the internet.

Lack of Dedicated IT Skills: Behind every successful digital transformation or pathway is a dedicated, highly-skilled IT team. However, building this team is very most skilled professionals refer to be self-employed than been an employee. As more educational institutions pursue new technologies, a labor deficit is developing. According to one recent survey, 54% of organizations reported that skill shortages were holding them back from pursuing their digital transformation goals. In particular, they were lacking expertise in: Cybersecurity, Technical architecture, Enterprise architecture, Advanced data analytics. Hence, retainership or consultancy services will best fit for educational setups or established setups.

Implications of digital pathways for the future of education.

We explore how digital pathways can be used to support continued professional development of educators and increase access to education for students in underserved communities. As education systems evolve from traditional teaching and learning paradigm, they need to invest in practical ways to continuously improve and support professional development educators. In short, continuous professional development consists of the strategies deployed by schools and education bodies to ensure that their staff always improve, from the beginning of their careers to the end. These strategies often involve groups of teachers working together, in much the same way that their students would, to collaboratively solve problems and explore the best way to deliver effective student outcomes. Technology can be leveraged to enhance access, participation, engagement, and continued application of

© Akawuku and Okonkwo

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

new skills in the classroom. According to the Ministry of Education, schools can use educational technology to support both teaching and learning by infusing the classroom with valuable digital tools, expanding course offerings, increasing student engagement, and accelerating learning. Instructional technology offers nearly endless applications, but experts have identified three key areas where integrating technology can have a significant impact.

Collaborative Learning

Instructional technology provides unparalleled opportunities for collaborative learning, which has great future implementations. Advances in technology have made sharing information easier than ever before. Today, educators have access to digital tools that allow students to work collaboratively outside of the classroom, discussing ideas or completing projects remotely and eliminating constraints such as standard classroom hours or geographic location bringing about global competitiveness. Instructional technology also provides opportunities for students to work collaboratively with teachers, discussing ideas or asking questions outside of the physical classroom. For example, teachers could hold digital office hours, making themselves available via instant messaging or video chat to support students as they tackle the day's homework.

Virtual Classrooms and Online Learning

Virtual classrooms can be a useful tool at every level of education. One common challenge of the traditional classroom environment is that students learn at their own pace, so teachers need to find a way to tailor their lesson plans to the average learner, rather than addressing each student's unique needs. Online courses level the playing field and provide students with the time and resources to develop the skills they need. For example, students could listen to a lecture for a second time if they didn't immediately grasp the subject matter or move ahead to the next one if they grasp a particular subject quickly. On top of this, online learning provides access to a wider array of topics, giving students opportunities to enrich their education by taking courses that their schools might not offer and providing synergy for personal development.

Real-Time Feedback

Instructional technology provides better capabilities for gathering or providing feedback compared with more traditional methods. Teachers can use a variety of digital tools to gauge where their students are in a particular lesson. For example, teachers might conduct an online survey of students' current understanding of a topic to gain insight into where they should focus the next lesson. Or they might opt for using digital education software so they can provide immediate feedback to students on lessons and homework, which could help keep students on track with learning objectives. Some schools have even been piloting virtual reality classrooms, where teachers can rehearse lessons or work through professional challenges in an artificial environment, helping them improve their abilities without negatively impacting real students.

CONCLUSION AND RECOMMENDATIONS

Digital classrooms are considered as the vital element in promoting and improving the traditional methods of teaching and learning, an expression of digital pathways. Although the task technology integration in teaching and learning promises highly optimized education delivery on one side and on the other, presents significant challenge to teachers (school teachers), school administrators, and owners alike. Nevertheless, exciting new educational technologies are increasingly available that offer teachers novel ways of presenting material to students and administrator strategic ways of managing and controlling educational resources. Recent research on technology use in the 21st century education indicates that significant advancement has been made to overcome the preliminary barriers to technology integration in Nigeria, especially concerning access to computing resources. Digital integration has also influenced the cost of the education. For starting a course in a desired university, students do not need to move to that university, and pay for transportation, accommodation and face security challenge(s). In addition, Timesaving is one of the most important consequences of digital integration to education.

RECOMMENDATIONS

To make further improvement include the following: 1) obtain funds for resources via non-traditional sources, (e.g., IGR, grants, digitization); 2) seek guidance from the Technopreneurs to identify effective professional technological policies workable in the Nigeria educational system; 3) exploit the expertise of master teachers in professional learning communities; 4) request training on newly adopted educational software directly from software companies; and 5) ensure that adequate technical, administrative, and peer support is available to teachers during the implementation (maybe by internal IT unit). In addition, overcoming second-order (internal) barriers to technology integration will likely be a more difficult hurdle. Our suggestions to confront the challenge of internal limitation (the teachers) (i.e., attitudes, beliefs, skills, and knowledge) include the following: 1) provide teacher training that highlights constructivism and student-centered education; 2) focus professional development efforts toward those which emphasize the use of technology in instruction, rather than for administrative tasks; 3) include visualization tools in student tracking technologies which allow teachers to easily identify and interpret student progress; 4)

© Akawuku and Okonkwo

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

involve teachers in the decision-making process when adopting new technologies; and 5) offer teachers training on the intersection of **technological** knowledge, **pedagogical** knowledge, and **content** knowledge. Technology integration in the classroom will require the ongoing collaborative efforts of teachers, educational technology professionals, school administrators, researchers, and educational software personnel. Fortunately, the benefits to schools, teachers, and students will yield tremendous returns. Through thoughtful implementation and use, digital pathways have the potential to revolutionize education and provide unprecedented levels of access to high-quality learning opportunities.

REFERENCES

1. Andrew William Moore (2009). Efficient memory-based learning for robot control. Available at <https://www.cl.cam.ac.uk/techreports/UCAM-CL-TR-209.html> retrieved 24th April 2023.
2. Aloysius H. Sequeira, (2012). Introduction to Concepts of Teaching and Learning available at https://www.researchgate.net/publication/272620585_Introduction_to_Concepts_of_Teaching_and_Learning retrieved 25th April 2023.
3. Brian A. Jacob (2016). The opportunities and challenges of digital learning. Available at <https://www.brookings.edu/research/the-opportunities-and-challenges-of-digital-learning/> retrieved 24th April 2023.
4. Carmen Steele (2018). Top Five Digital Divide Solutions available at <http://www.digitaldividecouncil.com/top-five-digital-divide-solutions/> retrieved 26th April 2023.
5. Education Monitoring Report (2016), Education for People and Planet: Creating Sustainable Futures for All.
6. Elliott, L., & Corrie, L. (2015). The GAVI approach to learning and teaching materials in sub-Saharan Africa.
7. Ranasinghe, A.I., (2009). The Benefit of Integrating Technology into the Classroom. International Mathematical Forum.
8. Vahideh Zolfaghari Mashhadia, Mohammad Reza Kargozarib, (2011). Influences of digital classrooms on education available at https://www.researchgate.net/publication/220307977_Influences_of_digital_classrooms_on_education retrieved 26th April 2023.
9. UNESCO. (2023). Learning and teaching materials available at <https://learningportal.iiep.unesco.org/en/issue-briefs/improve-learning/learning-and-teaching-materials> retrieved 26th April 2023.
10. Read, N. (2016). 'Measures of learning and teaching material availability and use in sub-Saharan Africa and other low-income countries. Background paper prepared for the Global
11. Read, T.; Treffgarne, C. (2011). 'Learning and teaching materials: policy and practice for provision'. Guidance Note. DfID.
12. Read, T. (2015). Where have all the textbooks gone? Toward sustainable provision of teaching and learning materials in sub-Saharan Africa. Washington, DC: World Bank.
13. Results for Development; International Education Partners Ltd. (2016). 'Global Book Fund feasibility study: Final report'. Washington, DC: Results for Development.
14. Smart, A.; Jagannathan, S. (2018). Textbook policies in Asia: Development, publishing, printing, distribution, and future implications. Manila: Asian Development Bank.
15. Jacob, B.A. (2016). 'The opportunities and challenges of digital learning'. Brookings, retrieved 26th April 2023.

Godspower I. Akawuku and Rapheal O. Okonkwo (2023). Digital Pathways to Teaching and Learning in the 21st century education in Nigeria. A keynote delivered at the Southeast regional Education conference and Exhibition on 28th April, 2023. NEWPORT INTERNATIONAL JOURNAL OF ENGINEERING AND PHYSICAL SCIENCES (NIJEP) 3(2):69-75.